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D. C. J.	D. CARADOG JONES. Senior Lecturer in Social Statistics, University of Liverpool.	Illegitimacy.

D. F. T.	Donald Francis Tovey, Mus.Doc. Reid Professor of Music, Edinburgh University.	Music.
D. G. H.	David George Hogarth, C.M.G., D.Litt., F.B.A. Keeper of the Ashmolean Museum, Oxford. President of the Royal Geographical Society, London, 1925. Fellow of Magdalen College, Oxford. Author of *The Ancient East*; *Arabia*; *The Wandering Scholar*; etc.	Lawrence, T. E.
D. Hy.	Douglas Hyde, LL.D., D.Litt. Professor of Modern Irish Language and Literature, University College, Dublin. Founder of the Gaelic League and President thereof, 1893–1915. President of the Irish Texts Society. Author of *A Literary History of Ireland*; *The Love Songs of Connacht*; *The Religious Songs of Connacht*; etc.	Irish Language; Irish Literature, *Gaelic.*
D. L.	Colonel David Lyell, C.M.G., D.S.O., M.Inst.C.E. Director of Pauling & Co. Ltd., London. Chief Railway Construction Engineer to the British Army in France during the World War.	Light Railways, Military.
D. McC.	D. McCandlish, M.Sc. Professor of Leather Industries in the University of Leeds.	Leather (*in part*).
D. W.*	Dion Williams. Brigadier General, United States Marine Corps.	Marines (*U.S.A.*).
E. A.*	Captain Edward Altham, C.B., R.N. (ret.). Editor of *The Journal of the United Service Institution*, London. Commanded H.M.S. "General Crawford" in operations at Zeebrugge and Ostend, April 1918.	Jellicoe, Earl; Jutland, Battle of.
E. A. B.	Edward Algernon Baughan. Dramatic and Film Critic of *The Daily News*, London, and *The Sunday Chronicle*. Formerly editor of *The Musical Standard*. Author of *Music and Musicians*.	Musical Comedy.
E. A. W.	Captain E. A. Woods, R.A.	Ordnance (*in part*).
E. Be.	Eduard Beneš. Minister of Foreign Affairs of the Czechoslovak Republic. Prime Minister of Czechoslovakia, 1921–2. Professor of Sociology at the University of Prague, 1922. Author of *Political Partisanship*; *Problems of New Europe and the Foreign Policy of Czechoslovakia*; *Difficulties of Democracy*; etc.	Little Entente.
E. B. Ph.	Earle Bernard Phelps. Professor in the College of Physicians and Surgeons, New York City. Formerly Professor of Chemistry in the Hygienic Laboratories, U.S. Public Health Service.	Milk (*in part*).
E. Ca.*	Emile Cammaerts. Professor of French Literature at Queen's College, London. Author of *Belgian Poems*; *New Belgian Poems*; *The Treasure House of Belgium*; *Belgium* (The Story of the Nations); etc.	Mercier, Cardinal.
E. C. Sn.	Ernest Charles Snow, M.A., D.Sc. Manager, United Tanners' Federation, London. Author of *Leather* in "The Resources of the Empire" series.	Leather (*in part*).
E. D. G.	Elmer D. Graper, Ph.D. Instructor in Government, Columbia University, New York. Author of *American Police Administration*.	New York State.
Ed. He.	Edouard Herriot. Prime Minister of the French Republic, 1924 and 1926. Senator 1912–9. Minister of Public Works, 1916–7. Formerly Professor of Rhetoric in the Lycée at Lyons. Author of *Madame Recamier et ses amis*; etc.	Jaurès, Jean.
E. E. F. D'A.	Edmund Edward Fournier D'Albe, D.Sc. Inventor of the Optophone. Vice-President of the Radio Association. Formerly Lecturer in Physics in the Punjab University. Author of *The Electron Theory*; *Two New Worlds*; *Contemporary Chemistry*; etc.	Optophone.
E. E. MacM.	Emily E. MacManus. Matron of the Royal Infirmary, Bristol.	Nursing: *Science and Technique.*
E. Ev.	Edwin Evans. Formerly musical critic of *The Pall Mall Gazette*, London. Author of *Tchaikovsky*; *The Margin of Music*; etc.	Orchestration.
E. Fo.	Evelyn Fox. Hon. Secretary, Central Association for Mental Welfare, London.	Mental Deficiency.
E. F. S.	Lieut.-Col. Edward Fairbrother Strange, C.B.E. Late Keeper of Woodwork, Victoria and Albert Museum, London. Author of *Alphabets, A Handbook of Lettering*; *Japanese Illustration*; *The Colour Prints of Japan*; *Flowers and Plants for Designers and Schools*; etc.	Handicrafts, Artistic (*in part*).
E. G. L.	Ernest Graham Little, M.D., F.R.C.P., M.R.C.S. M.P. for the University of London. Physician in charge of the Skin Department of St. Mary's Hospital; University of London Lecturer on Dermatology, St. Mary's Hospital Medical School.	London, University of.
E. G. S.	Emma Gurney Salter. Formerly of the Geographical section of the Naval Intelligence Department.	Morocco (*in part*).
E. J. B.	Edwin Julius Bartlett, A.M., M.D., D.Sc. Emeritus Professor of Chemistry, Dartmouth College, Hanover, New Hampshire, U.S.A.	New Hampshire.

E. J. B.*	ELBERT JAY BENTON, PH.D. Professor of History in Western Reserve University, Cleveland, U.S.A. Author of *The Wabash Trade Route*; *International Law and Diplomacy of the Spanish-American War*. Joint author of *Introductory American History*; *History of the United States*.	**Ohio.**
E. J. C.	LIEUT.-COL. E. J. CUMMINS, D.S.O., R.A. Instructor at the Artillery College, Woolwich.	**Ordnance, Military.**
E. J. Di.	EMILE JOSEPH DILLON. Foreign Correspondent of *The Daily Telegraph* (London). Author of *Russian Characteristics*; *Maxim Gorky*; *From the Triple to the Quadruple Alliance*; *The Eclipse of Russia*; etc.	**Isvolsky, A. P.**
E. L. B.*	EDWARD LESLIE BURGIN, LL.D. Principal and Director of Legal Studies to the Law Society, London. Member of the General Council of the League of Nations Union. Author of *Administration of Foreign Estates*.	**Legal Education** (*in part*).
E. L. C.	EDGAR LEIGH COLLIS, M.D., M.R.C.P., M.R.C.S. Talbot Professor of Preventive Medicine, Welsh National School of Medicine, Cardiff. Late Director of Health, Ministry of Munitions. H.M. Medical Inspector of Factories, 1908–17.	**Industrial Welfare.**
E. L. T.	EDWARD LEE THORNDIKE, A.M., PH.D., SC.D., LL.D. Professor of Psychology, Teachers' College, Columbia University, New York. Author of *Educational Psychology*; *Mental and Social Measurements*; *Animal Intelligence*; *The Original Nature of Man*; etc.	**Intelligence Tests.**
E. M.*	ELIE MOROY.	**Hospitals** (*in part*).
E. Mi.	EMILE MIREAUX. Director of the Society for Economic Studies and Information, Paris. Associate Professor at the University of Paris. Author of *La France et les huit heures*; *Les nouvelles formules d'organisation economique*; etc.	**France:** *Finance.*
E. M. M.	SIR EDWARD MORTIMER MOUNTAIN, BART. Managing Director of the Eagle,Star and British Dominions Insurance Company, London.	**Fire Prevention** (*in part*).
E. O. J.	EDWIN OAKES JORDAN, B.S., PH.D. Professor of Bacteriology and Chairman of the Department of Hygiene and Bacteriology, University of Chicago. Joint editor of *The Journal of Infectious Diseases*. Author of *General Bacteriology*; *Food Poisoning*; etc.	**Food Poisoning.**
E. R.	COLONEL E. RÉQUIN. Military Representative of France on the League of Nations.	**Marne, Second Battle of the.**
E. Ra.	ELEANOR RATHBONE, M.A., J.P. Member of the Liverpool City Council. President, National Union of Societies for Equal Citizenship. Author of *The Disinherited Family*; *A Plea for Family Endowment*.	**Family Allowances.**
E. R. B.*	EDWARD RICHARDS BOLTON, F.I.C., F.C.S. Vice-President of the Institute of Chemistry of Great Britain and Ireland. President of the Society of Public Analysts. Managing Director, Technical Research Works, Ltd., and Director of Loders and Nucoline, Ltd. Author of *Oils, Fats, Waxes and Resins* (with R. G. Pelly).	**Margarine** (*in part*); **Oils and Fats** (*in part*).
E. R. J.	EMORY RICHARD JOHNSON, M.L., PH.D., SC.D. Professor of Transportation and Commerce, and Dean of the Wharton School of Finance and Commerce, University of Pennsylvania. Author of *Principles of Railroad Transportation*; *Principles of Ocean Transportation*; etc.	**Interstate Commerce.**
E. Ru.	SIR ERNEST RUTHERFORD, O.M., D.SC., F.R.S. Cavendish Professor of Experimental Physics and Director of the Cavendish Laboratory, Cambridge University. Professor of Natural Philosophy, Royal Institution, London. Nobel Prizeman for Chemistry, 1908. President of the British Association, 1923. Author of *Radioactivity*; *Radioactive Transformations*; *Radioactive Substances and Their Radiations*; etc.	**Matter.**
E. S. H.	ELIZABETH SANDERSON HALDANE, C.H., LL.D., J.P. Vice-chairman, Territorial Nursing Service. Deputy President of the Perthshire Branch, British Red Cross Society. Author of *The British Nurse in Peace and War*; *The Life of Descartes*; etc.	**Nursing** (*in part*).
E. S. R.	EDWARD STUART RUSSELL, M.A., D.SC., F.L.S., F.Z.S. Director of Fishery Investigations, Ministry of Agriculture and Fisheries, London. Author of *Form and Function*; *The Study of Living Things*.	**Intelligence, Animal.**
E. T.*	EDWARD TUTHILL, M.A., PH.D. Professor of History, University of Kentucky. Author of *Government of Kentucky*.	**Kentucky.**
E. T. D'E.	SIR EUSTACE HENRY WILLIAM TENNYSON-D'EYNCOURT, K.C.B., F.R.S., M.I.C.E. Managing Director, Armstrong Whitworth and Co., Ltd. Director of Naval Construction at the Admiralty, 1912–24.	**Monitor.**

E. U.	EVELYN UNDERHILL (MRS. STUART MOORE). Upton Lecturer on Religion, Manchester New College, Oxford, 1921–2. Hon. Fellow of King's College for Women, University of London. Author of *Mysticism, a Study in the Nature and Development of Man's Spiritual Consciousness*; *Practical Mysticism*; *The Essentials of Mysticism*; etc.	**Mysticism.**
F. A. Cl.	FREDERICK ALBERT CLEVELAND, PH.B., PH.D., LL.D. Formerly Professor of United States Citizenship, Maxwell Foundation, Boston University. Author of *Organized Democracy*; *First Lessons in Finance*; etc.	**Massachusetts.**
F. B. M.	MAJOR-GENERAL SIR FREDERICK BARTON MAURICE, K.C.M.G. Director of Military Operations, Imperial General Staff, 1915–8. Author of *The Russo-Turkish War, 1877–8*: *Forty Days in 1914*; *The Last Four Months*; etc. Contributor to *The Cambridge Modern History*.	**Haig, Earl.**
F. Bo.	FERRUCIO BONAVIA. Assistant musical critic of *The Daily Telegraph*, London.	**Opera.**
F. D. L.	RT. HON. SIR FREDERICK JOHN DEALTRY LUGARD, G.C.M.G., C.B., D.S.O. British Member of Permanent Mandates Commission, League of Nations. Governor-General of Nigeria, 1914–9. Governor of Hong Kong, 1907–12. Author of *Our East African Empire*; *The Dual Mandate in British Tropical Africa*; etc.	**Mandates.**
F. E. W.*	LIEUT.-COL. FREDERICK ERNEST WHITTON, C.M.G. Formerly Secretary, Historical Section, Committee of Imperial Defence, London. Editor of *The Fighting Forces*. Author of *The Marne Campaign*; *The Decisive Battles of Modern Times*; etc.	**Frontiers, Battles of the** (*in part*); **German Offensive** (*in part*); **Marne, First Battle of the.**
F. Fi.	FRANZ FISCHER. Director of Kaiser Wilhelm Institute for Coal Research, Mulheim-on-the-Ruhr. Professor at the Technical High School, Berlin. Member of the Reich Coal Council. Author of *The Conversion of Coal into Oils*.	**Fuel Problems.**
F. Fo.	FERDINAND FOCH, O.M., G.C.B. Marshal of France and British Field-Marshal. Commander-in-Chief of the Allied Armies in France, 1918. Member of the *Académie Française* and of the *Académie des Sciences*. Author of *Les Principles de la Guerre*.	**Morale in War.**
F. G. C.	FREDERICK GARDNER COTTRELL, PH.D. Director of the Fixed Nitrogen Research Laboratory, U.S. Department of Agriculture. Inventor of the Fume Precipitation Process.	**Fume Precipitation.**
F. G. K.*	RT. HON. FREDERICK GEORGE KELLAWAY. Managing Director, Marconi's Wireless Telegraph Co., Ltd., and the Marconi International Marine Communication Co., London. Postmaster-General 1921-2.	**Marconi, Guglielmo.**
F. G. Ke.	SIR FREDERICK GEORGE KENYON, G.B.E., K.C.B., D.LITT. Director and Principal Librarian, British Museum. President of the Bibliographical Society, London, 1924. Honorary Fellow of Magdalen College and of New College, Oxford. Author of *The Buildings of the British Museum*.	**Museums.**
F. G. Y.	FREDERICK GEORGE YOUNG. Dean of the School of Sociology and Professor of Sociology in the University of Oregon. Editor of the *Quarterly Journal* of the Oregon Historical Society. Author of *Financial History of Oregon*.	**Oregon.**
F. H. C.	FRED H. COLVIN. Editor of *The American Machinist*, New York.	**Machine Tools.**
F. H. H.	FRANKLIN HENRY HOOPER. American Editor of *The Encyclopædia Britannica*. Formerly Assistant Editor of *The Century Dictionary*.	**Liberty Loans.**
F. H. H.*	FRANK HEYWOOD HODDER, PH.M. Professor of American History in the University of Kansas. Author of *Civil Government of Kansas*; *Outlines of American History*; etc.	**Kansas.**
F. H. W.	FRANKLIN HARCOURT WENTWORTH. Editor of the quarterly magazine of the American Fire Protection Association. Author of *Factories and Their Fire Prevention*; etc.	**Fire Prevention** (*in part*).
F. J. D.	ENGINEER-CAPTAIN F. J. DROVER, R.N. Author of *Marine Engineering Practice*; *Coal and Oil Fired Boilers*; *Marine Engineering Repairs*; etc.	**Flettner Rudder;** **Marine Engineering.**
F. J. Se.	F. J. SELLICKS. Football Correspondent to *The Illustrated Sporting and Dramatic News*, London. Joint Editor of *The Blue Magazine*, London.	**Football, Rugby.**
F. Kle.	FRITZ KLEIN, PH.D. Member of the staff of the *Deutsche Allgemeine Zeitung*.	**Luther, Hans.**
F. L. L.	LADY LUGARD, D.B.E. (FLORA SHAW). Formerly Head of the Colonial Department of *The Times*, London. Author of *A Tropical Dependency*; etc.	**Nigeria.**
F. P. R.	FRANK PLUMPTON RAMSEY. Fellow and Lecturer, King's College, Cambridge.	**Mathematics:** *Logic*.

F. R. C.	Frank Richardson Cana, F.R.G.S. Editorial staff of *The Times* (London). Author of *South Africa from the Great Trek to the Union*; etc. Member of the editorial staff of the *Encyclopædia Britannica*, 11th edition.	Gambia; Kenya; Liberia; Madagascar; Mozambique; Natal; Nyasaland.
F. W. A.	Francis William Aston, Sc.D., F.R.S. Fellow of Trinity College, Cambridge; Nobel Prizeman for Chemistry. Author of *Isotopes*.	Isotopes.
F. W. Th.	Frederick William Thomas, M.A. Librarian to the India Office, London. Lecturer in Comparative Philology and Reader in Tibetan, University College, University of London. Late Fellow of Trinity College, Cambridge. Hon. Secretary of Royal Asiatic Society and Director, 1921–2. Formerly Editor of *Epigraphia India*.	Indian Literature.
G. Ab.	Grace Abbott, M.A. Chief of the Children's Bureau, U.S. Department of Labor. Author of *The Immigrant and the Community*.	Maternity and Infant Welfare (*in part*).
G. A. Bu.	George Arthur Burls, M.Inst.C.E. Author and joint author with Sir Dugald Clerk, of works on internal combustion engines.	Internal Combustion Engine.
G. Ar.	Sir George Compton Archibald Arthur, Bart. Formerly Private Secretary to Earl Kitchener. Author of *The Life of Lord Kitchener of Khartoum*.	Kitchener, Earl.
G. B. D.	George Bucknam Dorr, M.A. Founder and Superintendent, under the U.S. Government, of Lafayette National Park, Maine. Author of U.S. Government bulletins on the national parks.	National Parks and Game Preserves.
G. Be.	Gertrude Margaret Lowthian Bell, C.B.E. Late Oriental Secretary to the British High Commissioner of 'Iraq. Author of *Review of the Civil Administration of Mesopotamia*.	'Iraq: *Political History*.
G. Bo.	George Boncescu. Rumanian correspondent of *The Times* (London).	Ferdinand, King of Rumania.
G. C. D.	G. C. Dixon. Literary Editor, *The Daily Mail* (London). Author of *From Melbourne to Moscow*.	Hughes, W. Morris.
G. E. B.	George Earle Buckle, M.A., LL.D. Editor of *The Times* (London) 1884–1912. Formerly Fellow of All Souls College, Oxford. Author of *Life of Disraeli* (vol. III., IV., V. and VI).	Grey of Fallodon, Viscount; Henderson, A.; Lansdowne, Marquess of; Law, A. Bonar; Long, Viscount; Lyttelton, Alfred; McKenna, Reginald; Milner, Viscount, etc.
G. G. A.	Major-General Sir George Grey Aston, K.C.B. Lecturer on Military History, University College, University of London. Formerly Professor of Fortification at the Royal Naval College, Greenwich. Author of *Sea, Land and Air Strategy*; *Memories of a Marine*; etc.	Great Britain: *Defence*.
G. G. A. M.	George Gilbert Aimé Murray, D.Litt., LL.D., F.B.A. Regius Professor of Greek, Oxford University. President of the League of Nations Union. Author of *History of Ancient Greek Literature*; *Rise of the Greek Epic*; *Euripides and his Age*; etc.	Greek Literature: *Ancient*.
G. Gl.	George Glasgow. Author and Publicist. Author of *The Minoans*; *Ronald Burrows: a Memoir*; etc.	Masaryk, T. G.
G. H. Ga.	George Henry Gater, C.M.G., D.S.O. Education Officer, London County Council. Formerly Director of Education, Lancashire County Council.	Industrial Schools.
G. H. H.	Godfrey Harold Hardy, D.Sc., LL.D., F.R.S. Savilian Professor of Geometry, Oxford University; Fellow of New College, Oxford. President of the Mathematical Association, London, and Hon. Secretary, the Mathematical Society. Author of *A Course of Pure Mathematics*; etc.	Mathematics (*in part*).
G. L. B.	Guy Leslie Buckeridge, M.R.C.S., L.R.C.P. Surgeon Commander in the R.N.	Medical Service, Naval (*in part*).
G. M. G.-H.	Geoffrey Malcolm Gathorne-Hardy, M.C. Barrister-at-Law. Hon. Secretary, British Institute of International Affairs.	Faeroe Islands.
G. O'B.	George O'Brien. Author of *Economic History in the 17th Century*; *Economic History of Ireland (1800–47)*; etc.	Irish Free State: *Financial and Economic History*.
G. R.*	Lieutenant-Colonel Guido Romanelli. Commandant of the Artillery Headquarters at Messina. Formerly Chief of the Italian Military Mission to Hungary for the Armistice. Commendatore of the Crown of Italy.	Kun, Bela (*in part*).

G. S.*	GEORGE SAMPSON, M.A. Inspector of Schools, London County Council. Member of the Departmental Committee on English Studies. Author of *English for the English*. Editor of *Nineteenth Century Essays*; *Cambridge Readings in Literature*; *The Cambridge Book of Verse and Prose*; etc.	Kipling, Rudyard.
G. Se.	GILBERT SELDES. Author of *The Seven Lively Arts*.	Motion Pictures: *Art.*
G. Sl.	GILBERT SLATER, M.A., D.Sc. Formerly Professor of Indian Economics in the University of Madras, and Publicity Officer for Madras, 1921–2. Author of *The Davidian Element in Indian Culture*.	India (*in part*).
G. St.	GUSTAV STRESEMANN. Minister for Foreign Affairs, Germany. Formerly Chancellor of the Reich. Signed the Pact of Locarno on behalf of Germany, December 1925. Author of *Macht und Freiheit*, etc.	Locarno, Pact of.
G. St.*	SIR GERALD STRICKLAND, G.C.M.G., LL.B. M.P. for the Lancaster Division. Member of the Malta Legislative Assembly. Owner and Director of Progress Printing Co., and *The Times* of Malta. Governor of Western Australia 1909–13, and of New South Wales 1914–7. Author of *Correspondence and Remarks on the Constitution of Malta*, etc.	Malta.
G. W. K.*	GEORGE WASHINGTON KIRCHWEY, LL.D. Head of the Department of Criminology, New York School of Social Work. Formerly Warden of Sing Sing Prison. Author of *Readings in the Law of Real Property*, etc.	Habitual Offenders.
G. W. T. B.	G. W. T. BRUINS. Professor of Economics at the Rotterdam School of Commerce. Author of the Memorandum prepared for the International Financial Conference at Brussels, 1920.	Netherlands: *Financial and Economic History.*
H. A. G.*	HAROLD ATHELING GRIMSHAW, M.Sc. (Econ.). Lecturer in Public Administration at the London School of Economics, London University. Member of the International Labour Section of the League of Nations.	Hours of Labour.
H. B.*	SIR HERBERT ATKINSON BARKER. Specialist in manipulative surgery.	Manipulative Surgery.
H. B. Br.	HENRY BRITTEN BRACKENBURY, M.R.C.S., L.R.C.P. Member of the Council of the British Medical Association. Chairman of the Insurance Acts Committee, London.	Insect Bites and Stings; Insurance, Social (*in part*).
H. B. C. P.	HUGH B. C. POLLARD. Late Editor of *Discovery*, London. Author of *A History of Firearms*, etc.	Microscopy.
H. Bi.*	HENRI BIDOU. Member of the staff of *Le Journal des Débats* (Paris). Chevalier of the Legion of Honour.	Galliéni, General; Joffre, Marshal; Lanrezac, General.
H. B. M.	H. B. MEEK. Professor in charge of Hotel Courses at the New York State College of Home Economics, Cornell University.	Food Service.
H. Br.*	HENRI BRENIER. Director-General of the Chamber of Commerce, Marseilles. General Secretary to the National Colonial Exhibition at Marseilles, 1922, and to the Colonial Organisation Congress, 1922.	Indo China, French; Morocco (*in part*).
H. Bra.	HERBERT BRANDE. Advertising Manager, New York. Formerly editorial writer on *The Chicago Tribune*.	Instalment Selling (*in part*).
H. C. D.	HARRISON CLIFFORD DALE, A.M. Professor of Economics and Political Science, University of Idaho. Author of *The Ashley-Smith Exploration and the Discovery of a Central Route to the Pacific: 1822–1829*, etc.	Idaho.
H. Ch.	HUGH CHISHOLM, M.A. Editor of the 11th and 12th editions of *The Encyclopædia Britannica*.	George V. (*in part*); Montessori System.
H. C. P.*	RT. HON. SIR HORACE CURZON PLUNKETT, K.C.V.O., F.R.S. Vice-President of the Department of Agriculture and Technical Instruction for Ireland, 1899–1907. Founder of the Irish Agricultural Organisation Society, 1894. Commissioner, Congested Districts Board, Ireland, 1891–1918. Chairman of the Irish Convention, 1917–8. Author of *Ireland in the New Century*, etc.	Ireland: *Agriculture.*
H. C. Wa.	H. C. WATTS.	Mauritius.
H. D. K.	HARRY DEXTER KITSON, A.M., PH.D. Professor of Psychology, University of Indiana. Author of *Scientific Study of the College Student*; *Manual for the Study of the Psychology of Advertising and Selling*; *The Mind of the Buyer*; etc.	Job Analysis.

H. F.	HENRY FORD. Organiser and President of the Ford Motor Co. Author (with Samue. Crowther) of *My Life and Work* (1922).	**Mass Production.**
H. F. Ba.	HENRY FREDERICK BAKER, Sc.D., F.R.S. Lowndean Professor of Astronomy and Geometry, Cambridge University. Fellow of St. John's College, Cambridge. Senior Wrangler (equal), 1887, and first Smith's Prizeman, 1889.	**Geometry.**
H. F. O.	HENRY FAIRFIELD OSBORN, D.Sc., LL.D., PH.D. Honorary Curator of the Department of Vertebrate Palaeontology of the American Museum of Natural History. Senior Geologist, United States Geological Survey. Research Professor of Zoology, Columbia University, New York. Author of *Age of Mammals*; *Men of the Old Stone Age*; *Origin and Evolution of Life*; etc.	**Mongolia, Palaeontologic Discoveries in** (*in part*).
H. Gu.	HUGH GUNN, M.A. Director of Education and Member of the Legislative Council, Orange River Colony, 1902–10. Editor of *The British Empire.*	**Hertzog, General.**
H. H.*	HARRY HANSEN. Literary Editor of *The Daily News*, Chicago. Book critic for *Harper's Magazine.* Author of *The Adventures of the Fourteen Points.*	**Lawson, Victor.**
H. H. L. B.	HUGH HALE LEIGH BELLOT, H.A., D.C.L. Barrister-at-Law. Honorary secretary of the International Law Association. Formerly Acting Professor of Constitutional Law in the University of London. Author of *The Law of Children and Young Persons.* Editor of Pitt Cobbett's *Leading Cases on International Law*; etc.	**Marriage Laws.**
H. H. M.	HENRY HERMAN MEYER, A.M., D.D. Editor of Sunday School Publications of the Methodist Episcopal Church, U.S.A. Author of *The Lesson Handbook* (annual); *The Graded Sunday School in Principle and Practice.*	**Methodism** (*in part*).
H. I. P.	HERBERT INGRAM PRIESTLEY, M.A., PH.D. Professor of Mexican History and Librarian of the Bancroft Library, University of California. Author of *The Mexican Nation*; etc.	**Guatemala; Honduras; Mexico; Nicaragua.**
H. J. F.	HERBERT JOHN FLEURE, D.Sc. Professor of Geography and Anthropology, University College of Wales Aberystwyth. Hon. Secretary, Geographical Association; and Hon. Editor of *The Geographical Teacher.* Author of *Human Geography in Western Europe*, etc.	**Geography; Human Geography.**
H. J. G.	SIR HENRY GAUVAIN, M.D., M.CH. Medical Superintendent, Lord Mayor Treloar Cripples' Hospital and College, Alton and Hayling Island, Hants. Hon. Consulting Surgeon to the Welsh National Memorial Association for the treatment of Tuberculosis. Consultant in Surgical Tuberculosis to the London, Essex and Hampshire County Councils.	**Heliotherapy.**
H. J. G.*	HIPPOLYTE JEAN GIRAUDOUX. Chevalier of the Legion of Honour. Author of *Amica America*; *La Prière sur la Tour Eiffel*; etc.	**France:** *Colonies.*
H. J. Go.	HERMAN JOHN GOUGH. Of the National Physical Laboratory, Teddington, Middlesex.	**Fatigue of Metals.**
H. J. R.	CAPT. H. J. ROUND, M.C. Of the Marconi Wireless Telegraph Co., Ltd.	**Microphone.**
H. L. C.	HUGH LONGBOURNE CALLENDAR, M.A., LL.D., F.R.S. Professor of Physics at the Imperial College of Science, South Kensington, London. Formerly Fellow of Trinity College, Cambridge. Author of *Properties of Steam*; *Thermodynamic Theory of Turbines.*	**Heat.**
H. M. P.	RT. HON. HUGH MCDOWELL POLLOCK. M.P. for South Belfast. Minister of Finance, Northern Ireland. Late Chairman, Belfast Chamber of Commerce.	**Ireland, Northern:** *Financial and Economic History.*
H. P. M.	H. P. MACOMBER. Secretary and Treasurer, Society of Arts and Crafts, Boston, Massachusetts.	**Handicrafts, Artistic** (*in part*).
H. R. A.	HON. HERBERT R. ATKINSON. Instructor at the Artillery College, Woolwich. Formerly Experimental Officer at the Small Arms School, Hythe, Kent.	**Machine Guns.**
H. Ro.	SIR HUMPHRY DAVY ROLLESTON, BART., K.C.B., M.D., D.Sc., D.C.L. Regius Professor of Physic, Cambridge University. Physician in Ordinary to His Majesty King George V. President of the Royal College of Physicians of London. Author of *Diseases of the Liver*; etc.	**Goitre; Medicine.**
H. Sa.	HIROSI SAITO, M.A. Secretary of Embassy and Consul in the Japanese Diplomatic and Consular Service, Member of the Japanese Delegation to the Peace Conference in Paris, 1919, and to other Inter-Allied and International Conferences in Europe, 1919–21.	**Formosa** (*in part*); **Japan** (*in part*); **Korea** (*in part*).
H. S. G.	HENRY SOLON GRAVES, LL.D. Provost, Dean of the School of Forestry and Sterling Professor of Forestry, Yale University.	**Natural Resources, Conservation of.**

H. Sp.	E. Harold Spender, LL.D. Formerly on the staff of *The Pall Mall Gazette*, *The Westminister Gazette*, *The Daily Chronicle*, *The Manchester Guardian*, and *The Daily News*. Author of *A Briton in America*; *David Lloyd George*; *Herbert Henry Asquith*; *The Cauldron of Europe*; etc.	**George, David Lloyd.**
H. St. J. B. P.	Harry St. John Bridger Philby, C.I.E. Chief British Representative in Transjordan, 1921–4. Commander, British Political Mission to Central Arabia, 1917–8. Author of *The Heart of Arabia*.	**Hejaz.**
H. T.*	Harry Taylor, D.S.M. General in United States Army. Chief of Engineers, United States War Department.	**Great Lakes and St. Lawrence; Mississippi** (*River*).
H. W.*	Harold W. T. Wager, D.Sc., F.R.S. H.M. Inspector of Schools, Secondary Branch, Board of Education, London. Hon. Lecturer in Botany in the University of Leeds. Author of *Physiology of Plants*; *Teaching of Botany*; etc.	**Mycology.**
H. W. H. K.	Henry William Howard Knott. Barrister-at-Law. Formerly Lecturer at the Law School of the University of Manitoba, Winnipeg.	**Hughes, Charles E.**
H. W. V. T.	Harold William Vazeille Temperley, M.A., Litt.D., O.B.E. University Reader in Modern History and Fellow of Peterhouse, Cambridge. British Representative on the Albanian Frontiers Commission, 1921. Military Adviser at the Peace Conference, Paris, 1919. Editor of *A History of the Peace Conference of Paris*. Contributor to *The Cambridge Modern History* and *The Cambridge History of Foreign Policy*.	**Neuilly, Treaty of, etc.**
H. W. W.	Herbert Wrigley Wilson, M.A. Chief Leader Writer on *The Daily Mail*, London. Author of *Ironclads in Action*. Contributor to *The Cambridge Modern History*.	**Northcliffe, Viscount.**
I. Fi.	Imre Ferenczi. Member of the Diplomatic Division of the International Labour Office, Geneva.	**Migration.**
I. G.	Sir Israel Gollancz, Litt.D., F.B.A. Secretary of the British Academy. University Professor of English Language and Literature, King's College, London. Fellow of King's College. President of the Philological Society, London, 1919–22.	**Learned Societies.**
I. Max.	Sir Ivor Maxse, K.C.B., D.S.O. General Officer Commanding 19th Division 1914–7 and XVIII. Corps 1917–8. Inspector-General of Training to the British Armies in France, 1918–9. Commander-in-Chief, Northern Command, England, 1919–23. Author of *Seymour Vandeleur*.	**Infantry.**
J. A. H. C.	James A. H. Catton. Editor of *The Athletic News*, Manchester, 1900–24. Contributor on athletic subjects to *The Observer* (London) and *The Evening Standard* (London).	**Football, Association.**
J. A. J.	James Alton James, B.L., Ph.D. Professor of History and Dean of Graduate School, Northwestern University, Illinois. Author of *George Rogers Clark*.	**Illinois.**
J. Al.	Sir James Allen, G.C.M.G. Formerly High Commissioner in London for New Zealand; Minister of Finance, Minister of Education and Minister of Defence, New Zealand.	**New Zealand:** *Political History*.
J. A. Ro.	James Alexander Robertson, Ph.B., L.H.D. Research Professor of American History, John B. Stetson University, Deland, Florida. Formerly Chief of the Near Eastern Division Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D.C. Co-Editor of Blair and Robertson's *The Philippine Islands, 1493–1898*.	**Guam.**
J. A. T.	John Arthur Thomson, M.A., LL.D. Regius Professor of Natural History in the University of Aberdeen. Gifford Lecturer, St. Andrew's, 1915. Terry Lecturer, Yale University, 1924. Author of *The Study of Animal Life*; *Outlines of Zoology*; *Heredity*; *Darwinism and Human Life*; *What is Man? Concerning Evolution*. Joint Author (with Professor Patrick Geddes) of *Evolution*; *Sex*; *Biology*.	**Heredity.**
J. A. W.	James Albert Woodburn, Ph.D., LL.D. Professor of American History, Indiana University. Author of *The American Republic and its Government*; etc.	**Indiana.**
J. B. S.	James Brown Scott, A.M., J.U.D. President of the American Institute of International Law. Editor-in-Chief of *The American Journal of International Law*. Trustee and Secretary of the Carnegie Endowment for International Peace. Author of *An International Court of Justice*; etc.	**Naturalisation** (*in part*).
J. Ci.	Jaroslav Cisar, Ph.D. Secretary on Special Mission, Czechoslovakian Legation, London. Author of *The Czecho-Slovak Republic*.	**Jebavy, V.**
J. C. K.	J. C. Kielstra. Professor of Colonial Economics in the School of Agriculture, Wageningen, Holland.	**Guiana, Dutch.**

J. C. McL.	JOHN CUNNINGHAM MCLENNAN, LL.D., D.Sc., F.R.S. Professor of Physics and Director of the Physical Laboratory, University of Toronto. Formerly President, Royal Canadian Institute and Royal Society of Canada. Scientific Adviser to the British Admiralty, 1919. Author of numerous papers on radioactivity, the production and liquefaction of helium, and spectroscopy.	Helium.
J. Co.	JOSEPH L. COHEN, M.A. Lecturer in Economics, Cambridge University. Member of the Advisory Committee on Social Insurance of the International Labour Office. Author of *Insurance against Unemployment*; *Insurance by Industry Examined*; *Workmen's Compensation in Great Britain*; *Social Insurance Unified*; etc.	Insurance, Social (*in part*).
J. de G. H.	J. DE GRAAFF HUNTER, M.A., Sc.D. Mathematical Adviser to the Survey of India. Author of *Formulae for Atmospheric Refraction and their Application to Terrestrial Refraction and Geodesy*; etc.	Geodesy.
J. D. Ro.	JOHN DAVY ROLLESTON, M.A., M.D. Medical Superintendent, Western Fever Hospital, Metropolitan Asylums Board, London. Formerly Senior Assistant Medical Officer, Grove Hospital, London. Editor *The British Journal of Children's Diseases.*	Infectious Fevers.
J. Du.	MAJOR-GENERAL JOHN DUNCAN, C.M.G., D.S.O. Commanded the 11th Division in Gallipoli, 1915, and the 22nd Division in Macedonia.	Italy: *Defence.*
J. E.*	REV. JOHN ELSWORTH. Minister of the Wesleyan Methodist Church. Member of Committees for arranging the details of Methodist Reunion.	Methodism (*in part*).
J. E. C.	JANET ELIZABETH COURTNEY, O.B.E. J.P. (MRS. W. L. COURTNEY). Author of *Free Thinkers of the Nineteenth Century*; *Recollected in Tranquillity.* Joint-author of *Pillars of Empire.* Joint-author of Index to the 11th Edition of *The Encyclopædia Britannica.*	George V. (*in part*), etc.
J. E. H. R.	JAMES ERNEST HELME ROBERTS, M.B., B.S., F.R.C.S. Surgeon with charge of out-patients, St. Bartholomew's Hospital, London. Senior Surgeon, Brompton Hospital for Consumption and Diseases of the Chest, London.	Heart and Lung Surgery.
J. E. S. B.	JOHN EDWARD SPENCER BRIND, C.B., C.M.G., D.S.O. Deputy Director of Military Operations and Intelligence at the War Office, London, 1923. Temporary Colonel Commandant attached to the Aldershot Command Staff.	German Offensive: *Battle of the Lys.*
J. E. Se.	JOHN EDWARD SEARS, C.B.E., M.A., M.I.MECH.E., A.M.INST.C.E. Deputy Warden of the Standards, Board of Trade, London, and Superintendent of the Metrology Department, National Physical Laboratory, Teddington, Middlesex.	Measurements; Measuring Instruments.
J. E. T. H.	JOHN ERNEST TROYTE HARPER, M.V.O., C.B. Rear Admiral R.N. Director of Navigation at the Admiralty, 1919–21. Commanded His Majesty's yacht "Victoria and Albert," 1911–4. Compiler of a special report on the Battle of Jutland.	Navigation.
J. E. W.*	JEANNE ELIZABETH WIER. Professor of History and Political Science in the University of Nevada. Executive Secretary of the Nevada Historical Society.	Nevada.
J. F.	JAMES FORD, PH.D. Associate Professor of Social Ethics in Harvard University. Sometime Division Manager, U.S. Housing Corporation. Editor of the *Report* of the U.S. Housing Corporation. Author of *Co-operation in New England*; and *Social Problems and Social Policy.*	Housing: *United States.*
J. F. C. F.	JOHN FREDERIC CHARLES FULLER, D.S.O. Military Assistant to the Chief of the Imperial General Staff. Chief General Staff Officer, Tank Corps, 1917–8. Formerly Chief Instructor, Staff College, Camberley. Author of *Tanks in the Great War*; *The Reformation of War*; *Sir John Moore's System of Training*; etc.	German Offensive: *St. Quentin.*
J. F. N.	REV. JOSEPH FORT NEWTON. Formerly Pastor of the Church of the Divine Paternity, New York City. Editor of *The Master Mason.*	Freemasonry (*in part*).
J. G. B.	SIR JOSEPH GUINNESS BROODBANK. Chairman of the Dock and Warehouse Committee of the Port of London Authority, 1909–20. President of the Institute of Transport, 1923–4. Author of *History of the Port of London.*	London, Port of.
J. G. C.*	HON. JOSEPH GORDON COATES, M.C. Prime Minister of New Zealand. Formerly Postmaster-General and Minister of Public Works, Railways, Telegraphs, Roads and Public Buildings, and Native Affairs.	New Zealand: *Economic and Financial History.*
J. G. D.	JAMES G. DOUGLAS. Vice-Chairman of the Senate of the Irish Free State, 1925. Chairman of the Board of the National Land Bank, Ltd.	Irish Free State: *Constitution.*

J. G. de R. H.	JOSEPH GREGOIRE DE ROULHAC HAMILTON, PH.D. Kenan Professor of History and Government in the University of North Carolina. Author of *Reconstruction in North Carolina*; *North Carolina since 1880*; etc.	North Carolina.
J. G. Sm.	JOHN GEORGE SMITH, M.A., M.COM. Mitsui Professor of Finance, University of Birmingham. Member of the Warwickshire Agricultural Wages Committee. Author of *Organised Produce Markets*; etc.	Marketing (*in part*).
J. H.*	JULIUS HIRSCH, PH.D. Formerly Minister of Public Works in the German Reich.	Germany: *Finance.*
J. H. Go.	JOHN HENRY GORVIN, C.B.E. General Secretary to the International Relief Credits Committee, Paris, 1921. Representative in Russia of the High Commissioner for Russian Relief, 1922–3, and of the Refugee Section of League of Nations, 1923–5.	Nansen, Fridtjof.
J. H. H.*	VERY REV. JOSEPH HERMAN HERTZ, PH.D., LITT.D. Chief Rabbi of the United Hebrew Congregations of the British Empire. Chairman of the Administrative Board, Institute of Jewish Studies, University of Jerusalem. President of the Jews' College, London. Author of *The Jew in South Africa*; *A Book of Jewish Thoughts*; etc.	Judaism.
J. H. Ho.	JACOB H. HOLLANDER, PH.D. Professor of Political Economy in Johns Hopkins University, Baltimore. Treasurer of Porto Rico, 1900–1. Financial Adviser of the Dominican Republic, 1908–10. Author of *The Abolition of Poverty*; *War Borrowing*; etc.	Haiti.
J. H. Hu.	JOHN H. HUBBACK. International Institute of Agriculture, Rome. Formerly President of the Liverpool Corn Trade Association.	Grain Trade (*in part*).
J. H. Mo.	JOHN HARTMAN MORGAN, K.C., M.A. Barrister-at-Law; Professor of Constitutional Law, University College, University of London. Deputy-Adjutant-General, Interallied Military Commission of Control in Germany, 1919–23. Author of *The Place of a Second Chamber in the Constitution*; *The New Irish Constitution*; etc.	Great Britain: *Constitution.*
J. H. O.	JOSEPH HOULDSWORTH OLDHAM, M.A. Secretary, International Missionary Council, London. Editor, *The International Review of Missions*. Author of *The World and the Gospel*; *Christianity and the Race Problem*; etc.	Missions.
J. H. S.	J. H. SUTCLIFFE, O.B.E. Secretary of the British Optical Association.	Optical Glass.
J. H. W.	J. H. WALKER. Superintendent of Central Heating, Detroit Edison Company. Joint Author of *Heating and Ventilation* (1918). Past President of the *National District Heating Association*.	Heating and Ventilation.
J. J.	JAMES JOHNSTONE, D.SC. Professor of Oceanography, University of Liverpool. Author of *Conditions of Life in the Sea*; *British Fisheries*; etc.	Oceanography.
J. J. D.	JAMES JOHN DAVIS. United States Secretary of Labor.	Labor, Department of.
J. J. T.	SIR JOSEPH JOHN THOMSON, O.M., C.M., SC.D., F.R.S. Master of Trinity College, Cambridge. Hon. Professor of Physics, Cambridge University and Royal Institution, London. President of the Royal Society, London, 1916–20. Nobel Prizeman for Physics, 1906. Author of *Conduction of Electricity through Gases*; *The Structure of Light*; etc.	Gases, Electrical Properties of.
J. K.	JOSEPH KITCHIN, F.S.S. London Manager of the Union Corporation, Ltd.	Gold.
J. La.	JAMES LAVER. Department of Engraving, Illustration and Design, Victoria and Albert Museum, South Kensington, London.	Illustration (*in part*).
J. L. L.*	JOHN LIVINGSTON LOWES, PH.D. Professor of English and formerly Dean of the Graduate School of Arts and Sciences, Harvard University. Author of *Convention and Revolt in Poetry*.	Amy Lowell.
J. Lu.	JULIEN LUCHAIRE. Director of the Bureau of Intellectual Co-operation, Paris. Honorary Professor, University of Grenoble; late Inspector-General of Public Instruction in France.	Intellectual Co-operation.
J. M. L.	JAMES MILLER LEAKE, PH.D. Professor of History and Political Science in the University of Florida. Author of *The Virginia Committee System and the American Revolution*; etc.	Florida.
J. M. L.*	JAMES MELVIN LEE, LITT.D. Director of the Department of Journalism, New York University. Literary editor of *The Editor and Publisher*. Author of *A History of American Journalism*; etc.	Newspapers (*in part*).

J. M. M.	JOHN MALCOLM MITCHELL, M.C., F.S.A. (Scot.). Secretary, Carnegie United Kingdom Trust. Vice-President, Library Association. Author of *The Public Library System of Great Britain and Ireland*. Editor of *The Rural Libraries Handbook* (1922), etc.	**Libraries.**
J. N. M.*	JOHN NICHOLAS MAVROGORDATO. Author of *Cassandra in Troy*; *Letters from Greece*; *The World in Chains*; etc.	**Greece** (*in part*).
Jo. B.	JOSHUA BLOCH. Chief of the Jewish Division, New York Public Library.	**Hebrew Literature.**
J. P. V.-S.	JOHN PATRICK VILLIERS-STUART, C.B., D.S.O. Colonel, Indian Army (ret.). Served N.W. Frontier, India, 1901–2; East Africa 1903–4; European War 1914–8.	**Mountain Warfare.**
J. R. M.	RT. HON. JAMES RAMSAY MACDONALD, M.P. Prime Minister of Great Britain, 1923–4. Chairman of the Parliamentary Labour Party and Leader of His Majesty's Opposition. Author of *Socialism and Society*; *Labour and the Empire*; *The Social Unrest*; *Parliament and Revolution*; etc.	**Labour Party.**
J. S. Fa.	JOHN SHIELDS FAIRBAIRN, M.B., B.CH., F.R.C.S., F.R.C.P. Obstetric Physician and Lecturer on Midwifery and Diseases of Women, St. Thomas's Hospital, and Physician, General Lying-in Hospital, London. Author of *A Textbook for Midwives*; *Gynaecology with Obstetrics*; etc.	**Obstetrics.**
J. S. G.*	JOHN STANLEY GARDINER, F.R.S., F.L. Professor of Zoology and Comparative Anatomy, Cambridge University. Director of Scientific Investigations, Ministry of Agriculture and Fisheries, London.	**Fisheries.**
J. Sh.	JOHN SHAPLEY. Morse Professor of the Literature of the Arts of Design, New York University. President of the College Art Association of America. Editor of *The Art Bulletin*. Associate Editor of *The American Journal of Archaeology*.	**Mural Painting.**
J. S. M. W.	JOHN SEBASTIAN MARLOW WARD, M.A., F.S.S.S. Head of the Intelligence Department of the Federation of British Industries. Author of *Textile Fibres and Yarns of the British Empire*; *An Outline History of Freemasonry*; etc.	**Fibres**; **Freemasonry** (*in part*).
J. T. H.	JOHN THEODORE HEWITT, M.A., D.SC., PH.D., F.R.S. Formerly Professor of Chemistry, East London College, University of London. Author of *Synthetic Colouring Matters*, etc.	**Nitrogen, Fixation of.**
J. Vi.	JONAS VILES, PH.D. Professor of American History in the University of Missouri. Author of *History of Missouri*; *Outline of American History*; etc.	**Missouri.**
J. We.*	JOSEPH WELLS. Vice-Chancellor of Oxford University and Warden of Wadham College. Formerly Fellow and Tutor of Wadham College. Author of *Oxford and its Colleges*; *Wadham College*; *The Charm of Oxford*; etc.	**Oxford.**
J. W. G.	JOHN WALTER GREGORY, D.SC., F.R.S. Professor of Geology in the University of Glasgow. Author of *The Great Rift Valley*; *The Dead Heart of Australia*; *The Menace of Colour*; etc.	**Geology.**
J. W. Go.	JAMES WINDER GOOD. Assistant Editor, *The Irish Statesman*. Irish Correspondent of *The New Statesman* and *The Manchester Guardian*. Author of *Ulster and Ireland*; *Irish Unionism*.	**Irish Free State**: *Defence*.
J. Wi.	JAMES WILLIAMSON, M.I.C.E. Member of the firm of Sir Alexander Gibb and Partners, Engineers, London.	**Ferro-Concrete Engineering.**
J. Wi.*	SIR JAMES GLENNY WILSON. Formerly President of the New Zealand Farmers' Union.	**Grain Trade** (*in part*).
J. W. P.	J. W. PEARSON. Managing Director, British Oil and Cake Mills, Ltd., London.	**Oils and Fats** (*in part*).
J. W. T.	JOHN WILSON TAYLOR, A.M., PH.D. Assistant to the American Editor of *The Encyclopædia Britannica*. Formerly Professor of Greek, Ohio University.	**Herbert C. Hoover.**
K. B.	KARL BALLOD. Professor of Economics, University of Riga.	**Latvia**: *Financial and Economic History*.
K. C. M. S.	KENNETH CHARLES MORTON SILLS, M.A., LL.D. President of Bowdoin College, Brunswick, Maine. President of the Board of Visitors to the Naval Academy at Annapolis, 1920–1.	**Maine.**
K. M.	KENGO MORI. Financial Commissioner of Japan in London, Paris and New York.	**Formosa** (*in part*); **Japan** (*in part*); **Korea** (*in part*).
K. No.	KARL NORDHOFF. Of the statistical section of the Reichsbank, Berlin.	**Germany**: *Currency*.
K. P.	KARL PRIBRAM. Director of the Investigation Department, International Labour Office, Geneva. Professor of Political Economy and Statistics, University of Vienna.	**Housing** (*in part*).

K. S. L.	KENNETH SCOTT LATOURETTE, M.A., PH.D., D.D. Professor of Missions, Yale University. Formerly Professor of History, Denison University, Granville, Ohio. Author of *The Development of China*; *History of Early Relations Between the United States and China, 1784–1844*; etc.	**Manchuria; Mongolia.**
K. von O.	KARLLUDWIG VON OERTZEN. Chief of the Intelligence branch of the personal staff of the Ministry of Defence, Berlin.	**Germany:** *Defence.*
L. Ab.	LASCELLES ABERCROMBIE, M.A. Professor of English Literature, University of Leeds. Formerly Lecturer in Poetry, University of Liverpool. Author of *Thomas Hardy, A Critical Study*; *Theory of Art*; *Theory of Poetry*; *Idea of Great Poetry*; etc.	**Hardy, Thomas.**
L. C. H.	L. COKE HILL, M.E.I.C. Chief Engineer for John S. Metcalf Co. Ltd., Montreal.	**Grain Elevators.**
L. D. W.	LILIAN D. WALD. President of the Henry Street Settlement and of the Social Halls Association, New York City. Vice-President of the New York Association for Parks and Playgrounds, etc. Author of *The House on Henry Street.*	**Nursing** (*U.S.A.*).
L. E.	LUIGI EINAUDI. Professor of Finance in the University of Turin and in the Commercial University Luigi Bocconi of Milan. Senator of the Kingdom of Italy. Editor of *La Reforma Sociale.* Author of *Corso de Scienza della Finanza*; *La guerra e il systema tributario italiano*; etc.	**Italy:** *Financial and Economic History.*
L. E. H.	LEONARD ERSKINE HILL, F.R.S. Director of the Department of Applied Physiology, National Institute of Medical Research, Hampstead, London. Formerly Professor of Physiology, London Hospital. Author of *Manual of Physiology*; etc.	**Kata Thermometer.**
L. F. R.	L. F. RICHARDSON, F.R.S. Lecturer in Physics, Westminster Training College, London.	**Meteorology** (*in part*).
L. F. Sh.	L. F. SHEPPICK. Assistant Editor of *Milling*, London.	**Flour Milling.**
L. G.*	LEON GASTER. Hon. Secretary of the Illuminating Engineering Society, London.	**Illumination Engineering.**
L. G. R.	LEANDER GASPARD ROUSSIN, C.M.G. British Delegate on the International Financial Commission, Athens. Formerly Financial Secretary to the Ministry of Finance, Cairo.	**Greece** (*in part*).
L. J. S.	LEONARD JAMES SPENCER, SC.D., F.R.S. Assistant Keeper, Mineral Department, Natural History Museum, London. Editor of *The Mineralogical Magazine.* Author of *The World's Minerals.*	**Mineralogy.**
L. L.	LOUIS LOUCHEUR. Minister of Finance in the French Cabinet, and Minister for the Liberated Regions of France in the Briand Cabinet, 1921–2. Minister of Munitions in the Clemenceau Cabinet, 1917–20.	**France:** *Invaded Regions.*
L. M.	EMILE MARIE LOUIS MADELIN, D. ès L. Chairman of the French Alliance of the United States and of Canada, 1907–8. Chevalier of the Legion of Honour. Author of *La bataille de France*; *Les Heures merveilleuses d'Alsace et de Lorraine*; *L'expansion française*; etc.	**Foch, Marshal.**
L. McC. N.	LOUIS MCCOY NULTON. Rear Admiral, U.S. Navy, and Superintendent, U.S. Naval Academy.	**Naval Academy** (*U.S.A.*).
L. M. F.	LEONARD M. FANNING. Director of Publicity and Statistics, American Petroleum Institute. Editor of *The Oil Trade Journal.*	**Gasolene.**
Lo.	RIGHT HON. THE MARQUESS OF LONDONDERRY, K.G. Formerly Minister of Education, Northern Ireland. Chancellor of Queen's University, Belfast.	**Ireland, Northern:** *Political History.*
L. Pr.	LIONEL GEORGE PRESTON, C.B. Rear-Admiral R.N. Commanded the Patrol, Minesweeping, Training and Fishing Protection Flotilla, 1919–20. Director of the Minesweeping Division, Admiralty, London, 1917–9.	**Minelaying and Minesweeping.**
L. R. B.	LYDIA RAY BALDERSTON, B.S., M.A. Instructor in Household Arts, Teachers College, Columbia University, New York. Author of *Laundering*; *Housewifery.*	**Laundry Work.**
L. Ri.	LOUIS RIPAULT. Private Secretary to the President of the Chamber of Deputies, France. Author of *Histoire du Canada*; *Histoire des Etats-Unis*; etc.	**Herriot, Edouard.**
L. Ro.	SIR LEONARD ROGERS, C.I.E., M.D., F.R.S., F.R.C.P., F.R.C.S. Member of Medical Board, India Office, London. Physician and Lecturer, London School of Tropical Medicine. Late Professor of Pathology, Medical College, Calcutta.	**Kala-Azar; Leprosy.**

L. St.	LEONARD STEIN. Of the Zionist Organisation, London.	**Jews.**
Lt.	RIGHT HON. LORD LOVAT (Simon J. Fraser), K.T., K.C.M.G., K.C.V.O., D.S.O. Formerly Director of Forestry, British Expeditionary Force in France. Chief Commissioner, Forestry Commission of Great Britain.	**Forestry.**
L. T.	LEV DAVIDOVICH TROTSKY. Head of the Central Committee for Concessions, Union of Soviet Republics. Formerly People's Commissar for Foreign Affairs, and Commissar for War, Moscow.	**Lenin, Nikolai.**
L. V.*	LUIGI VILLARI. Member of the Staff of the League of Nations, 1920–3. Subsequently attached to the Emigration Department of the Italian Foreign Office. Commendatore of the Crown of Italy. Author of *Italian Life in Town and Country*; *The Awakening of Italy*; etc.	**Fascism;** **Italy:** *Political History*; **Mussolini, B.;** **Nitti, Francesco.**
L. Wi.	LOUIS WILEY, LL.D. Business Manager of *The New York Times*.	**Ochs, Adolf.**
M. A. C.*	MAURICE ALAN CASSIDY, M.D., F.R.C.P. Physician in charge of Out-Patients and of Electro-Cardiographic Department, St. Thomas's Hospital, London. Physician to the Metropolitan Police and to the Lord Mayor Treloar Cripples' Hospital, Alton.	**Heart Diseases.**
M. A. H.	MARY AGNES HAMILTON. Member of the Balfour Committee on British Trade and Industry. Member of the staff of *The Economist*, London, etc. Under the pen name of "Iconoclast" wrote *The Man of Tomorrow*; *J. Ramsay MacDonald*; etc.	**MacDonald, J. R.**
M. A. Van G.	M. A. VAN GENNEP. Editor, *Revue de Folklore*. Author of *Totémisme*, etc.	**Folklore.**
M. Bo.	MARGARET GRACE BONDFIELD. M.P. for the Wallsend Division. Parliamentary Secretary to the British Ministry of Labour, 1924. Labour adviser to Labour Convention at Washington, 1919. Hon. Secretary of the National Federation of Women Workers. Chairman, General Council of the Trade Union Congress, 1923.	**Maternity and Infant Welfare** (*in part*).
M. Bo.*	MORITZ JULIUS BONN. Professor of Economics at the School of Commerce, Berlin. Author of *Die englische Kolonisation in Irland*; *Amerika als Feind*; etc.	**Germany:** *Economic and Financial History*.
M. C. M.	MAX CORNILS MANGELS. Legal member of the department for administering the Kiel Canal.	**Kiel Canal.**
Me.	RIGHT HON. LORD MESTON, K.C.S.I., LL.D. Secretary to Finance Department, Government of India, 1906–12. Formerly Lieut.-Governor, United Provinces of Agra and Oudh. Represented India on the Imperial War Cabinet, and at the Imperial Conference, 1917. Finance Minister on Executive Council of the Governor-General of India, 1919.	**Gandhi, M. K.;** **India** (*in part*).
M. Gu.	M. GUILLAUME. Managing director of *Le Petit Journal*, Paris.	**Lyautey, General;** **Mangin, General;** **Nivelle, General.**
M. L. R.	MCKENDREE LLEWELLYN RANEY. Librarian of Johns Hopkins University, Baltimore.	**Johns Hopkins University.**
M. Mac.	SIR MURDOCH MACDONALD, K.C.M.G., M.INST.C.E. M.P. for Inverness. Consulting Civil Engineer. Late Adviser and Under-Secretary of State for Public Works in Egypt. Civil Engineer, Assuan Dam Protective and Heightening operations, and Isna Barrage Construction.	**Irrigation Engineering.**
M. Mo.	MURIEL MONTGOMERY. General Secretary, Girl Guides Association, London.	**Girl Guides.**
M. N.	MARION I. NEWBIGIN, D.SC. Editor of *The Scottish Geographical Magazine*. Author of *A Geographical Study of the Peace Terms*; *Mediterranean Lands*; etc.	**Mediterranean Sea.**
M. N. T.	M. N. TCHERKINSKY. Chief Editor in the Bureau of Economic and Social Intelligence of the International Institute of Agriculture, Rome.	**Land Tenure.**
M. of B.	RIGHT HON. LORD MONTAGU OF BEAULIEU. Adviser on Mechanical Transport Services to the Government of India, 1915–9. Vice-President of the Royal Automobile Club, London. Founder and former editor of *The Car* (London).	**Motoring.**
M. S.	MAY SMITH. M.A. Senior Investigator to the Industrial Fatigue Research Board, Medical Research Council, London.	**Industrial Psychology.**
N. M. Pe.	NORMAN MOSLEY PENZER, M.A., F.R.G.S., F.G.S. Author of *Cotton in British West Africa*; *The Tin Resources of the British Empire*; *The Mineral Resources of Burma*; *Non-Ferrous Metals and other Minerals*; etc.	**Lead;** **Manganese;** **Mica;** **Nickel.**

O. G. L.	ORIN GRANT LIBBY, PH.D. Professor of American History, University of North Dakota. Secretary of the North Dakota State Historical Society. Editor of *Collections of State Historical Society of North Dakota* (vol. i.–iv. and vi.).	North Dakota.
O. J. R. H.	OSBERT JOHN RADCLIFFE HOWARTH, O.B.E., M.A. Secretary of the British Association. Member of the Geographical Section, Naval Intelligence Department, London, 1915–9. Author of *Commercial Geography of the World*, etc. Joint-editor of *The Oxford Survey of the British Empire*.	Liverpool; Manchester; Oceania; etc.
O. W. R.	OWEN WILLANS RICHARDSON, D.Sc., F.R.S. Yarrow Research Professor of the Royal Society, London. Director of Research in Physics, King's College, University of London. Late Fellow of Trinity College, Cambridge, and Professor of Physics, Princeton University, U.S.A.	Magnetism.
P. B.	PIERRE FRANCIS BERNUS. Foreign editor of *Le Journal des Débats*, Paris correspondent of *Le Journal de Genève*; Chevalier of the Legion of Honour.	Millerand, A.
P. C. P.	PAUL CHRISLER PHILLIPS, M.A., PH.D. Professor of History in the University of Montana. Joint author of *The West in the Diplomacy of the American Revolution*. Author of *The Story of Columbus*; etc.	Montana.
P. E. L.	P. EVANS LEWIN, M.B.E., F.R.HIST.S. Librarian of the Royal Colonial Institute, London. Author of *The Germans in Africa*; *A Geography of Africa*.	Gold Coast.
P. G.*	PIETER GEYL, LITT.D. Professor of Dutch History, University College, University of London. Author of *Holland and Belgium*; etc.	Netherlands: *Political History*.
P. H. N.	PAUL HENRY NYSTROM, PH.D. Director of the Retail Research Association, New York. Formerly Professor of Economics in the universities of Wisconsin and Minnesota. Author of *Economics and Retailing*; *Retail Selling and Store Management*; *Textiles*; etc.	Marketing (*in part*).
P. J.	PAUL EMILE JAVARY. Chief Engineer for the development of the Chemin de fer du Nord, France.	France: *Communications*.
P. L.	PAUL LAMBOTTE. Director of Fine Arts for Belgium. Government Commissioner for Fine Art Exhibitions. Author of two volumes in the *Collection des artistes belges contemporains*.	Laermans, Eugène.
P. La.	PHILIP LAKE, M.A. University Reader in Geography, Cambridge.	Geology: *New Theories*.
P. Le.	PHILEAS LEBERGUE. Greek correspondent of *Le Mercure de France* under the name of Demetrius Asteriotis.	Greek Literature: *Modern*.
P. Lo.	PERRY LONGHURST. Author of *Wrestling*.	Gymnastics.
P. M. H.	PETER MARTIN HELDT. Engineering Editor of *Automotive Industries*. Author of *The Gasoline Automobile*; etc.	Motor Vehicles.
P. N.	SIR PHILIP ARTHUR MANLEY NASH, K.C.M.G., D.S.M., M.INST.C.E. Chairman of Metropolitan-Vickers Electrical Co. Ltd. Director of National Filling Factories, Ministry of Munitions, 1915–6. Inspector-General of Transportation, Western Front, 1918. Director-General of Traffic, Ministry of Transport, 1919–21.	Factory Design.
P. T. M.	SIR PATRICK THOMAS MCGRATH, K.B.E., LL.D. President, Legislative Council, Newfoundland. Managing Director and Editor of *The Evening Herald*. Newfoundland Correspondent of *The Times*, London. Author of *Newfoundland in 1911*; *From Ocean to Ocean*; etc.	Labrador; Newfoundland.
P. Vi.	SIR PAUL VINOGRADOFF, F.B.A., D.C.L., LL.D. Formerly Corpus Professor of Jurisprudence, Oxford University. Fellow of the Russian Academy, Petrograd. Member of International Academy of Comparative Law, Geneva. Author of *Villainage in England*; *The Growth of the Manor*; *Outlines of Historical Jurisprudence*; *Self-Government in Russia*; etc.	Nicholas II. (*Tsar*).
P. W. L.	PERCY W. LOVELL. Hon. Secretary of The London Society.	London.
R. B. F.	RAYMOND BLAINE FOSDICK, M.A. Formerly Commissioner of Accounts, City of New York. Author of *American Police Systems*; *European Police Systems*; *Keeping our Fighters Fit*; etc.	New York City.
R. C. A.	ROY CHAPMAN ANDREWS. Chief of Division of Asiatic Exploration, American Museum of Natural History, New York; Leader of Expeditions to Tibet, China, Mongolia, etc. Author of *Camps and Trails in China*; etc.	Mongolia, Paleontological Discoveries in (*in part*).

R. C B.	ROBERT CLARKSON BROOKS, PH.D. Professor of Political Science, Swarthmore College, Pennsylvania. Author of *Corruption in American Politics and Life*; *Political Parties and Electoral Problems*; etc.	**Initiative.**
R. C. F.	R. C. FARMER, O.B.E., D.Sc., PH.D., F.I.C. Late Chief Chemist, Explosives Department, Ministry of Munitions. Author of *The Manufacture and Uses of Explosives*; *Industrial and Power Alcohol*; various scientific papers on explosives and general chemical subjects.	**Filtration.**
R. Cr.	DAME RACHEL ELEANOR CROWDY, D.B.E. Chief of Social Questions and Opium Traffic Section, Secretariat League of Nations. Principal Commandant of V.A.D.'s in France and Belgium, 1914-9.	**Opium, Traffic in.**
R. D.	SIR ROBERT DONALD, G.B.E., LL.D. Late Chairman, Empire Press Union. Formerly Managing Director of United Newspapers, Ltd. Chairman, Publicity Committee, British Empire Exhibition, 1924.	**Newspapers** (*in part*).
R. D. O.	RICHARD DIXON OLDHAM, F.R.S. Formerly President of the Geological Society, London. Author of various papers on Geology and kindred subjects.	**Isostasy.**
R. F. M.	ROBERT FOSTER MOORE, O.B.E., F.R.C.S. Ophthalmic Surgeon, St. Bartholomew's Hospital. Surgeon, Moorfields Eye Hospital. Consulting Ophthalmic Surgeon, Maudesley Hospital, London. Secretary Ophthalmological Society of the United Kingdom. Author of *Medical Ophthalmology*; etc.	**Ophthalmology.**
R. Gi.	ROY GITTINGER, PH.D. Dean of Undergraduates and Professor of English History in the University of Oklahoma. Author of *The Formation of the State of Oklahoma*; etc.	**Oklahoma.**
R. G. H.	RALPH GEORGE HAWTREY. Assistant Secretary to the Treasury, London. Author of *Currency and Credit;* etc.	**Great Britain:** *Finance.*
R. G. H.*	ROBERT G. HODGSON. Editor of the *Fur Trade Journal of Canada*. Author of *Fur Farming in Canada*; *Trapping in Northern Canada*; etc.	**Fur Trade.**
R. G. P.	RUSSELL G. PELLY, F.I.C. Joint Author of *Oils, Fats, Waxes and Resins.*	**Margarine** (*in part*).
R. Hd.	SIR ROBERT ERSKINE HOLLAND, K.C.I.E., C.S.I., C.V.O. Member of the Council of India. Agent to the Governor-General in Rajputana, 1920–5.	**India** (*in part*).
R. Jo.	SIR ROBERT JONES, K.B.E., D.S.M., F.R.C.S. President, Association of Surgeons of Great Britain; Lecturer in Orthopaedic Surgery, University of Liverpool. Director of Orthopaedic Surgery, St. Thomas's Hospital, London. English Editor of *The International Journal of Orthopaedic Surgery*. Author of *Surgery of Joints*; etc.	**Orthopaedic Surgery.**
R. J. T.	ROBERT JOHN THOMPSON, C.B., O.B.E. Assistant Secretary, Ministry of Agriculture and Fisheries, London.	**Great Britain:** *Agriculture.*
R. L. W.	RAY LYMAN WILBUR, A.M., M.D., LL.D. President and Formerly Dean of the Medical School, Leland Stanford Jr. University, California.	**Leland Stanford Jr. University.**
R. Ma.*	RENÉ MARAN. Novelist. Awarded the *Prix Goncourt* in 1921 for his novel *Batouala*. Author of *Le visage calme*; etc.	**French African Literature.**
R. Mac.	ROBERT MACHRAY. Contributor to magazines and journals especially on subjects connected with the Middle and Far East, the Baltic states; etc.	**Gdynia.**
R. M. H.	ROBERT MITCHELL HENRY, M.A. Professor of Latin and secretary of the Academic Council, Queen's University of Belfast, Ireland. Chairman of Trade Boards of Northern Ireland. Author of *The Evolution of Sinn Fein*; etc.	**Ireland:** *Political History.*
R. P.*	ROBERT PEELE, E.M. Professor of Mining in the School of Mines, Columbia University, New York. Author of *Compressed Air Plant*. Editor-in-chief of *Peele's Mining Engineer's Handbook*; etc.	**Mining.**
R. P. B.	ROBERT PRESTON BROOKS, PH.D. Dean of the School of Commerce, University of Georgia; formerly Professor of History. Author of *A History of Georgia*; *The Agrarian Revolution in Georgia*; etc.	**Georgia (*U.S.A.*).**
R. Po.*	ROSCOE POUND, A.M., PH.D., LL.D. Carter Professor of Jurisprudence and Dean of the Faculty of Law in Harvard University. Sometime Commissioner of Appeals of the Supreme Court of Nebraska. Author of *Readings on Roman Law*; *The Spirit of the Common Law*; *Interpretation of Legal History*; etc.	**Legal Education.**

R. Rn.	R. Romein. Member of Transit Section, League of Nations, Geneva.	**Inland Water Transport; Oder.**
R. Ro.	Sir Ronald Ross, K.C.B., K.C.M.G., M.D., D.Sc., F.R.S., F.R.S. (Edin.). Director in Chief, Ross Institute and Hospital for Tropical Diseases, Putney Heath, London. Consultant in Malaria, British Ministry of Pensions. Formerly Consultant in Malaria to the War Office, London. Nobel Prizeman for Medicine, 1902. Former Vice-President and Royal Medallist of the Royal Society, London. Author of *The Prevention of Malaria.*	**Malaria** (*in part*).
R. S.*	Reinhard Scheer. Admiral and Commander-in-Chief, German High Seas Fleet, 1916–8, and Chief of German Admiralty Staff till 1919. Author of *Deutschlands Hochseeflotte im Weltkriege.*	**Germany:** *Naval Policy.*
R. Sc.	Robert Scott, M.B., Ch.B. Barrister-at-Law. Formerly Major in the R.A.M.C.	**Medical Legislation.**
R. S. C.	Robert Seymour Conway, Litt.D., F.B.A. Hulme Professor of Classics, Victoria University of Manchester. Author of *The Restored Pronunciation of Greek and Latin*; *The Italic Dialects*; *New Studies of a Great Inheritance*; *The Making of Latin*; etc.	**Latin Literature.**
R. S.-D.	Richard Storry-Deans, LL.B. M.P. for the Park Division of Sheffield. Barrister-at-Law. Author of *Parent and Child*; *Students' Legal History*; *Notable Trials*; *Trials of Five Queens*; etc.	**Hogg, Sir Douglas.**
R. V. S.	Richard Vynne Southwell, M.A., F.R.S. Fellow and Lecturer in Mathematics, Trinity College, Cambridge. In charge of Non-Rigid Airships Design at R.N. Air Station, Kingsnorth, 1915–8, and of Aerodynamic and Structural Experiments at the Royal Aircraft Establishment, Farnborough, 1918–9. Late Superintendent of the Aerodynamics Department, National Physical Laboratory, Teddington.	**Materials, Strength of.**
R. V. V.	Roland Venables Vernon, C.B. Financial Adviser to Government of 'Iraq. Assistant Secretary, Ministry of Munitions, 1915–8. Deputy Accountant-General, Board of Education, 1920–1. Appointed on financial mission to 'Iraq for British and 'Iraq Governments, 1925.	**'Iraq:** *Financial and Economic History.*
R. We.*	Raymond Weeks, A.M., Ph.D. Professor of Romance Languages, Columbia University, New York. Inventor of instruments for the study of phonetics.	**Foreign Languages** (*in part*).
R. W. P.*	Sir Robert William Perks, Bart. Chairman of the Metropolitan District Railway, 1902–6. Treasurer, Wesleyan Methodist Twentieth Century Million Fund. M.P. for the Louth Division of Lincolnshire, 1892–1910.	**Methodism** (*in part*).
R. W. S.-W.	Robert William Seton-Watson, Litt. D. Masaryk Professor of Central European History at King's College, London. Founder and joint editor, 1916–20, of *The New Europe.* Joint editor of *The Slavonic Review.* Author of *The Rise of Nationality in the Balkans*; etc.	**Montenegro.**
S. A. K. W.	Samuel Alexander Kinnier Wilson, B.Sc., M.D., F.R.C.P. Junior Neurologist, King's College Hospital, London. Consulting Neurologist, Metropolitan Asylums Board. Croonian Lecturer, Royal College of Physicians, London. Editor of *The Journal of Neurology and Psychopathology.*	**Neuro-Muscular System.**
S. C. H.	S. C. Hammer, M.A. Oslo Correspondent of *The Times*, London. Editor of *The Norway Year Book.*	**Norway:** *Financial and Economic History*; **Norwegian Literature.**
S. Cr.	Samuel Crowther, B.S., LL.D. Author of *Common Sense and Labour*; *Life of George W. Perkins*; *My Life and Work* (with Henry Ford).	**Henry Ford.**
S. G.	Stephen Lucius Gwynn. Irish Correspondent of *The Observer* (London). Member of the Irish Convention 1917–8. Author of *Irish Books and Irish People*; *The Irish Situation*; *The History of Ireland*; etc.	**Griffith, Arthur; Irish Free State:** *Political History*; **Healy, T. M.**
S. H. S.	S. H. Shoveller. Vice-President of the English Hockey Association. Captain of the English team, 1909–14, and 1920–1. Author of *Hockey.*	**Hockey** (*in part*).
S. H. W.	Captain Stanley H. Wilton, R.N. (ret.). Late Assistant Director of Naval Ordnance, Admiralty, London.	**Gunnery, Naval; Ordnance** (*in part*).
S. J. B.	Solon Justus Buck. Superintendent of the Minnesota Historical Society. Professor of History in the University of Minnesota. Author of *The Granger Movement*; *Illinois in 1818*; *The Agrarian Crusade*; etc.	**Minnesota.**
S. L.	Suzanne Lenglen. Winner of the Ladies' Singles, Ladies' Doubles and Mixed Doubles Lawn Tennis Championships at Wimbledon, London, 1925 and earlier years.	**Lawn Tennis.**
S. L. C.	Stevenson Lyle Cummins, C.M.G., M.D., LL.D. Colonel, Army Medical Service (retired). David Davies Professor of Tuberculosis, University College of South Wales and Monmouthshire, Cardiff.	**Influenza.**

S. Le.	Stephen Butler Leacock, Ph.D., Litt. D., F.R.S. (Can.). William Dow Professor of Political Economy, McGill University, Montreal. Author of *The Elements of Political Science*; and of many literary satires including *Nonsense Novels*; *The Hohenzollerns in America*; *The Garden of Folly*; etc.	New Brunswick; Nova Scotia; Ontario.
S. McC. L.	Samuel McCune Lindsay, Ph.D., LL.D. Professor of Social Legislation in Columbia University, New York. President of New York Academy of Political Science, New York. Author of *Railway Labor in the United States*; *Financial Administration of Great Britain*; etc.	Liquor Laws, *United States*.
S. R.	Samuel Rosenbaum. Formerly Assistant U.S. Attorney and Assistant City Solicitor, Philadelphia. Author of *Commercial Arbitration in England* and *The English County Courts*.	Judicial Reform.
S. S.	Sophy Sanger. Chief of section in the International Labour Office of the League of Nations, Geneva, 1920–4; Secretary of British Section, International Association for Labour Legislation, 1906–19, and Editor of the English Edition of the *Bulletin* of the International Labour office (Basle).	Factory and Workshop Law.
S. Sp.	Sigmund Spaeth, Ph.D. Formerly member of the Editorial Staff of *The New York Times*, and Musical Correspondent of *The Boston Transcript*. Author of *Milton's Knowledge of Music*; *The Common Sense of Music*.	Musical Instruments.
T. Co.	Sir Theodore Andrea Cook. Editor-in-chief of *The Field* (London). Author of *A History of the English Turf*; *The Art and Science of the Oar*; *The Fencer's Song*; etc.	Fencing; Olympic Games.
T. E. G.	T. E. Gregory, D.Sc. Cassel Reader in Banking and Currency, London School of Economics. Author of *Tariffs: a Study in Method*; etc.	Great Britain: *Banking*.
T. E. L.	Thomas East Lones, M.A., LL.D. Formerly Senior Examiner in H.M. Patent Office, London. Author of *Aristotle's Researches in Natural Science*; *Zinc and Its Alloys*.	Gas, Manufacture of; Gyroscope; Inventions; Liquid Air; Meter.
T. G. G. H.	Lieut.-Col. T. G. G. Heywood. General Staff Officer, British Territorial Army Air Defence Formations.	Intelligence, Naval and Military.
T. Ho.	Thomas A. Howard. Of Messrs. A. G. Spalding & Bros., Sports Outfitters, London and New York.	Hockey (*in part*).
Th. R.	Th. Ruyssen. Professor of the History of Philosophy, University of Bordeaux. General Secretary, International League of Nations Union, Brussels.	Minorities.
T. N. C.	Thomas Nixon Carver, Ph.D., LL.D. Professor of Political Economy, Harvard University. Author of *The Distribution of Wealth*; *Principles of Rural Economics*; *Principles of Political Economy*; etc.	Federal Farm Loan System.
T. R.	Terry Ramsaye. Editor of film productions and writer on motion picture subjects. Author of *A History of the Motion Picture*.	Motion Pictures: *History*.
T. S. A.	Thomas Sewall Adams, Ph.D. Professor of Political Economy in Yale University. Adviser on Taxation, U.S. Treasury Department. Author of *Taxation in Maryland*; etc.	Income Tax (*in part*).
T. W. Ho.	Sir Thomas William Holderness, Bart., G.C.B., K.C.S.I. Late Permanent Under-Secretary of State for India. Author of *Peoples and Problems of India*; *Narrative of the Indian Famine, 1896–97*.	India (*in part*).
U. B. P.	Ulrich Bonnell Phillips, Ph.D. Professor of American History in the University of Michigan. Author of *The Life of Robert Toombs*; *American Negro Slavery*; etc.	Michigan.
V. G.	Valtyr Gudmundsson, M.A., D.Ph. Professor of Icelandic Language and Literature in the University of Copenhagen. Member of the Icelandic Parliament, 1894–1914.	Iceland.
V. L. E. C.	Victor Louis Emilien Cordonnier. General commanding the French Army in the East under General Sarrail. Author of *The Japanese in Manchuria*.	Frontiers, Battles of the (*in part*).
W. A. B.	William Adams Brown, A.B., Ph.D. Roosevelt Professor of Systematic Theology, Union Theological Seminary, New York. Author of *The Essence of Christianity*; *The Church in America*.	Fundamentalism and Modernism.
W. B.-A.	W. Broughton-Alcock, M.D. Director of the Central Laboratory, Ministry of Pensions, London.	Malaria (*in part*).
W. B. H.	Walter B. Harris, F.S.A. Moroccan Correspondent of *The Times* (London). Author of *The Land of an African Sultan*; *Travels in Morocco 1888–9*; *Morocco that Was*; etc.	Morocco, Campaigns in.

W. Bn.	WILLIAM BATESON, M.A., F.R.S. Late Director of the John Innes Horticultural Institution, Merton Park, Surrey, and Professor of Biology, Cambridge University. Author of *Mendel's Principles of Heredity*; *Problems of Genetics*; etc.	**Genetics; Mendelism.**
W. B. S.*	WILFRED B. SHAW. General Secretary, Alumni Association, University of Michigan. Author of *History of University of Michigan.*	**Michigan, University of.**
W. D. L.	WILLIAM DRAPER LEWIS, PH.D., LL.D. Director of the American Law Institute. Formerly Dean of the Law Department, University of Pennsylvania. Author of *Restraint of Infringement of Incorporeal Rights*; *Life of Theodore Roosevelt*; etc.	**Judicial Reform.**
W. E. El.	WALTER ELLIOT ELLIOT, M.C., D.Sc., M.B., CH.B. M.P. for the Kelvingrove Division of Glasgow. Parliamentary Under-Secretary of Health for Scotland.	**Health, Ministry of.**
W. E. I.	MAJOR-GENERAL SIR WILLIAM EDMUND IRONSIDE, K.C.B., C.M.G., D.S.O. Commandant, Staff College, Camberley, Surrey. Commander-in-Chief, British Forces in Russia, 1918–9. Author of *Tannenberg: the first thirty days in East Prussia.*	**Masurian Lakes, Battles of the.**
W. F.	LIEUT.-COL. WOLFGANG FOERSTER. Late General Staff, German Army. Keeper of Public Records, Potsdam. Formerly member of the Historical Section of the General Staff. Chief of the General Staff of the XI. Corps, 1915. Author of *Prinz Friedrich Karl von Preussen*; *Graf Schlieffen und der Weltkrieg.*	**Hindenburg, Paul von; Ludendorff, Erich.**
W. F. B.	WILLIAM F. T. BUTLER, M.A. Assistant Commissioner of Intermediate Education, Ireland. Formerly Professor of Modern Languages in Queen's College, Cork. Member of the Royal Irish Academy.	**Irish Free State:** *Education.*
W. F. F.	WALTER FRANCIS FREAR, LL.D. Formerly Chief Justice and late Governor of Hawaii. Chairman of the Hawaiian Code Commission, 1903–5. Author of *The Evolution of the Hawaiian Judiciary.*	**Hawaii.**
W. F. O'C.	LIEUT.-COL. SIR WILLIAM FREDERICK TRAVERS O'CONNOR, C.S.I., C.I.E. Formerly Resident in Nepal and British Envoy in Nepal. Signatory of Treaty between Great Britain and Nepal, 1925. Author of *Folk Tales from Tibet*; etc.	**Nepal.**
W. F. W.	WALTER FRANCIS WILLCOX, PH.D., LL.D. Professor of Economics and Statistics, Cornell University. Author of *The Divorce Problem—A Study in Statistics*; etc.	**Negro.**
W. G. Ma.	SIR WILLIAM GRANT MACPHERSON, K.C.M.G., M.B., D.P.H. Major-General, Army Medical Service. Editor-in-Chief, *Medical History of the War.* Served at the War Office as Deputy Assistant and Deputy Director-General of the Army Medical Service, and as a Member of the Advisory Board for Medical Services, and of the Army Sanitary Committee. Director of Medical Services, British Force in Macedonia, 1915–6.	**Medical Service, Army.**
W. Go.*	SIR WILLIAM A. M. GOODE, K.B.E. Unofficial Adviser to the Hungarian Government. President of, and British Representative on, the Austrian Section of the Reparation Commission, Vienna, 1920–1. Author of *Economic Conditions in Central Europe*; etc.	**Horthy, Admiral; Hungary** (*in part*); **Karolyi, Count.**
W. Gr.	WALTER GRAVELL, PH.D. *Ober Regierungsrat* in the Statistical Offices of the Reich, Berlin. Member of the German Statistical Society. Author of *Abhandlungen über Bevolkerungs-Berufs- und Betriebsstatistik*; etc.	**Germany:** *Area and Population.*
W. G. S. A.	WILLIAM GEORGE STEWART ADAMS, M.A. Gladstone Professor of Political Theory and Institutions, Oxford University. Fellow of All Souls College. Member of the British Development Commission.	**Government.**
W. H. C.	W. H. COATES, LL.B. Secretary of Nobel Industries, Ltd. (London).	**Income Tax** (*in part*).
W. H. Di.	WILLIAM HENRY DINES, F.R.S., F.R.MET.SOC. Author of *Characteristics of Free Atmosphere* and of numerous scientific articles in the *Proceedings* of the Royal Society, *The Journal of the Royal Aeronautical Society*; etc.	**Meteorology** (*in part*).
W. H. L.*	W. H. LEFFINGWELL. Management Engineer. Author of *Office Management*; etc.	**Office Appliances; Office Management.**
W. K. McC.	WILLIAM KIDSTON MCCLURE, C.B.E. Correspondent of *The Times* (London) in Rome. War Correspondent of *The Times* on the Italian Front, 1915–7. Author of *Italy's Part in the War*; *Italy in North Africa*; etc.	**Italian Campaigns; Italo-Turkish War.**
W. L. B.	WILLIAM LEWIS BLENNERHASSET, D.S.O., O.B.E. Formerly acting British Vice-Counsul at Kovno, Lithuania. Member of the London Stock Exchange.	**Finland:** *Political History*; **Lithuania:** *Political History.*
Wm. A.	SIR WILLIAM JAMES ASHLEY, PH.D., M.A., M.COM. Formerly Vice-Principal and Professor of Commerce of the University of Birmingham. Member of numerous British Committees on Economic Questions. Author of *Introduction to English Economic History and Theory*; *The Rise in Prices*; *The Economic Organisation of England*; etc.	**Imperial Preference.**

W. Me.	WILFRED MEYNELL. Editor of the Collected Works of Francis Thompson. Author of *Life of Benjamin Disraeli*; etc.	**Meynell, Alice.**
W. Mi.	WILLIAM MILLER. Correspondent of *The Morning Post* (London) in Athens and Rome. Author of *The Latins in the Levant*; *The Ottoman Empire and its Successors*; *A History of the Greek People* (*1821–1921*); etc.	**Fiume; Macedonia.**
W. M. J.	WILLIAM M. JARDINE, B.S., LL.D. United States Secretary of Agriculture. Formerly President of Experiment Station, Kansas State Agricultural College.	**Farmers' Organisations** (*in part*).
W. N. R.	WILLIAM NELSON RUNYON, A.B., LL.B. Judge, U.S. District Court, District of New Jersey. Instructor in New Jersey Law School. Formerly Acting Governor of New Jersey.	**New Jersey.**
W. O. S.	WILLIAM OSCAR SCROGGS, A.M., PH.D. Financial Writer on *The New York Evening Post*. Formerly Professor of Economics and Sociology, Louisiana State University. Author of *Filibusters and Financiers*.	**Louisiana.**
W. P. P.*	WOLF POCKLINGTON POND. Editor of *The Spur*, New York. Correspondent of *The Sporting Chronicle*, Manchester.	**Horse-Racing** (*in part*).
W. Rn.	WALTER ROSENHAIN, F.R.S., D.Sc. Superintendent of the Department of Metallurgy in the National Physical Laboratory, Teddington, Middlesex. Member of International Committee on Nomenclature of Iron and Steel. Author of *Introduction to the Study of Physical Metallurgy*; etc.	**Metallurgy.**
W. S. B.	AIR VICE-MARSHAL SIR WILLIAM SEFTON BRANCKER, K.C.B. Director of Civil Aviation at the Air Ministry, London. British Representative on the International Commission of Air Navigation.	**Flying.**
W. S. L.-B.	WALTER SYDNEY LAZARUS-BARLOW, M.D., F.R.C.P. Member of Cancer Committee, Ministry of Health, London. Late Professor of Experimental Pathology and Director of Cancer Research Laboratories, Middlesex Hospital, London. Author of *A Manual of General Pathology*.	**Medical Research.**
W. S. N.	HON. WILLIAM S. NOSWORTHY. Minister of Finance, Stamp Duties, Agriculture and Immigration; and Minister in charge of Land and Income Tax, State Allowances, Valuation, Tourist and Health Resorts and Legislative Department, New Zealand.	**New Zealand:** *Population and Settlement.*
W. W. M.	WILLIAM WATTS MACON. Editor of *The Iron Age*, New York.	**Iron and Steel.**
Y. H.	YRJO HIRN. Professor of Modern Literature, University of Helsingfors, Finland. Author of *Det heliga skrinet, Studier i den Katolska Kyrkans Poesi ock Konst*; etc.	**Finnish Literature.**

THE ENCYCLOPÆDIA BRITANNICA

THE SECOND OF THE THREE NEW VOLUMES

FABRE TO OYAMA

FABRE, JEAN HENRI (1823–1915), French entomologist, was born at St. Léons in Aveyron Dec. 21 1823. He received the elements of a classical education at Rodez, continuing it further at the école normale of Vaucluse. But his whole bent was for science, and after he had become a teacher at Carpentras, he worked in his spare hours at physics and mathematics, and became interested in insects, the study of whose habits was to form his life-work (*see* 3.626, 6.672, 14.180). His observations were published in *Annales des sciences naturelles* (1855–8), followed by *Souvenirs entomologiques* (1879–1907). He died at Sérignan, Provence, Oct. 11 1915.

FACTORY AND WORKSHOP LAW (*see* 16.7).—Factory and workshop law forms part of the mass of modern legislation referred to as "industrial law" or "labour legislation" (*see* 16.7). The limited term "factory and workshop law" arose from the way in which the British Parliament defined workplaces for the purposes of regulation. The line of demarcation thus drawn between manufacturing and other occupations and the particular grouping of subjects regulated by the British Factory and Workshop Acts are more or less arbitrary and are not necessarily found in the laws of other countries. Nor is it possible, in a practical study of British legislation, to adhere strictly to Factory and Workshop Acts properly so-called. There are many statutes of recent years which affect the health, safety and welfare of workers in factories and workshops without fitting in to the general scheme of the Factory and Workshop Acts. A list of Acts since the beginning of 1911, amending those Acts or having an important bearing upon conditions of work in factories and workshops is appended. In addition, a large number of Orders have been issued both under the Act of 1901 and under the later Acts, which have given important new powers of regulation to the Home Secretary. Indeed it is largely by Orders that the factory and workshop law of Great Britain has been kept up to date.

I. GREAT BRITAIN

Taking the matters regulated by the Consolidating Factory and Workshop Act of 1901, as a basis, we may consider recent developments under the following six headings:—

1. *Health and Safety.*—The formerly important provisions for protecting children from risk of accident or injury to health became obsolete, when "children" as defined by the Act of 1901 were excluded from work of all kinds in factories and workshops. On the other hand, certain general provisions of the Employment of Children Act, 1903, apply, in Scotland only, to girls and boys of 14 years of age employed in factories and workshops, since the Scottish Education Act of 1918 raised to 15 the age of children affected by them. The provisions of the Act of 1901 relating to humidity and ventilation in cotton-weaving sheds were modified by regulations substituted for them under powers given by the Cotton Cloth Factories Act of 1911. The conditions under which accidents must be notified have been changed both as regards the nature of the accidents notifiable and as regards procedure.

Under sections included in the Workmen's Compensation Act, 1923, any accident occurring in a factory or workshop causing death or disabling a worker for three days must be notified, and notice is given to the inspectors of factories only, the former duties of certifying surgeons in this connection having been abolished by the Police, Factories, etc. Act, 1916. However, the duties of certifying surgeons in connection with health remain, and have been extended both by Orders making several further diseases compulsorily notifiable, and also by the Lead Processes Act of 1920, which prescribes the periodical medical examination of all women and young persons employed in lead processes (a rule which previously existed only in those lead trades for which it had been prescribed by regulations). This Act contains, in addition, some general rules of hygiene to be observed whenever any woman or young person is employed in contact with lead compounds. It is, however, chiefly important in having been adopted in order to give legal confirmation to a recommendation of the International Labour Organisation (I.L.O.), since nearly all the ground was already covered by regulations under section seventy-nine of the Act of 1901.

Great progress has been made with regulations under that section. Between 30 and 40 codes of regulations are in force, mostly very detailed and highly technical. By means of this system of regulations, the British law for the protection of workers in trades involving special risks is kept fully abreast of medical knowledge and scientific discovery. Many other countries have, especially in recent years, adopted a similar system. But none can show regulations more carefully and scientifically prepared or better observed in practice. The regulations are aimed at every kind of special industrial risk—risk of poisoning, risk of infection, risk from injurious fumes and from excessive and injurious dust, risk of accident, risk of overstrain. The regulations of 1925 restricting the lifting of weights in the woollen or worsted industry relate exclusively to the last-named risk. One of the most interesting sets of regulations, and quite the most elaborate, is the code for the pottery industry drawn

up in 1913 after an exhaustive investigation by a departmental committee. Every process and branch of this complicated industry is dealt with in detail.

Interesting examples of technical rules for the prevention of accidents are to be found in the regulations of 1922 for woodworking and in the revised regulations for dock work issued in 1925. Occupations less ostensibly dangerous than those regulated under section 79 of the Act of 1901 may be made the subject of so-called Welfare Orders under section 7 of the Police, Factories, etc. Act of 1916. Welfare orders may deal with facilities for preparing and taking meals, with the supplying of drinking water, protective clothing, ambulances and appliances for first-aid, seats in work-rooms, washing facilities and accommodation for clothing, with the supervision of workers and (a later addition, by Order) with the provision of rest-rooms. Many of the subjects thus relegated in the British system to Orders are to be found in the statutes of other countries and will no doubt be included in some future consolidating British Act. Meantime these Orders provide a practical, if gradual, means of bringing the British law of a quarter of a century ago up to date as far as the health and well-being of the workers is concerned. Arrangements for "first-aid" (or ambulance rooms) were later prescribed for all "factories," namely by section 29 of the Workmen's Compensation Act, 1923. This section also gave the Home Secretary wider powers in the matter of accident prevention. For instance, sub-section (3) gives powers so defined as to enable him to require employers to put into operation modern safety methods (inspired largely by American practice and adopted of recent years by many British firms on their own initiative), such as the appointment of safety engineers or representative safety committees, whose business it is to check the human as well as the mechanical element in accidents (*see* SAFETY FIRST). The Anthrax Prevention Act, 1919, was adopted in order to enable practical use to be made of a newly discovered method of disinfecting raw wool and hair likely to be infected with anthrax.

2. *Hours of Work.*—The provisions of the Factory and Workshop Acts relating to hours of work have been only slightly altered during the period under review. Consequently they have grown out of date, and are in practice largely obsolete. The restrictions placed upon the night work of women and boys by the Act of 1901 were supplemented by the Employment of Women, Young Persons and Children Act, 1920, adopted so as to embody in law the provisions of the Conventions on that subject. As far as concerns women the Act made no practical difference. But as regards male young persons it allows fewer exceptions to the general prohibition of night work than the old law and never allows boys under 16 to work at night. It therefore overrules or modifies many of the special exceptions formerly allowed both as regards employment in night shifts and as regards encroachments on the rigidly prescribed period of 11 hours night's rest.

The Act introduced another important change, permitting the employment of women and boys over 16 in two day-shifts of eight hours. This necessitated an extension of the strict outside limits for employment under the Act of 1901, since the two shifts could not be fitted in unless the second shift could continue at work up to 10 o'clock at night. The clause aroused considerable opposition and was eventually adopted in a guarded form. In the first place, it was of only temporary operation, and from 1925 needed to be annually extended. In the second place, the Home Secretary may only allow the two shifts in any undertaking on the joint application of the employer and a majority of the workers concerned, and the Act enables an organised trade as a whole to resist the introduction of the two-shift system by means of a kind of veto. The Home Secretary may attach conditions to the permission, such as the adoption of various "welfare" arrangements, including, for instance, the provision of special transport facilities for women and young persons having to travel to or from work at an unusually early or late hour. The indirect effect of the Trade Boards Acts on hours in factories and workshops may well be noted. Although the trade boards cannot directly regulate hours of work, they influence actual hours by fixing a standard week (usually about 48 hours) beyond which higher rates of wages must be paid.

3. *Exclusions from Industrial Work.*—As regards the exclusion of persons from industrial work, the most important recent change has been the raising to 14 of the age limit for young workers to enter upon such employment. This rule was applied by the Employment of Women, etc. Act of 1920 to "industrial undertakings," so defined as to cover all "factories and workshops." The same result had already been attained by the two Education Acts of 1918, which are still relied on for controlling the admission of children to domestic workshops. The Scottish Education Act of 1918 excludes children from factories and workshops up to the age of 15 unless they have procured exemption from school attendance. Both under the Education Act of 1921 and the Scottish Act of 1918, employers may be required to allow young persons over 14 time off from their work for attendance at continuation classes. The Lead Processes Act, 1920 (see 1 above) out of deference to a recommendation of the International Labour Organisation, excluded women and young persons by law from certain lead processes in which, in practice, they were not employed at all.

4. *Home Work.*—Home Work Orders were issued in 1911, 1912 and 1913, extending to a number of trades the provisions of the Act of 1901 relating to lists of outworkers and the prohibition of work in unwholesome or infected premises.

5. *Particulars of Work and Wages.*—Part VII. of the Act of 1901, relating to particulars of work and wages, has been extended by Order to a large number of additional trades.

6. *Enforcement of the Law.*—The factory inspectorate was entirely reorganised after the War. For this no legislation was necessary. One result of the reorganisation was the abolition of the special women's branch and the admission of the women inspectors to all grades with the same duties as the men inspectors. The enforcement of the sections of the Act of 1901 relating to the employment of women after childbirth and to bakehouses have been transferred to the Ministry of Health and the Scottish Board of Health.

II. THE BRITISH DOMINIONS

Both in Northern Ireland and in the Irish Free State the British factory and workshop law existing at the time when the recent constitutional changes were introduced remains in operation for the time being. The Parliament of Northern Ireland can now amend or develop the law, subject to the possible intervention of the British Parliament. The Irish Free State, like all other self-governing Dominions, is free to legislate on this matter quite independently of the British Parliament, but up to March 1926, had made no changes beyond issuing two sets of regulations under section 79 of the Act of 1901. The other British Dominions have steadily developed their industrial legislation. In Australia factory and workshop law of old standing and often amended has in many cases been consolidated more or less recently. It is important to note that industrial arbitration awards and the determinations of wages boards form an essential part of the law in Australia and New Zealand and represent a type of regulation not to be found in so fully developed a form in any other country, though South Africa has recently adopted a somewhat similar method suited to her industrial conditions. In Canada, the most interesting recent legislation from the point of view of factory and workshop law is that of British Columbia putting into operation the proposals of the I.L.O. on hours of work and the employment of women before and after confinement. In India, likewise, certain proposals of that body have been put into force by an Act which made many important amendments in the Factory Act.

III. EUROPEAN COUNTRIES

Both in the years immediately preceding and during the War, nearly all the countries of Europe were gradually developing or consolidating their industrial law. France began the codification

of her labour laws in 1910, and Book II. of the Code of Labour, which covers most of the subjects here considered, was issued in 1912. All existing Industrial Codes have been amended more or less since 1910 and new and improved Factory Acts, superseding older laws, were adopted in Sweden in 1912, Denmark in 1913, Switzerland in 1914 and Norway in 1915. Special laws protecting women and young workers only were newly adopted or amended in Austria, the Netherlands and Portugal in 1911, in Greece and Spain in 1912 and in Belgium in 1914, while developments in legislation concerned with industrial hygiene and safety may be noted in Finland (1914), Germany (the Home Work Law of 1911), Greece (1911, and a bakeries law of 1912) and the Netherlands (a special law for the protection of dock labourers, 1914; and an amendment of the Safety Act, 1915). Finland issued an ordinance in 1917 covering nearly all the ground of factory and workshop law.

Since 1918 there has been a still more remarkable activity in labour legislation, due in large measure to the industrial ferment caused by the War. As the process of legislation goes on, we can continually trace the influence of the I.L.O., tending to make the laws approximate broadly in aim, but not preventing them from differing widely in form and detail. The newly created or enlarged countries have the task of adapting the laws already existing in newly acquired territory. Of these, only the Serb-Croat-Slovene Kingdom has as yet fully co-ordinated and codified her industrial law (by the Workers' Protection Act of 1922). Poland has incorporated certain principles of industrial regulation in her Constitution.

The most striking part of post-War labour legislation is that which restricts the hours of labour of adult men (as well as of women and boys) to approximately eight a day (*see* HOURS OF LABOUR). Many countries have, in addition, amended their law so as to conform to various proposals of the I.L.O. relating to the employment of women and boys at night and in lead processes, the protection of women workers before and after childbirth and the age limit for the employment of children. It should be noted that night-work for adult men is prohibited in general, subject to special exceptions, in several European countries (Belgium, Czechoslovakia, Netherlands, Norway, Poland and Switzerland) and may be restricted by order in Hungary and the Serb-Croat-Slovene Kingdom. Home-work laws, dealing with hygiene as well as wages, were adopted in 1918 in Austria and Norway, and in 1919 in Czechoslovakia. The tendency for compensation laws to deal also with accident prevention should not be overlooked. A new departure may be noticed in recent laws giving workers the right to a period of annual leave with pay. Laws have been adopted in a number of countries to establish or reorganise systems of inspection, and the influence which works councils (*q.v.*) may have upon the observance of factory and workshop law should be noted. Soviet Russia has produced a comprehensive labour code and a large number of detailed regulations for health and safety.

IV. THE UNITED STATES AND SOUTH AMERICA

In the United States, labour legislation has been checked to some extent by the lack of a uniform standard among the States, and by the rigid application by the courts of constitutional principles now out of harmony with public opinion. But, in spite of this, factory and workshop law has steadily developed in most of the States during the period under review, and some States have now advanced labour codes. The problem of child labour has been receiving much attention and a constitutional amendment is being considered to enable Congress to regulate the employment of children. In some States great improvement in accident prevention and hygiene have been brought about through the action of industrial commissions or boards, with wide powers of investigation into, and regulation of, trades. An original plan has been adopted to provide for the rehabilitation of workers permanently injured by their work, on the analogy of those injured by war (Vocational Rehabilitation Act, 1920).

In the republics of Central and South America, a considerable amount of factory and workshop law is to be found, in some cases embodied in elaborate codes. In Mexico, the Labour Codes of the various States are based on general principles laid down in an amendment to the federal Constitution of 1917.

V. ASIATIC COUNTRIES

Factory and workshop law made a start in Japan with the Factory Act of 1911, which was amended in 1923 and supplemented by an Act on the minimum age for industrial employment in order to put into operation certain of the standards specially recommended for Japan by the I.L.O. The only other Asiatic country where factory legislation is, as yet, at all advanced, is India, to which reference has already been made. But, in 1923, a Factories Act emerged in China, and Persia issued a decree for the protection of workers in carpet factories.

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(2) *Acts of British Dominions.* Australia: The Commonwealth Conciliation and Arbitration Acts, 1904–20 (see vol. 18, 1920, *Acts of the Commonwealth of Australia*); Commonwealth Conciliation and Arbitration Act, 1921. New South Wales: Factories and Shops Act, 1912; Industrial Arbitration Acts, 1912–20 (Incorporated version: *Statutes of New South Wales*, 1921, vol. 2); Industrial Arbitration (Amendment) Act, 1922; Eight Hours Act, 1916; Eight Hours (Amendment) Act, 1922. Queensland: Factories and Shops Acts, 1900–22 (*i.e.*, Acts of 1900, 1908, 1914, 1916, 1917, 1920 and 1922); Industrial Arbitration Acts, 1916–25 (*i.e.*, Acts of 1916, 1923, 1924, 1925). South Australia: Industrial Code, 1920; Industrial Code Amendment Acts, 1921 and 1924. Tasmania: Factories Acts, 1910 and 1917; Wages Boards Acts, 1920 and 1924. Victoria: Factories and Shops Acts, 1915–22 (*i.e.*, Acts of 1915, 1919, 1920 2nd session [two Acts], and 1922). Western Australia: Factories and Shops Act, 1920; Factories and Shops Amendment Act, 1921 (No. 4 of 1922); Factories and Shops Amendment Act, 1923; Industrial Arbitration Acts, 1912 and 1920. Canada: See *Labour Legislation in Canada as existing Dec. 31 1920*, and subsequent annual supplements (Department of Labour, Ottawa). India: The Indian Factories Act, 1911; The Indian Factories (Amendment) Acts, 1922 and 1923. New Zealand: Factories Act, 1921–2; Industrial Conciliation and Arbitration Act, 1925. South Africa: Factories Act, 1918; Mines and Works Act, 1911; Regulation of Wages Act, 1918; Industrial Conciliation Act, 1924; Wages Act, 1925.

(3) *International Sources.* (*a*) Most of the world's factory and workshop law of recent years can be found in one or other of the following collections of translations of labour laws: I. *The Bulletin of the International Labour Office (of Basle)*, which ceased with the year 1919 (vol. 14 of the English edition, corresponding to vol. 18 of the German and French editions; *Bulletins des Internationalen Arbeitsamtes* [Jena]; *Bulletin de l'Office International du Travail*, Berger Levrault). II. *The Legislative Series of the International Labour Office*, Geneva (German edition: *Gesetzreihe*; French edition: *Série Législative*) appearing annually, the laws being issued first in a series of advance brochures, referred to by abbreviated names of countries and numbered under each country. The brochure edition began in English for the year 1919 and covers the same ground as the *Bulletin of Basle* for that year. The annual volumes began with the year 1920. The volume for 1921 was issued in two parts. III. The *Annuaire de la Législation du Travail* (in French only, but giving the original texts also in some years) published annually by the Belgian Govt. up to the year 1913 and closing with a collection of labour laws in several volumes covering the War period. (*b*) *Factory Inspection, historical development and present organisation in certain countries*, I.L.O., Geneva, 1923; *International Labour Review* (monthly), articles on the labour laws of various countries, and summaries of official reports of factory inspectors.

(4) *National Sources.* France: *Code du Travail et de la Prévoyance Sociale*, editions by Berger Levrault or Dalloz.

Great Britain: *Redgrave's Factory Acts*, 13th edition by C. F. Lloyd (Butterworth, 1924); *Factory and Workshop Orders*, issued every few years by the Home Office (H. M. Stationery Office); *Annual Reports of the Chief Inspector of Factories.*

United States of America: *Labor laws of the United States with decisions of courts relating thereto*, Bulletin of the Bureau of Labor Statistics, No. 370, 1925 (see also list of other *Bulletins* on labor legislation and court decisions, appended to No. 370). (S. S.)

FACTORY DESIGN.—The selection of the site and the design of factory buildings are most important economic factors in manufacture because they may contribute very seriously to the cost of production, not only on account of the initial outlay of capital required, but because of their influence on efficient production. The elimination of waste, whether of material, time or effort, is the chief feature of all manufacturing, and the design of factory buildings plays its part in this elimination.

The haphazard methods of erecting factory buildings are passing, and more systematic consideration is being given to their planning and erection, though even at the present time more effort is devoted to providing good machinery than good, suitable buildings. The factors most largely influencing the design of factory buildings are large scale and standardised production; factory legislation, both government and local; building by-laws; insurance conditions, and the welfare of the employees.

Regarding the actual design and building of factories, the determining factor is naturally the character of the product, but certain general considerations apply whatever the product. The architect of every new factory should make himself thoroughly familiar with the processes and products of the factory before attempting his design, which should be made with a view to meeting adequately the future needs of the industry which, under favourable conditions, will naturally expand, especially as the present-day tendency is towards amalgamations and the formation of large corporations. One of the best ways of providing for this contingency is to design all buildings on the principle of suitable standardised units which can be increased as necessity arises. These standardised units should represent a complete organisation, but should be so arranged as to make future extensions possible without interfering with the existing business.

Selection of Site

The effect of location is common to all factory design, and in selecting a site all the following should be taken into account:—

Nearness to raw material supply is an important factor where raw materials are bulky and cheap, but as the bulk decreases and the value increases this factor becomes less important. It is necessary to study the convenience of existing railway lines, freightage, etc. Proximity to a canal is not the important feature it was formerly. The contour of the land should be studied, not only in so far as it presents a suitably level site for building purposes, but also in relation to canals, railways and other means of transport.

The supplies of electricity, gas and water are all important considerations, especially where, as in the case of some industries, enormous quantities of any one are needed, as, for example, in the pulp and paper industry, which requires a vast amount of water; or where the cost of power represents a large part of the ultimate cost of the product. The climate is an important factor in certain industries, as for example, in the textile industry where a humid atmosphere is necessary, though in this case it is becoming less important than formerly because the humidity can be controlled artificially.

Suitable Labour Supply.—Where the necessary labour supply is of the unskilled type this is not an important factor, but where skilled labour is essential, it is necessary to locate the industry in a district where training and heredity have developed the required type. Skilled labour is not so migratory as unskilled on account of social and family attachments, etc.

Room for Expansion.—It would, of course, be futile to place a factory in a crowded and congested area where there is no space for expansion. The present tendency is for factories to be built on the outskirts of existing industrial areas because here (providing transport facilities are satisfactory, which is not always the case) land is usually cheaper, taxation lower and working conditions better than in the towns. It is, however, difficult to induce labour that is accustomed to town life to migrate to country districts and this, coupled with the housing question (*see* Housing) may be an important factor operating against an otherwise ideal site. Further, some industries may be dangerous or offensive, and these must be located well away from congested areas.

Other Factors.—Capital available for investment, laws affecting the tenancy of land, sewage, floods, drinking water supply, etc., are all important points to consider in the selection of a site.

Types of Factory Building

The type of building erected for a factory depends entirely on the product to be manufactured, and the architectural form is dominated by this factor, and, in the majority of cases, by the great need for economy, but an attractive looking plant has a marked effect on employees, and has an advertising value.

Main Types.—There are, in general, three main types of factory building:—

1. The single story building of the weaving-shed type, having a saw-toothed roof consisting of a series of unequally inclined ridges, glazed usually only on the north side which permits of uniform lighting without shadows. In the single story type when the site does not permit of north lighting, the ridges, which must be equally inclined, can be glazed on both sides. This type (see fig. 1 on plate) is not well adapted for overhead shafting, cranes, etc.
2. The one-story building with large truss spans, provided with accommodation for travelling cranes, etc. This is the foundry, forge and machine shop type and is suitable for medium and heavy work (see fig. 2 on plate).
3. Multi-story buildings for all kinds of manufacture and storage, except in the case of the heaviest industries (see fig. 1 on plate).

Naturally, each type has its advantages and disadvantages and must be considered in relation to the product of the factory, but generally, when cost of land is not prohibitive, and the product is bulky, the natural choice would be towards a one-story building. Each of these three types of building permits of a construction of any one of the following kinds:—

(*a*) Timber and masonry, known as "Mill construction."
(*b*) Steel framework.
(*c*) Reinforced concrete.

Whatever type of construction is employed, the predominating necessity is "fireproofness." In the event of a fire, although the actual amount of material damage is recoverable by insurance, the loss through disorganisation is not recoverable, and frequently is so overwhelming as to prevent ultimate reorganisation.

Mill Construction.—Mill construction is of various types, but in the main, the outside walls are of masonry, the floors of wood, and the roofs, posts, joists and girders of wood or metal. Where much timber is involved the great disadvantage of this type, which for other than heavy work is in other respects satisfactory, is that for fire-resisting purposes it cannot be recommended. This type of building is seldom used for heights of more than six floors on account of its lack of lateral stability, which is chiefly dependent on the masonry of the walls, and which, if developed to any height, would require to be supported by excessive-sized pillars and increased thickness in the lower stories. The adoption of this type of building is getting less and less.

Steel Framework.—Buildings of this type were made possible by the introduction of the Bessemer process of steel manufacture. Here rolled steel structural members are used and filled in with walls, floor and roof, etc. The steel members are riveted, or bolted together. Where long spans without support are necessary, steel framework is essential, and it is also necessary in the case of high walls exposed to wind pressure and to the lateral forces of moving cranes. Steel framework buildings are not fireproof because exposed steelwork twists and buckles when subject to intense heat, thus wrecking the building more quickly than the fire itself. If the structural steel framework is encased in fire-resisting material such as concrete, it is admirably suitable for the interior of a factory (*see* Ferro-Concrete).

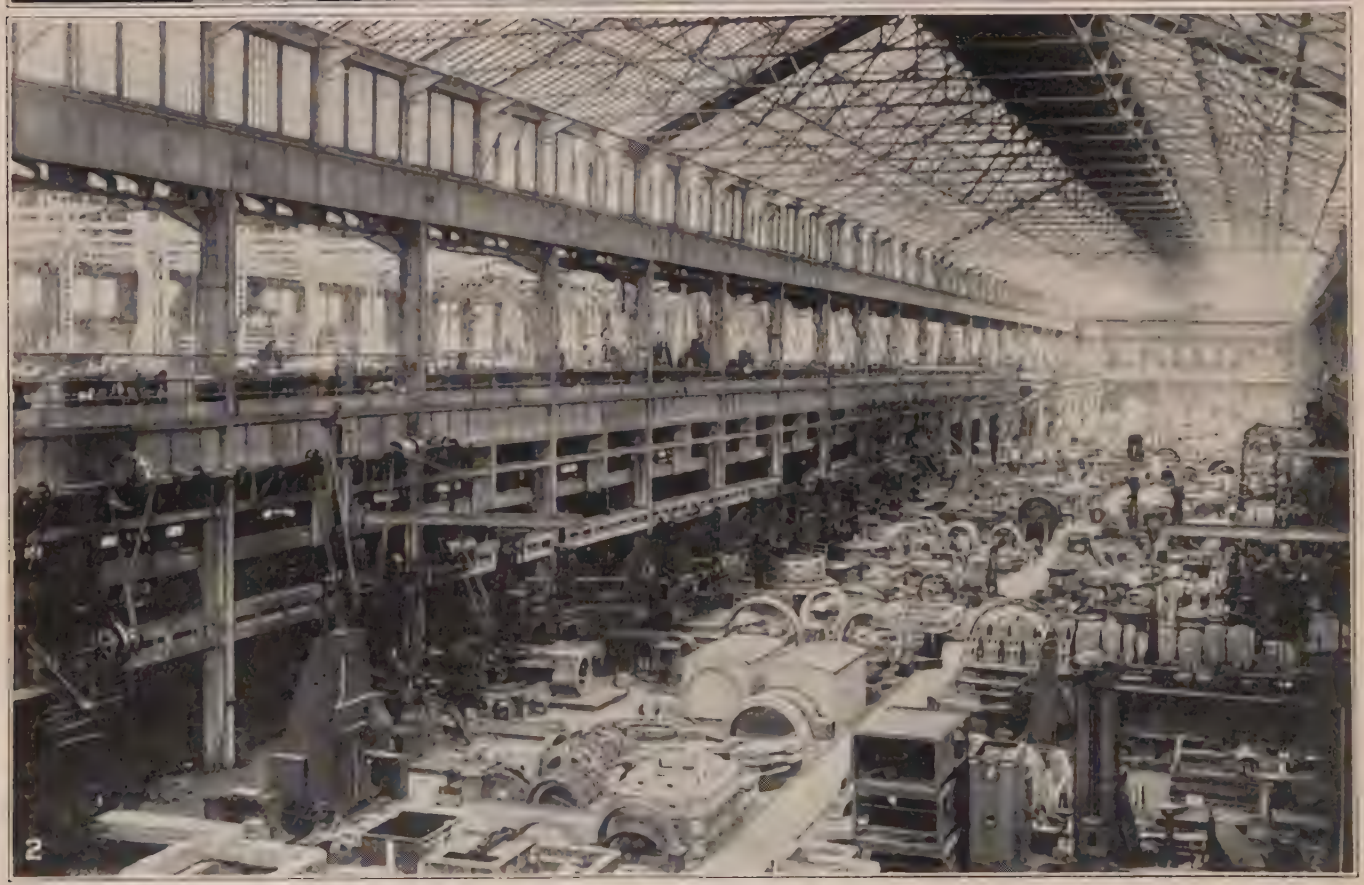
Reinforced Concrete.—Buildings of this material have come to be recognised as one of the standard types for industry. The material is classed as "fireproof" and will stand the destructive effects of fire as well as any material. It is not usually damaged beyond repair by fire, and seldom, if ever, destroyed. It is a particularly durable material, and its durability improves with age. It is particularly well suited for multi-story buildings containing vibrating machinery or machines with heavy reciprocating parts. "Daylight factories" giving the maximum of natural lighting have come into vogue with reinforced concrete

Courtesy of A. M. Creighton, Esq. and Turner Construction Co.

MODERN FACTORY DESIGN (AMERICAN)

Shoe-factory, near Boston, Mass., designed for a maximum of daylight. Harry Field Kellogg, Architect. This L-shaped building, with combined clock and sprinkler-tank tower at its western angle, is built of reinforced concrete throughout. The piers are between 16 and 17 ft. apart, with glass in metal sashes extending from pier to pier. The brick curtain walls, of no structural function, lend a touch of colour to the building; being only the height of a work-bench, they do not decrease the effective lighting of the factory. The floors are of flat slab construction.

FACTORY DESIGN



MODERN FACTORY DESIGN

FIG. 1. Single-storey weaving shed and multi-storey spinning mill of unit construction.
FIG. 2. Interior of single-storey engineering shop.

because columns or pillars may be more slender and the steel framework windows used give an increased lighting area. In cases where the floor load is higher than 200 lb. per sq. ft., reinforced concrete buildings are cheaper than those of mill construction.

Reinforced concrete buildings have developed almost entirely since 1910. The first line of development was along the form of beam and girder construction, but now the flat slab method of flooring is used, especially in cases where the live load is 150 lb. or more per square foot. For lighter loads, the development has been towards the long span joist construction with a filler of metal, tile, terra-cotta or gypsum block, which reduces dead load and saves concrete.

Details of Construction

Foundations.—In choosing a site an important point is that of its levels, and a site poor in this respect purchased at a low figure may eventually prove a most costly one. It is also important to have full knowledge of any mineral workings going on, or likely to go on, as these might cause subsidence. The foundations of buildings which are to house heavy machinery must be ample enough to absorb vibration, and in the case of such implements as the steam and power hammer, or jarring machinery for foundries, the foundations should be entirely separate from all building structures or their foundations. It is important to choose a site where there exists a good subsoil of clay or rock, otherwise the expense of piling or rafting might make the cost of the buildings very high or even prohibitive.

Floors.—These should be designed to provide facilities for future changes, especially if they are of reinforced concrete, and ducts should be arranged to accommodate pipes, etc. Conduits should be properly placed and openings provided for belts, shafting and other accessories, properly protected. Where apparatus must be taken through floors, ample openings and trap doors or removable floor slabs are essential. Floors formed of concrete and merely spade-finished are unsuitable, and their durability should be increased by some form of floor-hardener or by the application of paving. Pavings are of many kinds, metallic, granolithic, cemented, of fir boarding laid on battens, pitchpine boarding, bricking, maple boarding, rock asphalt, wood blocks, etc. Each of these types has its advantages and disadvantages, some being unsuitable on account of dust, others on account of the discomfort to workers, and every building requires separate consideration. Floor areas must be laid out so as to avoid the conflict of travel in opposite directions and to permit of easy transport.

Lighting.—Windows, while no more expensive in initial outlay than walls, are an expensive item in upkeep, and with a large area of glazing the size of glass forming a unit should be of the order of 1 ft. 4 in. by 2 ft. or even larger, if of the roughcast or "Prismatic" type. It is not usually essential that all parts should be made to open. Steel sashing, although difficult to clean and a source of lost heat, is preferable to wooden sashing as it provides increased lighting facilities, giving 80% to 90% light area as against 50% to 70% for wooden sashes and frames. One-story saw-toothed buildings should have roof windows facing north to avoid direct sunlight.

Walls.—The thickness of building walls is dictated by Building Acts and by-laws, and in most countries there is no possibility of erecting such walls of less thickness than 9 in. or 14 in., depending on the height and length of the wall and whether steel framework is used. As already stated in connection with the various types of building construction, various materials are used for walls such as brick, concrete, stone, etc. Where hoists and cranes are fitted these must be provided with ample support.

Roofs.—Roofs are one of the large items in building construction. Their particular form is dependent upon the intended purpose of the building; a high pitched gabled roof is the best for forges, foundries and other shops engaged in hot processes in which large quantities of heat require to be dissipated, and in other cases where a level ceiling is not required; the glazed saw-toothed form of roof provides the best condition of steady, uniform, natural lighting; the flat roof is the natural type for buildings with interior columns. Whatever the type the essential features are water- and fire-proofness. For general purposes the best material is mineral rock asphalt, which is unaffected by heat or cold and requires no yearly treatment, and is also capable of withstanding traffic without damage. Where sloping roofs are used, steel or reinforced concrete roof principals are employed, and this method of support is now as cheap as steel. Slates as a covering are high in first cost and heavy for long span roofs, but if of good quality are very durable. Bituminous felts and other compositions in sheet form are low in first cost, but require special treatment every few years.

Heating and Ventilation.—Of these two subjects the latter is the more important. In an ordinary factory the air should be changed three to five times per hour, while under some circumstances it should be changed as many as 20 times per hour. The temperature also varies with the nature of the work carried on, but a good average is 57° F., though for heavy manual labour a lower temperature should prevail, and for sedentary work, a higher. Various systems of ventilation and heating are employed, but the most suitable for the particular case must be selected, care being taken to economise space and avoid interference with cranes, conveyors, etc. (*see* Public Health).

Stairways, Lifts, Elevators, etc.—Stairways should be ample for emergencies, and give passengers the least inconvenience, a 6½ in. rise being considered good practice. Lifts should be encased with brick walls to prevent the spread of fire, and the openings should be fitted with doors of fire-resisting material made to close automatically in case of fire.

Power Supplies.—Where power is generated on the site, the plant should be located at a point most convenient for the handling of fuel and ashes, and all boiler and engine-room equipment should be capable of extension. Where live steam is used in the manufacturing processes, the power plant should be situated centrally in order to avoid the necessity of long lengths of piping and excessive loss of heat.

Fire Protection.—The installation of apparatus to deal with outbreaks of fire is a necessity in all industrial buildings. The most usual form is by the sprinkler system in which pipes are fixed horizontally along the ceiling, and supplied with water which is not released until the temperature in the building is sufficiently high to melt the solder which holds the automatic valve of the sprinklers in position. When this is released the water is discharged over the affected area. Where sprinklers are not used, hydrants with lengths of hose should be fixed near stairs and in easily accessible positions and fire buckets and chemical fire extinguishers should be placed within the reach of anyone in the building. In the case of some trades, buckets of sand are more useful than water. Lightning-conductors should be fixed to all buildings.

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FAEROE ISLANDS (*see* 10.123).—A group of 21 islands belonging to Denmark, situated in the North Sea, 7° east, 62° north. The area is 511 sq. m. and the population (1921) 21,532. Since 1910 the development of an active movement in favour of self-government has been the most prominent feature of politics in the Faeroes. Though the *Sjálvstýrisflokkur*, or Home Rule party, was first organized as lately as 1906, it is true that some points in the nationalist programme have an earlier origin.

Rise of Nationalism.—The endeavour to secure for the national speech of the inhabitants a position of equality with the official Danish may be said, indeed, to date from the middle of last century, when V. U. Hammershaimb, by systematising the local language, adapted it to literary use. The encouragement of this language was a main plank in the programme of the *Föroyingafelag*, a society instituted in 1889. The addition, however, to such comparatively innocent expressions of nationalism, of claims for complete political autonomy and even independ-

ence, is doubtless largely due to the stimulus of recent events. The success of a similar movement in Iceland (*q.v.*), which secured for that colony, in 1918, a status of sovereign independence, has no doubt played its part, and it is significant that it was in the same year—1918—that the Home Rule party of the Faeroes first obtained a majority in the local Lagting. To this stimulus was added, at about the same time, the prominence given to self-determination during and after the World War.

But above all, the dispute between Denmark and Norway over the question of Greenland revived old complaints as to the methods whereby the Danish negotiators, at the Treaty of Kiel in 1814, managed to retain possession of the ancient Norwegian colonies, Iceland, Greenland and the Faeroes, while the separatist tendencies of the Home Rulers were encouraged by certain sections of the Norwegian press and by private individuals in Norway. Under these influences the nationalist leader in the Faeroes, Johannes Patursson, went so far, in 1923, as to suggest the possibility of complete separation from Denmark and an ultimate union with Norway. This, however, is no part of the official programme of his party, the political aims of which do not seem to go much further than an effort to secure autonomy by giving to the Lagting legislative instead of, as at present, merely advisory powers.

With regard to the language question, some progress has been made, and since 1912 the use of the local as well as the Danish language in education and in the conduct of religious services has, to some extent, been authorized. The claims of extreme nationalists in this respect are, however, not yet satisfied. The complaints of Danish misrule made by Home Rulers seem, as is usual in such cases, based more on the events of the past than the present. The Danish Govt. has voted considerable sums towards the construction of roads and harbour works, as well as to the support of education. The large increase in the population, which has nearly doubled since the beginning of the century, indicates a considerable measure of prosperity.

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(G. M. G.-H.)

FAGUET, ÉMILE (1847–1916), French critic and man of letters (*see* 10.125), published in his later years *Rousseau penseur* (1910); *Madame de Sévigné* (1910); a study of *Rostand* (1911); *Vie de Rousseau* (1911); *Les amies de Rousseau* (1912); *Rousseau artiste*, etc. (1912); *En lisant Molière* (1914) and *Mgr. Dupanloup* (1914). He died in Paris June 7 1916.

FAIRBAIRN, ANDREW MARTIN (1838–1912), British divine (*see* 10.129), died in London Feb. 9 1912.

FAIRBANKS, CHARLES WARREN (1852–1918), American politician, was born near Unionville, O., May 11 1852. Graduating from Ohio Wesleyan University in 1872, he was admitted to the bar in 1874, and began practice at Indianapolis, Ind., where he became a railway financier. He was chairman of the Republican State Convention in 1892, 1898 and 1914, and in 1896 was elected to the U.S. Senate. He was chairman of the U.S. representatives on the British-American Joint High Commission for dealing with Canadian questions in 1898 and 1903, being re-elected to the Senate in the latter year. In 1904 he was elected Vice-President as a Republican with Theodore Roosevelt. In 1916 he was again nominated for the vice-presidency, but was defeated. He died at Indianapolis June 4 1918.

FAIRBANKS, DOUGLAS (1883–), motion picture actor and producer, was born at Denver, Colo., May 23 1883. He studied at the Colorado School of Mines and later attended Harvard University, but left the university to enter a brokerage firm in Wall Street. In 1901 he abandoned finance and took up the stage as a career, eventually starring in several plays, among them *The Man of the Hour* and *The Gentleman from Mississippi*. Leaving the stage in 1915, he devoted himself to the screen and achieved success in *The Lamb*, his first picture. In 1917 he became head of his own producing company. His pictures have been distinguished by the wholesomeness of their themes and the extraordinary amount of action displayed. His later productions, such as *The Thief of Bagdad*, exhibit great mechanical ingenuity and a genius for picturesque background. His other pictures include, *The Mark of Zorro*, *The Three Musketeers*, *Robin Hood*, *Don Q* and *The Black Pirate*. He married, March 28 1920, as his second wife, Mary Pickford.

FAISAL AL HUSAIN (1885–), King of 'Irāq, was born at Taif, the third son of the Sharif Husain. Faisal traced his descent from Fatimah, only surviving child of the Prophet, through Hasan, her eldest son by marriage with 'Ali Ibn Abi Talib, fourth Amir Al Muninin. After the custom of his house, Faisal was sent when only seven days old, to Rahab Palace, the country seat of the Al 'Aun family, in the territory of his clan, Beni 'Abadiyah and their confederates the 'Ataibah. Here the boy was raised among the tribesmen, and remained until he was seven. In 1893, when Husain was ordered to Constantinople, Faisal accompanied him and was educated privately in that city. In 1905 he married his cousin, and returned to the Hejāz in 1909, when his father was appointed Sharif.

In 1913 Faisal became deputy for Jiddah and proceeded to identify himself with the Arab National movement. He commanded his father's forces in 'Asir in 1914, and was at Mecca on the outbreak of the World War. He was posted with the Turkish Governor of Syria in 1915, but escaped to the Hejāz early in the following year, and there played a leading part in the Arab revolt, commanding the Arab forces with Gen. Allenby's army until the capture of Aleppo in Oct. 1918. His influence with the tribes did much to keep Husain's tribal levies in the field. As Commander-in-Chief of the Arab Army under the Allied Commander-in-Chief he then undertook the administration of the newly-constituted Syrian State, and after attending the Peace Conference in Paris returned to Syria in April 1919. In Sept. he again visited Europe and remained until Feb. 1920; in the following month he was proclaimed King of Syria, but being unable to come to terms with the French Mandatory power he left Damascus in July 1920. After spending the winter in England he proceeded to 'Irāq as candidate for the throne in June 1921, and was elected king by a plebiscite in which he received 96% of the votes cast (*see* 'Irāq).

FALKENHAYN, ERICH VON (1861–1922), Prussian general, was born Sept. 11 1861 at Burg Belchau in the district of Thorn (Torun). He took part in the China expedition of 1900 and remained in China with a brigade of occupation till 1903. In 1906 he was appointed chief-of-staff of the XVI. and afterwards of the IV. Army Corps; in 1913 he became general and was appointed Prussian minister of war. He succeeded Gen. von Moltke in Dec. 1914 as chief of the general staff of the army, was advanced to the rank of general of the infantry, and helped to plan the summer offensive of 1915 against Russia and the operations by which in the winter of 1915–6 Serbia was overrun. He was made responsible, however, for the ill-success of the German attacks of 1916 at Verdun, and was replaced as chief of the general staff by Hindenburg in Aug. of that year. He was then assigned the leadership of the IX. Army against Rumania. In 1917 he took command of the so-called Asiatic Corps, for operations in the Caucasus, and in 1918 and 1919 was at the head of the X. Army. Falkenhayn wrote *Die Oberste Heeresleitung 1914–6 in ihren wichtigsten Entschliessungen* (1920) and *Der Feldzug der 9. Armee gegen die Rumänen und Russen 1916–7* (2 vol., 1921). He died April 8 1922 at the castle of Lindstet, near Wildpark.

FALKLAND ISLANDS, BATTLE OF THE.—One of the principal naval actions of the World War was fought on Dec. 8 1914, to the southeast of the Falkland Is. between a British battle-cruiser squadron under Vice-Adml. Sir Doveton Sturdee and the German squadron under Vice-Adml. Graf von Spee. The table on p. 7 shows the details of the respective forces

Fleet at Port William.—Adml. Sturdee arrived at Port William (adjoining Port Stanley) in the Falklands in the forenoon of Monday, Dec. 7. The "Canopus," an old battleship, was already there, moored in Port Stanley and waiting with the local volunteers to resist any attack. The squadron was ordered to keep steam for 12 knots at two hours' notice; the "Macedonia"

took the guard, and coaling started. Adml. Sturdee's own colliers had not arrived: there were only three in harbour and the coal in one had deteriorated. The " Carnarvon " finished coaling at 4 A.M. Dec. 8; the " Invincible " started at 6 A.M., and the " Inflexible " at 7:20 A.M. The " Bristol " had drawn fires to remedy defects and the " Cornwall " had opened up one engine. This was the situation when at 8 A.M. the " Glasgow " fired a gun.

Type	Ships	Guns	Speed
British			
Battle-Cruisers	" Invincible " " Inflexible "	8 12-in. 8 12-in.	25 knots 25 knots
Armoured Cruisers	" Carnarvon " " Cornwall " " Kent "	4 7·5-in., 6 6-in. 14 6-in. 14 6-in.	22·5 knots 23 knots 23 knots
Light Cruisers	" Glasgow " " Bristol "	2 6-in., 10 4-in. 2 6-in., 10 4-in.	25 knots 24 knots
Armed Merchant Cruiser	" Macedonia "	..	..
German			
Armoured Cruisers	" Scharnhorst " " Gneisenau "	8 8·2-in., 6 5·9-in. 8 8·2-in., 6 5·9-in.	22·5 knots 22·5 knots
Light Cruisers	" Leipzig " " Nürnberg " " Dresden "	10 4·1-in. 10 4·1-in. 10 4·1-in.	22 knots 23 knots 24 knots
Supply Ships	" Seydlitz " " Baden " " Santa Isabel "	..	..

German Fleet Sighted.—A signal was flying at the look-out station on Sapper's Hill above the harbour. It reported two strange ships in sight. A scene of bustle and commotion ensued. At 8:14 A.M. the signal was made to prepare to weigh and raise steam for full speed. Colliers were cast off, guns cleared away and great clouds of smoke began to pour from the funnels as the ships raised steam. The ships which had appeared so unexpectedly were the " Gneisenau " and " Nürnberg," which Von Spee had sent in advance to effect a landing. They were not visible from the " Canopus," but with the help of a fire control station on the hill she opened fire on them with her 12-in. guns at 9 A.M. The range was over 14,000 yd. and the shots fell short, but they made the " Gneisenau " turn away.

The " Scharnhorst " was still some 15 m. off but the clouds of smoke rising over the hills had made Von Spee uneasy. From the " Gneisenau " came a report of six warships in the harbour, and the German admiral, confirmed in his misgivings, ordered her to steer east and not to accept battle. By 10 A.M. the " Invincible," " Inflexible " and " Cornwall " were under way and leaving harbour. Huge clouds of smoke hid them for a time, but they cleared away, revealing the tripod masts of battle-cruisers and Von Spee knew that his hour had come.

Pursuit of German Fleet.—By 10:30 A.M. Sturdee was clear of the harbour; the Germans were hull down to the southeast about 11 m. off, and the admiral hoisted the " general chase," a signal for each ship to steam as hard as she could in pursuit. It was a perfect day with a blue sky and calm sea. A light wind was blowing from the northwest. The day may be resolved into two phases —the pursuit from 10:20 A.M. to 1:20 P.M., and the action from 1:20 P.M. to 6 P.M. At 10:50 A.M. Sturdee ordered the " Inflexible " to take station on his port quarter, thereby annulling the signal to chase. By 11 A.M. the Germans were showing above the horizon and the battle-cruisers eased to 24 knots. The " Glasgow " was on the " Invincible's " port bow, the " Kent " on her port beam. The " Carnarvon " and " Cornwall " were 5 m. astern.

The crews were piped to dinner and, to give the " Carnarvon " a chance to get up, the admiral reduced to 19 knots. Meanwhile Von Spee's colliers had been sighted to the westward off Port Pleasant (20 m. west of Port William) and the " Bristol," which was just leaving harbour, was sent after them with the " Macedonia " at 11:30 A.M. By this time the chase was gradually coming round to southeast by east. The " Carnarvon's " efforts to get up were unavailing and Sturdee increased to full speed. By 12:50 P.M. the battle-cruisers were going 25 knots, overhauling the Germans fast.

The " Leipzig " soon felt the pace and began to drop behind. At 12:55 P.M. her range had fallen to 16,000 yd. and the " Inflexible " opened fire on her. Von Spee, to save his light cruisers, ordered them to scatter at 1:20 P.M. and they broke away to the southward, but the British cruisers were ready, and without waiting for orders, the " Glasgow," " Cornwall " and " Kent " went off in hot pursuit (see fig. 1).

Conflict of Battle-Cruisers.—Von Spee, as his light cruisers left him, turned at 1:25 P.M. to the eastward to accept battle, and took station ahead of the " Gneisenau," while Sturdee's battle-cruisers to the northward turned into line ahead on an easterly course. At 1:30 Von Spee opened fire at 14,000 yd. but the range was too great for the 8·2 in. guns and he led round to the northeast. The range fell to 12,500 yd. and about 1:45 P.M. the " Invincible " was hit, and Sturdee turned away to open the range and take advantage of his heavier guns. The windward position was a severe handicap. Dense clouds of smoke

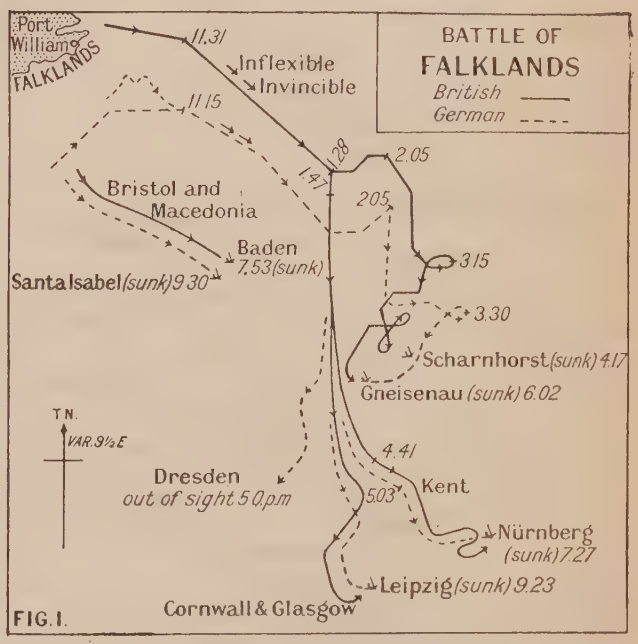

FIG. 1.

were pouring from the battle-cruisers shrouding the ships and smothering the range. By 2 P.M. the range had increased to 16,000 yd. and the guns ceased fire. No serious damage had been done, the " Gneisenau " had received only two hits, and one of her 8·2 in. casemates had been temporarily disabled.

At 2:05 P.M. Von Spee turned right away to the southward, bringing the battle-cruisers right astern, and some minutes elapsed before the movement was seen; then Sturdee turned after him to the southward, increasing speed, and the chase began again (see fig. 2). It continued for nearly 40 min., while Sturdee crept gradually up on von Spee's port quarter. At 2:50 P.M. the range was down again to 14,000 yd., and turning two points to port, Sturdee opened fire again. Von Spee again accepted action and turning to the east opened fire at 2:55 P.M. (see fig. 2). The action ran to the eastward till 3:15 P.M. with the range falling gradually to 11,000 yards. The British guns were now establishing a mastery. The " Scharnhorst " was burning, her fire had slowed down and she sheered to starboard for a time with a damaged rudder.

But again the smother of smoke made spotting difficult, and at 3:15 P.M., to escape from it, Sturdee turned the battle-cruisers right round to port together, so that the " Inflexible " was now leading to the westward. Von Spee in reply at 3:27 P.M. led round to port, in succession bringing his starboard guns into action. The action now ran to the south-westward with the

British battle-cruisers circling round the Germans at a range of 11,000 to 12,000 yards. By 4 P.M. the "Scharnhorst" was blazing from stem to stern, her guns were silent, her superstructure was a mass of ruins; she was listing heavily to port and barely making 12 knots. Smoke was again obscuring the range and the "Inflexible," to get rid of it, circled round to starboard at 4:10 P.M. engaging the "Gneisenau" on a northeasterly course (see fig. 2).

End of the "Scharnhorst."—The "Invincible" ran on a little farther to the southward and then circled round to the northeast. The "Scharnhorst's" end was now near. She turned to starboard a mass of smoke and flame, then at 4:17 P.M. heeled completely over to port and sank with her flag flying. Not a soul was saved. The "Invincible" and "Inflexible" were now engaging the "Gneisenau" on an opposite course; at 4:30 P.M. Sturdee, then on a northeasterly course, circled round to starboard, and ordering the "Inflexible" to form single line ahead

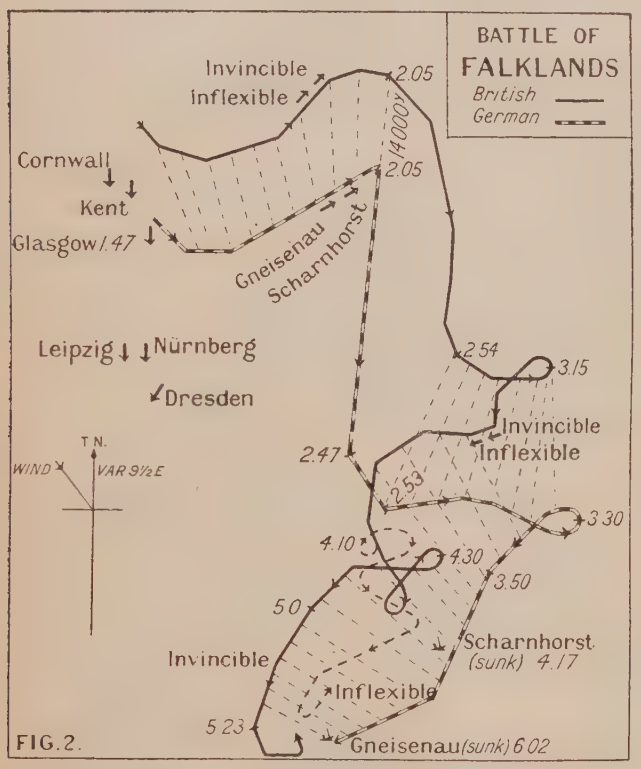

FIG. 2.

shaped course to the westward. The "Gneisenau" was some 13,000 yd. to the southeast, struggling desperately along on a southwest course.

The "Gneisenau" Sunk.—At 4:45 P.M. the "Inflexible," again hampered by the smoke, turned to port, and, leaving the flagship, ran to the eastward, opening on the "Gneisenau" with her starboard guns, and turning southwest again at 4:55 P.M. kept the "Gneisenau" at about 12,000 yards. By 5:15 P.M. the latter was in a sorry plight. Her foremost funnel had toppled over; she was listing heavily to starboard and barely making headway. The sunshine had gone and a drizzling rain had commenced to fall. Her fore turret still fired fitfully. At 5:45 P.M. she fired her last shot and at 6:02 P.M. heeled slowly over to starboard and sank. The British rescued 187 survivors from the icy water.

Pursuit of Light Cruisers.—Meanwhile the German light cruisers were heading to the southward with the "Glasgow," "Kent" and "Cornwall" at their heels. The actual speeds are doubtful. On the British side, the "Glasgow" could probably go 25 knots, and the "Cornwall" and "Kent" can be credited with at least 22½ and 22 knots. The "Dresden" could probably go 25 knots, the "Nürnberg" 22, while the "Leipzig," whose engines and boilers were in bad condition, could barely do 20 to 21. The German ships, which had been cruising continuously for four months, found it hard to maintain their speeds. When the chase began the British cruisers were some 10 to 11 m. behind. The "Glasgow" soon forged ahead and at 2:53 P.M., in spite of the efforts of the "Dresden" to divert her by sheering off to the southwest, opened fire on the "Leipzig" and obtained a hit on her which reduced her speed.

Light Cruiser Action.—By 4:15 P.M. the "Cornwall" was coming up and opened fire on the "Leipzig" at 12,000 yd., but the range in the failing light was too great, and it was not till 4:25 P.M. that her shots were falling close. The "Glasgow" had received one or two hits and, forsaking any attempt to overtake the "Dresden," circled to starboard at 4:27 P.M. and passed behind the "Cornwall." The chase continued to the southeastward till 4:55 P.M., when the "Leipzig" turned to the southwestward, and the "Cornwall," following suit, engaged her with the port guns (see fig. 1). The "Glasgow" came into action again, the "Leipzig's" speed gradually sank and the British cruisers kept her under continuous fire at 9,000 to 10,000 yards. By 6 P.M. a drizzling rain had begun to fall and the "Glasgow" signalled to close. The "Cornwall" crept up and Capt. Ellerton began to fire lyddite with terrible effect.

The "Leipzig" Sunk.—By 7 P.M. the "Leipzig's" speed was reduced to 15 knots, but she was still firing fitfully. The whole of her stern was wrapped in flame and the main mast, melting in the heat, had collapsed. The British cruisers ceased fire and closed, but her flag was still flying defiantly and, at 7:50 P.M., they reopened fire for a quarter of an hour. Boats were lowered to rescue the crew. She was heeling heavily to port and at 9:23 P.M. turned over and sank (53° 55′ S., 55° 55′ W.). Only five officers and 13 men were saved.

"Nürnberg" in Action.—The "Kent," to the eastward all this time, had been vigorously pursuing the "Nürnberg" and by feeding the fires with all the spare wood in the ship, from hen coops to capstan bars, had brought the range down to 12,000 yd. by 5 P.M. The "Nürnberg" opened fire and was sending her 4·1 rounds right over the "Kent," when the latter's 6-in. guns were still falling 1,000 yd. short, but the weather was growing thick and it was becoming difficult to spot. Then came a change; the "Nürnberg's" boiler tubes gave out; her speed sank to 18 knots and the "Kent" overhauled her rapidly. At 5:45 P.M. the "Kent" was on her port quarter 7,000 yd. off, and the "Nürnberg" turned to northeast to engage her (see fig. 1).

The light was failing and Capt. Allen forced the pace and closed to 3,000 yards. The "Nürnberg" could not stand the fire and turned away to the southward at 6:02 P.M., but the "Kent" followed her round. By 6:10 P.M., the "Nürnberg" was blazing with only two guns in action, and the "Kent" circling round raked her at 3,500 yards. By 6:25 P.M. she was merely a burning wreck, listing heavily, but with her flag still flying, and the "Kent" opened fire again. Just before 7:30 P.M. the "Nürnberg" turned over and sank, but though the boats were searching up till 9 P.M., only seven survivors were found.

The following table shows the casualties of the British and German forces:—

	Ship	Hits Received	Casualties	Rounds Fired
British	"Invincible"	22	0 k. 1 w.	573 12-in.
	"Inflexible"	3	1 k. 2 w.	661 12-in.
	"Glasgow"	2	1 k. 4 w.	316 6-in.
	"Cornwall"	18	0 k. 0 w.	1,000 6-in.
	"Kent"	36	4 k. 12 w.	646 6-in.
	"Carnarvon"	0	0 k. 0 w.	..
German	"Scharnhorst"	Sunk	All	..
	"Gneisenau"	Sunk	187 saved	..
	"Leipzig"	Sunk	18 saved	..
	"Nürnberg"	Sunk	7 saved	..
	"Dresden"	Escaped	..	..

k. = killed. w. = wounded.

German Colliers Captured.—Meanwhile the German colliers "Santa Isabel" (Hamburg-South America) and "Baden" (Hamburg-America) had been found by the "Bristol" and "Macedonia," chased to the southeast and captured about 4 P.M. (see fig. 1). Sturdee had given the order to sink all transports, and, though they were not transports, but colliers full of valuable coal, they were sunk. The "Seydlitz" (Norddeutscher

Lloyd) escaped to the southward and found safety amongst the icebergs of the Antarctic. The "Dresden" had disappeared to the southwest about 5 P.M. and reached Magellan Straits on Dec. 10. Three long months elapsed before she was hunted down and sunk by the "Glasgow" and "Kent" on March 14.

Conclusion.—This was the end of the engagement known as the Battle of the Falklands, the end of Von Spee's squadron, of Von Spee and both his sons. It marked the end, too, of a definite phase of the struggle at sea. The German cruiser warfare collapsed, and outside the North Sea and the Baltic, England held an unchallenged command of the sea.

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FALL RIVER, Mass., U.S.A. (*see* 10.155), was outranked in 1919 by New Bedford (*q.v.*) in the value of cotton goods produced. In 1920 it ranked first in the proportion of children employed, 18·5% of all 10–15 years of age; second in illiteracy, 11·9% of the population 10 years of age and over being unable to write; third in the proportion of women at work, 41·6% of all females 10 years of age and over, and had a high infant mortality. The total value of its manufactured products was $64,146,000 in 1909; $163,246,000 in 1919; $133,407,969 in 1921; $172,395,700 in 1923. The average number of wage-earners in the factories was practically the same in 1909 and 1919 (37,139 and 37,015 respectively), and after a drop in 1921, rose to 37,018 in 1923. Fall River was seriously affected by the general depression of 1920–1 and by the growing competition of southern cotton-mills. At times, after the close of the World War, the number of unemployed was estimated at 20,000 or 30,000, or even more. In 1922 a fuel-oil refinery, with a monthly capacity of 1,000,000 barrels, was added to the industries of the city. The construction of an electric super-power plant on the Taunton river was begun in 1925. A city plan was adopted in 1923.

FAMILY ALLOWANCES.—The custom of paying, in addition to wages, allowances for children and sometimes for wives, grew up out of the economic conditions during and after the World War, though before that vestiges of it existed here and there in a few occupations, notably in agriculture, where payments in kind varying with the size of the labourer's family have long been general in most countries. During the War all the belligerent States paid allowances for the wives and children of the men in the fighting services, and in the public services of most European countries, the war bonuses made necessary by the rise in prices were proportioned in some way to the size of the worker's family, or at least differed for married and unmarried. Probably these two war customs prepared the way for the rapid development which has followed in some countries.

In the services of the State and of local authorities the payment of allowances for children has become established in France, Germany, Belgium, Holland, Switzerland, Italy, Czechoslovakia, Jugoslavia, Norway (municipal services only) Sweden, Finland and Poland. In several of these (*e.g.*, Switzerland and Italy), attempts have been made, so far unsuccessfully, to drop the payment as conditions became more normal. In most countries, a distinction is made between the children of salaried officials and those of weekly wage-earners, the allowances for the former being at a higher rate and continuing during the years of university education, while those of the latter terminate at 13 or 14. Otherwise the allowances do not vary with the remuneration of the worker, except in Holland, where they are expressed as a percentage of his salary, with a minimum and a maximum. In Switzerland, allowances are confined to the lower paid officials. Everywhere the allowances represent only a small part of the cost of a child; being on a flat rate they are more important to the lower paid than to the higher paid officials. Thus in Germany, where the allowances in the public services are relatively more important than in most countries, and where they include an allowance for the wife, it is reckoned that the average income of a married official is raised by this means from 15 to 30%, according to his grade, above that of an unmarried official. For a man with a large family the value is of course considerably more than this. The Federal Govt. of Australia gives the children of its employees an allowance of 5s. a week until the age of 14.

Next to the public services, mining is the occupation where the system is most widely established. It is practically universal in the mining industry of Germany, France, Belgium, Austria and Yugoslavia and in some of the mining districts of Holland, Czechoslovakia, Poland and Sweden. Here, as elsewhere, the allowance represents only a contribution towards child maintenance. It is reckoned that in the Ruhr a workman with three children receives by this aid about 16% more than a single man. In Germany and France the cost of the allowances to the employers is equivalent to about 6 or 7% of the wage bill. In most countries the married workers' privileges include coal and in some a house free or at a low rate.

THE SYSTEM AT WORK

In other industries, the family allowance system is widely extended only in France, Belgium, Germany and Austria, though there are instances of it in other countries.

The French System.—In France its development has been greatly helped by the device of the equalisation fund (*Caisse de Compensation pour allocations familiales*), which guards successfully against the danger that family allowances paid for by employers might prejudice men with families in obtaining employment. Such funds were first proposed in 1918 by M. Romanet, a benevolent Roman Catholic employer of the metallurgic industry of Grenoble. The idea spread rapidly, and by the end of 1925 there were in France 180 equalisation funds, covering over 10,000 firms. The method is simple:—The fund may be either "professional," *i.e.*, confined to a single industry or kind of occupation, or "regional and interprofessional" *i.e.*, open to all employers who desire to join within a given area. The scale of allowances (which varies considerably in different funds) having been fixed, the number of children covered is ascertained at fixed periods, and each adherent employer is assessed for his share of the cost, the assessment being based either on the amount of his wage-bill, the number of his workers or the number of hours worked. When the number of workers is the basis, some funds fix a lower scale for women and youths than for adult male workers. Some funds actually pay the allowances to the parents; in others the employer pays and subsequently claims from the fund the excess, or pays into the fund the deficiency of his payment over the sum due from him.

The allowances are usually paid monthly and, in an increasing proportion of funds, not to the workman but to the children's mother. It is found that this method is not only more certain to benefit the children, but less apt to arouse the jealousy of the single man, who is thus led to regard the allowances, not as an addition to wages, and thus an infraction of the principle of equal pay for equal work, but as a recognition of the separate service of parenthood. The desire for an increased population is shown by the grading of the allowances upwards, *e.g.*, in May 1924 the average of the scale in all the funds was per month 19 fr. for one child, 46 for two children, 81 for three, 124 for four. At this date the average monthly wage of an adult labourer was 500 francs. Many funds also pay bonuses at childbirth (*primes de naissance*) and during the period of lactation (*primes d'allaitement*). Many maintain subsidiary health services, such as health visitors, day nurseries, convalescent homes, etc.

The cost of the allowances to employers varies from 1 to 7% of the wage bill. Including the public services, mines, railways and other large enterprises, which pay allowances directly, the number of workers covered in 1925 was reckoned at 3,500,000 and the annual cost of allowances at over 1,000 million francs.

The system is increasingly popular with employers, who find their reward in the increased well-being and contentment of their workers. The attitude of the trade unions has changed from one of suspicion to a definite and cordial acceptance of the principle, coupled with resentment of employers' control and demand that it shall be made universal, compulsory and collectively controlled.

Other European Countries.—In Belgium, the methods adopted are modelled closely on those of France. Progress began several years later, but has been rapid; and the system appears equally destined to become a permanent part of industrial life, welcomed both by employer and employed. In his report for 1925, the British commercial secretary attributed the freedom of the country from industrial strife partly to this cause and says:—

It is almost generally admitted now that the family bonus system is of real economic value, and that by improving the present and future conditions of the working class it is capable of exerting a direct and beneficial influence on the prosperity and producing capacity of the country.

In Germany, during the five years following the World War the payment of family allowances was probably as common as in France,

but much less generally popular. Employers tended to regard the allowances as a temporary addition to wages which could be dropped when conditions became more normal. Hence few equalisation funds were started, and the allowances being paid to the worker with his wage was apt to excite the single man's jealousy, while the married man feared to be prejudiced in seeking work. In 1925 the number of collective agreements containing family allowances showed a falling off. It is not yet certain whether the tendency will be permanent.

In Austria, the payment of children's allowances through equalisation funds was, in 1921, made compulsory on all employers, as a kind of compensation to the workers for the removal of the bread subsidy. The amounts, however, were exceedingly small, and at the end of the period stipulated by the law, the system, to a great extent, lapsed, except in the public services and in the mining industry.

Australia.—In Australia, since 1907, wages have been subject to a legal minimum, settled by the Courts and supposed to be roughly based on the needs of the "normal" family of five persons (four persons in New South Wales). In 1919, owing to the discontent caused by rising prices, a Royal Commission on the basis wage, composed of equal numbers of representatives of employers and employed with an impartial chairman, was set up to determine what was the actual cost of maintenance of a five-member family at a standard of reasonable comfort. The sum fixed for each of the five States averaged £5 16s., the existing basic wage being then £4. The Commonwealth statistician promptly reported that the whole produced wealth of the country, if equally divided, would not yield the necessary amount. The chairman of the commission, Mr. A. D. Piddington, then submitted the proposal that the basic wage should be based on the needs of man and wife and supplemented by an allowance of 12s. per week for each child, paid out of a State fund to which each employer should contribute 10s. 9 p. per week per employee. He pointed out that the ordinary conception of the basic wage postulated 2,100,000 non-existent children, the total number of actual children (under 14) of employees being 900,000. The only actual fruit of this proposal, up to 1926, has been the aforesaid 5s. allowance paid for each child of a Commonwealth employee. But child endowment has figured largely in the programme of Australian politicians. A Bill embodying Mr. Piddington's proposal passed the Lower House of New South Wales in 1920; a Bill for the State endowment of children was introduced by the succeeding Labour Govt. of New South Wales. The South Australian Labour Govt. in 1925 promised, but failed, to introduce a similar measure. The Federal Govt. has also played with the question.

Great Britain.—Although Great Britain possesses the earliest equalisation fund in existence (in fact though not in name) in that established about a century ago by the Wesleyan community for children of ministers, the family allowance system has so far not taken much root in the country, except in the fighting services. The subject, however, has been widely discussed since the development of the foreign schemes. It is significant of its growing hold on public opinion that during 1925 the London School of Economics introduced substantial educational allowances for the children of its professorial staff, the Independent Labour Party adopted as part of its programme a state scheme of children's allowances, and the Coal Commission report recommended such allowances as "one of the most valuable measures that could be adopted for increasing the well-being and contentment of the mining population."

Conclusions.—Advocates of the principle contend that as the national income or dividend is an uncomfortably tight fit, it will be impossible to satisfy the general demand for a reasonably high standard of life so long as the needs of the family during the years of its greatest dependency are only met through a wage paid equally to the childless man. They further argue that the value of children to the community, as its future citizens and workers, is not adequately recognised by a system which assigns to the family unit an income no larger than that enjoyed by the single individual; that as a result the more thoughtful and ambitious workers are tending drastically to restrict their families, while the less thoughtful and less ambitious practise no such restriction. To this is added the plea that the maximum production of wealth will only be achieved when competition between men and women workers is at once free and fair; that this is impossible without "equal pay for equal work," and that this again is impracticable until family responsibilities are met by family allowances.

There is a division of opinion among advocates of family allowances in Great Britain between those who prefer the foreign system of equalisation funds paid for by employers, those who would like to see family allowances provided through contributory insurance, and those who believe that the whole cost should be met by the State.

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FARINA, SALVATORE (1846–1918), Italian novelist (*see* 10.179), died at Milan Dec. 15 1918. His best-known work is *La piu bella fancuilla dell' universo* (1911). See V. Dendi, *Un Romanzo dimenticato, S. Farina* (1921).

FARINACCI, ROBERTO (1892–), Italian politician, was born Oct. 16 1892 at Isernia, in the province of Campobasso. Educated at Cremona, he entered the railway administration, becoming station-master at Cremona. While still a very young man he took to politics, and on the outbreak of the World War conducted an active interventionist propaganda. As soon as Italy went to war he volunteered for active service, but 18 months later was ordered to resume his civilian duties. After the Armistice he was one of the first to join Mussolini's Fasci di Combattimento and he organised the movement in Cremona. In 1921 he was returned to the Legislature as member for Mantova-Cremona, but was unable to take his seat in the Chamber, being under age. He had now become the leading figure in Cremona, and through the daily paper founded by him, *Cremona Nuova*, acquired an increasing influence in the Fascist party. He also found time to complete his studies and secured a university degree in law. When Mussolini came into power, although not given office, Farinacci continued to be one of the Premier's most trusted advisers. In 1924 he was again returned to the Legislature and in March 1925 he became, on Mussolini's nomination, general secretary of the Fascist party.

FARMERS' ORGANISATIONS (*see* 10.181).—The wholesale intervention of various Governments in agricultural production and the regulation of prices which was necessary during the World War have provided great stimulus to the organisation of farmers into associations capable of negotiating with the Governments of their respective countries. The growth of the Federation of Farm Bureaus in the United States and of the National Farmers' Union in Great Britain are but examples of associations not called into existence by the War but which have strengthened their position and learned to play a representative part during these critical years.

It has become evident, however, that any national movement for the stabilisation of the prices of agricultural produce at a level that will be remunerative to the farmer must be severely limited by international competition in the world's market. Consequently a widespread feeling has grown up that an international combination between producers is necessary in order to secure some common action among the farmers of all countries whereby their interests may be protected.

The International Institute of Agriculture at Rome is, however, organised on an official basis. There is no direct representation of farmers, and the line of work taken up by the Institute has been mainly confined to the collection and dissemination of information. The constitution of the Institute which is defined by treaty provides no machinery for enabling farmers' associations to formulate an international expression of agricultural opinion, but the question is still under consideration. There exists an International Commission of Agriculture with its seat in Paris, which from time to time (1923 in Paris, 1925 in Warsaw) convenes an International Congress of Agriculture. It is under consideration whether this organisation cannot be given a character more directly representative of the associations of farmers in various countries.

The same basic idea has been earnestly advocated by the writings and personal influence of Dr. E. Laur, the Director of the Swiss Farmers' Union. In Sept. 1925, Dr. Laur summoned an international conference of representatives of agricultural associations which met at Berne and was largely attended by delegates of farmers' organisations in Europe and the United States

of America. The Conference affirmed the need for an international organisation that could promote common action amongst agricultural producers all the world over and decided to take steps to secure the support of the properly constituted bodies in the various countries. A meeting was convoked in Rome for April 1926 on the occasion of the meeting of the General Assembly of the International Institute of Agriculture. (A. D. H.)

Organisations in the United States

The following article deals with the development of Farmers' Organisations in the United States, where the movement has grown more rapidly and attained greater dimensions than in any other part of the world. For similar organisations in other agricultural countries, the articles thereon should be consulted. (*See* also Agriculture; Co-operation, Agricultural; Marketing.)

The organisations in the United States fall into two general classes: (1) organisations interested in the general problems of agriculture, *i.e.*, education, legislation, credit, transportation, etc.; and (2) co-operative organisations of farmers formed for the purpose of marketing farm products or purchasing farm supplies. This classification does not include the various state and Federal institutions engaged in agricultural teaching, research and service.

Principal Organisations.—Prominent among the general farmers' organisations are the Grange or Patrons of Husbandry, the American Farm Bureau Federation, the Farmers' Educational and Co-operative Union, and the Equity. Other organisations that restrict their activities to a special industry or phase of agriculture are the National Co-operative Milk Producers' Federation and the National Council of Farmers' Co-operative Marketing Associations. A number of local or regional organisations serve the interests of farmers and shippers of farm products. The organisation of the Grange comprises subordinate (or local) county and state granges. The state organisations make up the National Grange. The work of the local granges is chiefly fraternal, educational, social and recreational, while the state organisations and the National Grange give attention to broad questions of agricultural policy, education and legislation. The local units of the American Farm Bureau Federation are county organisations, which were formed originally to employ and co-operate with an agricultural adviser for the county, who was also a state and Federal employee. In most states the county agricultural adviser was in 1926 paid wholly from public funds, though he might work in close co-operation with the county farm bureau or other farm organisation. County farm bureaus were first federated in state organisations, and in 1919 the national organisation, the American Farm Bureau Federation, was formed. This organisation obtained a membership of over 1,000,000 farmers the first year of its existence. Since 1920 it has taken an active part in the formation of large-scale, co-operative marketing agencies for grain, live stock and fruits and vegetables. Some state farm bureaus have a close affiliation with co-operative marketing associations which they have fostered.

Marketing.—The organisation of farmers for business purposes has been mainly in the field of co-operative marketing. The most reliable estimates placed the total business of co-operative marketing associations at $2,500,000,000 for the year 1925. This business was conducted by approximately 12,000 associations, whose membership totalled over 2,700,000, more than one-third of the total number of farmers in the United States. The number of farmers who were members of co-operative associations was divided by commodities as follows: grain, 520,000; dairy products, 460,000; cotton, 300,000; tobacco, 300,000; live stock, 400,000; fruits and vegetables, 180,000; eggs and poultry, 50,000; wool, 50,000; nuts, 20,000; all other, 420,000.

The first nation-wide survey of the extent of co-operation among farmers was begun in 1913. Data for the years 1912, 1913, 1914 and 1915 were collected and tabulated. The most complete information was secured for the year 1915. Reports were received from 5,424 co-operative associations with an estimated membership of 651,186 and an estimated volume of business amounting to $635,838,684. The largest volume of business, $289,689,200, was credited to the farmers' grain elevators. Fruit and vegetable associations with $201,542,600 were second, and associations marketing dairy products were third with $89,061,300. The second survey was made in connection with the taking of the 1919 census. Sales through farmers' marketing organisations at this time were reported as $721,983,639 and 511,383 farms reported sales through such organisations. At the same time 329,449 farms reported purchases through farmers' buying associations totalling $84,615,669. The third survey was undertaken by the U.S. Dept. of Agriculture in 1921. Reports had been received from 10,500 associations up to 1925, and it is on these reports that the estimate of total business, already given, is based. The interesting feature as regards these figures as compared with those given for 1915 is the increase in the amount of business done by cotton, tobacco and live-stock marketing associations. In fact, large-scale co-operation in the South has developed entirely since 1920.

Local Associations.—In Jan. 1926 there were approximately 11,500 active local co-operative associations—independent organisations and units of federations—whose members were for the most part limited to farmers using the same shipping point. The local association is the earliest form of co-operation among farmers in the United States. It performs, as a rule, the services of a country dealer. Fruit and vegetables are assembled, packed and stored by local associations; milk is manufactured into butter and cheese; grain is bought; live stock is assembled and shipped and supplies are purchased and distributed by this type of organisation. Most of them handle only one commodity or a group of related commodities, such as several vegetables, or butter and eggs. Approximately 9,500 of the local associations operate independently. They sell their products to local dealers or through commission merchants in the terminal markets. In some cases they employ the services of private distributing firms, or more rarely sell direct to wholesalers.

About 2,000 local organisations, however, are member units of federations formed for the purpose of performing the selling services which the small independent local associations cannot handle to the best advantage. The federation is an organisation in which the local units are the members and own the stock of the organisation, if it is incorporated with capital stock. Over 450 creameries in Minnesota, for example, have affiliated to form a federation to sell the butter manufactured by them. Two hundred local citrus packing associations in California sell their products through a co-operative central agency which they own and control. In this manner the group of local units are adequately represented in the markets at a reasonable cost. Approximately 50 federations were in operation in 1925. The annual sales aggregated $400,000,000, and over 220,000 farmers were members of the local units that affiliated to form these federations.

Regional Associations.—A third type of co-operative organisation is the centralised regional association. The first co-operative organisation of this type was formed in 1912. Since 1920, associations for the marketing of tobacco, cotton, fluid milk and dried fruit have been formed according to the centralised plan. A centralised regional association usually extends over a large area, frequently an entire state, or a producing region including portions of several states. It combines the functions of the independent local association and the federation. All members affiliate directly with the organisation, it owns the local warehouses and other necessary local facilities, and performs the local functions of assembling, storing, grading, or processing the product in addition to the marketing functions of distributing and selling. The number of members in associations of this kind exceed 60,000 in some instances. About 75 associations of this kind have been formed. They have approximately 900,000 members, and their total sales in 1925 were approximately $600,000,000. It will be noted, therefore, that approximately one-third of the co-operative marketing business was carried on in 1925 by 125 centralised regional and federated regional organisations. Sales agencies for the co-operative handling of live stock have been established at 20 of the terminal markets. During 1925 these agencies received live stock which sold for more than $280,000,000. Co-operative terminal market agencies have also been formed in a few markets for the sale of grain.

Capper-Volstead Act.—The rapid growth of large-scale co-operative organisation, which began in 1920, created a demand for state laws providing for the incorporation of the co-operative associations. In 1925, 46 of the states had laws permitting co-operative organisations to incorporate, with or without capital stock, and to incorporate in their articles of incorporation and by-laws provisions that would ensure the co-operative nature of the enterprise. Many of these laws also define the status of co-operative associations with reference to state anti-trust laws. In 1922 Congress enacted the Capper-Volstead Act which, in effect, sets forth the right of producers of agricultural products to act together in associations, and prescribes certain conditions which organisations of agriculture producers must meet in order to be considered co-operative for the purposes of the Act. The second section of the Capper-Volstead Act provides that the

Secretary of Agriculture may take steps to prevent the undue enhancement of prices of agricultural products by co-operative organisations.

The steady growth of co-operative marketing among farmers in the United States indicates that it has become established as a permanent method of marketing farm products. Since 1924 the development of new co-operative enterprises has been comparatively slow. More effort is being directed toward strengthening existing organisations and introducing more efficient methods of marketing farm products.

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FARM MACHINERY.—The increased demand for food supplies is met in two ways, by increasing the yields and by increasing the acreage, both of which require more labour in agriculture. To increase or even to maintain the efficiency of farm labour, and to keep down production costs in countries where labour is scarce, farm machinery is a necessity. It is sure to be in the future, as in the past, a factor of increasing importance in the agricultural, social and industrial structure of all civilised countries. In the United States the value of farm machinery manufactured yearly has increased approximately 250% since 1910, and the inventory value of machinery on farms has more than trebled. Progress may be classified under four headings: (1) new implements; (2) changes in design to adapt well-established implements to mechanical power; (3) changes in sizes of implements to meet changes in farm practice; and (4) refinements, standardisation, improved materials and research in farm machinery. Of the mechanical changes, those under items (2) and (3) have been the most extensive and have had the most influence in countries which have long used farm machinery.

Some New Implements Described

Corn Picker.—The mechanical corn (maize) picker, although not a new idea, is being increasingly adopted by the farming public. This machine snaps the ears from the standing stalks, then husks and elevates the ears to a wagon drawn at the side of the picker. It is fast becoming a necessity in economical production in the great maize areas where hand labour is scarce.

Ensilage Cutter.—The field ensilage cutter may also be classed as new since 1910. As an attachment to a tractor this device cuts the maize into ensilage lengths directly from the standing stalk, and loads the finely cut material on a wagon hauled at the side. The material is then drawn to the silo and blown into it by a blower. Although this method may not always lessen the cost of ensiling maize, it eliminates much hard hand labour and frees the farmer somewhat from the obligations of exchanging labour with his neighbours. Not long ago it was said that shocking grain and loading manure were the only big jobs left on the farm for hand labour. But since then the grain shocker and the manure loader have been developed sufficiently to be listed as distinctly new devices. Each of these, however, still presents some difficulties.

Cotton Picker and Beet Topper.—Neither the mechanical cotton picker nor the sugar-beet topper has been perfected sufficiently to go into general use. When the cotton picker is widely used it will undoubtedly revolutionise the agriculture of the more highly developed cotton areas; its influence socially and industrially is hard to predict.

Sugar-cane Harvester.—A new machine displacing much hand labour in the sugar-cane industry is the mechanical harvester which cuts, strips and bunches the cane in one operation. The successful application of a large, expensive machine of this kind to a specialised industry suggests the future use in general agriculture of large machines which combine operations and save labour and cost. The attention which farmers in humid regions are giving to the combination grain harvester and thresher illustrates this progressive tendency. It is only by recent investigations that the grain combine has been found to have possibilities outside of the semi-arid sections of the United States. Another example of "combine" machinery is a machine that will cut, dry and bale alfalfa hay in one trip over the field.

Adaptation to Requirements of Small Farms

Tractors.—The introduction of the tractor (*q.v.*) as a new form of power effected many changes in the older farm implements. About 1916 the light four-wheeled tractor appeared, soon to create somewhat of a revolution in the farm machinery field. The light tractor, costing less than its predecessors, has carried power farming to thousands of farms which perhaps could not have otherwise afforded it. This demanded an accompaniment of lighter and less costly implement units, leading to the introduction of the light, rigid hitch, two-wheeled tractor plough, and to the two-three-wheeled plough which uses three wheels while ploughing and only two while turning or being transported. The latter is equipped with a semi-floating hitch instead of the full floating hitch of its predecessors or the rigid hitch common in the typical two-wheeled tractor ploughs. These light ploughs, while not distinctly new implements, embody radical changes in plough design. They accompanied the light tractor into all countries into which the latter has penetrated, and have helped introduce power farming and have had a great influence in agriculture—they are one of the outstanding developments in farm machinery.

Implements Adapted to Tractors.—As the economy of the tractor on the average farm depends to some extent upon the number of uses to which it can profitably be put, manufacturers have tried to adapt to the tractor as many existing types of implements as possible. Grain drills equipped with tractor hitch and power-lift, so that the operator can control the lifting and dropping of the furrow openers from the tractor seat, have appeared during the last few years. If the farmer wishes to use his light, four-wheeled tractor for cultivating, he can secure a tractor hitch for a two-row cultivator; then by using an extension control, a comparatively new development, he can control and guide the tractor from the cultivator seat.

A special tractor mower is on the market. This machine is like the standard mower, but is built heavier and carries the control levers and lifting mechanisms which can be operated from the tractor seat. Potato and beet machinery is now furnished with either tractor or horse hitches. Some tractors now carry a "power take-off," through which power to propel the mechanism of the implement attached is taken directly from the tractor motor. This arrangement has caused some changes, especially in grain binders and corn pickers, and may prove revolutionary in general implement design. The grain binder so driven is lower and more compact, since the main wheel need not be used to develop power.

General Purpose Tractor.—Another tractor development that bids fair to influence farm machinery design widely is the idea of a general-purpose tractor. Attempts to make the tractor itself the base to which implement elements can be attached are beginning to be successful. A mower bar as an attachment to a light tractor was developed about 1918, but in a more recent tractor of special design four cultivator rigs can be attached to accomplish double-row cultivating. When the same power base is needed for mowing hay, the cultivator attachment is removed and a mowing attachment is set upon the tractor's draw-bar. Undoubtedly the designers of such a general-purpose tractor contemplate for use with it a four-row planting attachment and perhaps a raking attachment. Thus the same power unit will perform the ploughing, harrowing, grain seeding and grain harvesting operations of its predecessors, and will be able to work in row crops and in the hay field where the conventional type of tractor is somewhat handicapped. The essential part of the implement as an attachment for the tractor will be less expensive than the complete independent unit designed to be hauled. Hence, the tractor has greatly influenced existing design, and may influence future developments even more.

Size of Implements.—Increased attention has been given to the size of implement units which would prove most economical as to capacity, power and labour requirement and investment. The two-row cultivator has recently increased in popularity, because with it one man can cultivate 90% more acreage a day than with the single-row machine, with an increase of only 50% in power. Within the past few years 10-ft. grain binders have appeared for use with tractors. The tendency, however, is not toward larger sizes of all kinds of machines. The reduction of the combined harvester and thresher to a more economical size for the smaller grain farms is bringing this machine into quite general use in the principal wheat sections of the world.

The advent of mechanical power on farms of medium size makes it possible for the farmer to accomplish independently some belt-power jobs which formerly he had to hire to have done. As a result there is increasing demand for the small grain-thresher and for the small sizes of ensilage-cutters, huskers, shredders and shellers. In some countries the "custom" thresherman seems doomed. This present tendency toward small sizes of some belt machines to accompany the small tractor is not as fundamental as, nor should it seem contradictory to, the previously mentioned tendency of farmers to think about larger, faster, cheaper ways of producing food. At present the popular sizes of implement units depend upon the popular sizes of farms; and the size of farm has been determined largely by other than the machinery factors. The implement size, therefore, has been a result rather than a cause. But one must not overlook the possibility of modern agricultural thought and vision leading to farm machinery changes in both type and size that may reverse the old status. Farm machinery development may point the way to rather pronounced changes in agricultural organisation, and competition may be the direct cause for the transition. There seems to be renewed interest in the possibilities of corporate farming. Rather pertinent claims are made concerning the possibility of carrying to the farm more of the manufacturing process, allowing the larger, industrialised farm to deliver its product in more fabricated form. If the economics involved dictate such procedure, farm machinery will be of paramount importance.

Refinements in Design.—Refinement in farm machinery design and manufacture has continued during the past decade. Implements are now of neater design or are more trim; their parts are more accessible; fast-wearing parts can be replaced at minimum cost; weight has been reduced where possible; the operator's efficiency has been increased by changes in design which consider his problems and convenience; greater efficiency in the implement itself is sought constantly; and closer inspection at the factory assures the purchaser of a more reliable product. The use of better materials has resulted in increased strength with less weight, in better soil-working surfaces and in greater durability. Improved types of ball and roller bearings have recently found a definite field in farm machinery. Simplification of implement types as well as standardisation of implement parts is in progress.

Research.—Studies of the trend and application of farm machinery, research in its design and behaviour, and investigations of the necessary requirements are approaching the fundamentals in the Americas as well as in England and in continental Europe. To illustrate with one of many examples, development in soil-working machinery is handicapped to some extent by absence of adequate information on some phases of soil dynamics. Highly scientific analyses have been made of the mathematics and mechanics of some machine parts designed to till the soil, but the application of such information cannot be fully realised until more is known about the causes for certain behaviours in soils. There is not even a world accepted standard by which the efficiency of tillage machines can be measured or compared. The agricultural engineer comes face to face with crops and soils problems heretofore unsolved and sometimes unseen by the agronomist. The emergency is forcing co-operative effort in basic research. The field is not only a wide one, but also a promising one for the scientist. Agricultural, engineering and other scientific societies are beginning to foster such research, even on an international basis. (C. O. R.)

FARM ORGANISATION AND EQUIPMENT.—The study of the organisation of the farm is a comparatively recent development of modern agricultural research. In its earlier stages the investigation of the farmer's problems was confined to matters arising out of the application of the physical sciences to the production of crops and the feeding and breeding of live stock. The basis of the organisation of agricultural research was that the practice of farming was, in its essentials, the application of the knowledge of the chemist, the botanist, the zoologist and so forth.

More recently it has come to be recognised that important as this aspect of agricultural development undoubtedly is, farming is also a business, the successful conduct of which can be determined only by a study of its economic structure. The production of crops and stock is in many respects an art, but is an art by which the farmer has to live, and maximum productivity secured by the uncontrolled application of scientific knowledge concerning the properties of feeding stuffs and manures is not always synonymous with maximum profit.

Law of Diminishing Returns.—So long ago as 1879 Sir John Lawes drew the attention of farmers to this question. He showed that there was no connection between maximum production and economic production; on the contrary, over-stimulation of the crop might bring the scientific farmer to economic disaster. In other words, agricultural production conforms to the law of diminishing returns.[1] The point at which increased production becomes unprofitable depends upon the price of the commodity, other things being equal; in a rising market this point will rise and the farmer will be justified in farming for a higher output; but in a falling market the man who has to live by the land must reduce his capital outlay notwithstanding the facilities for higher production which science has placed at his disposal (*see* AGRICULTURE).

An illustration of the importance of the study of organisation is to be found in the comparisons which are often instituted between the intensity of farming in England and in certain Continental countries, notably Denmark. The case of Denmark is cited as an example of what can be done to develop production from the land without the artificial stimulus applied in certain other European countries. It is pointed out that, notwithstanding a fiscal policy which admits of free imports of agricultural produce, Danish agriculture has flourished during a period in which the industry in England has been stationary; the extent of arable land, and, with this, the agricultural population, has been maintained whilst the land of England has been going back to grass to the accompaniment of an exodus of the rural population; that the yield of the soil of Denmark has steadily increased until it has reached a point considerably in excess of that of this country (*see* DENMARK: AGRICULTURE).

In their crude form these statements appear to be justified, but a study of the organisation of farming in the two countries goes far to disprove the crude conclusions so often drawn to the detriment of the business acumen and technical capacity of the English farmer. The economic circumstances which give rise to the differences in agricultural progress in England and on the Continent may be classed under two heads: (*a*) the proportion of small farmers, and (*b*) the competition of urban industries. (*See* LAND TENURE; TARIFF.)

Only by the study of farm organisation, both at home and abroad, can a proper interpretation be placed upon crude statistics of agricultural production, which are apt to prove dangerous weapons without it.

Size and Efficiency as a Productive Unit.—The maintenance of a high standard of production is very generally associated in Continental agriculture with farming in small units, and the advocates of the extension of the small-holding movement in this country base their case very largely on this fact. Figures collected in the course of investigations of farm organisation go to show that this extra production is apparent rather than real, and that it is purchased by the expenditure of capital and labour which would be more productively employed on larger areas Here is a table showing the manual labour and the horse labour requirements of farms in three agricultural districts, grouped by

[1] *Is Higher Farming a Remedy for Lower Prices?* J. B. Lawes. A Lecture delivered before the East Berwickshire Agricultural Association, May 3 1879. *Rothamsted Memoirs*, vol. 5.

size; it will be seen that in each of them the labour required in production, whether manual or horse, varies inversely with the size of the holding, or, alternatively, that the efficiency of labour varies directly with the size of the holding:—

Size Group	Persons Employed per 100 Acres	Draught Horses Employed per 100 Acres
Acres	No.	No.
District 1		
Under 50	7·1	4·4
50–100	5·0	3·7
100–150	4·0	3·0
Over 150	2·4	2·5
District 2		
Under 50	7·1	5·1
50–100	6·4	3·7
100–150	4·2	3·5
150–250	3·3	2·5
Over 250	2·6	2·1
District 3		
Under 100	4·1	5·3
100–300	3·0	3·7
300–500	2·3	2·6
500–700	2·5	2·3
700–1,000	2·3	2·3

It might be argued, however, that the higher labour requirements on the smaller farms are the measure of their greater productivity, and the following table, showing the extent to which the production per unit of land and per unit of labour is affected by the size of the holding, supplies some confirmation of this. The sales per acre in the group shown here (which corresponds to District No. 2 in the above table) show that the total production varies inversely with the size of the farm. The economic effect of this, however, is considerably discounted by the next column, showing the sales per person employed, when once more the greater advantage of the larger holdings is clearly indicated:—

District 2 Size Group	Sales per Acre			Sales per Person Employed		
Acres	£	s.	d.	£	s.	d.
Under 50	11	19	9	168	19	0
50–100	9	19	2	156	2	0
100–150	7	19	1	189	0	0
150–250	7	5	8	222	12	0
Over 250	8	4	4	316	19	0

To consider, now, the capitalisation of the farm, evidence of the influence of size is afforded by the table below, in which is shown the value of the implement equipment, per 100 acres, on farms in three other districts. Here, again, it is apparent that the capital cost of the implements per unit of land falls as the size of the holding increases.

District A		District B		District C	
Size Group	Value of Equipment	Size Group	Value of Equipment	Size Group	Value of Equipment
Acres	£	Acres	£	Acres	£
Under 100	446	Under 100	374	0–49	328
101– 300	286	101–180	266	50–99	294
301– 500	192	181–300	212	100–149	269
501– 700	164	Over 300	157	150–199	234
701–1000	173	..	..	200–299	213
..	..	..	..	300–499	179
..	..	..	..	Over 500	139

The question at once suggests itself—" What is the economic unit of production? " The answer will not be forthcoming until more work on the study of farm organisation and equipment has been carried out. In some of these tables it will be observed that the rate of variation slows down as the size of the holdings increases; in fact, if curves were plotted they would rise or fall steeply through the smaller size groups and then tend to flatten out from about the 300–400 acre farm upwards. In other words there is evidence that the " economic unit " of farming, in the districts used for the purposes of illustration, does not occur until this size group is reached, and that it continues for some considerable period above it. Evidence is not yet complete on the question of a top limit, but there are certain indications that one-man management does not continue its efficiency beyond a certain point. Thus, in a certain district, which contained a good many holdings extending to 1,000 acres and over, the efficiency curve rises sharply from the " under 100 acres " size group up to the " 300 acres—500 acres " group, flattens out from this point up to the " 500 acres—700 acres " group, and then shows a distinct tendency to fall. This is illustrated in the following table, showing the production per man employed (*i.e.*, sales less cost of raw materials) according to size of holding:—

Size Group	Value of Production per Man Employed
Acres	£
Under 100	181·1
100–300	211·6
300–500	254·2
500–700	283·2
Over 700	245·1

This result is no more than an indication of what may be expected to emerge in future work, but the point is worth studying. For American conditions, *see* UNITED STATES: AGRICULTURE.

However, the study of farm organisation according to the size of the holding gives other results besides evidence of efficiency. The next table shows the influence of size on the nature of the farmer's business. In the district chosen it is clear to what an extent dairying is the concern of the small farmer, whereas sheep and corn growing become intensified as the size of the farm increases. It is interesting to note that as regards meat the size has very little influence on the quantity produced, but an examination of the data shows that it is mainly pork and veal in the case of the smaller groups, and beef and mutton in the case of the larger ones.

Production per Acre

Size Group	Meat	Dairy Produce[1]	Per Acre		Potatoes	Hay	Straw
			Wool	Grain and Pulse			
Acres	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Under –100	56	638	..	353	46	163	7
100–300	46	340	0·9	355	15	140	49
300–500	42	128	1·0	498	31	219	166
500–700	50	148	1·2	451	358[2]	202	78
700–1,000	50	72	2·0	484	25	178	110

[1] In terms of milk.
[2] This high figure is due to the influence of one farm in the group which specialized entirely in potatoes.

Economic Research.—On the continent of Europe investigation has been conducted mainly by the aid of book-keeping, directed towards the determination of the cost of the main products of the farm, the capitalisation of different farming systems, the rental value of the land, the labour income of the peasant and so forth. In particular, the work of Dr. Ernst Laur amongst the Swiss peasant farmers and that of Dr. O. H. Larsen, in Denmark, may be cited. In America a great development of economic study of the agricultural industry has been witnessed during the present century. About the year 1905 " farm management " became definitely a subject of study at the hands of the technical staffs of the agricultural colleges. As on the continent of Europe, book-keeping afforded the principal instrument of study, and cost investigations were conducted in most of the clearly defined crop areas. Following the formation of the American Farm Management Association, a few years later, by those engaged in this work, the attention of economists as well as of agriculturists was attracted to this subject. The number of workers in the field increased rapidly, methods of study were rapidly developed and the Association was reconstituted as the American Farm Economic Association with a membership which now runs into hundreds, and a quarterly Journal (*see* FARMERS' ORGANISATIONS). The importance with which the

economic study of farm organisation is regarded in the States to-day was foreshadowed by the Secretary of Agriculture in his Foreword to the *Year Book* of the United States Department of Agriculture for 1921:—

> The *Year Book* for 1921 emphasises the economic side of our agriculture because help in their economic problems is now the most urgent need of our farmers. That is not to say that the Department is losing sight of production matters. The farmer needs all the help in his production problems that the Department of Agriculture, colleges and experimental stations can give him; but the need of the most importance now is the development of an entirely new realm of organised knowledge bearing upon the economic factors of agriculture looking forward toward cheaper production, improved methods of distribution and enlargement of markets, in order that prices the farmer receives shall be more fairly related to his cost of production.

The agricultural work of the colleges and experimental stations is now largely directed to serving the ends indicated in the foregoing quotation, and a significant fact is the institution of the new Bureau of Agricultural Economics in the Department of Agriculture at Washington.

In England, the study of farm organisation and equipment on a systematic basis dates from the establishment of the Agricultural Economics Research Institute in 1913, as a result of an application by the University of Oxford to the Ministry of Agriculture for a grant in aid of economic research in agriculture. As in other countries the Institute started its work by the costing method, and allowing for the interruption caused by the War it has continued with it as one line of investigation ever since. Costing is, of course, only the means, it is not the end itself and it may be useful to those who have not studied the process to give a few examples illustrating the kind of information got from this rather complicated exercise.

First, there is the evidence it supplies on the efficiency of farm management in all its aspects. To take one of these for example, the use of manual labour. One object of any system of farming should be to give employment to a regular staff of men at all seasons of the year. Few systems do this better than the ordinary four-course rotation and some of the modifications of it, but many rotations make the farmer dependent to a large measure on casual seasonal labour. The results of costing show that dependence on casual seasonal labour has the effect of raising unit labour costs, and though systems of farming involving much seasonal labour are often justified on account of the usually profitable nature of the crops grown (as in the case of potatoes), it may well be that in certain cases the relative costliness of the labour involved may lead the farmer to consider whether after all it gives him an adequate return for the extra working capital and trouble involved. The introduction of silage or of the sugar beet crop into the rotation can have a very upsetting effect on labour organisation, unless plentiful supplies of casual labour are available at the right seasons, and cost records are the only means by which to confirm or correct the farm-manager's general ideas of the economic value of these and other new crops.

To take, as a second example, the organisation of the horse labour on the farm. It costs so much to keep a horse for the year, and on the great majority of farms the figure does not vary very appreciably. But it does not follow that there is little variation in the cost of horse labour, for the cost of a day's work depends not only on the cost of keeping the horse, but on the number of days during which it is effectively employed. Allowing for Sundays and Christmas Day and for Saturday half-days, the maximum number of working days is 286 in the year, and every day less than this number worked by horses adds proportionately to the cost of the labour performed. Figures collected recently from seven farms showed that the percentage of idle days varied from 13% up to 39%, and it will be realised how seriously the cost of horse labour mounts up in proportion as the number of idle days increase. This is a typical example of the way in which costing may direct the attention of the farmer to possible weaknesses in his management. It may be simply that he has too many horses, in which case results such as these will make him consider the possibility of their reduction. It may be that his system of cropping is such that he needs an abnormal equipment of horses at certain seasons of the year, in which case he will be led to consider whether his system is so profitable as to make the idle horses at other seasons worth while, or whether he could not modify it in some way which would enable him to keep his horses more regularly employed.

A third example of the use of costing is the compilation of comparative labour costs, to establish measures of individual efficiency in the use of manual labour. The figures in the following table, compiled by Mr. A. Bridges, represent the normal utilisation of labour for crops and live stock on a series of farms in the eastern counties of England; similar figures have been published by Dr. A. G. Ruston, of Leeds, and various tests of a like character can be devised which serve as standards of efficiency for other aspects of farm management.

Average Labour Requirements of Farm Crops and Stock
Arable Land

	Man days per Acre
Cereal Crops	
Winter Wheat	6·85
Spring Wheat	6·58
Winter Oats	7·58
Spring Oats	6·21
Barley	7·13
Beans	6·50
Peas	10·23
Root Crops	
Turnips and Swedes (eaten off)	8·31
Mangolds	16·73
Potatoes	33·80
Carrots	61·42
Seeds	
Mown	2·18
Grazed	0·71
Grass	
Meadow Hay	2·09
Pasture	0·09
Live Stock	
Cows	23·00
Other Cattle	7·13
Pigs	1·90
Sheep (Arable Breeds)	1·29

In the absence of data such as these nothing is more baffling than the attempt to trace leakages in farm management which cannot be located by any other means and which are often most surely responsible for the difference between profit and loss in farming. In a great number of cases the partial failure of the farmer is due to faulty organisation of labour or to some similar cause which defies detection by any process of inspection. As the practice extends of recording daily the operations on the farm it will be possible to establish, district by district, certain efficiency standards by which to test individual farm management. A good example of what has been done already in this direction is afforded in the case of milk-recording where, by careful observation and record, the farmer is provided with the means of weeding out the unprofitable elements in his dairy herd. The case provides an illustration of that which will be possible in many other directions when full records of the various matters arising in farm management are available, and similar weaknesses in the organisation of production can be detected.

Although the costing method was thus the first line of attack on the problems of agricultural economics it was always realised that it would not be sufficient in itself, and it was suggested that valuable information could be collected by means of economic surveys of farming districts. The evidence to be got in this way is less complete than that furnished by the more intensive costing method; on the other hand, a much greater mass of it can be collected by the expenditure of an equal amount of time and energy. At the outset, these surveys were planned to deal with particular problems; thus, Mr. A. W. Ashby conducted a survey of allotments and small-holdings in Oxfordshire, as the basis for a study of the rural allotments and the small-holding problems, and similarly, Mr. J. Orr conducted surveys of the systems of farm management in the counties of Oxfordshire and Berkshire,

and considered the problems arising therefrom. But this method was found to be incomplete, for although it may happen that special problems will arise for investigation, the study of farm economics as a whole cannot best be pursued by the examination of particular questions. It was decided, therefore, to inaugurate general surveys, designed to collect all the information of any kind whatever which can be got by inquiry on the farm, for tabulation in a variety of ways, and then to study the tables in order to see what information they afforded. The method has been made familiar by the work of American farm economists. This work has formed a part of the activities of the Oxford Institute, and data have been collected from nearly 1,500 farms.

A more recent investigation undertaken by the Institute, and one likely to be developed in the near future, is the study of the organisation of agricultural marketing. The economic weakness of the existing marketing methods has often been a subject of comment, and particular attention has been attracted to it recently by the Report of the Departmental Committee on Distribution and Prices of Agricultural Produce. It was felt that it should be possible to organise an advisory service for farmers in marketing problems, in fact, that such a thing should be an essential part of the general advisory services available to them (*see* AGRICULTURE: ECONOMICS and MARKETING).

Since 1922 arrangements have been completed by the Ministry of Agriculture for the local study of farm organisation and equipment throughout England and Wales, to supplement the work carried on by the Agricultural Economics Research Institute at Oxford and with this body as a co-ordinating centre. For the purpose of advisory work among farmers the country was mapped out, some years ago, into provinces, each of which is equipped with an advisory staff of experts in the various branches of agricultural science. These staffs have now been strengthened by the inclusion in each of an advisory economist, who is occupied with the study of farm management problems arising within his particular province. Their function is mainly to assist the farmers of their districts to greater efficiency in the control of farm management, whilst, at the same time, the information and data accumulated by them in the course of their work is available for the use of the central institute at Oxford for co-ordination and review upon a national basis.

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(C. S. O.)

FARNELL, LEWIS RICHARD (1856–), British scholar, was born in Salisbury Jan. 19 1856. Educated at the City of London School and Exeter College, Oxford, in 1880 he won a fellowship at Exeter College. After studying classical archaeology in Berlin and Munich and travelling in Greece and Asia Minor, he became classical lecturer at Exeter College in 1883, and the following year sub-rector. Later he became university lecturer in classical archaeology. In 1893 he was appointed senior tutor of Exeter College and in 1894 proctor of the university. In 1909 he was elected first Wilde lecturer in comparative religion and in 1911 Hibbert lecturer. He was appointed rector of Exeter College in 1913 and from 1920 to 1923 was vice-chancellor of Oxford University. Among his written works are *Cults of the Greek States*, 5 vol. (1896); *The Evolution of Religion* (1903); *Greece and Babylon* (1911); *The Higher Aspects of Greek Religion* (1912); and *Outline History of Greek Religion* (1920).

FAROE ISLANDS: *see* FAEROE ISLANDS.

FARRAND, LIVINGSTON (1867–), American educationalist, was born at Newark, N.J., June 14 1867. After graduating from Princeton University in 1888, he studied medicine at the College of Physicians and Surgeons, New York (M.D., 1891). During the next two years he studied at Cambridge, England, and at Berlin. From 1893 to 1903 he was an instructor and, from 1901, adjunct professor in psychology at Columbia University; from 1903 to 1914 he was professor of anthropology. In 1897 he accompanied the Jesup North Pacific Expedition, which visited the Indians of British Columbia. From 1912 to 1914 he was treasurer of the American Health Assn. and editor of *The American Journal of Public Health*. From 1914 to 1919 he was president of the University of Colorado, but in 1917 was granted leave of absence, following his appointment by the International Health Board of the Rockefeller Foundation to direct the work against tuberculosis in France. In 1919 he was made chairman of the central committee of the American Red Cross. In 1921 he was elected to succeed Jacob Gould Schurman as president of Cornell University. He wrote *The Basis of American History* (1904) and various articles on psychology and anthropology.

FASCISM.—The Italian Fascist movement dates officially from the foundation in March 1919 by Benito Mussolini (*q.v.*), then editor of *Il Popolo d'Italia*, of the first *Fascio di Combattimento* at Milan, although many of its ideas had been inspired by the Nationalist movement dating from 1910, and by Syndicalism, of which Mussolini himself had been a leader. This first Fascio was composed of some 150 of Mussolini's friends who had supported his interventionist action at the beginning of the World War, mostly ex-socialists of the Syndicalist wing, and nearly all ex-combatants. The first Fascist programme was confused, demagogic and had a Republican trend, but the national patriotic note was conspicuous, and proper recognition was demanded for the men who had fought and won the War. The word *Fascio* means a bundle or bunch, and was taken to define the close union of the adherents of the movement; as an emblem, the *fasces* of the Roman lictors on a tricolor shield was adopted.

At first the Milan Fascio only attracted a fraction of the people who opposed Bolshevik Socialism, and it still savoured too much of Mussolini's revolutionary past to secure general support. Fascism was also inspired by a sense of exasperation at the foreign policy of the Government, which did not, the Fascists believed, defend Italian interests at the Peace Conference with sufficient firmness and dignity. This aspect of Fascism was largely the outcome of nationalism, which had first given the Italian people a sense of the importance of foreign affairs and of the necessity for colonial expansion. After D'Annunzio's evacuation of Fiume at the beginning of 1921 many of his *legionari* joined Fascism, some of whose outward manifestations and the semi-mystical character, as well as the Roman reminiscences and ritual, they inspired.

The Squadre.—At the elections of 1919 none of the Fascist candidates were returned. During the troubles of 1919 and most of 1920 Fascism as an organisation played but a small part. But the Fascist idea was spreading all over Italy, and during the municipal elections held in many cities in the late autumn of 1920 the Fascists collaborated with the other anti-Socialist parties, and in several instances formed with them national blocs, which defeated the Reds. In the Bologna riots (Nov. 1920), which broke out on the occasion of the inauguration of the Socialist-Communist town council, it was the Fascists who, although only 200 strong, organised the reaction of the majority of the citizens and brought about the rapid collapse of the Red organisations, first in that city and subsequently throughout the Po valley. The first armed Fascist *squadre* were now formed for the defence of the nation against what amounted in many places to revolutionary tyranny. These *squadre* consisted of young men, mostly ex-combatants, many of them decorated for valour and adorned with wound badges, of others too young to have served and of not a few older men, exasperated at the spectacle of their country, victorious in the War, but fallen into a slough of despond and browbeaten by a factious minority. There was as yet no real Fascist doctrine beyond this vague sense of outraged patriotism. The *squadristi* were mostly

armed with cudgels, although many possessed revolvers and carbines, for at that time a large number of ex-service men had brought back arms of some sort from the War. Another weapon, a novelty in partisan conflicts, was castor oil, large doses of which were administered to recalcitrant Socialists and Communists, and sometimes even to other opponents of Fascism. During 1921 and 1922 encounters between Fascists and the Reds were of almost daily occurrence. In that period over 1,000 Fascists fell victims to their opponents, and in most cases were murdered by treachery for no other reason than that they were Fascists; but their comrades were not slow to avenge these outrages. When early in 1921 the Communists broke away from the Maximalist Socialist party and indulged in a series of murderous outbreaks in the hope of terrorising the masses into joining them, the Fascist reprisals were ruthless.

What attracted the sympathy of public opinion towards Fascism was the extraordinary bravery and devotion to an ideal of the *squadristi*. At a time when armed Communists were lying in wait at street corners or behind closed shutters to attack anyone wearing the Black Shirt or the Fascist badge, these youths marched on regardless of danger, ready to sacrifice their lives for the national cause. Even orthodox Liberals, Catholics and others supported Fascism, in which they saw the only hope for the salvation of the country from chaos. Many adhered to the movement for selfish reasons—landlords and manufacturers who simply regarded it as a form of protection for the rights of property which the Government allowed the seditious elements to violate with impunity, and others became Fascists out of a spirit of adventure, to secure positions for themselves or for other personal reasons.

A Mass Movement.—In its early days the movement was unconnected with any particular labour policy, although Syndicalists were among its founders; later, individual workmen, peasant-proprietors and farm hands joined it individually; but, with the success of the Fascist campaign against the Red organisations in the Po valley at the end of 1920 masses of workers became Fascists, and often whole unions came over in a body. This development changed the character of Fascism, and converted it from a minority to a mass movement. At the elections of May 1921, held under the auspices of Sig. Giolitti, 38 Fascists were returned, including Sig. Mussolini himself, and 10 Nationalists. In the new Chamber the Fascists and Nationalists formed a fighting band of vigorous youths strenuously opposed to the Reds—a nucleus which gathered around its standard members of other patriotic parties. At the Fascist congress in Rome in Nov. 1921 a review of the Fascist forces was held, and Fascism was constituted as a regular political party, the *Partito Nazionale Fascista,* and its statutes were then drafted.

The Programme of the Fascists

The programme of the Fascists differs from that of other parties, as it represents for its members not only a rule of political conduct, but also a moral code. The programme states that

"the nation is not merely the sum total of living individuals, nor the instrument of parties for their own ends, but an organism comprising the unlimited series of generations of which individuals are merely transient elements; it is the synthesis of all the material and non-material values of the race."

The state must be reduced to its essential functions as a legal and political organ, the powers of parliament limited to questions concerning the individual as a citizen and the state as the organ for realising the interests of the nation, whereas the activities of individuals as producers should be dealt with by technical councils. Trade unions must be encouraged as a means of developing production, but they should not arbitrarily level all capacities. The prestige of the state must be restored at all costs. The national finances must be placed on a sound basis, free from all traces of demagogy. Fascism recognises the social functions of private property, proposes a system of State discipline over class conflicts, and demands that both employers' and workmen's organisations shall be legally recognised and invested with responsibility; no strikes in the public services are to be tolerated. The state should restore to private enterprise all industrial undertakings which it has proved incapable of running. In foreign affairs Italy must "reaffirm her right to complete historic and geographic unity, and fulfil her mission as the bulwark of Latin civilisation in the Mediterranean." The party is indissolubly bound up with its *squadre*—the volunteer militia at the service of the state. It was this congress that declared that Fascism would substitute itself for the State whenever the state should prove incapable of suppressing the elements of disorder and disintegration.

The organs of the party are: the Directorate—the executive organ, composed of the general secretary and 10 other members elected by the national council, the central committee, composed of the various district delegates and the members of the Directorate, elected by the national council for a year and entrusted with the conduct of the political and administrative action of the Fasci and with disciplinary authority; the national council, composed of the members of the central committee and the provincial secretaries, and invested with controlling authority over the Fasci; the general secretariat, nominated by the national council; the Fasci, or local sections of the party, all the Fasci of a province constituting a provincial federation; *the squadre di combattimento;* entrusted with the duty of repelling the violence of adversaries, which should hold themselves in readiness to act at the bidding of the leaders of the party for the defence of the national interests; the parliamentary group, composed of the Fascist members of Parliament; the various auxiliary groups, such as *the Women's Fasci, the Avanguardie, the Balilla, etc.;* the congress, composed of delegates of the provinces, which meets at irregular intervals to express the views of Fascism as a whole.

Attitude to Monarchy.—Fascism had been gradually shedding its demagogic elements, and at Udine, on Sept. 29 1922, Mussolini expressed his adherence to the monarchy, thereby securing widespread support for Fascism among many who had hesitated on account of its "implicit republican tendency." Fascism has ended by becoming the strongest bulwark of the monarchy, because, unlike other monarchical parties, it had no need to conciliate the revolutionary elements. The whole conception of Fascism is based on rigid hierarchy.

Italy under the Fascists

When Fascism came into power (Oct. 28 1922), Sig. Mussolini, although rejecting alliances with other parties, accepted their collaboration, and admitted several of their members into his first Cabinet. Nationalism was absorbed by Fascism early in 1923, but as the Opposition became more violent in its attacks, especially after the Matteotti murder, the party tended to concentrate more and more on itself, satisfied with its own strength and the general approval of public opinion, not attached to any party; and it still has millions of supporters who are not Fascists. The party underwent certain changes in its constitution, among which the most important were the fusion with nationalism and the creation of the Fascist grand council. This body, which sums up, co-ordinates and directs all the activities of the party, is composed of the Prime Minister as chairman, all the Fascist members of the Government, the general secretary of the party and certain other party officers both central and local. At its meetings the opinion of Fascism in the direction of various legislative reforms is manifested, and the proposals voted are then submitted to the Cabinet. Although party and Government are separate, the connection between the two is very close, as Sig. Mussolini is at once the head of the Government and the leader of the party.

Relations with the Vatican.—Fascism, since it has become the Government of Italy, has shown a marked sympathy for Catholicism, which as the religion of the vast mass of the Italian people is regarded to some extent as a national institution. Relations between Fascism and the Vatican have become very friendly, and the anti-Fascist tendencies of the *Partito Popolare* are by no means approved of in Vatican circles. Occasional minor disagreements with the Vatican in no way affect the general policy of the party.

Fascist Aims.—The Fascist tendency to isolate itself and reject alliances with other parties was steadily advocated by Roberto Farinacci (*q.v.*) after his appointment as general secretary early in 1925. After the Matteotti trial in March 1926, he resigned his appointment, having accomplished the task of reorganising the party, and was succeeded by Auguste Turati. The party directorate was also changed. But the general character of Fascism remains unaltered. Its aim is to get its main principles generally accepted by the nation and embodied in a series of legislative reforms which shall make of Italy an essentially National State, as opposed to the pre-existing Liberal State, wherein the seditious elements were free to conspire against the general welfare in the interests of class or clique. These reforms comprise the restoration of national finance, the reorganisation of the bureaucracy in the interests of efficiency, the reform of education, the peaceable regulation of labour conflicts, the re-establishment of discipline in every department of the state and every aspect of national life, the improvement of agriculture and the progress of industry. Many of these reforms have already been carried out, and others are in progress. Opponents accuse Fascism of crushing liberty; but the Fascists reply that if the freedom of the Press is limited, and parties, other than the Fascist, are reduced to inactivity, the essential liberty of the people has been secured as never before—the freedom to work and produce for the common good—and that only a strong Government like that of Sig. Mussolini could achieve such a series of necessary and far-reaching reforms, which Liberal Governments may have desired, and even attempted, but had always failed to carry out owing to the tyranny of parliamentary obstruction. The people, he said in July 1924, never asked him to free them from a tyranny which did not exist, but asked for railways, houses, roads, bridges, drains, water and light.

Fascist Doctrine.—Fascist doctrine, as it has been evolved during the last years, was authoritatively set forth by Prof. Alfredo Rocco, Minister of Justice, in a speech at Perugia on Aug. 31 1925. After rejecting the liberal, socialist and democratic theories of the state, he declared that, according to Fascism, society does not exist for the individual, but the individual for society; although Fascism does not annul the individual as the individuals annulled society under certain older doctrines, but merely subordinates him to society, while securing his right to develop his personality. Economic progress is a social interest, but Fascism considers it best to leave the production and distribution of wealth to individual enterprise in order to secure the maximum results in the interests of the community. The social problem is not solved, however, by merely rejecting the socialist doctrine; Fascism wishes to secure justice between classes, but class warfare must be eliminated, as it is the state which must establish justice between classes just as it does between individuals. Sig. Mussolini in an article in *Gerarchia* (Oct. 1925) compares "the incessant and fertile activity of the Government with the paralysis of all the opposition parties within the Chamber and without. Everyone, explicitly or otherwise, is convinced that in the Italy of 1925 Fascism alone towers like a giant." The defects of Fascism are the general defects of the Italian character: the tendency to rhetoric, *arrivismo* (excessive pushfulness of men on the make), which has been accentuated by the creation of the many party offices and appointments, often filled not by the worthiest but by the most pushful and ambitious. Of the deeds of violence occasionally committed by Fascists, usually reprisals for similar deeds committed by adversaries, Sig. Mussolini wrote in the above-quoted article: "This violence does not facilitate the work of the Government, but compromises it."

Fascist Labour Organisation.—Labour syndicalism has become one of the most important aspects of Fascism. The first statute of the party, drafted in Dec. 1921, defined the Fascist labour corporations. Labour is declared to be the basis of human welfare and progress, and all who devote themselves to productive work are regarded as workers. Fascist syndicalism, unlike the Socialist unions, accepts the patriotic idea, recognises the importance of capital, and considers the fate of the worker as bound up with that of the whole nation. There are now 21 corporations, each of them representing "the union of the various trades, arts or professions related to or dependent on the same kind of labour or industry," and comprising separate unions of manual workers, engineers and experts, and managers and employees. It was not found possible to unite both employers and employed in the same corporations, but there are many joint committees for various purposes. All corporations and syndicates are united under the confederation of corporations, which is the supreme organ of Fascist syndicalism, entrusted with the task of reconciling the interests of the various categories and classes, securing equitable labour contracts with the employers and promoting social legislation. The whole idea of class war is rejected, as classes cannot be allowed to take justice into their own hands any more than private individuals. Fascist syndicalism is gradually coming to monopolise labour, as the older Socialist and Popolare unions are losing all influence over the masses, and the Fascist corporations have become the sole representatives of the working classes in their dealings with the employers. Time will show whether the system will work out satisfactorily, but there is no doubt that the development of Fascist syndicalism has reduced strikes to negligible proportions, increased production and improved the conditions of the working classes by progressive social legislation and in other ways. In Dec. 1925 a law was enacted granting the syndicates legal recognition, and creating the labour tribunals to which all labour conflicts must be referred; strikes and lock-outs are therefore illegal. This is the most far-reaching reform of the Fascist Government. The president of the Fascist federation is the deputy Edmondo Rossoni, elected by the national council. The whole organisation is strictly centralised and hierarchical.

The National Milizia.—Before Fascism came into power its action was largely that of the armed *squadre*, and it was the 200,000 Black Shirts[1] who effected the "March on Rome," enabling Fascism to become the government of the country. But once this was achieved, the existence of irregular Fascist forces was incompatible with Sig. Mussolini's intention of constitutionalising the Fascist movement. To have disbanded them would have savoured of ingratitude, while their constituent elements might still be useful to overawe the revolutionary and anti-national parties and to consolidate the Fascist *régime*. At a Cabinet Council on Dec. 28 1922 it was decided to disband all the *squadre—Fascist, Nationalist, Arditi* and *Legionari fiumani*, and by royal decree of Jan. 14 1923 the *Milizia volontaria per la sicurezza nazionale* was created in their place. The force was voluntarily recruited from among the *squadristi*, the men appointed by the Prime Minister or the authorities delegated by him, and the officers by royal decree on the proposal of the Ministers of War and of the Interior. Neither officers nor men are paid, except those on permanent duty at the general or territorial headquarters (700 in all), while those who are temporarily called out for service outside their place of residence receive a daily allowance.

The total budget comes to 35,000,000 lire annually, although certain special detachments, such as the railway *milizia*, are paid for by other departments. The force, which comprises some 190,000 men, is "at the service of God and the Italian Fatherland, and takes orders from the head of the government." Its duties are "to assist, together with the armed forces for the public safety and the army, in the maintenance of internal order and to prepare citizens for the defence of Italian interests in the world." It has relieved the army of many troublesome services, and although it has never been necessary to employ it to put down revolutionary outbreaks, its mere existence has sufficed to deter the seditious elements from such action. The organisation of the *milizia* was subsequently brought into closer harmony with existing institutions; the royal decree of Aug. 4 1924 provides that its members shall take the oath of allegiance to the King, and that the officers shall be recruited from among the reserve officers of the Army, Navy and Air Force. The force is also entrusted with the pre-military training of youths under 20; the object of this measure is to give a large part of the nation a military education without involving the country in too heavy expenditure. Three legions of the *milizia* have served with distinction in Libya.

In 1926 the party comprised 9,000 Fasci, with about 742,978 registered members (April 21). The party directorate decided at this time not to accept any more members to the Fascist party, all new applications for admission being held on until 1927. There were also

[1] Estimates of their number vary considerably, owing to the fact that while 200,000 or more men were mobilised not all of them actually entered Rome.

590 *Women's Fasci* with 25,000 members, 16 *Legioni Avanguardisti* (youths from 15 to 18 years old) and 18 *Legioni Balilla* composed of boys under 15. In addition the Fascist labour syndicates comprised about 2,150,000 members not counting the Fascist railwaymen's syndicate (80,000 members), the maritime federation and certain other special unions.

BIBLIOGRAPHY.—Of the vast literature on Fascism the following works may be quoted:—

(*a*) *Italian works in favour of fascism:* The speeches of Mussolini, collected in various volumes, including one in English edited by Baron Quaranta di San Severino; the speeches of Enrico Corradini (Discorsi politici, Florence, 1923); the speeches of Carlo del Croix and of Edmondo Rossoni; Camillo Pellizzi, *Problema e realtà del fascismo* (Florence, 1924); Margherita Sarfatti, *Life of Mussolini* (English trans. London, 1925); Carmelo Licitra, *Dal liberalismo al fascismo* (Rome, 1925); Pietro Gorgolini, *Il Fascismo nella vita italiana* (Turin, 1922); also published in English: *The Fascist Movement in Italian Life* (London, 1924); Luigi Villari, *The Awakening of Italy* (London, 1924), and *The Fascist Experiment* (London, 1925).

(*b*) *Italian Works Against the Movement:* Carlo Avarna di Gualtieri, *Il Fascismo* (Turin, 1925); Ivanoe Bonomi, *Dal socialismo al fascismo* (Rome, 1924), also published in England; *From Socialism to Fascism* (1924); G. Ferrero, *Da Fiume a Roma* (Milan, 1923), also published in English; *Four Years of Fascism* (1924); G. Matteotti, *Un anno di domino fascista* (Rome, 1923), English trans.; *The Fascisti Exposed* (1924); Luigi Sturzo, *Pensiero antifascista* (Turin, 1925).

(*c*) *Other Books:* Jean Alazard, *Communisme et fascisme en Italie* (Paris, 1922); G. M. Godden, *Mussolini and the Birth of the New Democracy* (London, 1924); Homen Christo, *Mussolini bâtisseur d'avenir* (Paris, 1923); Ludwig Bernhard, *Das System Mussolini* (Berlin, 1924); Robert Michels, *Der Aufsteig des Fascismus* (Tübingen, 1924); Maurice Pernot, *L'expérience italienne* (Paris, 1924); Perceval Phillips, *Red Dragon and Black Shirt* (London, 1922); Odon Por, *Fascism* (London, 1924). See also the *Almanacco enciclopedia del Popolo d'Italia* (Milan, 1922, 1923, 1924, 1925, 1926). There is a bibliography (including articles in periodicals by C. Bracale and C. Urban in *Guida bibliographica di cultura fascista* (Rome, 1925). (L. V.*)

FASHION: *see* COSTUME.

FATIGUE OF METALS.—This is a generic term denoting all phenomena associated with the behaviour of metals subjected to repetitions of a range of stress. The term, however, is more generally applied to the progressive deterioration, leading to ultimate fracture, caused by repetitions of a cycle of stress, the maximum stress of the cycle being numerically less than that stress which causes failure on a single application. Fracture by fatigue can be caused by repeated cycles of direct, bending, torsional or combined stresses, and is accelerated by the presence of shock conditions or surface defects, sudden discontinuities of section, etc., which create local concentrations of stress.

Three Types of Stresses.—Cyclical variations of stress can be divided into three main types: *Alternating stresses* (maximum and minimum stress of cycle differ in sign), *pulsating stresses* (stresses vary from zero to maximum value) and *fluctuating stresses* (vary in magnitude but not in sign). *Any* stress cycle is defined numerically by the expression, $M \pm \frac{1}{2}R$, where M is the average stress, and R is the range of stress (algebraic difference of maximum and minimum stresses). Fatigue range or limiting range (R) is the greatest range of stress which can be applied for an indefinitely great number of repetitions without causing fracture. *Endurance,* under a given range of stress, is the number of repetitions necessary to cause fracture.

In 1849 Jones and Galton investigated the behaviour of cast-iron bars subjected to pulsating bending strains. Fracture occurred in less than 100,000 strainings when the range of strain exceeded one-third of the static ultimate deflection. The endurance decreased at an increasing rate with increased ranges of strain. Bars which had been partially fatigued suffered no loss in static ultimate strength. Somewhat similar tests, on a wrought-iron built-up girder, were made by Fairbairn in 1860–1. The loading was applied with shock. Fairbairn's conclusions confirmed those of the earlier workers and also pointed to the existence of a definite fatigue range for metals. These conclusions received further support from the experiments of Wohler (1871), in which, for the first time, strict attention was paid to the *magnitude* of the applied stresses. Wohler used iron and steel subjected to cycles of direct, bending and torsional stresses.

Subsequent to these early classical investigations, the fatigue of metals has formed the subject of several hundreds of independent researches. The main objects of these investigations and the conclusions drawn from the results are briefly summarised below.[1]

Evidence of a Limiting Range of Stress.—The results of a series of endurance tests, where any one type of straining action and a constant value of the mean stress of the cycle are employed, show that the endurance (N) to fracture increases at an increasing rate as the range of stress (S) decreases. A curve connecting S and N tends to become parallel to the N axis. It is regarded as established that, in the case of ferrous metals, the S/N curve, has become parallel to the N axis at values of N of 10^7 or 2×10^7 reversals, and remains so for the maximum endurances investigated (10^8 to 10^9 cycles). This is also true for some of the pure metals and non-ferrous alloys. Tests on *some* non-ferrous metals and alloys, however, have shown fractures to occur after several hundred millions of reversals, although, at these endurances, the slope of the S/N curve is very small. In general, *sound metals appear to possess a definite limiting range of stress* (R_L).

Two relations have been suggested both of which can be expressed by the formula $R_L = R_{LR}(1-\frac{M}{f})^x$ where R_L is the limiting range when M is the corresponding value of the mean stress, R_{LR} is the limiting range when M = 0, f is the static ultimate strength of the metal, and x has the value of 1 or 2. Some experimental results agree with one of these relations, others conform to neither. For cycles of direct stresses, the linear relation is generally a safe rule between the limits of M = 0 and $M = \frac{1}{2}R$. Some experiments employing torsional stresses have shown that the value of R_L is not altered appreciably by wide variations in the value of M.

Effect of Frequency of Cycle (F) on Limiting Range (R_L).—It is now established that a constant value of R_L is obtained at frequencies up to 5,000 cycles per minute. Tests made on copper, iron and mild steel at frequencies of 3,000, 30,000 and 60,000 cycles per minute gave progressively greater values of R_L at the higher frequencies.

Under repetitions of the limiting range, or a numerically inferior range, a state is ultimately reached when no further plastic strain occurs; approximate elasticity only results as strain hysteresis can be detected. These *natural* elastic limits are not related to the *primitive,* or original, elastic limits of the material. When the applied range of stress exceeds the limiting range, plastic deformation occurs until the cracking stage is reached.

Effect on Limiting Range of Temperature of Test.—Available data relate only to reversed stresses (M = 0). The limiting range (R_L) is largely unaffected in value until temperatures of about 400° C. are reached. At higher temperatures R_L decreases, the rate of decrease varying with different metals. The effect of elevated temperatures on R_L is not, in general, as marked as on the static ultimate strength under prolonged loading; *e.g.*, the values of $\frac{1}{2}R_L$ for 4 steels and 1 non-ferrous alloy, at various temperatures between 550° C. and 750° C., has been found to be *equal to,* or *greater than,* the static strength (under prolonged loading) at the same temperatures.

Effect of Repeated Stresses on Microstructure of Metals.—Repeated stresses applied to *crystalline aggregates* cause slip bands to appear on the surfaces of favourably orientated crystals. If R_L is not exceeded, this local action ceases after a certain number of repetitions and the metal becomes strain-hardened. Under repetitions of greater stress ranges, microscopic cracks are initiated in the regions of maximum slip, and fracture is caused by propagation of these cracks throughout the metal. Even in ductile materials, the process of initiation and propagation of these cracks may be so highly localised that the appearance of fracture is one usually associated with that of brittle materials. Precisely similar surface phenomena are exhibited by single metallic crystals subjected to repeated stresses, suggesting that fatigue failure is essentially a process of deterioration of crystalline material and that the chief effect of the inter-crystal boundaries in aggregates is to inhibit slip due to the change in orientation of neighbouring crystals.

[1] Except where otherwise stated, the remarks apply only to tests conducted at air temperature.

A fundamental theory of fatigue has yet to be advanced. The attrition theory (Ewing and Humfrey) is not supported by the results of recent research. A number of theories have been based on the assumption (Beilby) that plastic strain in metals causes a change from the crystalline to the amorphous state on the surfaces of slip. The manner in which the fatigue crack is initiated has not been explained satisfactorily. The results of experiments on single crystals (Gough, Hanson and Wright) suggest that the effect of slip is to produce local distortions within the crystal, thus setting up internal stresses which, under repetitions of stress ranges, lead to the disruption of inter-atomic bonds and the initiation of cracks. The breaking-up, under strain, of a crystal grain into a number of crystallites of slightly varying orientations, is an alternative hypothesis which is consistent with observed facts. Little doubt exists that, in some manner, fatigue failure is the direct result of local plastic deformation, and it seems highly improbable that fatigue would occur in a material which is truly elastic.

The importance of an understanding of fatigue phenomena in its relation to industry cannot be over-estimated. Those machine and structural components whose working conditions can be so adjusted as to exclude the possibility of fatigue failure constitute a very small minority. The whole trend of development of modern engineering lies in the direction of the employment of higher working stresses, speeds and temperatures. These considerations, together with the necessities of eliminating unnecessary material —to reduce first cost—and the reduction of the weight power factor—which has become of prime importance since the advent of aircraft—tend to make the static strength properties of metals (except at elevated temperatures) of less relative importance than their fatigue properties. A conservative estimate of failures in modern engineering practice attributes 80% of such failures to fatigue. As fatigue failures are usually unaccompanied by any marked preliminary warnings, a deplorable loss of life has often resulted. *See* METALLOGRAPHY; METALLURGY; MATERIALS, STRENGTH OF.

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FAURÉ, GABRIEL (1845–1924), French musical composer (*see* 10.209), died at Passy Nov. 4 1924.

FAUVISM: *see* PAINTING.

FAWCETT, MILLICENT GARRETT (1847–), British writer and political worker, was born at Aldeburgh, Suffolk, June 11 1847. In 1867 she married the economist, Henry Fawcett (*see* 10.215). She herself produced various works on economics, including *Political Economy for Beginners* (1870), *Tales in Political Economy* (1874) and, with her husband, a volume of *Essays and Lectures* (1872). Mrs. Fawcett was one of the early workers for women's suffrage, and in 1907 became President of the National Union of Women's Suffrage Societies. She was strongly opposed to the tactics of the militant suffragists, and expressly dissociated the N.U.W.S.S. from any sympathy with such methods. The constitutional methods adopted by the body included an alliance formed with the Labour party (1912) by which the society agreed to support Labour candidates in preference to Liberal when the latter proved unsatisfactory on the suffrage question. Her later books include *Life of Queen Victoria* (1895); *Life of Sir William Molesworth* (1901); *Five Famous French Women* (1906); *Women's Suffrage* (1912); and *What I Remember* (1924). She was created G.B.E. in 1925.

FAYOLLE, MARIE ÉMILE (1852–), French soldier, was born at Puy (Haute-Loire) May 14 1852. He entered the École Polytechnique in 1873, and joined the 16th regiment of artillery in 1875. Captain in 1882, he entered the École de Guerre in 1889, and returned there as professor (of the artillery course) in 1897; in 1900 he was made titular professor and remained there till 1907. In the face of the orthodox doctrine he urged the importance of concentration of fire and the obstacle it offered to an attacker; this view he expressed in an admirable brochure entitled *Concentration des feux et concentration des moyens* (1912). On Aug. 13 1914 Fayolle who had been made a general of brigade in 1910 was given the command of the 70th reserve division. He distinguished himself at the battle of le grand Couronné and afterwards in Artois. The 70th division together with the 77th formed under Gen. Pétain the III. Army Corps which played a brilliant part in the offensive of May 9 1915. Gen. Fayolle succeeded Gen. Pétain on June 21 in command of the XXXIII. Corps, which he directed during the attack at Souchez and Vimy of Sept. 1915.

On Feb. 26 1916 Gen. Fayolle was given the command of the VI. Army which took part in the battle of the Somme; in the beginning of May 1917 he succeeded Gen. Pétain at the head of the Centre Group of armies (holding the Champagne and Verdun fronts). On Nov. 18 1917 he was sent to Italy but was recalled on Feb. 8 of the following year in expectation of the German offensive, which came on March 21; two days later he took command of all the forces engaged between Péronne and Barisis—which formed the Reserve Army Group. By March 31 the German attempt to break through was definitely checked, as also a fresh effort between June 9 and 13. In July the Reserve Army Group comprised the I., III., X. and VI. Armies which carried out the two great offensives of July 18 and Aug. 8 1918. After the armistice Fayolle's Army Group was entrusted with the occupation of the Rhine provinces; he entered Mainz on Dec. 14 1918, making Kaiserslautern his headquarters. He was made a marshal of France on Feb. 21 1921.

FEBVRE, ALEXANDRE FRÉDÉRIC (1835–1916), French actor (*see* 10.231), died in Paris Dec. 14 1916.

FEDERAL FARM LOAN SYSTEM.—The Federal Farm Loan Act of 1916 was adopted in the United States at a time when the increasing use of costly equipment and the rising price of farm land had combined to make the problem of financing the American farmer a difficult one.

His need for short-time credit, generally, had been met in various ways; his chief difficulty was to find long-time or mortgage credit. When the farmer must make a heavy investment, he needs a long loan. The only satisfactory security he can offer is a mortgage, and the market for farm mortgages is limited. Local mortgage brokers or bankers having the necessary expertness could lend on a limited number of mortgages and, after adding their own endorsements, discount the loans with eastern investors. In other cases, some of the large insurance companies sent their own experts into selected regions to place loans secured by mortgages. Again, a number of large corporations, commonly called mortgage banks, were organised to lend on mortgage security and to sell their own bonds to the investing public. Such a corporation, having bought a number of mortgage notes aggregating $100,000, would deposit them with a trustee as security for its own bonds to the same amount. These bonds were then sold to the general investing public, but sold on the general reputation of the corporation issuing them, and not on the buyer's expert knowledge of the individual mortgages.

The Act of 1916.—The Federal Farm Loan Act of 1916 was passed to extend this principle and enable it to meet the need for mortgage credit throughout the country. This Act created a Federal Farm Loan Board, consisting of the Secretary of the Treasury and four others to be appointed by the President, to have general administrative control. Under this board there were created 12 farm land banks, located in the 12 districts into which the country was divided; in each district there are organised, under its farm land bank, an indefinite number of farm loan associations, composed wholly of farmers desiring to borrow money on mortgage; and they borrow from the farm land bank of their district.

The 12 Federal farm land banks are located in the following cities:—Springfield, Mass.; Baltimore, Md.; Columbia, S.C.; Louisville, Ky.; New Orleans, La.; St. Louis, Mo.; St. Paul, Minn.; Omaha, Neb.; Wichita, Kan.; Houston, Tex.; Berkeley, Cal.; Spokane, Wash.

The Act permits joint stock land banks to come in under the Federal Farm Loan system. Sixty-nine had done so before Feb. 28 1925, with capital stock of $35,307,085, with bond issues aggregating

$454,540,200, and with loans to farmers aggregating $464,873,770. Every Federal farm land bank was required to have, before beginning business, a subscribed capital stock of not less than $750,000, from which to purchase the first batch of mortgages from the farm loan associations. Additional funds were to be raised through the sale of bonds to the investing public. Each issue of bonds was to be based upon a batch of mortgages previously purchased and deposited as security under the direction of the farm loan board. If the total $750,000 of capital stock of any Federal farm land bank was not subscribed within 30 days after the opening of the books, it became the duty of the Secretary of the Treasury "to subscribe the balance thereof on behalf of the United States," and amendments were passed (Jan. 18 1918 and May 26 1920) authorising the Secretary of the Treasury to purchase $200,000,000 of such bonds during 1918–21.

On Feb. 28 1925 the U.S. Govt. held $1,513,045 of the capital stock of the farm land banks. The total bonds authorised and issued by them was $949,130,492. The total capital stock of the 12 farm banks amounted to $50,390,330, held as follows:—

By the U.S. Govt.	$ 1,513,045
By National Farm Loan Assns.	48,471,970
By borrowers through agents	403,730
By individual subscribers	1,585

The total amounts loaned by the 12 Federal land banks, as recorded for 1920 and 1925, are as follows:—

	To Nov. 30 1920.	To Feb. 28 1925.
Springfield	$13,550,345	$ 35,930,637
Baltimore	14,732,783	51,142,223
Columbia	20,406,515	57,481,504
Louisville	27,691,200	92,287,466
New Orleans	25,811,705	93,063,031
St. Louis	30,951,675	66,280,807
St. Paul	49,554,700	113,430,039
Omaha	48,905,890	114,387,435
Wichita	31,531,300	83,282,745
Houston	40,754,766	104,651,436
Berkeley	18,645,900	39,531,815
Spokane	46,084,535	93,520,812
Total	$368,621,314	$944,989,970

The course of the money is as follows: first, from the investor to the farm land bank in exchange for bonds; second, from the farm land bank to the farm loan association in exchange for a batch of mortgages; third, from the farm loan association to the individual farmer in exchange for an individual mortgage. The securities, however, proceed in the opposite direction; first, a mortgage is given by the individual to his local farm loan association in exchange for money; second, this and other similar mortgages are transferred from the farm loan association to the farm land bank in exchange for money; third, the farm land bank deposits these mortgages under the direction of the Federal Farm Loan Board and, on that security, issues its own bonds and sells them to investors.

Under the Farm Loan Act the bonds of the farm land banks are exempt from taxation, in order to make such bonds so attractive to the general investor as to compensate for a low rate of interest, and thus to enable the farmer to borrow at a lower rate than would otherwise be possible. Bonds issued prior to May 1 1920 paid 4½%. Subsequent issues pay 5%. This provision was bitterly attacked on the ground that it was class legislation, discriminating in favour of farmers as against other classes. The matter was under litigation for many months, but finally in February 1921 the Supreme Court decided in favour of the constitutionality of the Act. (T. N. C.)

FEDERAL RESERVE BANKING SYSTEM: *see* BANKING: UNITED STATES.

FEDERAL TRADE COMMISSION.—This American commission was created by Act of the U.S. Congress, approved Sept. 26 1914, for the prevention of unfair methods of competition in commerce and for the collection of information respecting corporations engaged in interstate commerce and respecting export trade associations and conditions. It is composed of five members appointed by the President, and confirmed by the Senate; not more than three members may be of the same political party. The commission elects its own chairman. It entered upon its official duties March 16 1915. With it was merged the Bureau of Corporations, previously under the jurisdiction of the Department of Commerce.

Powers.—If the commission has reason to believe that a "person, partnership or corporation" practises any unfair method to the prejudice of the public interest, it shall serve a notice upon such party, submit a statement of the charges and set a date for a hearing. The party complained of has the right to appear and show cause why the commission should not require the cessation of practices alleged to be in violation of the law. If the party refuses to obey the orders of the commission, the commission may apply to the U.S. Circuit Court of Appeals. Banks and common carriers are excepted, they being under other Federal supervision. The commission is empowered to investigate from time to time "the organisation, business, conduct, practices and management" of any commercial corporation excepting banks and common carriers, and its relation to any other corporation, and to make recommendations for a readjustment of its business alleged to be violating the anti-trust laws, including those relating to price discriminations, intercorporate stock-holdings and interlocking directorates. The purpose of the commission is to advise and regulate. It is also empowered to investigate trade conditions of foreign countries as affecting the foreign commerce of the United States, and to report to Congress with recommendations. The commission comprises three departments: administrative; economic, in charge of investigations; and legal, whose duty it is to conduct investigations in connection with applications for the issue of notices, gather evidence for use in trials, and furnish examiners and lawyers to represent the commission in proceedings before the commission and in court.

Methods.—The activities of the commission are (*a*) quasi judicial, (*b*) economic. Under the first heading comes the prevention of unfair methods of competition. On its economic side the commission investigates (i) on its own initiative any corporation engaged in interstate commerce; (ii) on the direction of the President or either House of Congress any corporation alleged to be violating the anti-trust Acts; (iii) either on its own initiative or that of the Attorney-General the manner in which a court decree dissolving a trust is being carried out. It can also, at the instance of the Attorney-General, recommend the readjustment of the business of any corporation alleged to be violating the anti-trust Acts so as to conform to the law.

Another Act of the U.S. Congress, approved Oct. 15 1914 (commonly called the Clayton Act), specifically declared certain practices illegal and gave the Federal Trade Commission jurisdiction to prevent them. (*See* also INTER-STATE COMMERCE; TRUSTS.)

FEDERZONI, LUIGI (1878–), Italian politician and journalist, was born at Bologna Sept. 17 1878. Educated at the university there, he took to journalism and literature, and for several years was on the staff of the *Giornale d'Italia*, Rome. In politics he was a Conservative, and became a warm supporter of the Nationalist movement. After the Florence Nationalist congress in Dec. 1910, he helped to found the *Idea Nazionale*, at first the weekly and subsequently the daily organ of the Nationalist movement. At the elections of 1913 Federzoni was elected for one of the divisions of Rome. In the Chamber he never missed an opportunity to combat the Socialists, Republicans and Democrats. As soon as Italy intervened in the World War he joined the army as a lieutenant of artillery; he afterwards joined a trench mortar battery and was awarded a medal for valour. Federzoni supported Mussolini when the latter issued his manifesto of Oct. 26 1922 announcing the march on Rome. In the Cabinet formed by Mussolini five days later Federzoni was Minister for the Colonies. In this capacity he provided for the reconquest of all the Libyan territories evacuated during the War, and proceeded to reorganise the whole colonial administration. After the Matteotti murder in June 1924 Mussolini selected Federzoni for the post of Minister of the Interior.

FÉLIX, LIA (1830–1908), French actress (*see* 10.239), died in Paris Jan. 15 1908.

FENCING (*see* 10.247).—The period from 1910 to 1926 was a very critical one for British fencing. Up till 1914 it was increasing in popularity and rising in its general standard when, with the outbreak of the World War, its activities came to an abrupt end. When, in 1919, more normal conditions had returned, the outlook was not of the best. The experienced fencers were suffering from their long period of inaction and there were no young fencers ready to step into their places; for fencing, above all

other sports, demands a long period of apprenticeship. It is a wonderful tribute to the fascination of the art, that in 1925 fencing had become more popular than ever, that its general standard is considerably higher than in the years before the War and that its appeal is far more general.

Fencing in the Services.—A marked feature of this improvement is to be seen in the Royal Navy, the Army and the Royal Air Force. In the past the leading civilian fencers regarded the fencing of army and navy officers with scant respect, but in the six years from 1920 to 1925 inclusive, 5 out of the 18 amateur championships held with the three weapons, foil, épée and sabre, were gained by officers on the active list of the services. This improved standard is to be noted also at the universities and at the public schools, though naturally not to the same extent.

Fencing Clubs.—The most hopeful development for the future, however, lies in the more general appeal of fencing. In addition to the established salles, the London Fencing Club with Prof. Mimiague, the Salle Bertrand, Salle Tassart, Salle Alibert, Salle Gravé, the Royal Automobile Club with Prof. Volland, other fencing clubs have been recently formed which extend the pleasures of fencing to a class which in pre-War days never thought of it. Such are the Grosvenor Club, the Lensbury Club and the Tom Hughes Club, among others, and the members of these clubs are rapidly attaining a marked proficiency with foil and épée. Outside London, in the provinces, at Birmingham especially, and in Scotland, the popularity of fencing is increasing.

Two features of present-day fencing are to be regretted. In the first place the introduction of épée methods into foil play has become marked in recent years, and as long as the foil is regarded as a competitive weapon these methods will no doubt continue. In the two competitions for the Thompson trophy, between American and British representatives, the former easily defeated the more stylish British foil-fencers by using the weapon as a fighting rather than as a fencing implement, and their victories no doubt had an effect on the younger generation of foil-fencers.

The second indictment refers to épée fencing. Assaults with that weapon are now decided in international events by two hits out of three instead of by a single hit. There appear to be three good and sufficient arguments against this practice: (*a*) Where the target is the whole body, so great concentration is required that a single hit is quite sufficient to determine the issue: (*b*) the knowledge that a single hit is not fatal tends to carelessness over the first hit; (*c*) a fencer who has won the first hit can win the encounter equally with a good second hit or a coup double, and anything which tends to exploit the coup double is much to be deprecated.

The Olympic Games.—In the Olympic Games of 1912, the British team did not make a great show, but in the International Fencing Tournament, held at Earl's Court, London, Comm. E. W. H. Brookfield, R.N., tied for first place with the sabre. In 1914 that fine fencer, R. Montgomerie, by his victory in the épée championship, brought up the number of his individual championship successes to eight, a record for a British fencer. In the Olympic Games of 1920 Capt. R. Dalglish, R.N., was placed sixth in the final sabre pool and also awarded a special prize for "good sportsmanship."

Anglo-American Contests.—This Olympiad, with its apparently inevitable squabbles and bickerings, resulted in a special rapprochement between the teams of the United States and Great Britain and started the competition between the two nations for the Thompson trophy. The first meeting was held in America during Nov. 1921, and resulted in a victory for the United States by 25 points to 21, but Great Britain turned the tables in the summer of 1923. In 1923 E. Seligman won the sabre championship, a feat which he repeated in 1924, and so became the first British fencer to gain a championship with all three weapons, and he further distinguished himself by reaching the final pool of the foil championship in the Olympic Games of 1924 in Paris, when he had to retire owing to a strain, after beating the winner. He also qualified for the second round of the sabre championship and Capt. R. Dalglish, R.N., also did well; while C. H. Biscoe reached the semi-final pool of the épée championship. In these same Olympic events, the United States were well represented by Bloomer, Boyce, Calnan, Jeter, Breed, Milner, Gignoux, Macpherson, Lyon and Costner.

In 1923 two Grands Assauts d'Armes were held at the Hotel Cecil and the Grocers' Hall, London, and one in 1924 at the Royal Automobile Club, London. In these many of the most distinguished continental fencers took part, both amateur and professional, including A. Massard, M.C., L. Gaudin, R. L. Heïdé, C. Lafontan, A. Pope, Aldo Nadi, E. Tack, F. de Smedt, J. Rossignol and many others. Fencing among women has developed extraordinary popularity. In 1925 the three outstanding women fencers in Great Britain were Miss Gladys Davis, Miss Gladys Daniell and Mrs. Freeman.

Winners of the Amateur Championships

Foil	Épée	Sabre
1910 R. Montgomerie	E. M. Amphlett	A. Ridley-Martin
1911 E. M. Amphlett	J. P. Blake	W. Hammond
1912 P. G. Doyne	R. Montgomerie	Capt. C. F. Vander Byl
1913 G. R. Alexander	G. G. M. Vereker	A. Ridley-Martin
1914 R. M. P. Willoughby	R. Montgomerie	W. Hammond
1920 P. G. Doyne	M. D. V. Holt	Lieut. C. A. Kershaw, R.N.
1921 R. Sutton	Capt. H. F. S. Huntington	W. Hammond
1922 R. Sutton	G. M. Burt	A. H. Corble
1923 Maj. Stenson Cooke	M. D. V. Holt	E. Seligman
1924 Flight-Lieut. F. G. Sheriff	C. H. Biscoe	E. Seligman
1925 Flight-Lieut. F. G. Sheriff	Maj. C. B. Notley	Lieut.-Comm. C. A. Kershaw, R.N.

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FENG YU-HSIANG, Chinese soldier, and the so-called "Christian general" first came into prominence when, on Aug. 25 1921, he was appointed tuchun, or military governor, of Shansi. In 1922 he was transferred to Peking and played a decisive part in the Chihli-Fengtien war of that year. During 1923 his troops were stationed at Nan-Yüan, near Peking, and it was inevitable, in view of the doubtful authority of the President and his Ministry, that he should play an important part in the political intrigues of the capital. These manoeuvres culminated in his resignation, the flight of President Li and the *coup d'état* which resulted in the assumption of office by Tsao-Kun. Feng retired to the northwest frontier, where he became director of defence, but returned to aid Chang-Tso-lin against Wu Pei-fu in 1924. After Wu's defeat, Feng turned against his ally and seized Peking, thus forcing Chang to retreat to Mukden. He dominated the capital throughout 1925 and at the end of the year captured Tientsin. Chang's victory at Mukden, however, led to Feng's retirement to Mongolia. Feng earned his sobriquet by embracing Christianity after witnessing, it is said, the heroism displayed by missionaries during the Boxer outrages.

FERDINAND (1861–), EX-KING OF BULGARIA (*see* 10.269).—King Ferdinand in 1911 was the instigator of the Balkan League between Bulgaria, Serbia, Greece and Montenegro, which was formed in 1912 and enabled these four states to declare war against Turkey that same year. This pact provided for the future division of the Balkan Peninsula, reserving to the arbitration of the Emperor of Russia the solution of any doubtful claims. The war started in Oct. 1912, before the conclusion of the Treaty of Ouchy, which put an end to the Italo-Turkish War (Oct. 15). Under the command of King Ferdinand, the Bulgarian Army dealt the most rapid and decisive blows to the enemy; victorious on the battlefields of Kirk Kilisse and Lule Burgas, and having conquered most of Macedonia and Thrace, it started on the open road to Constantinople. Europe grew alarmed; the Great Powers brought about the armistice of Dec.

3 1912, and the London Conference, which started on Dec. 13.

These discussions, however, ceased abruptly, and military operations were resumed on Feb. 3 1913. The Bulgarian armies attacked at Gallipoli and Chatalja, and after a gallant siege entered Adrianople on March 26 1913. However, the Treaty of London which followed did not sanction these victories, and its decisions instead of inaugurating peace, provoked a war between the Balkan States, which began on June 30 1913, by a simultaneous attack of the Serbs and Bulgarians. The former allies became bitter rivals, Rumania and Turkey joining Montenegro, Greece and Serbia against Bulgaria, who, finding herself closed in by four enemies at once, was forced, after a few weeks of brave but useless resistance, to submit unconditionally to the victors' terms. The Treaty of Bucharest, signed on Aug. 10 1913, annihilated in one stroke the brilliant results obtained through the heroism of the Bulgarian armies in 1912–3. It deprived Bulgaria of all her conquests including the town of Silistra and part of the Dobruja and gave to the Serbians and Greeks the province of Macedonia for which Bulgaria had made all the sacrifices of the first Balkan War. This treaty was the principal cause of Bulgaria's participation in the World War on the side of Germany. It explains the resentment of King Ferdinand and his Govt. against the other Balkan States. Had the Allied Powers in 1914 guaranteed the revision of the Treaty of Bucharest, Bulgaria would have co-operated with them; but as they failed to do so, Germany was able, by illusory promises, to induce Bulgaria, who felt she had been unjustly treated, to fight for the German cause. These German manoeuvres did not succeed at once, for King Ferdinand began by proclaiming the neutrality of Bulgaria in Nov. 1914.

During May 1915 the Bulgarian Govt. sounded the four Great Powers, with regard to the fulfilment of Bulgaria's legitimate claims in Macedonia. As no concrete answer was returned, King Ferdinand turned to Germany, where his application was received with great cordiality. Berlin made lavish promises at once. German envoys hurried to Bulgaria, with a view to persuading the King and the Govt. to conclude a military alliance with Germany. The desire for revenge against Serbia, Greece and Rumania inspired Ferdinand to bind Bulgaria to the Central Powers. On Sept. 21 1915 he gave the order for general mobilisation, though his Govt. advised armed neutrality. In view of this equivocal situation Russia sent an ultimatum to Bulgaria on Oct. 4 1915, which was succeeded by formal declarations of war against Bulgaria on the part of Serbia, France, Great Britain and Italy. Bulgaria was definitely in the German camp; under Gen. Gekoff, commander-in-chief, her armies were victorious on most of the battlefields of Macedonia, Thrace and Rumania, in 1915, 1916 and 1917, against the Serbs, and against the Rumanians. The Kaiser, the King of Saxony and the King of Würtemberg all paid official visits to King Ferdinand at Sofia. However, in Sept. 1918, the Bulgarian Army, discouraged by innumerable hardships, was defeated at Dobropole, Macedonia, by the Allied troops. This was the sign for a general retreat. An armistice was signed at Salonika on Sept. 30 which ended the war between Bulgaria and the Allies. After this catastrophe King Ferdinand abdicated in favour of his son Boris on Oct. 4 1918 and left Sofia the same evening for Coburg where he has lived since in retirement. (A. St.)

FERDINAND I. (1865–), KING OF RUMANIA, was born Aug. 24 1865 at Sigmaringen, Prussia, the second son of Prince Leopold of Hohenzollern-Sigmaringen. As King Charles had no son it was decided that the succession should be continued in the family of Prince Leopold, and Prince Ferdinand, Charles's nephew, became Crown Prince of Rumania and heir presumptive to the Rumanian throne in March 1889. Prince Ferdinand took a great interest in military questions and the organisation of the Rumanian Army on modern lines was in no small measure due to his energy and enlightened advice. He was commander-in-chief of the Rumanian armies during the Bulgarian campaign of 1913. On Jan. 10 1893 he married Princess Marie, eldest daughter of the Duke of Edinburgh, Duke of Saxe-Coburg-Gotha. Six children were born of the marriage.

When Ferdinand ascended the throne on Oct. 11 1914, Rumania was passing through one of the most critical periods of her history. At the Crown Council held under King Charles at Sinaia soon after the outbreak of the World War, the members of the Cabinet who were in favour of intervention on the side of the Central Powers were greatly outnumbered and in spite of Charles's support of the minority, it was almost unanimously decided that Rumania should remain neutral. Later King Ferdinand, who had in the meantime succeeded to the throne, found himself in an extraordinarily painful situation when he realised that an armed intervention in the cause of Rumania's national unity was unavoidable. He, however, conquered his feelings as a German and a Hohenzollern, and when the moment came, he did not hesitate to declare war on his native country. As a consequence he was disowned by the Hohenzollern family.

When Bucharest was occupied by General Mackensen, King Ferdinand and the Royal family withdrew with the Government and the army into Moldavia. There he endured with the rest of the population a most appalling period of anxiety, sickness and want. The Bolshevist revolution and the collapse of the Russian armies came as a crowning misery. Fortunately however, the Rumanian Army, headed by King Ferdinand, repulsed the German attack at Mărăşeşti, thus saving the rest of the country from invasion. In 1918 the provinces of Bessarabia, Bucowina, Transylvania and the Banat had become united with Rumania, and on Oct. 15 1922 King Ferdinand was crowned at Alba Julia King of all Rumanians.

Two most important reforms, the agrarian reform and the inauguration of universal suffrage, were enacted under Ferdinand's reign. The expropriation of large estates and their conversion into small holdings did much to guarantee the peaceful development of an agricultural country such as Rumania. King Ferdinand was the first landlord to hand over his estates to his peasant-soldiers. It was also due to his initiative that the thorny Jewish question was solved by the grant of full civil and military rights to the Rumanian-born Jews. In Dec. 1925 Ferdinand's eldest son, Charles, renounced his claims to the throne, and Charles's son, Michael, became heir apparent. (G. Bo.)

FERRERO, GUGLIELMO (1871–), Italian journalist and author, was born at Portici, near Naples, July 31 1871. At an early age he joined the staff of the Radical semi-republican *Secolo* of Milan. He travelled abroad considerably, and made a certain reputation by his books *L'Europa giovane* (1897) and *Il Militarismo* (1898); Engl. tr., 1902. Later he studied Roman History, and in 1902 published his *Grandezza e decadenza di Roma*, which established his fame as historian among the general public rather than among scholars. He, in fact, applied the methods of journalism to history. In politics a Radical Democrat, on the outbreak of the World War he was an ardent supporter of the Allied cause, which he identified with that of democracy, and advocated Italian intervention. After the War he published numerous articles and several books in Italy and abroad, inspired by the most gloomy forebodings of imminent catastrophe for Italy, Europe and the world's civilisation. Among these later works is *Da Fiume a Roma* (Milan, 1923), also published in English under the title *Four Years of Fascism* (1924).

FERRIER, PAUL (1843–1920), French dramatist (*see* 10.288), died at Nouan-le-Fuzelier Sept. 11 1920.

FERRO-CONCRETE ENGINEERING (*see* also BRIDGES; DAMS; FACTORY; ROAD CONSTRUCTION).—Owing to a combination of circumstances, technical, economic and manufacturing, great developments in reinforced concrete have taken place since 1910, and as a structural system it is now widely appreciated for many purposes on account of its adaptability, lightness and economy of first cost and maintenance. The scarcity of steel during the World War caused reinforced concrete to be used for many structural purposes for which steel had hitherto been considered the most suitable material. Another factor in the development has been the progressive improvement in the strength and reliability of Portland cement as evidenced by the latest revision of the British standard specification for Portland cement, 1925, which calls for a neat cement tensile strength at 7 days of 600

lb. per sq. in. as compared with 450 lb. for the previous specification, 1912.

Rapid progress has also been made with a new type of aluminous cement ("ciment fondu"), originating in France, but now also made elsewhere, which, while setting initially no quicker than Portland cement, nevertheless attains or exceeds in 24 hours the strength of Portland cement at seven days, so that concrete made with such cement can be brought into service, if need be, in a day or two. It is claimed also that the cement resists the action of sea water, and that owing to the heat generated in setting, it can be used in frosty weather.

Along with the improvements in cements much progress has been made in the subject of proper grading, proportioning and mixing of aggregates, sands, cement and water in order to attain the densest, strongest and most watertight concrete. It is well recognised now that, with aggregate and sand of a given material, that mixture of graded material (large, medium and fine) which has the smallest proportion of voids, and which consequently weighs most per unit volume, will be capable, when mixed without excess of water, of furnishing the strongest concrete.

Technical Studies.—On the technical side, much work has been done in the theoretical analysis of the moments and stresses in arches and continuous framed constructions of varied forms, and the results are available for use in the more accurate determination of stresses and sections. Considerable study has also been given to the elastic properties of concrete in relation to the secondary stresses arising from temperature variations and shrinkage of the concrete.

Foundations.—Reinforced concrete construction is adapted to varied uses in foundation work. Thus, retaining walls of ample strength can be readily constructed in places where there is no room for a gravity wall of mass concrete. Heavy columns can be supported on a relatively thin but widespread foundation of reinforced concrete with great saving in weight, volume and depth of construction, as compared with mass concrete. On weak ground, a complete layer of light reinforced concrete in the shape of a plain or ribbed slab may be provided to distribute the entire load over the whole basement area of a structure in an economical and efficient manner unattainable with other methods of construction.

Caissons and Floating Craft.—An important development in subaqueous foundation work, such as dock walls, breakwaters and bridge piers (*see* PORT ENGINEERING) consists in the use of reinforced concrete caissons of rectangular, cylindrical or other form, which may be constructed in dry dock or on a staging on dry land, then launched or floated out, towed to the site, and deposited in position on a bed prepared by dredging or by divers. Such caissons form a permanent part of the construction and are generally used as a working base for further operations of sinking downwards and building upwards, the top being kept always above water. Sinking downwards through suitable materials may be effected by grabbing through open wells in the interior of the caisson, while for difficult cases the excavation may be carried on by men working under compressed air. Large concrete caissons have been applied in the construction of the upper portions of breakwaters as at Valparaiso[1] and elsewhere. In the Oswald Street Bridge at Glasgow,[2] cylindrical caissons 20 ft. diameter were used for the foundations of the piers. These caissons were constructed on a staging ashore, fitted with a false bottom, lowered into the water, floated out to position, deposited on the prepared bed, and after removal of the temporary bottom, sunk to the necessary depth by grabbing and excavation inside, the pier on top of a group of caissons being built up as the sinking proceeded.

Concrete Ships.—The results of the construction of reinforced concrete cargo vessels were satisfactory and indeed surprising as regards watertightness, main longitudinal and transverse strength and lightness of construction. The hull weight in careful designs was less than that of a wooden vessel, though somewhat greater than that of a steel hull. The principal disadvantage lay in the relative tenderness of the thin skin construction under the bumping and rubbing to which a vessel is often subject when in port and when touching the ground. The results were instructive as regards the possibilities of carrying out light watertight concrete constructions with rich concrete of small aggregate without the addition of any special waterproofing material and with very fine limits of cover of concrete and spacing of bars. In Great Britain, in addition to numerous barges and steam tugs, a few self-propelled cargo vessels were also constructed, the principal being the "Armistice"[3] of about 1,100 tons dead-weight capacity.

Flat Floors.—There has been a continued tendency toward simplification of structure with a view to speeding up and cheapening construction, culminating in the extensive use in the United States of the flat slab floor. In this type main and subsidiary beams are dispensed with and a floor of constant thickness with a flat under surface is supported directly on the columns, which have enlarged heads of square or moulded shape. The floor reinforcement consists of several systems of rods mainly radiating from the columns and placed near the upper surface over the columns and near the lower surface in the interior of panels.

The design of such floors is based on very approximate theory controlled by the results of stress measurements in tests of actual floors. The method has hitherto found but little application in Britain, where much more use had been made of light flat ceilinged floors having in their lower part rows of hollow tile blocks set so as to leave intermediate spaces for the formation of narrow reinforced beams, the floor being completed by a continuous concrete layer placed over the tiles and beams. Floors of this type are well adapted for filling in the panels between the main floor beams of structural steel-framed buildings, and have the advantages of lightness and good insulating qualities, while a plaster ceiling can be applied to the grooved soffits of the tiles.

Rich Concrete.—Greater recognition is now being given to the value of the cement element in concrete as affecting the strength, watertightness and endurance of the material. Starting from 1:2:4 mixture, the one most commonly used in reinforced construction, which is seldom quite watertight and on that account may in certain circumstances fail to protect the rods sufficiently, it is found that up to a 2:2:4 mixture the addition of cement is accompanied by a roughly proportionate increase in the compressive strength as well as by enhanced reliability, watertightness and protecting properties, to the extent that porosity in a 2:2:4 mixture is quite exceptional. The richest mixtures are required for sea construction, such as jetties, especially for the parts above low water, also for tanks, conduits and floating craft which have to withstand water pressure, and for piles which have to undergo severe hammering. Pressure conduits have been constructed of 20 ft. diameter for 50 ft. head and in smaller sizes for a maximum pressure of 180 ft. head. (*See* AQUEDUCTS.)

Long Span Arch Construction.—Wherever abutment and headroom conditions are suitable and the span is not small, arch construction compels consideration, as thereby a single main truss member (the arch) serves to carry the load as compared with two main members and a web system in the case of a beam or truss. Further, the arch has the economical advantage that the thrust is principally taken by concrete, which is cheaper for this purpose than steel, and in large arches only a relatively small proportion of reinforcement is required to take care of such tensile stresses as may develop due to live-load variations and the effects of shrinkage, temperature and rib-shortening in the concrete. The arch form, in addition, lends itself to the attainment of good appearance. The largest arch bridge completed in 1926 is the 432 ft. span road bridge across the Seine at St. Pierre du Vauvray, France. Whereas formerly 400 ft. was looked on as being near the practicable limit for a concrete arch, recent developments have greatly extended the limits and completely worked-out projects are now in existence for more than one bridge with spans of about 600 ft., and spans of well over 1,000 ft. do not appear to be unattainable.

[1] *Proceedings of the Institution of Civil Engineers*, vol. 214.
[2] *Engineering News Record*, Oct. 1925.
[3] *Proceeds of Inst. of Naval Architects*, 1918.

Aesthetic Appearance.—Surfaces of concrete do not lend themselves very readily to satisfactory architectural treatment, so that in many fine buildings the supporting framework of reinforced concrete is entirely hidden behind facework of masonry or other material. Good effects in buildings can be attained when the visible concrete is well finished and confined to well-proportioned and suitably lined vertical and horizontal bands of the framework, the rest of the elevation being formed of panelling and facework of other materials. In bridges, principal reliance must be placed on satisfactory form and proportions combined with very careful work in constructing and setting the moulds which form the exposed surfaces. Parapets and pillars of good finish and appearance may be precast in small pieces in carefully finished moulds, preferably of metal.

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FERTILISERS: *see* AGRICULTURE: SCIENTIFIC DEVELOPMENTS.

FEZ, Morocco (*see* 10.306), has been since 1912 under the French Protectorate. The population in 1921 was 70,540, including 2,218 Europeans. The city has still an active native industrial life and prosperous trade, while European industries, such as oil and soap manufacture, have been established. The town is lit by electric light derived from the falls of Wadi Fez. The municipal services have been reorganised by the French under the native pasha and his council, and an office of native industries has been set up to conserve the ancient handicrafts. The erection of the new European town of Fez has been begun near Dar Debi Bagh. Fez is connected with Rabat and Ujda by narrow-gauge lines, and the line to Tangier is finished as far as the Spanish frontier. There are some 30 native olive oil factories round the Bab-el-Ghisa, and the manufacture of silk textiles occupies about 30,000 people. There are good roads to Taza, Meknes and Qnitra. The new port at Qnitra is the nearest to Fez.

FIBRES (*see* 10.309).—No fundamental changes have taken place in the technology of fibres since 1910, although there have been many minor developments, including an increased use of the lesser fibres for industrial purposes. It is rather in the employment of substitutes and in the evolution of processes which have produced practically new substances such as "artificial silk" (*q.v.*) that the most striking changes have taken place.

War Substitutes.—During the World War period interesting technical experiments were made, particularly in Germany and Austria, with various substitutes. These were caused by the shortage of cotton and wool, due partly to the blockade and partly to the huge demand for these fibres for military purposes. Cotton was required for explosives and wool for uniforms and the like. Early in the War, German experts began to examine the possibilities of other fibres, hoping thereby to supplement their inadequate supplies of cotton and wool. From the standpoint of fibre technology, these experiments are undoubtedly important but so far have not been of much industrial use.

Experiments were made with nettles and with twisted paper yarns. The substitution of wood cellulose for cotton cellulose proved of the greatest immediate value to Germany. To a large extent she was thereby enabled to eke out her supplies of cotton cellulose and produced considerable quantities of nitro-cellulose propellant explosives from wood pulp. The wood cellulose was prepared from the bisulphite pulps of the paper industry by hydrolytic treatments and the result was a cottonisation of the pulp. This material is usually known as "Supersulfit" and has proved of considerable value during the post-War period for the making of paper. (*q.v.*).

Paper Yarn.—The "paper yarn" industry developed under the pressure of the War to an annual output of 200,000 tons. These yarns were used to quite a considerable extent for textiles, even complete suits being made from "paper cloth," but were characterised by the defects of short fibre length and failed to establish themselves as serious competitors with the older fibres such as cotton and wool.

Nettle Fibre.—Valuable experiments were made with nettle fibre, resulting in indications that it is almost a total failure. The common nettle or *Urticaceae* contains a rough fibre, and since the plant belongs to the same order as Ramie or Rhea fibre, high but illusory hopes were entertained that from it might be obtained a fibre of similar or even better quality, which could be used in the textile industry. Nettle fibre has great length of bast, and great variability in dimensions and has to be prepared by chemical methods of separation. The crop-weight is low and it is difficult to cultivate on a commercial basis. While stout plants can be gathered wild, when transferred to cultivated soil and planted in regular rows, they tend to deteriorate and become thin and weak. These difficulties may be surmounted, but so soon as the War ended fibre users quickly returned to the older and more satisfactory raw materials.

Jute.—Long before the War it was known among fibre experts that by treating jute with caustic soda a "woollenising" effect is produced. The structure of the fibre is altered, has many resemblances to wool, can be "carded," and mixes well with wool. This process was revived in Germany and Austria during the War and mixtures containing as much as 60% of this vegetable fibre were worked up and spun into serviceable yarns.

Sisal.—In the post-War period, so far as the old series of hard fibres are concerned, the most important developments have been in the direction of increasing their output by opening up new areas in which they are being grown on a commercial scale and in developing alternative plants, such as the expansion of the sisal industry in the British colony of Kenya. The sisal is an agave which is indigenous in Florida, the West Indies and Yucatan, and from its leaves sisal hemp is produced. The plant has, however, been transported to distant areas, and at Kenya it is now one of the chief exports of the country. In 1912 only 2,500 cwt. were exported; in 1919 the quantity had risen to 126,937. In 1924 Kenya and Uganda together exported 218,740 cwt. of sisal fibre and 9,720 cwt. of sisal tow.

The demand for sisal is due to the increasing demands for binder twine, needed by the mechanical reapers which are being employed in ever increased quantities by the great grain producing countries such as the United States, Canada, the Argentine and Australia, particularly for those machines which reap and at the same time bind into sheaves. Sisal hemp, a substitute for the original hemp, *Cannabis sativa*, is itself threatened by new competitors such as Mauritius hemp, Manila hemp and New Zealand hemp or *Phormium tenax*, which were well known and widely used before the War.

Bowstring Hemp.—This plant flourishes in the shade of old rubber and may therefore prove a valuable crop in old rubber clearings. It is propagated by seed, division or leaf cutting, the latter method being the most satisfactory. The distance of planting is two feet apart each way and the average yield is $1\frac{1}{2}$ tons per acre. The plant produces a fine, tough, white and elastic fibre, which is extracted from the leaf by methods similar to those employed in the preparation of sisal. It is usually shipped in bales of four to five hundred-weights. Although much valuable scientific information has been acquired concerning this plant—and it undoubtedly has considerable possibilities—its production is still in the experimental stage.

Roselle Fibre.—This is obtained from an annual shrub which belongs to the order of the hibiscus. The fibre is obtained from the branches and main stem, but the latter is of inferior quality. The fibre is suitable for making rope and good quality string, and it is claimed that it can be spun like jute but, so far, it is not certain that it can be produced on a commercial scale. The plant grows to a height of 10 or 12 ft. and therefore must not be planted within a radius of 5 ft. of young rubber trees. It is prepared by

retting in stagnant or slow moving water for 8 or 9 days, and all the work can be done by native hand labour and requires no elaborate machinery. It must, however, be bale-pressed for export.

Arghan.—This fibre stands half-way between the hard and soft fibres and appears to have some of the characteristics of each. It was originally discovered by Sir Henry Wickham in South America, but attempts are now being made to develop it on a commercial scale in Malaya. It was first considered as a material for twine and cordage but it possesses a tensile strength which gives a breaking strain of 50% above that of the finest Italian hemp or even the best flax. Moreover, it can be spun to a much finer lea than is required for twine. A firm cloth which bleaches and dyes well has been woven from it. Till recently it could only be spun on a flax machine but it now seems possible to use ordinary cotton machinery. It is a lance-leafed plant, similar to a pineapple, and the long leaves contain more than 20% of pure fibre. It is easily split up into long fibres, 7 feet or more in length, which are almost as delicate as silk, Specific leaves on each plant produce a softer and finer fibre than the others, and planters are concentrating attention on these. Arghan still is more of scientific than of commercial interest but possesses considerable possibilities.

Kapok.—This soft fibre is obtained from the pods of the Kapok or cotton tree, indigenous to Malaya, Java and the Philippines. Considerable and increasing quantities are being exported chiefly to Australia, America and Great Britain. The chief distributing centre in Europe is Amsterdam. It is non-absorbent and lighter than water. When stuffed into life-saving apparatus or into cushions, etc., it will sustain a heavy weight in water for many hours. In consequence it has largely replaced cork-lined appliances. The fibre is as buoyant as cork and can be compressed *en masse.* The peculiar property of the fibre is due to its structure. The fibre canal holds a large amount of air, and the smooth contour of the fibre and the resilience of the air-filled tube give a large air volume to the mass, even when compressed. The fibre is short, light and brittle, and despite much experiment so far, attempts to spin it on a large scale have not been successful. It has a fine lustre and great elasticity.

Flax.—Special efforts have been made to develop the production of flax in various parts of the British Empire in order to replace Russia who, in pre-War days, produced annually 525,000 tons of flax and exported at least half of it to Europe. Flax from the new Baltic States and from Soviet Russia has again begun to appear on the markets. The Belfast linen industry, in conjunction with the government, have in recent years devoted special attention to increasing the supply of fibre. In particular, efforts are being made to develop flax growing in England. A special committee was set up in Oct. 1924 to consider anew the whole matter, and in the *Journal of the Ministry of Agriculture* (1925, 32, 310) it was stated that the government had adopted the recommendation of this committee and had acquired two factories and constituted a society, not trading for profit. This society is The Flax Industry Development Society and its primary object is the supply of seed of good quality. It is believed this society will be able to supply a far better type of seed than that at present obtainable by flax growers and so lead to a great extension of flax growing of the finest quality within the British Isles and throughout the Empire. (*See* CELLULOSE.)

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FIJI ISLANDS (*see* 10.335) have an area of 7,425 sq. m. and a population of 139,541 (1911). The dominant feature of Fijian history during the years 1915–25 was the celebration at Levuka, on Oct. 10 1924, of the islands' jubilee as a Crown Colony. After 50 years of British rule the same "lali" or native drum was beaten at the same hour and place by the old chief who beat it at the cession of 1874, announcing the ceremonies arranged in honour of the occasion. Peace was the object of the cession, and the Fijian fully appreciates the peace that for nearly 50 years has remained unbroken. A large tabua (whale's tooth), presented on the occasion of the jubilee, was accepted by King George as a token of the loyalty and affection of his Fijian subjects.

Population.—The census of 1911 shows that the population in that year was 139,541; in 1921 there were 88,464 males and 68,802 females, total, 157,266. Of this total, Europeans number 2·4%, Fijians 53%, Indians 38%; the rest are mainly half castes, Polynesians, Rotumans and Chinese.

Constitution and Administration.—The present Constitution is regulated by Letters Patent of Jan. 31 1914 (amended in July 1916). It provides for an Executive Council to advise the Governor, and a Legislative Council; the former now consists of four official and two nominated unofficial members, and the latter consists of the Governor, not more than 12 nominated, 7 elected and 2 native members. The natives, however, retain a large share of self-government, and in the remote districts, where little commercial development has taken place, there is but slight modification in the old communal methods of native society. Younger natives, who through a certain amount of education have come under the influence of a European social system, are disposed to secure release from communal obligations and to support themselves on their own land or become wage-earners for varying periods in industrial centres or on plantations. Many are now engaged in the sugar-mills, and a considerable number as clerks, sailors, carpenters, boat builders and domestic servants. The vast majority, however, remain agriculturists living in native villages and cultivating their tribal lands. Educational administration was completely changed in 1916, when a board of education replaced the school boards, an education department was formed and ordinances passed to allow grants to be made to primary and vernacular schools. European education in the colony has made considerable progress, in spite of the fact that the problem is rendered more complex by the numerous races now domiciled in the islands. Facilities for primary education are good, and those for vocational training constantly improving.

Land Tenure.—The sale of native lands, except to the Government for specific purposes, was prohibited by an ordinance of 1912. The standard tenure is leasehold up to 99 years, with security to the tenant for permanent and unexhausted improvements. A native lands commission, comprising a European officer and three native chiefs, has been established to survey and register all native lands.

Trade and Industry.—The total trade in 1924 was £2,565,528, as against £1,999,004 for 1912, £2,329,908 for 1913 and £2,301,139 for 1914—a steady increase which has since been well maintained. There is a preferential tariff in favour of the products and manufactures of the British Empire; and of the total trade of the colony over 60% is with British Possessions, and about 11% with the United Kingdom, the balance, about 25%, being with Europe and the United States of America. The main agricultural industries have for long been the production of sugar, copra and bananas. The sugar industry has been hampered by inadequate labour and by a great increase in the world's production; copra has suffered from a restricted market, the banana industry from plant disease and a protective customs tariff in Australia. Hence the Government continues to make efforts to develop the new rice industry, which is important to the Colony with its large East Indian population. The cultivation of cotton, which had ceased in 1900, was resumed in 1922 and is almost entirely in the hands of East Indians. Other developing industries are dairying, sawmilling and the growing and canning of pineapples.

Communications.—There is regular monthly communication to and from Sydney via Auckland or directly, and also to and from Vancouver via Honolulu. The Colonial Sugar Refining Company has a narrow gauge railway extending from Tavua to Na Singatoka, a distance of 120 m. over which passengers are carried on specified days. The first section of the main trunk road, which ends at Sawani, was completed and opened to traffic in 1924, and, though the total length of metalled roads is less than 100 m., there is a good length of gravelled roads and of communally-maintained bridle tracks.

Finance.—The revenue for 1924 amounted to £484,834 as against £283,947 in 1912. Notwithstanding fluctuations the revenue has been steadily expanding for years, and though expenditure in the last 10 years has frequently exceeded it, there was a surplus of £50,316 in 1923 and of £33,764 in 1924. (A. R.*)

FILDES, SIR LUKE (1844–), British painter (*see* 8.339), was born at Liverpool and educated privately at Chester. He studied at the art schools of Warrington, South Kensington and

the Royal Academy, and exhibited his first Academy painting in 1872. Introduced to Dickens by Millais, Fildes was illustrating *Edwin Drood* at the time of the novelist's death. "The Casuals" (1874) showed him as a genre painter of power, and a series of Venetian pictures were very popular. He was made A.R.A. in 1879, and R.A. in 1887. "The Village Wedding" (1883) and, more especially, "The Doctor" (1892) is probably the most widely famous of his works. In later years he painted many portraits, among them state portraits of Edward VII. (1902), Queen Alexandra (1905), and George V. (1912). Knighted in 1906, Sir Luke Fildes became K.C.V.O. in 1918.

FILING SYSTEMS: *see* OFFICE APPLIANCES.

FILM: *see* MOTION PICTURES; PHOTOGRAPHY.

FILON, PIERRE MARIE AUGUSTIN (1841–1916), French man of letters (*see* 10.345), died at Croydon, England, May 13 1916. In 1910 he published a short biography, *Marie Stuart*, and in 1911 *L'Angleterre d'Edouard VII.*, and a dramatic poem, *Shakespeare amoureux*. His *Souvenirs et documents*, relating to his former pupil, the Prince Imperial, appeared in 1912.

FILTER-PASSING MICROBES.—These organisms are those which are small enough to pass through a "bacterial" filter. Bacterial filters are made of unglazed porcelain or compressed infusorial earth. The grains of the china clay or infusorial earth used for their manufacture are sufficiently small and uniform to leave insterstices, the cross section of which is 0·2 to 0·8 μ in diameter. If a liquid containing microbes whose smallest diameter exceeds 0.2 μ be pressed through the filter, the microbes remain impacted in the smaller crevices. As 0·2 μ is also the limit of size of a particle which can be resolved by the best microscopes (*see* MICROSCOPY) when white light is used, filter-passing organisms are either invisible or on the margin of visibility. Hence, most of them have been classed as "ultravisible viruses."

Discovery.—The first discovery, that an ultramicroscopic or filterable virus was the cause of an animal disease, was made by Loeffler in 1898 in the course of some experiments upon foot-and-mouth disease, in which a filter of infusorial earth was used to remove ordinary recognisable bacteria from the diluted contents of the superficial vesicles which are characteristic of this disease. The filtrate was free from any particles visible by the microscope and no bacteria developed in it on cultivation. Nevertheless, injection of this filtrate into animals caused disease. Material removed from the vesicles of the animal so infected and filtered again reproduced the disease in a fresh animal. Similar experiments were carried out through a number of generations of animals, so that there was no doubt that a virus capable of propagation in the animal body was contained in the filtrates. In the next few years the filterability of the virus was established in the case of infectious pleuro-pneumonia of cattle, South African horse-sickness and fowl plague.

Yellow Fever.—The cause of yellow fever has been shown by Noguchi to be a spirochaete which, owing to its thinness and motility, can pass through a bacterial filter.

Human Diseases.—Up to 1925 the virus of about 40 diseases of man and domestic animals had been found to pass through a bacterial filter by some reliable observer. The more important of these are the following: foot-and-mouth disease, contagious bovine pleuro-pneumonia, African horse-sickness, fowl plague, yellow fever, cattle plague, sheep-pox, *epithelioma contagiosum* of birds, swine fever, rabies, cow-pox (vaccinia), *molluscum contagiosum* of man, equine infectious pernicious anaemia, canine distemper, "blue tongue" of sheep, dengue fever, papataci or sand-fly fever, smallpox, trachoma, poliomyelitis, measles, typhus fever, trench fever, mumps, Rocky Mountain spotted fever and *herpes labialis*.

Influenza.—Recently, Olitzky has succeeded in propagating on special culture media seven varieties of small microbes from the filtrates through a "bacteria proof" filter of washings of the throats of individuals suffering from catarrhal diseases. One of them is credited, on substantial grounds, with being the cause of pandemic influenza (*q.v.*), another is supposed by its discoverer to be responsible for our common colds. The others do not appear to be of pathological significance.

Cancer Research.—There is now reason to suppose that filterable viruses play some part in the origin of cancer (*q.v.*). When a fragment of a malignant tumour is implanted in the tissues of an animal of the same species it generally grows and ultimately kills the animal. The animal cells of which the cancer is composed are endowed with a faculty for growth, uncontrolled by those factors which determine normal tissue equilibrium. The possibility that this property was due to infection of the cells by a microbe has, in the past, occupied the attention of investigators, but no experimental basis for this view was afforded till 1911, when Peyton Rous described a sarcoma of the fowl which differed from mammalian tumours in that it was transmissible from chicken to chicken by means of a filtrate from a filter which kept back all of the malignant cells (much too large to traverse its pores) and also any bacteria of ordinary dimensions. This filtrate could be dried at a low temperature and the powder retained its activity for years. It had no effect when injected into animals other than chickens, and it always produced the same type of tumour.

As the same result could not be obtained with a filtered extract of other malignant growths, this very important discovery was interpreted to mean that this fowl-sarcoma was a thing apart, although in structure and behaviour it closely resembled the mammalian sarcomata. Subsequently, its discoverer found that two other malignant tumours of fowls possessed similar properties, and quite recently Carrel has recorded the formation of malignant tumours in fowls following local irritation of the tissues with tar or arsenic, filtrates from which were also infective for chickens. Rous believed that the filterable agent which caused the tumours he studied was, probably, an extremely small microbe, but as he did not succeed in propagating it outside the body its nature remained undetermined. The nature of the infective agent in the filtrate of Rous's tumour has recently been disclosed by Gye, who has succeeded in growing it in test tubes in a special medium. The culture has been carried on through several generations of transplantations. By this means the virus has been purified from the other constituents of the original implant. The inoculation of this purified virus alone did not give rise to a tumour, but if mixed with an extract of the fresh tumour, in which the virus had been killed by chemical agents and which alone was innocuous, a tumour occurred. In other words, the conjunction of two factors, living virus and some non-living chemical substance or substances, is necessary to provoke the cells of the animal to that anarchical development which is characteristic of malignant growth.

Gye's Experiments.—Gye has also succeeded in showing that chicken sarcoma is not peculiar, as hitherto believed, and that a particular mouse sarcoma will sometimes yield an infective filtrate. In this case, however, a special technique had to be employed, the original method of Rous proving unsuccessful. This is a discovery of much significance and it seems probable that an extrinsic origin may be found in the case of other cancers in the near future.

The virus of Rous sarcoma has been presumed to be particulate as it is held back by the finer grades of filter, and recently Barnard, using ultra-violet light, has obtained photographs of small globoid bodies about 0·1 μ in diameter from cultures of the virus. These small bodies occurred in masses, suggesting colonies. They were not discovered in the medium before inoculation or when the cultivation of the virus proved unsuccessful. Whether they represent the microbes or aggregations of colloidal particles produced from the proteins of the medium by chemical changes associated with the growth of the virus occurring therein, is not at present determined.

Plant Diseases.—Filterable organisms are also responsible for many diseases of plants (*see* PLANT PATHOLOGY). In fact, their existence was first brought to light by Iwanowski in 1892 in connection with the mosaic disease of the tobacco plant. Iwanowski's discovery was lost sight of and the fact was rediscovered by Beijerinck in 1898. Many varieties of plants, including potatoes, tomatoes, beans, peaches, clover, peas, cucumbers, turnips, spinach, *datura*, *hyoscyamus*, *capsicum*, sugar-cane,

maize, sorghum and various grasses suffer from mosaic diseases. In most mosaic diseases the only obvious lesion is bleaching of the leaves in patches of varying extent, but sometimes, as in "leaf roll" of potatoes, "curly top" of beet and "spike" disease of sandalwood trees, definite destruction of tissue leading to malformation occurs. The loss of chlorophyll interferes with the nutrition of the plant by limiting the leaf area capable of utilising the radiant energy of the sun for the building up of carbohydrate from carbonic acid and water. To this handicap local necrosis of portions of the leaf and stalk is in some varieties superadded. The economic effect of these diseases may be, as in the case of the mosaic of sugar-cane, almost negligible or, as in the case of "peach yellows" and the "spike" of sandalwood, serious, as it destroys these trees.

Between these extreme instances, the infection results in more or less diminution of crop. Only the growing leaves are affected. Nevertheless the virus extends throughout the plant and sometimes to the seeds. Mosaic diseases are very infectious. Mere handling of a healthy plant after touching an infected one is, in some instances, sufficient to transmit infection. The disease is spread by leaf flies or beetles and by grafting (*see* ENTOMOLOGY, ECONOMIC). The virus is not capable of maintaining itself in the soil. There is a large number of different viruses which produce mosaic diseases. Some of them infect more than one species of plant. They can also inhabit resistant species of plants without these manifesting any symptoms, but the disease can be transferred from resistant plants to susceptible species by insects or grafting. Many attempts have been made to propagate these plant viruses in the laboratory upon plant-juices without success, but the virus of one of the mosaic diseases of the potato appears to have been recently cultivated by Olitzky.

Properties of Micro-organisms.—Little is known about most of these filterable viruses. They appear to be of various natures, and the only property common to them is minuteness. The parasite responsible for yellow fever is a small spirochaete, those occasioning bovine pleuro-pneumonia and human poliomyelitis are globoid in shape and just on the margin of visibility with the best microscopes.

It is not improbable that many of them flourish only inside the cells of animals and plants, which may explain the difficulty in cultivating them in artificial media. In some cases, small bodies of definite size, shape and staining characteristics are always to be seen in the cells at the seat of the lesion (trachoma, *molluscum contagiosum*, variola, vaccinia, bird-pox, typhus and Rocky Mountain spotted fevers). Whether these represent the microbe or granules in the cell contents produced under the influence of the virus is a matter of opinion. Until cultivation outside the body is achieved this controversy will not be settled.

Definite Results.—At present only the viruses of pleuro-pneumonia, poliomyelitis, yellow fever, chicken sarcoma and the microbe probably responsible for influenza have been certainly cultivated, although many claims to have accomplished this with other viruses have been made. Some of these viruses occur in the blood of the patient during the acute stage of the illness and are transported to a fresh host by the bite of blood-sucking insects.

Transmission of Infection.—The infections of yellow fever (*q.v.*) and dengue are conveyed by the mosquito (*Stegomyia fasciata*). That of papataci fever is transmitted by the sandfly (*Phlebotomus papatasii*) (*see* SANDFLY FEVER) and that of typhus and trench fevers by lice (*see* INFECTIOUS FEVERS). With these three fevers and also in the case of some of the mosaic diseases of plants which are transferred by leaf flies, some days elapse before the insect is capable of handing on the infection, indicating that an interval for the multiplication of the parasite is necessary. It is possible that a stage in the life-history of the parasite can only occur in the body of the insect host. Some filterable viruses, such as smallpox, cow-pox, foot-and-mouth disease and *molluscum contagiosum* give rise to superficial lesions, and are spread by contact; others occasion catarrh of the respiratory passages and are distributed by coughing and intimate contact, as in distemper, measles and pleuro-pneumonia.

Conclusion.—Most filter-passing microbes which have been discovered hitherto cause disease of plants or animals. It would be strange if only parasitic forms existed, for the majority of the larger microbes are not pathogenic but are concerned with the multifarious putrefactive and fermentative changes in organic matter on the surface of the earth. Accordingly, it would be natural to suppose that sub-microscopic germs with similar activities would be ubiquitous. The indications, at present, are, however, against this supposition, and sub-microscopic dimensions seem to be an attribute, more especially, of germs which are parasitic upon animals and plants. (C. J. M.*)

FILTRATION.—In many industrial processes it is necessary to separate finely divided solid materials from liquids. The process of filtration consists in passing the liquid through a porous medium, which retains the solid particles. In some cases this is done for the sake of purifying the liquid; in others the recovery of the solid is the main object. Many different types of filter are in use, and it is necessary to consider (1) the various porous materials which are available for filtration, and (2) the construction of the apparatus in which these are applied.

Filter Materials.—The following are the main types of material which are in use:

1. Sheets of woven or felted material. These comprise porous filter paper, cotton, woollen or linen cloth, felt and woven metal.
2. Unwoven fibrous material, such as cotton wool, linen fibre, cellulose pulp, metal fibres, sponge.
3. Granular or powdered materials, such as gravel, sand, earth, coke, sawdust, cork.
4. Porous plates of stone, porcelain, carbon, silica, etc.

The choice of material depends upon (*a*) the fineness of the substances to be filtered, (*b*) the chemical nature of the liquid, (*c*) convenience in collecting the solid material after filtration.

Laboratory Filtration.—Porous paper is generally used as the filter medium, being resistant to most of the liquids which require filtration. The commonest method of filtration is to fold a circular filter paper twice at right angles, and open it out to a cone with three thicknesses of paper at one side and one at the other. This is placed in a conical glass funnel, and the liquid is poured into it. In some cases, the filter funnel is provided with a hot-water jacket to keep the liquid warm during filtration. Filter paper is also manufactured in the form of thimbles, for extractions with solvents, such as alcohol and ether, in special apparatus.

The Buchner funnel is made of porcelain and has a flat, perforated bottom on which a circular filter paper is placed. This form of filter has the advantage that the filtration may be assisted by the application of suction below the filter.

The Gooch crucible is a porcelain cup with a perforated bottom. A thin layer of asbestos serves as the filter, and the crucible can be weighed, after drying, to ascertain the weight of solid material collected.

A recent advance in laboratory filters consists in the use of discs made up of a fritted mass of hard glass, which has been ground and sieved to a definite degree of fineness. These are fused into various types of glass apparatus, and are resistant to almost all chemical reagents.

Filtration of Drinking Water.—Domestic filters are usually supplied in the form of earthenware vessels with a filter bed of charcoal; in some cases filters of paper, asbestos or stone are used. It was originally thought that charcoal filters would unfailingly remove micro-organisms, but the action was subsequently found to be less complete than had been believed. Indeed, if the filter material be not removed at intervals, it may become the seat of organic growths. Large-scale filtration of town supplies of water is generally effected in sand filters.

Industrial Filtration.—When possible, it is advantageous to allow the solid precipitate to settle in the liquor for some time, and to run off as much as possible of the clear liquid. The sediment may then be stirred up with water, allowed to settle, and the liquid again decanted, so as to minimise the bulk of liquor to be filtered, and to facilitate the subsequent washing. The design of industrial filters varies according to the requirements. The chief considerations are that the filter shall present

a maximum available surface without occupying too much factory space, that it shall withstand the required pressures, that it shall not be easily clogged, but shall be readily cleaned and easily controlled at all points. In some cases, continuous working is desirable.

Simplicity and economy of construction often outweigh all other considerations, and for many purposes it is sufficient to filter through a bed of sand, or through a simple sheet of cloth resting on a flat, perforated support. Suspended bags of cloth are also frequently used, and have the advantage that the bag can be squeezed or wrung out after filtration to remove as much liquor as possible from the solid material.

Vacuum Filters.—As in laboratory filtration, suction is frequently applied to accelerate the flow of liquid. A filter cloth is spread on a perforated plate of earthenware or other material, and the receiver into which the filtrate flows is connected with a vacuum pump. Conversely, pressure may be applied to the surface of the liquid in the filter. In place of cloth filters, porous plates are sometimes used; these may be either flat plates or cylindrical " candles " of porous material, presenting an increased filter area.

Leaf filters may be used either for suction or pressure. A typical form of leaf consists of a rectangular frame of perforated pipes to which is attached a stiff, corrugated surface of coco-nut matting or other material, and the whole enveloped by a cloth bag. The liquid passes from the exterior to the interior of the leaf, and is assisted either by external pressure or by internal suction. A filtering unit consists of a number of parallel leaves, and thus presents a large filtering surface.

Filter presses are somewhat similar in principle. In one form, a number of recessed plates are supported on a framework, so that they can be firmly pressed together by a screw press. Sheets of cloth are placed between the plates, and thus, when the filter press is assembled, it forms a series of narrow partitions separated by cloth filters. Channels are provided so that the sludge to be filtered can be forced under pressure between the cloth sheets, and the filtered liquid is collected from taps at the bottom of the plates. After filtration, the plates are separated, and the cake of solid material is removed. In place of recessed plates, some filter presses have alternate plates and distance frames.

In centrifuges the filtration is assisted by the rapid rotation of a circular pan. The periphery of the pan is perforated, and provided on its inner side with a filter cloth, supported by a basket of metal. The rapid rotation (up to about 1,000 revolutions per minute) whizzes the liquid through the filter, with a force several hundred times greater than in gravity filtration.

In the above-mentioned filters, the solid material has to be collected at intervals, and this necessitates stopping the filtering operation. Continuous filtration can be effected by rotary filters. A hollow drum is supported in such a way that it can be rotated on a horizontal axis. The periphery of the drum is covered with a filter cloth, and the drum dips into the liquid to be filtered. By suction, the liquid is drawn through the filter cloth to the interior of the drum, and the solid remains on the outside. The drum rotates slowly, and a scraper is fixed in such a position that it scrapes off the solid material continuously.

A recent advance in filtration methods is the stream-line filter, which permits of the separation of extremely finely divided solid matter, which would pass through ordinary filter cloths. A large number of sheets of paper are pressed together, and the liquid is forced through the edge of the pack by the application of pressure. The channels between the sheets are so minute that the finest precipitates are retained. The filter is made in various forms to permit of continuous filtration, etc.

Aids to Filtration.—The greatest difficulties in filtration are presented by slimy substances, which clog the filter. Application of increased pressure only accentuates the difficulty, and considerable importance attaches to methods whereby the slimy material may be caused to clot together and settle out. This can be effected by the addition of kieselguhr, fuller's earth, clay, talc, silica-gel and various carbonates. Another procedure is to coat the filter with a layer of finely divided kieselguhr, boneblack, sawdust or other finely porous material, which retains the slime and prevents it from penetrating into the filter material. (R. C. F.)

FINANCE: *see* BANKING; CURRENCY; and the sections on national finance in FRANCE; GERMANY; GREAT BRITAIN; UNITED STATES, etc.

FINLAND (*see* 10.383).—A republic of northern Europe and a member of the League of Nations, in Finnish it is Suomen Tasavolta. Its area is 132,550 sq. m. and the population 3,435,249.

I. POLITICAL HISTORY

In the closing decades of the 19th century there was a remarkable development of Finnish nationalism, primarily directed against the Swedish language and Finno-Swedish cultural domination.

Second Period of Russification 1908–14.—The successive governors of Russia, however, regarded the democratic, almost self-governing grand duchy as infringing the principle of the autocratic state, and delivered their first attack upon the liberties of Finland (1899–1905). The policy of repression was arrested by the Russian revolution of 1905, the manifesto of the Emperor-Grand Duke of Nov. 4 (Oct. 22) annulling all unconstitutional interferences. But after two years of peace, internal progress and political development, the same pan-Slav conception of a great homogeneous Russia stretching from the warm-water ports of Scandinavia to the Pacific, which had caused the conflict between Finland and the Tsar, involved her in fresh collisions with the Duma.

New and provocative interference with Finland's constitu-

tional rights began. The Tsar peremptorily fixed an annual contribution in lieu of military service (Ukase of Oct. 7 1909) and the Imperial Duma approved of the principle (imp. law of Jan. 23 (U.S.) 1912). The Finnish Diet, though ready to compromise, was twice dissolved, and all the large measures of domestic reform which it passed were never heard of again. Such was the fate of the bill for the prohibition of alcohol, of measures relating to the care of children, insurance, old-age pensions, education, public health and the betterment of the landless worker upon the soil. Civil marriages, however, were instituted, illegitimate children placed upon a better basis, and the principle of "equal pay for equal work" was applied in teaching, the printing trade and, in 1913, in the state service. The Duma considered itself competent to decide what questions affected the interests of the Russian Empire, and for that reason did not fall within the competence of the Finnish Diet. The law, known as "Imperial Legislation Act," was passed on June 30 (17th) 1910, amid shouts of "Finis Finlandiae."

Immediately two imperial laws were laid before the Diet, which refused them both, and was thereupon dissolved. In one, already referred to, the Duma affirmed the principle of an annual Finnish indemnity in lieu of service, in the other full citizen rights were accorded to temporary Russian residents in Finland. The consequence of the last-named measure, apart from its injustice, was the overlapping of two different codes of law. Judges resigned rather than be a party to it; high officials suffered exile or imprisonment; every single provisional governor left voluntarily or under compulsion. The country was ruled by a packed Senate, the Diet was capriciously summoned and dismissed, the press censored. The Russification inflicted by the Duma was as oppressive as that of the Tsar.

The World War 1914–8.—It was left to Lt.-Gen. F. Seyn, the governor-general, to supervise the harassing restrictions of liberty which the World War brought with it. Though Finland escaped foreign invasion, two systems of fortified lines were constructed to protect the chief railways and the long sea border. The mercantile marine, exposed to destruction in the Baltic Sea, remained locked in the harbours of the Bothnian gulf, and, there being no leaks—as in Sweden and Denmark—in the Allied blockade, the price of living gradually rose by 25%. On the other hand, industries connected with military supply, as also iron, leather, glass, chemical and paper-manufacturing concerns, attained unexampled prosperity. The Russians, sporadically anxious to please, remitted the annual military indemnity, and merely imposed a 5% tax on property and mortgage.

Finland naturally feared that Russia, if she emerged victorious, would again turn oppressor. A strong party was anxious for a German victory, from patriotic motives. Only some 2,000 Finns volunteered for the Russian Army. About the same number enlisted on the German side, though ostensibly only for service on the eastern front.

The Russian Revolution, March–Nov. 1917.—The Tsar Nicholas II. abdicated on March 15 1917 and the new Provisional Govt. of Russia restored representative government in Finland. The Russianised Senate was disbanded and a temporary body of 12, half of whom were Social Democrats and the remainder representatives of the bourgeoisie, assumed executive power. Stakovich became governor-general and Rodichev, a tried friend, Secretary of State for Finland. The Socialist speaker of the Diet, M. Tokoi, was nominated president of the Senate; Kullervo Manner, of the same party, Speaker of the Diet. But in view of the anarchical conditions in Russia, the propertied classes of Finland quailed before the rising power of the Social Democratic party, which was politically orientated towards Russia. The intense industrial development of the last three years had strengthened hooliganism, and the War had brought to Finland some 40,000 Russian refugees from food shortage and the incipient riot. The Swedo-Finns aimed at complete independence, and the Finnish Govt. proclaimed that such was its policy.

The struggle between the Provisional Russian Govt. and the Finnish Diet crystallised around the law of July 18 1917 by which the Diet resolved that it alone decided, confirmed and put into practice all laws of Finland relating to home affairs, taxation and customs. This law reflected the standpoint of the Social Democratic majority, which demanded complete internal freedom but was ready to recognise Russia's supremacy in military matters and in foreign policy. Upon this issue a deadlock ensued, which the dilatory Russian Provisional Govt. never succeeded in settling. The Finnish Diet passed *en bloc* all reform bills previously held up by the Tsar, including the total prohibition of alcohol and the eight-hour day. Yet it passed no effective measure to avert the food-shortage, which was the inevitable result of the industrial effort of recent years and the neglect of agriculture. Prices soared ever higher, and from March 1917 to Feb. 1918 a veritable strike mania threatened the existence of the nation.

Meanwhile, the Bolshevik advent to power in Russia in Nov. 1917 created fundamental social and economic differences between the political parties in Finland. The pro-Russian sympathies of the Social Democrats deepened; on the other hand, the propertied classes—primarily the Swedo-Finn and Finno-Finn bourgeoisie—sought to cut adrift from a Russia which had no settled government. Accordingly, on Dec. 6 1917 the Diet and the now bourgeois Senate drew up an old-fashioned declaration of independence, which is held to mark the birth of Finnish freedom. The Bolsheviks on Jan. 4 1918 declared that the step taken conformed with their policy, whereupon the Swedish Govt. and the other Scandinavian countries acknowledged the independence of Finland. France did likewise and was followed by Germany. Immediately after their declaration of independence, the Finnish Govt. entered into negotiations with Germany. The Treaty of Brest Litovsk (March 3 1918) confirmed Finland's independence, and four days later she concluded a treaty with Germany which made her Germany's commercial ally and vassal.

The Bolsheviks, however, were bent on precipitating civil war. The Finnish Social Democrats were almost all Maximalists and anti-militarists, and, as such, averse even to the formation of a citizen army for the maintenance of order. They pinned their faith on the Muscovite connection to save their country from invasion—oblivious of the fact that the Russian revolutionary *soldateska* (reinforced from Russia), without restraint of discipline, starving and unpaid, was, to say the least, an uncertain factor. Soon so-called "Red Guards" began to ransack the country, while the White Guards, hurriedly organised by reactionaries, together with doubtful elements of the disbanded gendarmerie, resisted. The White Army, under Baron Carl Gustav Emil Mannerheim, a former Russian general of cavalry, proved insufficient to maintain order. Foreign intervention was sought, but while Sweden refused help, the Germans did not hesitate.

A German composite division, initially some 12,000 men strong under the Prussian General Count Rüdiger von der Goltz, landed in the rear of the Red forces and held these in a successful action near Karis on April 6. This enabled General Mannerheim to win the battle of Tammerfors, whereupon Goltz freed Helsingfors, entering this capital officially on April 14. Finally, the German victory over the Reds (April 30—May 2) at Lahti-Tavastehus contributed to Mannerheim's decisive victory near Viborg (April 28–29). The remnants of the Red Army were forced into Russia, but the cruelty of the Red insurrectionaries led to a White counter-terror. Some 15,000 men, women and children were slaughtered and, by June 27 1918, 73,915 Red rebels, including 4,600 women, were prisoners of war.

The Diet, which met in June 1918, was moderate in colour, since the Socialists, who formed 46% of the electorate, were excluded from the register. It authorised the Germanophil senator, Pehr Evind Svinhufud, to exercise the supreme power in so far as it had not already been conferred on the Senate, which was offering the crown to Prince Frederick Charles of Hesse, brother-in-law of the German Emperor.[1]

[1] Prince Charles accepted the crown, but never proceeded to Finland and the question of the Finnish monarchy was allowed to lapse.

But the Germans pursued the ulterior object of securing Finnish military co-operation against the Murman railway, which was guarded by a British expeditionary force. The claim of the liberators upon the gratitude of the Finns was assuming the most peremptory forms known to diplomacy when, on July 18, the Allied offensive in the west diverted Germany's forces. Thus valuable time was gained until the Armistice of Nov. 11 1918 caught Finnish reaction between wind and water. Svinhufud was succeeded on Dec. 12 by General Mannerheim as Regent, who formed a Coalition Govt. composed of six Republicans and six Monarchists. The most prominent pro-Germans were dismissed; Finland turned definitely towards the Entente and the monarchical period of German influence gave way to the democratic régime associated with England and America. The German troops, in part mutinous, were conveyed back to Germany in December. General Mannerheim, who was a monarchist, but not a pro-German, wielded the power of a quasi-dictator.

Restoration of Order.—In 1919 Mannerheim organised the "Skyddskorps" of 100,000 men to maintain order. The general election of March 1 showed the following division of parties: Social Democrats 80, Agrarians 42, Coalitionists 28, Progressives 26, Swedish 22, Christian Labour 2. The tendency towards a Republican form of government was outlined by the Agrarian party composed of small land-owners hostile to the Swedish-speaking monarchist section. The Social Democrats lost 12 seats, largely owing to the disfranchisement of 40,000 voters for participation in the Red revolt.

Mannerheim's popularity with the Right and the army tempted him to exploit the military impotence of Soviet Russia. When, at the end of May 1919, the Entente intervention on the Murmansk front brought the 237th Brigade (of the expeditionary force under the British Major-General Maynard) to the head of Lake Onega, the Finnish Govt. offered co-operation in return for the possession of Petrozavodsk. The offer being declined, a Finnish volunteer force nevertheless assaulted the town independently, but without success. Again, at the close of the year, when the White Russian General Yudenitch was marching on Petrograd, Mannerheim sounded the Allies on proposed Finnish intervention. He received no encouragement from Paris or London, nor from the Moderates at home.

Establishment of the Republic.—On June 17 1919 the Finnish Diet resolved to establish a republic. The new constitution came into force on July 17. There is a single chamber, the Diet, in which the sovereign power of the people is embodied. The executive power is in the hands of a president, who is elected for six years by 300 presidential electors elected by the citizens. He ratifies new laws or withholds consent, dissolves the Diet, orders new elections and conducts foreign affairs. All his powers are exercisable through the ministers and his decisions have to be taken in the Council of State (Cabinet) consisting of 10 ministers, who are legally and politically responsible. There are nine departments for local government, closely following the linguistic distribution. Both Finnish and Swedish are official languages. On July 25 Professor Kaarlo Juho Ståhlberg was chosen as first president by 143 votes against 50 recorded for Mannerheim. A Coalition anti-socialist government under M. Erich held office till April 9 1921. The Vennola Govt., a coalition of Progressive and Agrarian parties, then came into power. Commanding only 64 out of 200 seats in the Diet, it introduced the Amnesty bill which, after a chequered career, was passed on Dec. 18 by 165 votes to 68. On May 6 1919 Great Britain recognised the independence of Finland and the existing Govt. *de jure*.

A peace treaty was signed with Soviet Russia at Dorpat on Oct. 14 1920. Pechenga was ceded to Finland, which thus obtained an outlet on the Arctic Ocean, although Russia retained Eastern Karelia, where, after the collapse of General Skobelzine's White Russian Army, fighting had occurred with Bolshevist troops with results satisfactory to Finnish arms. The treaty was approved on Dec. 1 by the Diet with only 27 dissentient voices and ratified on Dec. 11 by the President. On Dec. 16 1920 Finland was admitted as a member of the League of Nations. As such it claimed sovereignty over the Aaland Is. (*q.v.*) which was disputed by Sweden. In June 1921 the League of Nations gave its decision in favour of Finland.

Despite the Treaty of Dorpat, relations with Soviet Russia did not improve. In Oct. 1921 the native Karelian population, racially allied to the Finns, broke out into open revolt against Moscow. After initial success, this "war of independence" was crushed by a Soviet army. But the Karelian question remained, and, at the instance of Finland, occupied the League of Nations all through 1923. The Permanent Court of International Justice, to which the legal aspect of the question was referred, decided in July not to deal with this matter, as Soviet Russia was not a member of the League and might not recognise its competence. The Council of the League, however, determined that this view of the Permanent Court should not hinder an attempt at a settlement, which resolve the Assembly of the League of Nations strongly supported. But the Soviet Commissar for Foreign Affairs, M. Chicherin, protested against the intervention of the League and declared Karelia part of Soviet Russia. His argument had the support of the Red battalions, which, after completely discomfiting the insurrectionaries, held the trump card of power. This rendered all diplomatic negotiation nugatory.

In these years, the guidance of Finnish foreign policy remained in the hands of Dr. R. Holsti, under successive administrations. In March 1922, this statesman met at Warsaw the Foreign Ministers of Estonia, Latvia and Poland, and signed an agreement by which the parties undertook "to observe benevolent neutrality towards any of the signatory states which might be attacked without provocation and to consult immediately with regard to subsequent steps to be taken." The Finnish Diet, in its spring session, refused to ratify this agreement, and Dr. Holsti relinquished office. The principle of policy enunciated upon this occasion by the Diet—the avoidance of treaty commitments of a military nature, continued to rule Finland's Baltic policy. On June 27 1924 Finland signed bilateral conventions with Sweden, Norway and Denmark for compulsory arbitration in the event of disputes.

Internal Policy.—The Karelian dispute with Soviet Russia reacted on Finnish internal politics. The long land-frontier to the East made it impossible to keep out Russian propagandists, and the discontent, thus fomented, threatened to imperil the economic recovery of the country. In May 1922 the Vennola administration resigned, but the new "Government of Officials" formed by Professor Cajander, did not long outlive the general election, which was held in July. The Social Democrats retained only 53 seats, while the Agrarians, with 45 and the Union party with 35, showed small gains, and the Progressives with 15 and the Swedish party with 25, small losses. The true victory lay with the Communists, who made their first appearance in the Diet with 27 seats. In Nov. 1922, therefore, the Agrarians, who had held their ground, formed a Centre Govt. under M. Kyösti Kaalio.

This administration passed the Religious Liberty Act, the Military Service bill and the "Lex Kaalio," which made provision for the landless population. In Oct. 1923 the Communist party was suddenly dissolved, its newspapers were suppressed, and 25 of its parliamentary representatives imprisoned. But this stroke reduced the Diet to a rump, and new elections became necessary in April 1924. The Kaalio Govt. resigned on the eve of the poll, being superseded by Professor Cajander's (second) "Government of Officials." The Social Democrats obtained 60 seats (+7), Communists 18 (−9), Agrarians 44 (−1), Union party 38 (+3), Progressives 17 (+2), Swedish party 23 (−2). On May 31 the Cajander Govt. made way for the non-Socialist Coalition Govt. formed by Professor Lauri Ingman (Union party).

M. Lauri Relander was elected President on Feb. 16 1925. The candidate of the Agrarians, he was elected by their votes and by those of the Finnish coalition and the Swedish party, which supported him when it was clear that their own candidates had no chance of success. He was president of the Diet in

1919 and was appointed Governor of the Viborg district in 1920, a position which he still occupied at the time of his election. He is a landed proprietor who has always taken great interest in agricultural questions and has published works on forestry in Swedish, Danish and German. His political views are moderate.

The Government of Professor Tulenheimo, in which the Union party and the Agrarian Union were represented, took office on March 31 1925. The chief political question it had to face was that of the military and naval estimates, which the parties of the Right desired to maintain at a comparatively high figure, while those of the Left desired a reduction. This left the cost of defence by land and by sea within reasonable bounds—at approximately 17% of the national expenditure.

In Dec. a new Government was formed by M. Kyösti Kaalio (Agrarian) in which again the Agrarian Union and the Union party were represented. (W. L. B.)

II. FINANCIAL AND ECONOMIC HISTORY

All through the War Finnish export trade, shut off from a large part of its foreign outlets, had to struggle with great difficulties. Until 1917, Russia remained a very considerable buyer of Finnish goods, but the revolution brought about a complete reversal of conditions, and trade with Finland became insignificant. At the close of the War, Finland, accordingly, had to shoulder the task not only of regaining her old markets in the West, but also of creating new markets to set off the loss of Russian trade. Similar difficulties were met in the import trade.

Imports and Exports.—The adjustment to the changed conditions was achieved with surprising rapidity, in spite of the unfavourable business conditions which prevailed on the leading markets. It was temporarily helped by the declining tendency of the Finnish exchange, which in the autumn of 1921 brought quotations down to a bottom level.

	Exports		Imports	
	Value Mill. Finnish marks	Percentage of volume of 1913	Value Mill. Finnish marks	Percentage of volume of 1913
1913	404·8	100·0	495·4	100·0
1919	880·4	47·6	2,509·9	77·8
1920	2,926·4	68·6	3,626·5	52·8
1921	3,389·4	69·0	3,585·7	54·5
1922	4,467·6	93·5	3,969·9	74·7
1923	4,392·5	94·8	4,600·3	101·5
1924	4,970·6	112·7	4,715·5	99·3

Great Britain took about 40% of Finnish exports in 1924. In the import trade the part played by Great Britain (19% in 1924), though considerable, is inferior to that of Germany (30% in 1924). The trade with Great Britain during recent years has gained ground when compared with pre-War conditions, but trade with Russia has not yet recovered. Timber products have long been of paramount importance in Finnish export trade, and timber exports after the War reached, and even exceeded, the record level of 1913. In 1924 the timber industry contributed close upon 60% of the total exports. The paper and pulp exports are second in importance only to the timber exports, the share of this industry in total exports amounting in 1924 to about 28%. Agricultural exports gradually revived, but the import of cereals, a very large item in Finnish foreign trade, was temporarily reduced. As a whole, Finnish agriculture showed some advance in comparison with pre-War conditions.

Currency.—The outbreak of war opened a period of serious monetary disturbance. The depreciation of the Finnish mark was, at first, largely due to the strain which Russian war finance put on the Finnish banking system. When, at the end of 1917, Finland gained her independence, she had to cover the increased expenditure imposed by her new position as an independent state, and that incurred in the suppression of the Red rebellion in the spring of 1918. As, in the disturbed state of the country, the taxes could not be punctually collected, the Government resorted to increased borrowing. Part of this demand for credit was met by means of new note issues which were made by the State Bank.

During the course of the years 1919, 1920, and 1921 the Finnish exchange declined seriously. In the latter part of 1922 the Bank of Finland embarked on a policy of stabilising the Finnish exchange in relation to the dollar, and since that date variations have been slight. At the end of 1925 the Finnish monetary system was put on a gold basis, the level of parity being approximately 193·23 Finnish marks to the £ sterling.

Finnish Monetary Statistics

Rates of exchange on New York quoted by the Bank of Finland. Par 5·18 mks. = 1 dollar			Index of Wholesale Prices
	Highest	Lowest	Annual Average Base 1913 = 100
1921 . . .	80·50	28·00	1263
1922 . . .	54·50	35·25	1219
1923 . . .	40·75	35·85	1095
1924 . . .	40·44	39·70	1100
1925 . . .	39·70	39·70	1129

Banks.—The leading banking institutes are at present Nordiska Föreningsbanken, Kansallis Osake-Pankki, Helsingfors Aktiebank and Unionbanken, which at the end of 1924 held about 80% of the total home deposits of the 19 joint stock banks in existence. The note circulation of Finland's Bank, the bank of issue, at the end of 1925, amounted to 1,309,000,000 gold Finnish marks, backed by a gold reserve of 331,000,000 gold marks and foreign assets exceeding 1,000,000,000 gold marks.

National Budget.—The improved conditions of production and trade formed a firm basis for financial reorganisation. Before the War the bulk of the Finnish State revenue was derived from customs duties and other indirect taxes and from the earnings of Government enterprises, mainly the railways. The chief change in national finance since the War has been the introduction of an income and property tax. The customs duties still form the main part of the state revenue, but direct taxes now yield about a quarter of the total tax revenue. The income from state enterprises is relatively less than before the War. The public debt, foreign and internal, in Sept. 1925, was estimated at a sum equivalent to $94,300,000. The debt is balanced by state forests, railways and other state property. There has also been a reorganisation of municipal taxation.

Tariff Policy.—The pre-War tariff might be characterised as a Protectionist one, but it granted practically no protection to grain-growing. Post-War legislation has provided agricultural protection and, with the elimination of the special facilities formerly existing between Russia and Finland, the grain duties now established may be expected sensibly to influence agricultural conditions. The new policy made no radical change in the tariff on manufactured goods, but sought to promote a more scientific distribution of duties and to secure as large an income as possible to the state. But the revision of the tariff was not completed in 1925. Commercial agreements have been concluded with France (July 13 1921), Great Britain (Dec. 14 1923), the United States (May 2 1925) and several other countries during the post-War period. Finland's prohibitory legislation in regard to wines and alcoholic liquors in some cases made the task of negotiation a difficult one. To Estonia Finland granted (Oct. 29 1921) considerable fiscal concessions not granted to any other Power, but Estonia plays a very small part, about 1% in Finnish trade.

Social Legislation.—An active policy aiming at improving the position of the numerous landless agricultural population had been set on foot some time before the War. After gaining her independence Finland adopted laws which with certain limitations gave tenants the opportunity of purchasing their holdings at a price below their value in the open market, and a large number of tenants have been turned into small owners. Recent social legislation further includes the adoption of an eight-hour day. Financial considerations have limited the scope of actual legislation for social insurance, but workmen's compensation for accidents has been put on a new and more comprehensive basis by legislation of 1917 and 1925.

The co-operative movement has made considerable progress in Finland. This holds true of consumers' co-operation as well as of several branches of agricultural co-operation. The central co-operative butter export association "Valio" has carried on by far the greater part of the total exports of butter and has, no doubt, been of great service in improving and standardising the quality of dairy produce. The butter exports mainly consist of high grade ware, and the grading takes place under state control. (A. My.)

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FINLAY, ROBERT BANNATYNE FINLAY, 1ST VISCOUNT, (1842–), British lawyer and politician, was born at Edinburgh July 11 1842. He was educated at Edinburgh Academy and University, and graduated in medicine. In 1867 he was called to the bar, in 1882 becoming a Q.C. and a bencher of the Middle Temple. He was elected as Conservative member for Inverness Burghs in 1885, and held this seat until 1892. In 1895 he regained the seat, and was made Solicitor-General in Lord Salisbury's Govt., when he was knighted. In 1900 he became Attorney-General, remaining in the Govt. until the Conservative defeat of 1906. In 1910 he was elected M.P. for Edinburgh and St. Andrews universities, and in 1916, on the formation of Mr. Lloyd George's Govt., became Lord Chancellor and a life peer. He retired in 1918, and in 1919 was created a viscount. In 1920 he was appointed British member of the Permanent Court of Arbitration at The Hague, and in 1921 became a member of the Permanent Court of International Justice established by the League of Nations. From 1902 to 1903 he was lord rector of Edinburgh University.

FINNISH LITERATURE (*see* 10.386).—Several of the writers in Finnish mentioned in the earlier article have since died. P. Cajander died in 1913, after having completed his translation of Shakespeare's plays in the previous year. Karl Bergbom, who made the Finnish National Theatre and was its first manager, died in 1906. Of lyric poets, J. H. Erkko died in 1906 and Arvi Jännes in 1915. The old peasant writer, P. Päivärinta, died in 1913, and his younger colleagues, Kauppis Heikki, in 1920 and J. Reijonen, in 1924. S. Ingman later took the name of "Ivalo" and abandoned the realistic description of present-day life for the historical novel. S. Alkio became a politician and leader of the Agrarian party, being several times a Cabinet Minister. Arvid Järnfelt, in his works published during this period, managed to shake off the preponderating influence of Tolstoy.

Prose.—The greatest writer of Finnish prose literature, Juhani Aho, died in 1921. Amongst his later works mention may be made of *Rauhan erakko* (1916), in which the writer protests against militarism, *Muistatko* (1920), an autobiographical study of childhood, and *Lastuja VIII.*, a collection of essays on salmon and salmon fishing, dating from the year 1921.

The most notable of the younger writers were Johannes Linnankoski (1869–1913) and F. E. Sillanpää (b. 1888). Linnankoski achieved European renown by his novel *Laulu tulipunaisesta kukasta* (1905)—"The Song of the Blood-Red Flower"—which has been translated into a number of languages. His best work from an artistic point of view is *Pakolaiset* (1908). Sillanpää has written several collections of short stories dealing with peasant life, and one great novel dealing with the time of the Red insurrection, which is an important document of social history. His strength lies in psychological descriptions of subconscious states. No other Finnish writer has been so successful in depicting the atmosphere in which the peasant lives his everyday life. Teuvo Pakkala (1862–1925) made his name by realistic studies of proletarian life, short stories and plays about the peasantry, and studies of children, which show great psychological insight. Joel Lehtonen (b. 1881), like Sillanpää, wrote novels inspired by the Red insurrection. The novels of Ilmari Kianto (b. 1874) on the peasantry are flavoured with satire. Kyösti Vilkuna (1879–1922) produced novels, short stories and plays. Among other things, he described the part which he himself played in the legal struggle against Russia and in the events leading up to the war of independence.

Of the numerous women writers, the following deserve mention: Aino Kallas (b. 1878), short story writer, one of her volumes, *The White Ship*, being published in English in 1924. The wife of an Estonian scientist and diplomat, she obtained an intimate knowledge of Estonian life, which forms the subject of many of her stories. Mailo Talvio (b. 1871) wrote numerous novels concerning life among the peasants and higher ranks of society. Maria Jotuni (b. 1880) possesses a realistic power and a robust humour which inform all her stories, novels and comedies. L. Onerva (b. 1882) is best known for her lyric poetry, but also wrote fiction and plays.

Poetry.—Among the poets writing in Finnish, Eino Leino (1878–1925) was unusually productive. He published dramas in prose and verse, novels, short stories, literary studies and numerous volumes of lyric poetry. His most successful works are his *Helkavirsiä*, historic poems in ballad form of a strongly national colour. Leino has also translated Dante's Divine Comedy into Finnish blank verse. Larin Kyösti (b. 1873) was another prolific writer, who achieved a well-deserved popularity by his popular poetry. The lyrical poetry of Otto Manninen (b. 1872) is highly esteemed by connoisseurs. Manninen did invaluable work as translator of the Iliad, Odyssey, Molière's metric comedies and other works. V. A. Koskenniemi (b. 1885), professor of literature at the Finnish University of Turku (Åbo) published numerous volumes of poetry. He lacks the spontaneity of Leino and Larin Kyösti, but is unsurpassed in Finnish literature as the creator of a lofty style, his favourite verse forms being the sonnet and the elegy.

Literature in Swedish.—The Swedish literature of Finland includes a number of poets who have gained reputations both in their own country and in Scandinavia. Mikael Lybeck (1864–1925) achieved his first successes with lyric poetry, but abandoned verse for prose during the last 20 years of his life. His short stories, novels and dramas are highly esteemed by literary critics, though they have not achieved any widespread popularity. Bertel Gripenberg (b. 1878) is the chief master of form among the poets writing in Swedish. He has handled many different kinds of verse with great skill, but specially favours the sonnet. The characteristics of his first volumes were dark passion, sensualism, pessimism and an aristocratic romanticism, but he has also found words to sing of the Finnish wildernesses, and has written patriotic lyrics, inspired by the Red insurrection and the War of Independence, in which an echo of Runeberg's heroism may be heard. Jakob Tegengren (b. 1875) writes in an elegiac key, and descriptions of nature occupy a large part of his works. In his later volumes a religious tendency is visible. Hjalmar Procopé (b. 1868) has written a few dramas, but is best known as a lyric poet. Arvid Mörne (b. 1878) sings of the archipelago, peasant life and the scenery of the Swedish-speaking districts in the south of Finland. He is the poet of the sea, more than any other of the writers in Swedish. But Mörne's writings also reflect his deep, radical opinions. He was ardently interested in social reform and the movement for popular education. In his later works, however, this spirit has given place to a subdued resignation. Mörne also achieved success as a dramatist and novelist.

Emil Zilliacus (b. 1878) published some highly appreciated collections of lyrical poetry. Jarl Hemmer (b. 1893) is the most lyrical and spontaneous of the Swedish poets of Finland. His poetry still preserves something of the melodiousness characteristic of Topelius's lyrics. Hemmer's verse has a winning, youth-

ful charm which yet does not preclude the expression of loftiness of thought. He also wrote a play, short stories and a novel dealing with the time of the War of Independence.

Runar Schildt (1888–1925) was the most eminent writer of Swedish prose in Finland. His short stories are characterised by a highly developed style, penetrating psychological insight and a humane, tolerant view of life. The subjects of some of them were taken from the War of Independence and the Red insurrection. Schildt was also a very successful dramatist. Vers libres and expressionist prose also found enthusiastic, and in some cases, gifted champions among the writers of Finland, both Swedish and Finnish.

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FIRE CONTROL: *see* GUNNERY, NAVAL.

FIRE PREVENTION (*see* 10.401).—Steadily mounting fire losses, particularly in North America, have greatly stimulated efforts looking toward fire prevention. Fire losses of created resources in the United States increased from $447,886,677 in 1920 to $548,810,639 in 1924. The latter figure exceeds the loss in 1906, the year of the San Francisco earthquake and fire, although in 1924 there was no great single conflagration. In Canada, the destruction of created resources increased in the same period from $27,600,000 to $33,300,000.

I. IN NORTH AMERICA

In forest fires, also, similarly excessive losses are sustained by the United States and Canada. In 1924 (U.S.A. Forest Service estimate) 29,000,000 ac. of forested land in the United States were swept by fires, numbering 92,000 in all and entailing an actual money damage of $38,000,000, a figure exceeding by $18,000,000 the previous nine-year average. Owing to different statistical methods in use, an exact comparison with European experience is at present impossible. In general, however, it may be stated that a stricter surveillance is observed in the State forests in Europe, made possible in part by the smaller areas to be watched. The State forests of Finland, in the period 1911–21, were damaged to the extent of less than 1/20th of 1% annually. In Norway, during the period 1913–23, the average yearly damage amounted to about $24,000, the area burned being about 1,770 ac. each year. In the Prussian State forests, 1901–10, the average forest area devastated annually by fire was about 1620 acres. In the Bavarian State forests, 1900–12, an average of 103 fires burned about 380 ac. annually, which was less than 1/50th of 1% of the total forest land.

Prevention of Forest Fires.—The chief causes of forest fires are lightning, incendiarism, sparks from locomotives and carelessness of campers and of lumbermen. To check the operation of these factors the supervision of forest areas, particularly in the United States and Canada, has been instituted by governmental action. Fire lanes are cut through the forest to act as breaks and are kept open by fire rangers in the employ of the Government. Other duties with which fire rangers are charged include an oversight of lumbermen, campers and other visitors in forest areas with a view of inculcating carefulness. They are expected also to take immediate action in the event of fire. Watch towers and airplanes are used in detecting any incipient conflagration.

Buildings and Stock.—The causes of fires in buildings and stock are chiefly defective chimneys; carelessness in handling fire and inflammable material; defects in electrical installations, and exposure, that is, ignition from fires in adjacent property. The use of wooden shingles on roofs and, in mercantile districts, wooden window trim in otherwise fire-resistant buildings facilitates the spread of flames. Some of the more recent conflagrations (1910–25) in the United States have been those of Paris, Tex. (1,440 buildings, loss $11,000,000); Nashville, Tenn. (648 buildings, loss $1,450,000); Augusta, Ga. (680 buildings, loss $4,500,000); Atlanta, Ga. (1,938 buildings, loss $5,500,000); Berkeley, Cal. (584 buildings, loss $10,000,000); and Chicago, Ill. (loss $8,000,000). To reduce fire risk, automatic fire alarm systems, automatic sprinklers and chemical fire extinguishers have been installed in the larger buildings and to some extent, in private houses. Conveniently hung coils of garden hose with means for attachment to the water tap are also of value.

In order to educate the public to the importance of such measures, fire prevention is taught in the schools of many of the United States and a " fire prevention week " has been instituted to call attention to this form of preventable waste. Among the agencies in promoting fire prevention in North America is the National Fire Protection Association, which formulates standards of fire protection appliances, and co-operates with local associations in lessening fire risks, such as furthering the use of safe electrical installations. The National Board of Fire Underwriters maintains laboratories for the testing of materials and devices falling within the scope of its services, makes civic surveys covering elements entering into fire risks, and furnishes a model building code for the guidance of cities desiring one. The U.S. Chamber of Commerce, also, acting through a committee on fire waste, promotes special studies of fire-risk conditions in individual communities and urges such action as appears desirable. In most cities, desirability of action along the following lines has been indicated: (*a*) Competent inspection by the fire department; (*b*) a more general use of fire-resistive roof coverings, protected window and door openings and automatic sprinklers; (*c*) adequate ordinances governing the storage and use of explosives and inflammable substances; (*d*) adequate means for the conviction of incendiaries; (*e*) public education in the transmission of fire alarms and use of first-aid extinguishing devices. (F. H. W.)

II. IN GREAT BRITAIN

With the growth of cities and consequent risk of conflagration, fire prevention is a subject which has received much attention since 1910. Societies have been formed for the special consideration of the matter, and public bodies and insurance companies have given every possible assistance in devising means and methods for the prevention of fire. Great Britain is much behind in the matter of official regulation for fire prevention, and insurance companies have done more than the authorities by encouraging improvements in construction and the introduction of appliances such as automatic sprinklers, automatic alarms, fire doors, etc.

A large proportion of fires is due to carelessness. There is the thoughtless individual who throws away a match before the spark is out, without looking where it falls, and the careless smoker who leaves cigarette ends in close proximity to combustible material. The " no smoking " sign in factory and warehouse is often ignored, and the guilty individual fails to realise how his act is a menace to life and property. If notices prohibiting smoking in factories or other buildings are posted up, they should be rigorously enforced. Smoking should be prohibited in all factories, and the growing tendency to allow smoking in theatres and music halls should be strongly deprecated.

There has been a large increase in the use of highly inflammable liquids and material, and public attention should be called to the danger, both in the use and in the storage of these. Many hazardous processes in manufacture from a fire hazard point of view can be rendered innocuous by the precautions recommended by insurance companies. Apart from individual carelessness, fires are often caused through defective building construction, such as wooden joists or beams under hearths and entering flues, etc., insecure heating apparatus and defective lighting systems.

Precautions.—In large cities, building by-laws are fairly strict, but insurance companies have done more than the authorities to encourage improvements in construction. Party walls through and above the roof and fireproof doors, where communications exist between buildings, often keep a fire from spreading. Insecure stoves and flue pipes should never be allowed and proper fenders and guards for fireplaces are amongst the simplest preventatives. Electric light installations should be overhauled by experts from time to time, and fuse boxes should not be tampered with by people ignorant of their use. Gas brackets and all

fittings should be securely fixed. It is the duty of each occupier of a building to watch for signs of defects, and either to report them or have the defects remedied.

Many devices are in use for detecting fire, known as automatic fire alarms. The general principle is that the heat generated by a fire causes a metal to expand, making electric connection and setting an alarm bell in motion. Automatic fire alarms may be connected up direct with fire brigade stations, thus securing an immediate turn-out to a fire. In spite of precautions, fires will occur, and every means should be taken to summon assistance and extinguish the outbreak. Fire precaution is a natural step after fire prevention. Every occupier of a building should know the exact position of the nearest fire alarm, so that the fire brigade can reach the scene without delay.

It is often said that the first five minutes at a fire is worth more than the next four hours, and water should be at hand to put out the flames. Buckets of water or chemical extinguishers should be in every building. There are many extinguishers on the market, some containing liquids, others powdered chemicals, but no class of fire extinguisher is a cure for all fires. The extinguishing agent must have either the property of allaying heat or a blanketing effect or a combination of both of these. Fire in ordinary combustible materials can be put out with water, but fires in oils, greases, etc., must be put out with a blanketing agent. Certain chemicals put a film or thin blanket over the liquid or material, thus excluding the oxygen long enough to allow the mass to cool below its burning point.

Fireproof buildings, efficient fire brigades and adequate water supplies have all contributed to reduce fire waste, but special mention should be made of the protection offered by automatic sprinkler installations. The installation of these is becoming quite common, and they have proved in practice to be wonderfully effective. Automatic sprinklers consist of a head or water-jet connected with water pipes, in which a pressure of water is maintained, the head being released by the melting of solder when there is sufficient heat generated by an outbreak of fire and the water automatically plays upon the fire, quickly subduing it. In connection with the installation there is also a fire gong, which automatically works with the opening of a sprinkler head, and assistance is thereby summoned at once.

(E. M. M.)

FISCHER, EMIL (1852–1919), German chemist (*see* 10.426), died in Berlin July 15 1919.

FISHER, JOHN ARBUTHNOT FISHER, 1ST BARON (1841–1920), British sailor (*see* 10.428). From 1910 until Oct. 1914 Lord Fisher remained in retirement, although Mr. Churchill, now at the Admiralty, constantly consulted him and it was on Fisher's advice that Jellicoe was designated admiral of the Grand Fleet in the event of war. (At the time of the Agadir crisis, however, Fisher had expressed to Lord Esher and others strong disapproval of the War Office plans engaging us in extensive land operations in France.)

Fisher was recalled as First Sea Lord in place of Prince Louis of Battenberg in the critical days at the end of Oct. 1914. The "Audacious" had been sunk, Cradock heavily defeated off Coronel, German submarines were active and there was no effective blockade of Germany. Fisher took the responsibility of weakening the British fleet in home waters and detached the "Invincible" and "Inflexible" to engage von Spee, with the result that a complete victory was gained in the battle of the Falkland Islands. To Fisher's boldness and realism again were due the new blockade policy and the laying of extensive mine fields. The association between Churchill and Fisher was most happy until it was broken by the Dardanelles enterprise. Fisher had never liked it; his own preference was for a landing on the coast of Prussia and the employment of Russian troops against the heart of Germany. But he was persuaded by Churchill into acquiescence.

When, however, the first attempt to force the straits had failed, and German submarines had made their appearance in Turkish waters, and it seemed doubtful whether the demands of the French campaign would allow the British to send the necessary reinforcements to the army in Gallipoli, Fisher felt that he could no longer continue to countenance the project of forcing the Dardanelles. At the War Council of May 14 1915 he had declared that "he was against the Dardanelles and had been all along." Churchill afterwards told him that it was not fair to obstruct necessary measures at the Dardanelles and then when things went wrong to turn round and say "I told you so, I was always against it." Fisher replied "I think you are right—it isn't fair." That night Mr. Churchill in order to encourage the entry of Italy into the War on the side of the Allies gave instructions that four cruisers should go to the Mediterranean 48 hours before the time arranged, and the minute was signed "First Sea Lord to see after action." That was the first document seen by Fisher on beginning work as usual at four o'clock next morning. He resigned and never entered the Admiralty again. His resignation coinciding with the crisis about high explosive shells, brought down the already shaken Liberal Govt., and led to the formation of the first Coalition. The manner of his leaving the Admiralty became Fisher less than anything in his life, but his motives were neither personal nor unworthy. He felt that as things were he had lost his power of service; that he could only hamper the Dardanelles and be "unfair" to Churchill without influencing events in the direction which he felt was right.

Fisher did useful work later in the War as Chairman of the Inventions Board, and when he died on July 10 1920 and was buried in Westminster Abbey, the crowds felt that they were mourning the greatest British sailor since Nelson. Their reverence was the more remarkable because Fisher never commanded a fleet in action, nor, except the Falkland Islands, is any great victory at sea traceable to his direct inspiration. His enemies accused him of exaggerating the material side of naval power at the expense of the moral and intellectual. He was not good in the logical presentation of an argument; he thought pictorially and the sequence of his ideas expressed themselves in a series of verbal explosions. But his prescience amounted at times almost to second-sight, and he had a genius for the burning phrase that lights up the truth from within. The most amazing quality of the man was that as he grew older he became more radical and revolutionary in his ideas. To the old man in 1919 his own Dreadnought of 13 years was a symbol of effete tradition; his slogan "Sack the lot" was not the prosecution of a personal vendetta against the Admiralty chiefs, but expressed his conviction that though the spirit was eternal, its forms were only made to be broken. He wrote two volumes of memoirs: *Memories* (1919) and *Records* (1919), before his death; somewhat scrappy and disorderly in composition but full of his glowing vitality. Fisher married, in 1866, Miss Kate Broughton, by whom he had one son, Cecil, and three daughters.

FISHER, ANDREW (1862–), Australian politician, was born at Crosshouse, Kilmarnock, Aug. 29 1862, and began life as a coal miner. He emigrated to Queensland at the age of 23, and eight years later was elected to the Queensland legislature. He was elected to the Commonwealth Parliament in 1901, joined Mr. Watson's Labour Cabinet of 1904 as Minister of Trade and Customs, and became leader of the Labour party in 1907 on Mr. Watson's resignation. In 1908 he became Prime Minister, but his administration lasted only six months. At the general election in 1910, however, his party was returned with a sweeping majority, and he was Prime Minister for three years, during which period he tackled the question of imperial defence, adopted Lord Kitchener's report of 1909 and passed a measure establishing universal military training. His Ministry fell in 1913, but at the election of Aug. 1914 he was again returned to power and gave Australia a vigorous lead in the early days of the World War. At the end of 1915 he resigned and took up the high commissionership vacated by Sir George Reid. This office he held until 1921.

FISHER, HERBERT ALBERT LAURENS (1865–), British man of letters and politician, was born in London March 21 1865. He was educated at Winchester and New College, Oxford, being elected in 1888 to a fellowship at the latter college, where he lectured for some years. He earned recognition as a scholarly

historian, and in 1911–2 was appointed Chichele lecturer in modern history at Oxford. He was also a member of the royal commission on the public services of India (1912–5). In 1912 he was appointed vice-chancellor of Sheffield University. In 1916, Mr. Fisher accepted the invitation to become Minister of Education in Mr. Lloyd George's Cabinet and was elected to Parliament for the Hallam division of Sheffield. In 1918 he was elected Liberal member for the English universities. An Education bill was introduced by him in Aug. 1917, which contained many important reforms (*see* EDUCATION). In Jan. 1925 he was elected warden of New College, Oxford, and he resigned his seat as member for the combined universities in Feb. 1926.

Among his books are *The Mediaeval Empire* (1898); *Studies in Napoleonic Statesmanship* (1903); *A Political History of England* (1906); *Bonapartism* (1908); *Life of F. W. Maitland* (1910); *The Republican Tradition in Europe* (1911); *Political Unions* (1911); *Napoleon Bonaparte* (1913); *The Common Weal* (1924), besides essays and review articles.

FISHER, IRVING (1867–), American economist, was born at Saugerties, N.Y., Feb. 27 1867. He studied at Yale (A.B., 1888), Berlin and Paris. At first he taught mathematics at Yale; but in 1895 was made assistant professor of political economy, and, in 1898, professor. He was editor of *The Yale Review*, 1896–1910. He served as chairman of many commissions dealing with public health, prohibition and labour. An authority on money inflation, he proposed that the purchasing power of the dollar be stabilised (*see* DOLLAR STABILISATION).

His writings include: *Mathematical Investigations in the Theory of Value and Prices* (1892); *A Brief Introduction to the Infinitesimal Calculus* (1897); *The Nature of Capital and Income* (1906); *National Vitality* (1910); *The Purchasing Power of Money* (1911); *Stabilising the Dollar in Purchasing Power* (1919).

FISHERIES (*see* 10.429).—Dealing first with British fisheries, it may be said that during the 20th century development has been rather slow, having been directed rather to the perfection of existing classes of boats and nets than to new inventions.

The otter is still the chief net for trawling from steam vessels. Its mouth must be given as wide a gape as possible, so that floats and other devices are being employed to prevent its upper rope from sagging so as to close its aperture; a third otter board is sometimes used in this position. The same trawl, but with reduced mesh, is also dragged to catch fish swimming near the bottom, particularly herrings; further development in midwater fishing in the deeper oceanic areas seems probable. Seining, or the surrounding of areas by netting so as to enclose the fish, a method extended by the Danes, is now generally pursued in all the shallower waters of the North Sea; it results in large catches, particularly of haddock and plaice, the fish arriving in less bruised condition than after the long haul of the sac-like trawl.

Surface Fishing.—Surface fishing methods show little change; they are now mainly practised by steam drifters, which follow the successive shoaling of herrings from the northwest coasts of Scotland in Jan. to the Shetlands and, down the east coast of Great Britain, to Lowestoft in October.

Trawling.—Steam trawlers varying up to 145 ft. in length have still further replaced sailing vessels, fleets of the latter only being maintained at Lowestoft (136 vessels), Brixham (90), Ramsgate (25), and Plymouth (12). Experiments in the utilisation of oil fuel are now proceeding. These changes mean the further concentration of the industry in large ports and under companies or big firms. The hake is now generally recognised as a table fish and is trawled as far south as the Moroccan coast to depths of 250 fathoms; this fishery, in association also with that of soles and skate, has resulted in important fishery developments in Milford Haven, Swansea and Cardiff. To the north, trawlers regularly fish in the Barents Sea and off Iceland, and trial voyages have been made from Hull to the Greenland banks (1925); otherwise there is little increase in the fishing area. The Norway haddock (*Sebastes*) is now regularly marketed at Aberdeen, and the sea bream and skate have generally found favour. In recent years the inshore fisheries have been greatly helped by a loan scheme of the Development Commissioners for the installation of motors in the smaller sailing craft; a further scheme on business lines for the insurance of inshore fishing craft has also been financed by the commissioners, thus giving the inshore industry the power to secure its capital. On other sides the production of sterilised ice is a development of importance, and an entirely efficient method of preservation by freezing in brine has been perfected, but not yet applied in Great Britain. The use of fish waste to form nutritive fish meals has been undertaken in the greater ports, and on the retail side fish-frying shops have so immensely increased that they form an important factor in the feeding of town populations.

EUROPEAN FISHERIES

European countries, bordering on the Atlantic, show in their high-sea fisheries similar changes to those of Great Britain and are serious competitors on most fishing grounds. Norway, in particular, has developed all its fisheries; its export trade of salt cod and other fish products is of importance. Russia, the oceanic fisheries of which have to some degree retrograded, has interfered on several occasions with British trawlers working off her northern coasts; here, as also off Iceland, Spain, Norway and Morocco the maintenance of the territorial limit of three miles is regarded by the British fishing industry as of vital interest. France shows development in all the fisheries of the Bay of Biscay, especially in sardines and tunny; her trawling fleet has increased and her larger boats still proceed on regular annual voyages to the Newfoundland banks and to Ireland. Spain and Portugal are more organised and have extended the catching power of their fisheries, but still confine their voyages to adjacent waters.

AMERICAN, ASIATIC AND AFRICAN FISHERIES

With increase of population the importance of fisheries is more widely realised, and, in North America, the United States and Canada have pursued an active policy of development in both fresh and salt waters; they export large quantities of canned and frozen salmon to Europe. Newfoundland is still mainly exporting salt-dried cod, not having as yet adequately exploited her large shoals of herring and her salmon.

Asia.—Japan shows advance in every direction, and New Zealand and various states of the Commonwealth of Australia are concerned with the exploitation of their fishing grounds.

Africa.—South Africa, which has extensive areas of suitable depths to the south and west, maintains a trawler fleet, while a crayfish fishery has been opened off Natal. Many trawlers were sold after the War to go to tropical countries, but so far systematic fishing in such waters by large power vessels has not proved profitable. The largest areas of suitable depths still almost unfished are between the Falklands and Patagonia and in that great bay to the east of the Malay peninsula. The "Discovery" expedition to south Georgia should throw light on the possibility of southern grounds, while the Malay Govt. has a research steamer on the stocks (1926).

THE INDUSTRY IN GREAT BRITAIN DURING THE WAR

In 1914 there were about 100,000 fishermen of all classes in Great Britain. Practically 40% of these at once joined the navy, while over 10% quickly responded to the urgent appeals of the military authorities. About 3,000 steam fishing vessels, trawlers and drifters in about equal numbers, were requisitioned for service, and many more were built for the same purpose. They were largely manned by fishermen recruited from those still fishing; often a requisitioned vessel carried her whole crew with her. They were employed in the Auxiliary Patrol, in mine-sweeping from the White Sea to the Straits of Marmora and in all operations necessary to keep the sea open for the operations of the British fleet, for the transport of troops and material to France, for the advent of forces from oversea colonies and the United States, and, above all, for the due arrival of food from every part of the world. The few vessels left continued fishing, and a system of fleets fishing in selected areas under the protection of their own guns and those of the navy was devised. The success of this was seen in the fourth year of the War, only 4 steam trawlers being sunk by enemy submarines as compared with 156 in the previous year. By the middle of 1917 there were only about 14,000 men still fishing, of whom over 10,000 were over age or unfit for service. Yet in the same year about 8 million cwts. of fish were landed, about 40% of the average annual catch for the 20 years preceding the War; the value, however, was nearly the same.

Arrangements were made whereby Belgian and Dutch fishing vessels were based on British ports. The shell-fish industry was fostered and developed. The deficiency in fish was further reduced by importation, particularly from Norway and Holland.

Reconstruction Problems.—The reconstruction of the industry after the War presented problems of peculiar difficulty owing to the rapid fall in the price of fish, while all commodities used in the industry remained at over double pre-War costs. The greatest difficulty of all was to preserve the herring fishery, which depended for its existence on the export of about 80% of its catch to Germany and Russia as brine-cured herring, thus differing from the trawl fishery, the output of which is absorbed by the home market. The fishermen concerned had taken an essential and vital part in national defence, and their industry was threatened with complete annihilation, the loss of its skilled craftsmen and the rotting of its boats. The government took over the finance, and thus practically the management of this fishery by the "herring guarantees" of 1919 and 1920. The cost of this bold and unprecedented action amounted to £1,712,675. It was eminently successful, for the industry, thus re-established, survived a disastrous seasonal fluctuation in 1921 and now again flourishes, aided by good subsequent years and a new export trade of fresh herrings to the Continent.

Administration.—The interests of the fishing industry are cared for by the fisheries department of the Ministry of Agriculture and Fisheries, by the Fishery Board for Scotland and by corresponding departments in Ulster and the Irish Free State. There is a series of local county Sea Fisheries Committees around the coasts of England and of Boards of Conservators of certain salmon rivers; they are responsible for local by-laws for their territorial waters and rivers, but any such can be disallowed by the central authority. There are practically no restrictive regulations to administer, the central departments being maintained to help and foster the industry in the interests of the state. The high seas outside territorial waters are open to the fishermen of all countries and supply about 96% of the British catch, the larger trawlers and drifters not being allowed to fish within territorial waters. Under powers sanctioned by Parliament in 1889, the Moray Firth was closed to British trawlers, but this regulation is not enforceable against the trawlers of other nations outside the three-mile limit. For the most part the government departments act as expert intermediaries in the interests of the industry with all the government offices concerned (Admiralty, Board of Trade, Foreign Office, etc.), with market authorities and with railways. Officers are stationed in all the larger ports to help and advise the fishermen and to keep the Ministry informed of current fishery matters. The organisation of the statistics relating to the industry has been mainly the work of the English Ministry, difficulties due to the necessarily rapid handling of the fish on arrival in ports having to be overcome by the devising of unobjectionable tests and checks of all sorts.

Scientific Investigations.—The Fishery Departments of England, Scotland and the Irish Free State have each a scientific division, and each has its own research vessel with headquarters respectively at Lowestoft, Aberdeen and Dublin. The Irish vessel is also used for local policing purposes, as also is a further vessel under the Lancashire and North Western Sea Fisheries Committee. Fisheries protection on the high seas is a function of the navy. Great Britain also maintains a staff of fish measurers, who go to sea on commercial fishing vessels. Something of the kind is done by other countries.

International Investigations

In 1902 the International Council for the Exploration of the Sea was organised, Denmark, Germany, England, Finland, the Netherlands, Norway, Russia and Sweden being signatories to an agreement for the pursuit of scientific research into all the waters off northern Europe. It naturally became inactive during the War, but was reconstructed in 1920, France then giving her adhesion. It now includes all the countries of western Europe except Germany and Russia. Each country according to its means maintains research vessels, and each works on a determinate scheme, settled at the annual meeting, at which the facts collected are discussed. The departments of Scotland and Ireland organised scientific divisions to carry on their share of the work, but that of England was managed until 1910 by the Marine Biological Association.

The International Council is divided into Statistical, Hydrographical, Limnological and Plankton committees, together with committees for the following areas: North Sea, Baltic Sea, Atlantic Slope, North Western (Iceland, Faroes, etc.), North Eastern (off Norway and Arctic), with, as their first care, to consider the practical fishery problems arising, or likely to arise, in their own areas. Its greatest accomplishment of recent years has been the organisation of the collection of statistics of all countries concerned on a uniform basis, the form adopted being largely that of the statistical branch of the Ministry of Agriculture and Fisheries.

Problems Investigated.—The main problem before the council is to trace to their causes the fluctuations to which statistics show that all the great fisheries are subject. To this end the council has organised a general programme of biological work for all its members, co-operative research, the results of which are generally published nationally. In Great Britain there was a fear that the areas of the principal fisheries were being overfished; the fish supposed of most importance here was the plaice, as to which there were no reliable statistics, while its life-history was little known. Consequently a large part of the research power of England and Scotland has been concentrated on this fish, and the depletion of the plaice fishery of the North Sea by overfishing almost to the limits of safety has been established.

Various remedies have been suggested and carefully examined, such as regulating the size of the mesh of nets employed, prohibiting the sale of undersized fish, and completely or partially enclosing some of the nursery grounds. The first, so far, has been found to be impracticable, as the trawl has to catch round as well as flat fishes, but experiments with a view to overcoming the difficulties are being made. The second would entail undesirable regulations and costly inspection. In respect to the third, the closure of the North Sea during the War formed a gigantic experiment, the catch by English vessels in this sea increasing from 24,000 tons in 1913 to 33,000 in 1920, but falling to 22,000 tons in 1923. The fall was clearly due to overfishing, as shown by steam trawler average daily catches of 2·1, 3·4 and 1·9 cwts. of plaice in the three years respectively. The difficulty of closing areas lies in the necessity of negotiating international agreements, as all desirable areas to be closed are outside the limits of territorial waters to the east of the North Sea.

Other notable reports of the International Council, which has its headquarters at Copenhagen, and of the British Fishery Departments deal with the natural history and growth of the herring, of the plaice and of the cod, the determination of the water movements of the North Atlantic, the deposits of the North Sea, the movements of certain fish as shown by marking experiments, and the transplantation of plaice to the Dogger Bank. A report of the English Ministry describes the gear employed in 1923 and a Report of a Treasury Committee published in 1908 in the evidence recorded gives a full account of nearly every aspect of the fishing industry as it then existed. The annual administrative reports of the English and Scotch departments should also be consulted.

The researches of the government departments concerned are also largely aided by the work of the staffs of scientific marine laboratories situated at Plymouth, Cullercoats, Millport and Port Erin, each of which has its public aquarium. These, while founded by private enterprise, are materially assisted by grants from the Development Commission, on the recognition of the well-known fact that economic results usually follow scientific researches. Of these the largest is Plymouth with special departments for zoology, physiology and fisheries; it is the property of the Marine Biological Assn., which in its *Journal*, by agreement, publishes the result of research from all the British marine laboratories.

Statistics of the Industry

The approximate total value of the sea fisheries catch of the countries of western Europe in 1922 amounted to £48,000,000 (British Is., 39·5%; France, 17·6%; Spain, 15·5%; Norway, 7·5%; Denmark, 5%; Holland, 4%; Portugal, 3·4%; Germany, 3·3%). Canadian fisheries in 1924 were $44,500,000 (Provinces: Atlantic, $17,500,000, Inland, $5,500,000 and Pacific $21,500,000); Pacific salmon, $13,000,000 and Atlantic lobsters, $4,000,000; over 60% was exported. The recorded values for the United States in 1923 were about the same, but the inland fisheries were $13,000,000; exports were $12,000,000.

Great Britain

	Catches		Craft Employed		Employment	
	Demersal fish cwts.	Principal Pelagic fish cwts.	1st Class	2nd Class	Regular	Irregular
1909–13 average	11,613,066	10,769,178	6,602	5,203	67,962	13,150
1920 .	12,573,805	8,333,991	5,581	6,227	61,683	10,925
1924 .	10,880,251	9,800,481	4,921	5,777	54,610	8,947

This table shows vividly the modifications which have taken place in the Fishing Industry of Great Britain during the period under review. The type of fishing-boat has also changed greatly. In 1913, 3,233 steam-boats (3,222 1st class and 11 2nd class boats) were employed. In 1924, the number was 3,087, of which 3,078 were 1st class. Motor-craft, however, increased from 842 in 1913 (335 1st class and 507 2nd class) to 4,311 in 1924 (1,192 1st class and 3,119 2nd class). Sailing craft in 1913 were 7,730 (3,045 1st class and 4,685 2nd class), while in 1924 they were 3,300 (651 1st class and 2,649 2nd class). Corresponding figures are not available from other countries where statistics are based on different data and collected by different methods.

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FISHING: *see* ANGLING.

FITZMAURICE-KELLY, JAMES (1857–1923), British man of letters, was born in Glasgow June 20 1857. Educated at St. Charles's College, London, he became Taylorian lecturer in Spanish at Oxford in 1902. From 1909 to 1916 he was Gilmour professor of Spanish language and literature at the University of Liverpool; and in 1908 and 1912 Norman MacColl lecturer at Cambridge University. During 1907 and 1908 he lectured for the Hispanic Society of America at various American universities and at London University. In 1916 he was appointed Cervantes professor of Spanish language and literature at the University of London, a post he held till his resignation in 1920. Among his numerous published works should be mentioned *The Life of Miguel de Cervantes Saavedra* (1892); an introduction to the editio princeps of *Don Quixote* (1898–9); a *History of Spanish Literature* (1898); *Cervantes in England* (1905); *Miguel de Cervantes: a memoir* (1913); *Cervantes and Shakespeare* (1916); *Góngora* (1918); and *Fray Luis de Leon* (1921). He edited among other publications, the *Oxford Book of Spanish Verse* (1913) and the complete works of Miguel de Cervantes Saavedra (1901–). He died at Sydenham, London, Nov. 30 1923.

FIUME (Slav "Rijeka" both meaning "the river"), a port on the Adriatic (*see* 10.449). As the only port of Hungary, Fiume had had little history, but the city sprang into world-wide notoriety and became a burning question after the World War. The question of Fiume even threatened to become the cause of a further war between Italy and Yugoslavia. The "secret" treaty of London of April 26 1915, which contained Italy's terms for entering into the War, assigned Fiume to Croatia, and Senator Tittoni (subsequently Minister of Foreign Affairs) informed the writer that Baron Sonnino who negotiated that treaty for Italy, never once asked for Fiume; had he done so at that time, he could have had it for the asking. This point is important, because the Italian Press afterwards blamed the Allies for "refusing" Fiume to Italy.

The Italian Claims.—The first Italian claim to Fiume was made by Sig. Bissolati immediately after his resignation from the Cabinet at the end of 1918. Baron Sonnino's inaction in this matter was due to the fact that in 1915 he had neither anticipated, nor desired, the total breakup of the Dual Monarchy, but wished, while annexing the purely Italian provinces of Austria, to leave Fiume to Hungary, instead of including it, as a future rival to Trieste and Venice, among the Italian ports at the head of the Adriatic. But in 1919 the official Italians demanded Fiume on the principle of "self-determination," because the majority of its inhabitants was Italian, and largely so if Fiume proper were separated from its Yugoslav suburb of Sušak on the opposite side of the rivulet, which had given to Fiume its name, and which the Slavs called simply Rečina, and the Italians "Eneo"—a poetical title for so prosaic a stream. That Fiume was in 1919 predominantly Italian is true, but the Italian element had immigrated within comparatively recent years; the very detailed description of Fiume about 1855 by Charles Lever (the British consul at Trieste) in his novel, *That Boy of Norcott's*, mentions Slavs and Hungarians but never Italians there.

Meanwhile, on Oct. 23 1918, Croat troops had seized Fiume and in Nov. there was a dual occupation, against which the Yugoslav national council protested, by Italian and Serbian troops, while Italian naval forces entered the harbour. The Serbian troops were, however, withdrawn and replaced by Americans, pending the decision of the Fiume question by the Peace Conference. The Italians' position was similar to that known in English law as "pleading inconsistent defences." They claimed North Dalmatia, overwhelmingly Slav by race, in virtue of the Treaty of London, which President Wilson repudiated, and Fiume in virtue of the Wilson principle of "self-determination."

The D'Annunzio Adventure.—They ultimately obtained Fiume, thanks to the raid made by Gabriele D'Annunzio, who mustered a body of men at Ronchi near Trieste, and on Sept. 12 1919 occupied the contested town. There despite official notes, he remained as "commandant," offering to a prosaic age the spectacle of a poet as governor, and surrounding a commonplace town with the glamour of his dithyrambic speeches. He drew up a constitution for the "Carnaro," as he called his miniature state, and soon Fiuman divorces became the fashion for Italians unable to dissolve their marriages at home. He delivered frequent speeches, and represented the oppressed nationalities of the whole world as looking to Fiume, "the holocaust city," for consolation in their affliction. He descended with his "legionaries" upon Zara and meditated an extension of his territories still farther southward. While successive Italian Governments gave him no official support, he received considerable sympathy from the Nationalist elements in Italy and was regarded with corresponding aversion by the Yugoslavs, whose prowess in the Middle Ages he had sung in a poem of encyclopaedic erudition at the outset of the War.

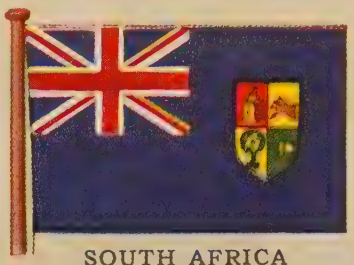
But when Signor Giolitti in 1920 became for the last time Premier and concluded the treaty of Rapallo with the Yugoslavs, he resolved to turn the poet out of Fiume, and that eminently common-sense politician did so by force. The "commandant's" official residence was bombarded by the "Andrea Doria," and he narrowly escaped the martyrdom which he had proclaimed for himself and his followers, a "holocaust" for his country. After the "heroic age" of his rule there came the prosaic interlude of his local rival, Sig. Zanella, who represented the autonomous, as opposed to the Italian National, party, and aimed at bringing about a good understanding with Yugoslavia. A *coup d'état* by *Fascisti* and "legionaries" took place in 1922; the Government offices were stormed; Sig. Zanella abdicated in favour of a "government of national defence," and was escorted over the frontier in an armoured car; Sig. Prodan, a local engineer, succeeded him, and annexation to Italy was proclaimed. Official Italy, however, acted with caution and persuaded Sig. Giurati, a *Fascista* deputy, to decline the proffered post of "Civil Commissioner," while D'Annunzio from his retreat on the lake of Garda denounced the dissensions of Fiume, and refused to return and lead the Fiuman movement.

Negotiations between Italy and Yugoslavia.—Finally General Giardino became Governor, and Signor Mussolini made a serious attempt to come to terms with the Yugoslavs. The river had in the course of generations changed its course, forming a

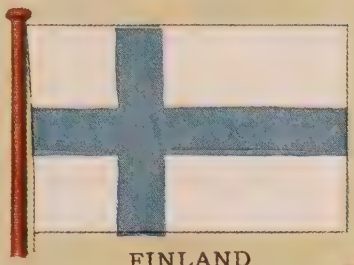
FLAGS

AUSTRALIA

IRISH FREE STATE



SOUTH AFRICA



FINLAND

CZECHOSLOVAKIA

PALESTINE

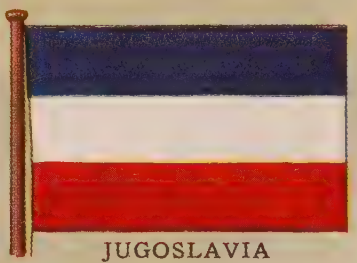
DANZIG

GERMANY

SOVIET RUSSIA

ESTONIA

AUSTRIA



JUGOSLAVIA
Kingdom of the Serbs,
Croats and Slovenes

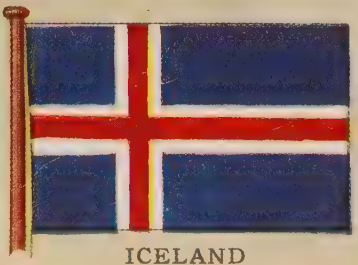
POLAND

LITHUANIA

CHINA

LATVIA

EGYPT



ICELAND

" Delta," as it was called, and thus rendering doubtful the boundary of Fiume towards Sušak. Both Italians and Yugoslavs claimed the " Delta." The smaller harbour, too, called in Hungarian times " Port Baross " after a former governor, but rechristened by the Italians " Porto Nazario Sauro " after one of the heroes of the War, was a matter of dispute, but by a letter written by Count Sforza, then Italian Minister of Foreign Affairs, a few hours after the signature of the treaty of Rapallo in Nov. 1920 it was ceded to Yugoslavia.

Even after the refusal of D'Annunzio (afterwards created by the Fascisto Government " Principe di Monte Nevoso "), bickerings still continued and the two rival races did their best to give one another economic pin-pricks and thereby nearly ruined the trade of the once flourishing port of Hungary. Thus, the Italian railway time-table was so arranged that the trains did not connect at the frontier-station of Postumia, while the Yugoslavs stopped their through railway service to Fiume altogether, so that the traveller from Fiume into Yugoslavia had to drive across the wooden bridge into Sušak and thence a mile or more to a roadside station on the line to Zagreb. Grass grew in the dockyards of the port and there were at one time only two steamers in the harbour. Just before the Corfu incident, Sig. Mussolini sent an ultimatum to Yugoslavia, and the fleet which bombarded the Greek island is said to have been originally intended for Fiume. But milder counsels prevailed, and at last a series of arrangements was concluded at Florence between the Italian and Yugoslav Govts. on Jan. 27 1924. Fiume with the larger harbour was definitely recognised as Italian; Port Baross and " the Delta " became Yugoslav, and through railway traffic, after several years' intermission, was renewed.

In 1925 the trade of the town improved; and the passage across the bridge to Sušak was no longer impeded by formalities. But the Fiuman frontier towards the north is fantastic, for a mere corridor, through which the road and railway run, connects the town with Abbazia, and is commanded by the old Roman fortress of Castua, high on the hills which dominate the Quarnero. Superficial peace reigns at Fiume; but Italy does not need three ports in the northern Adriatic and the opening (in Aug. 1925) of the last link in the Lika railway connecting Spalato with the Yugoslav hinterland is a fresh blow to Fiume, while the old Hungarian-Croatian steamship line now rechristened " Jadranska Plovidba " (" Adriatic Steamship Co.") starts from Port Baross and boycotts Italian Zara. The delimitation of the frontier by the Italo-Yugoslav commission has just been concluded. Population of the town of Fiume (1921), 45,000.

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(W. Mi.)

FIVES (*see* 10.450).—In Great Britain the forms most usually met with are known as Eton Fives and Rugby Fives. There are also Winchester Fives and other less-known varieties. A few rules of an older form of the game as played about 1825 still existed in 1925. Both the main games are played chiefly at the great public schools, but there are also a number of courts in various parts of the country, and the game is played in the north of England by working men. In 1924 a Fives Assn. was formed and two open competitions, one at Eton Fives and one at Rugby Fives, were instituted.

FLAG (*see* 10.454).—As one of the international attributes of a state or a sovereign, a flag has in modern times been liable to assume a new form or disappear, according to the vicissitudes of the individual political entity to which it is appurtenant. The years since 1910 witnessed greater transformations in the flags of the world than were occasioned even by the Napoleonic wars and the Congress of Vienna. As a result of the World War three Imperial houses came to an end, some European states ceased to exist as such, new states emerged and old states assumed new forms. A necessary consequence of this was that historic banners such as the standards of the Hohenzollerns, the Habsburgs and the Czars ceased to exist or became obsolete, new national flags appeared and the blazonry of some of the old flags was materially changed.

Most of the states brought into existence by the Treaty of Versailles adopted flags which, though varying in design, embodied heraldic features of older banners. For example, the republic of Austria adopted the former flag of the Austro-Hungarian imperial navy without the charge, whereas the new flag of Hungary is that of the former Kingdom of Hungary. The new flag of the German Republic substitutes the national colours, black, red and gold, in place of the black, white and red which had been the distinguishing colours of the German mercantile marine. On the other hand, the former Russian national colours gave place to a new design, which departed from all traditions of heraldic law, *i.e.*, a flag bearing the letters РСФСР (Russian Socialist Federation of Soviet Republics) imposed on a red ground. Of the new Baltic States, Finland, Latvia and Lithuania adopted flags devised in historic affinity with mediaeval banners associated with their respective localities. Estonia, however, brought into existence a new flag of no heraldic value, bearing three horizontal bars, blue, black and white, signifying respectively the blue sky, the black earth and the white shirt of the peasant. The port of Danzig adopted with modifications the flag of the city when it was an independent member of the Hanseatic League. The historic flag of Poland—before the partition—consisted of a scarlet field with a white eagle in the centre, but the flag of the new republic is of scarlet and white, the eagle being discarded. The former design is used, however, as a badge in the shape of a shield when necessary. The flag of the Kingdom of the Serbs, Croats and Slovenes is a combination of the old Serbian royal flag with that of Croatia, both these older flags having red, blue and white in differing orders, and the Montenegrin flag has disappeared.

Outside of Europe the changes have not been so marked. Egypt, as a sign of release from Turkish suzerainty, has in her flag discarded the red ground and substituted green, the design otherwise remaining intact. The Republic of China has rejected the historic dragon on a yellow ground, replacing it with a flag of five horizontal bars of different colours representing her five racial elements, *i.e.*, Mongol, Chinese, Manchu, Mahomedan and Tibetan. The flag of Morocco, as an acknowledgment of French suzerainty, now carries a tricolour canton. An entirely new flag is that of the Kingdoms of the Hejaz and 'Iraq, whilst the flags of Portugal, Panama, Turkey and Siam have undergone changes of varying importance.

See the plate of flags here given; also *Admiralty Book of Flags of All Nations*, printed for H.M. Stationery Office, London, 1916, kept up to date by the publication periodically of *Errata* officially issued.

FLAGG, ERNEST (1857–), American architect, was born at Brooklyn, N.Y., Feb. 6 1857. He studied at the École des Beaux-Arts, Paris, and in 1891 began to practise as an architect in New York City. He designed St. Luke's Hospital and the Singer Building, New York City, the tower of the latter (612 ft.) being the highest commercial structure in America at the time of its erection (1908). Other public buildings designed by him include the Corcoran Art Gallery, Washington, D.C., and the U.S. Naval Academy, Annapolis, Maryland. He also designed many private residences and wrote *Small Houses—Their Economic Design and Construction* (1922).

FLAMETHROWER (Ger.: *Flammenwerfer*).—This weapon was first used by the Germans in the winter of 1914–5, and with marked success in the Bois d'Avocourt (Verdun) on Feb. 26 1915. The French followed in their use. The British used them on the Somme and in the Zeebrugge attack, St. George's Day, 1918. The American Expeditionary Force did not use them at all.

Structure.—A flamethrower consists of (*a*) the container filled with some mixture of heavy and light oils, (*b*) the strong walled vessel filled with air, nitrogen, CO_2, etc., under high pressure, and (*c*) a discharge tube, with nozzle and, in most cases, an ignition device. Between (*a*) and (*b*) is a reducing valve, and between (*b*) and the nozzle a firing valve or trigger. Flamethrowers were short-range weapons, and were of two types, the

heavy and the portable. The heavy type attained an extreme range of 134 yd. (British model), while with the portable British model a range of 45 yd. was attained, and maintained some 15 to 18 shots from a single filling of three gallons. The most satisfactory propellant was found to be nitrogen—either the pure product or a "deoxygenated air" produced in one field by a mobile plant.

Ignition was effected in the British types by two sparking plugs mounted in a cup containing petrol and fired by a magneto generator. The French fixed to the nozzle a tubular magazine which held a long stick of alumino-thermic composition kept up by a coiled spring and primarily ignited by a cerium steel briquet. The Germans used a double-walled cylinder, attached to the nozzle and charged with an alumino-thermic composition open to the air at the top. Inside the hollow of the cylinder and in prolongation of the bore of the nozzle tube were a piston, a spring, a striker needle, mounted on a pellet, and a cap with powder-relay. Between the cap and the needle was a fixed disk of cardboard. On release the impact of the jet on the piston compressed the spring and the striker against the cardboard disk, the needle penetrated the disk, and the spring, depressing itself, forced it on to the cap and fired the powder-relay which ignited the composition.

It is not possible to formulate any definite opinion as to the tactical value of heavy flamethrowers of the battery type. The portable type was found on occasions to be more useful than other close range auxiliaries of the infantryman.

FLATS: *see* ARCHITECTURE.

FLECKER, JAMES ELROY (1884–1915), British poet, was born at Lewisham, London, on Nov. 5 1884. He was educated at Dean Close School, Cheltenham, of which his father, W. H. Flecker, was headmaster; at Uppingham School; Trinity College, Oxford (1902–6), and Caius College, Cambridge (1908–10). He then entered the British consular service and went to Constantinople in 1910, in the same year issuing his *Thirty-six Poems*, reissued in 1911 as *Forty-two Poems*. *The Golden Journey to Samarkand*, with its notable preface summing up Flecker's Parnassian theory of poetry, appeared in 1913, after he had been compelled by consumption to leave his post at Beirut for treatment in Switzerland. He died at Davos-Platz Jan. 3 1915 and was buried at Cheltenham. Later in 1915 appeared *The Old Ships*. His spectacular Oriental drama, *Hassan*, was published in 1922 and produced in 1923, and an earlier play, *Don Juan*, appeared in 1925. His *Collected Poems* were issued in 1916. The most interesting of his few prose works was a novel, *The King of Alsander* (1914). See *Life* by Geraldine Hodgson (1925).

FLEMING, SIR SANDFORD (1827–1915), Canadian engineer and publicist (*see* 10.494), died at Halifax, N.S., July 22 1915.

FLETTNER RUDDER.—The design of this rudder constituted a radical departure from the design which for so long remained unaltered. All rudders may be said to be current-operated, but in this type the current is also used for altering the position of the rudder. The forces necessary to move the rudder of a big ship against the action of the current are very great; and a ship's steering engine requires to be of considerable horse-power, and of very robust construction. The gearing attached is heavy and more or less complicated. Such powerful steering gears should no longer be necessary. With the current-operated rudder, large ships can be steered direct by hand by the utilisation of the variations in pressure of the current on the rudder.

The principle of the invention is that of inducing negative pressure by moving the after-portion of the blade of the rudder, and of using the lateral effect thus caused by the difference of pressures on its after-part to move the rudder itself. For ships up to about 10,000 tons the Flettner rudder requires no engine to operate it, whilst in larger vessels the only additional effort necessary is that to overcome the friction in the transmission gear. The saving in effort is round about 95%. Instead of the large rudder it is only necessary to move a small one, having superficial area equal to about one-twentieth of that of the large rudder. Again, the small secondary rudder can never be placed in a position relative to the current which would cause the centre of pressure to move backwards at high speeds of ship. Manoeuvring power is greatly increased, because the rudder adjusts itself to the stream. The rudders are made either single or three-bladed, the most favoured design being the single-bladed spade type of more or less square form, which will be described in some detail.

Description of the Rudder.—The partially balanced main rudder, which is free to rotate about its axis, is steered by the secondary rudder, also balanced, hung at its after-edge. Movement by the secondary rudder is effected by the operating gear contained in a housing fixed to the main rudder.

A vertical shaft leads downwards from the operating gear through the hollow rudder stock, and terminates in a yoke which is coupled to a similar yoke on the secondary rudder by a pair of connecting rods. The operating gear is driven direct through a system of shafts and bevel wheels from alternative steering positions situated respectively on the bridge and the poop deck. In addition to the hand wheel, automatic steering is also provided by a gyroscopic compass gear, working through a $\frac{1}{2}$-H.P. electric motor coupled to the steering wheel on the bridge by a chain.

The horizontal section of the rudder is of stream-line form. This shape avoids the disturbance in the even flow of water over the surface of the rudder which would otherwise be caused by the protrusion of the thick rudder-stock. It also adds to the stability of the rudder in the midship position. Moreover, this shape gives room for the protection of the connecting rods operating the secondary rudder except at the after-end, where an additional sheet-steel covering is built on as previously stated. The main rudder, which is free to rotate about its axis, is steered by the secondary rudder on its after-edge. When the latter is moved by its connecting rods, relatively to the main rudder during movement of the ship or in the slipstream of the propeller, the resulting deviation of the slipstream causes a different balance of pressures as between main and secondary rudders, *i.e.*, the main rudder being free to move, is deflected by the current through a certain angle. In going astern the balance of pressures is reversed through 180 degrees so at the moment when change of direction of the slipstream occurs the rudder automatically *turns* round through half a circle. The operating gear on the rudder-head determines the movements of the secondary rudder with relation to the steering wheel, the main rudder and the ship. (F. J. D.)

FLEXNER, SIMON (1863–), American pathologist, was born at Louisville, Ky., March 25 1863. Graduating from the University of Louisville in 1889, he pursued his studies further at Johns Hopkins University and the universities of Strasbourg, Berlin and Prague, and at the Pasteur Institute, Paris. He was associate professor and later professor of pathological anatomy at Johns Hopkins during 1889–99, becoming in the latter year professor of pathology at the University of Pennsylvania. In 1903 he was appointed director of the laboratories of the Rockefeller Institute for Medical Research, New York. Dr. Flexner became widely known in 1905 for his successful treatment of cerebrospinal fever by the use of a serum, the administration of which reduced the mortality rate from 90% in untreated cases to 46·3% in cases where the serum was used. He has published numerous monographs, including *The Pathology of Toxalbumin Intoxication* and *Mode of Infection, Means of Prevention and Specific Treatment of Epidemic Meningitis* (1917).

His brother Abraham Flexner (b.1866) became, in 1917, secretary of the General Education Board. His views on education as set forth in *A Modern School* (1916) and *A Modern College* (1923) occasioned much discussion. He wrote also *Prostitution in Europe* (1914) and works on medical education. (*See* SPINAL MENINGITIS.)

FLINT, ROBERT (1838–1910), British divine and philosopher (*see* 10.521), died in Edinburgh Nov. 25 1910.

FLINT, Mich., U.S.A. (*see* 10.521), had a population in 1910 of 38,550, and in 1920 of 91,599, of whom 15,213 were foreign born; in 1925 the Census Bureau estimated the population at 130,316. The area in 1910 was 8,120 ac.; in 1925, 19,115 acres

The manufacture of motors and trucks, and of such contributory articles as sparking plugs, carburetters, motor axles, paints and colours, and malleable iron castings is the backbone of its prosperity. Postal receipts increased fourfold between 1910 and 1924. Industrial development was paralleled in the building of homes, including noteworthy projects by some of the large motor companies; street paving and lighting; and the construction of hotels, banks, department stores, theatres and office buildings. A city-planning board was created in 1917. The park area was increased to 882 ac. by 1925. Schools were built rapidly and sites acquired to provide for future expansion. In 1923 a belt-line railway was opened.

FLORIDA (*see* 10.540).—The population of the state in 1920 was 968,470, a gain of 215,851 in the decade 1910–20. During the five years 1920–5 the increase of population has been even more remarkable, the state census for 1925 showing an increase of 295,079, or 30.4% since 1920, the total population being given as 1,263,549. In 1925 there were 21 cities with a population of over 5,000; those then exceeding 10,000 were: Jacksonville (95,206), Tampa (94,808), Miami (69,754), St. Petersburg (26,706), Pensacola (24,958), Orlando (22,273), West Palm Beach (19,122), Key West (13,533) and St. Augustine (10,190). The rapid development of Florida cities and towns is giving the state a larger proportion of urban population than any other southern state. However, Florida's population is still predominantly rural. In 1920 only 36.7% of the entire population was urban (living in cities or towns of over 2,500). During the winter months the population is largely augmented by thousands of tourists and winter residents, quite a number of whom become permanent residents or invest in Florida property. For many years the coast resorts were the chief objectives, but many of the inland towns and cities are now attracting out-of-state visitors. Far larger numbers of pleasure seekers have visited Florida in the two years 1924–5 than ever before, and this movement is certain to grow.

Industries and Commerce.—Florida's most extensive industry is agriculture. According to figures of the Florida Experiment Station there were approximately 5,940,000 ac. of land in farms in 1925, not including open or fenced range lands. Of this, 1,400,000 ac. were in crops, and 618,000 ac. of crop lands were idle; 275,000 ac. were in fruit; 1,500,000 ac. were in pasture; and 2,147,000 ac. in woodland. On approximately one-third of the cultivated acreage crops were produced by intertillage (the growing of two or more crops on the same land at one time) and by succession planting (where two or more crops follow each other on the same land in one year). The number of farms in Florida, was 50,016 in 1910, 54,005 in 1920 and 59,817 in 1925. Fruit is Florida's most important crop. The citrus industry has prospered despite the fact that some of the groves in the more northern part of the state have suffered from heavy frosts in severe winters. In 1920 the production of oranges was 8,500,000 boxes, and of grape fruit 5,000,000 boxes. In 1925 the production was 10,700,000 boxes of oranges and 6,300,000 boxes of grape fruit. In the sub-tropical part of the state pineapples, lemons, guavas, and avacadoes are grown profitably on a commercial scale. Other fruits produced are peaches, pears, bananas, grapes, figs and limes. The more important crops with their 1925 acreage yields and values, are tabulated in the next column.

There was a falling off in the production of cotton during the decade 1910–20; however, a good cotton season during 1925, and the use of short staple cotton which is more resistant to the boll weevil, more than doubled the state's production over the crop of 1920. The tobacco-growing section of western Florida produces profitably a shaded leaf, grown from Cuban and Sumatran seed, which is in great demand in cigar manufacturing. The pecan industry is comparatively new, most of the commercial groves having been planted since 1905. It is believed that in the northern part of the state the pecan crop may soon compete closely with the citrus crop of the southern part. The production of early vegetables for the northern markets is developing rapidly, and the Florida producer can put vegetables on the markets earlier than any of his competitors. The chief obstacles are costly rates and inadequate railway freight and express service. Much attention was formerly paid to stock-raising, but with the taking up and development of much of what was formerly open-range land, the figures for 1925 show a decided shrinkage in the production of livestock since 1920. In 1925 there were 662,000 cattle, including milch cows, valued at $13,240,000;

	Acres	Production	Value
Staple Crops:			
Corn	580,000	8,700,000 bu.	$ 8,700,000
Cotton	106,000	40,000 bales	3,541,000
Hay	82,000	57,000 tons	1,296,000
Sugar-cane	9,000	2,100,000 gal.	2,205,000
Sweet Potatoes	29,000	2,465,000 bu.	4,060,000
Tobacco	7,000	5,460,000 lb.	1,693,000
Truck Crops:			
Irish Potatoes	23,000	2,599,000 bu.	6,757,000
Snap Beans	20,530	1,663,000 hmprs.	2,494,000
Celery	4,320	2,000,000 crates	3,700,000
Cucumbers	10,830	1,256,000 hmprs.	1,520,000
Lettuce	3,400	765,000 crates	1,170,000
Peppers	3,400	1,115,000 bu.	2,787,000
Strawberries	3,170	6,023,000 qt.	1,807,000
Tomatoes	33,470	2,811,000 bu.	6,325,000
Watermelons	20,910	7,841 cars	2,352,000
Fruit and Nuts:			
Grape fruit	..	6,300,000 crates	11,340,000
Oranges	..	10,700,000 crates	26,750,000
Peaches	..	115,000 bu.	190,000
Pecans	..	1,340,000 lb.	348,000

61,000 sheep, valued at $200,000; 506,000 swine, valued at $3,289,000; 31,000 horses, valued at $3,000,000 and 43,000 mules, valued at $5,934,000. These livestock statistics include only farm animals.

In 1925 Florida produced mineral products to the value of $10,908,000, the more important of which were phosphates, lime, limestone, brick, tile, kaolin and fuller's earth, of which latter Florida produces about three-fourths of the entire U.S. output. In 1924 the production of phosphate was: land pebble, 2,348,137 long tons, valued at $7,987,752; and hard rock, 199,516 long tons, valued at $1,071,675. Florida's lumber production, due to exploitation, shows a decline since 1916, when an output of 1,425,000,000 ft. was reached; the 1924 production, mainly cypress and yellow pine, was 980,014,000 feet. Considerable hard wood (chiefly hickory) is produced. Naval stores are produced from the pine forests, where the sap of the trees is collected and distilled, yielding turpentine and resin. In 1923 Florida produced 9,747,000 gal. of turpentine valued at $10,000,000 and 660,000 bbl. of resin valued at $4,000,000.

In 1924 Florida manufactured 546,799,000 cigars, valued at $35,000,000; and 2,767,000 cigarettes, valued at $55,000. A rapidly developing manufacture is that of commercial fertilisers, large amounts of phosphate mined in the state being used for this purpose. Some index of Florida's recent business growth can be gained from the following banking statistics: deposits in National banks in Jan. 1920, $187,286,267; in Jan. 1925, $375,042,947; in state banks and trust companies in Jan. 1920, $197,809,947; in Jan. 1925, $287,636,588.

History.—The outbreak of the World War in 1914 interrupted two of Florida's more important exports to Europe, *i.e.*, naval stores and phosphates, thus creating a temporary business depression. In the naval-stores industry the recovery was comparatively rapid, owing to the high prices of and increased domestic demand for the products, after the first few months of the War. The phosphate industry was more seriously affected, as Germany had been a large purchaser. Many phosphate mines closed down, to resume operations only after the signing of the Armistice.

The political history of the state during the years 1910–25 was uneventful. The question of Prohibition played a large part in state politics until the ratification of the Eighteenth Federal (Prohibition) Amendment by the Florida Legislature

Dec. 14 1918. Since 1876 Florida has been uniformly Democratic and, except in 1916, when a contested primary election in the Democratic party resulted in the nomination of Sidney J. Catts as a prohibitionist and in his election as governor, all of the state's executives have been Democrats. The governors since 1910 were: Albert W. Gilchrist (1909–13); Park Trammell (1913–7); Sidney J. Catts (1917–21); Cary A. Hardee (1921–5), and John W. Martin, (1925–). In 1924 Florida adopted an amendment to the state constitution forbidding the Legislature to levy an income or inheritance tax. (J. M. L.)

FLOUR MILLING (*see* 10.548).—Profound changes have occurred during the period covered by our work (1910–26) in the geographical distribution of the flour-milling industry. The great increase that took place in the production of wheat in the U.S.A., Canada, Australia and Argentina, the relatively low cost of production in those countries, and the cheapness of transportation, together with the universal drift of the population from the rural to the urban districts, brought about the building of large flour-mills at the principal ports of Great Britain and other countries, and the gradual extinction of many small rural mills.

American Milling.—In the three Canadian provinces of Manitoba, Saskatchewan and Alberta, alone, in less than a quarter of a century the quantity of wheat grown was increased from 23,000,000 to 446,000,000 bu., and the export flour trade rose from 306,339 bar. (196 lb.) in the season 1871 to over 11,000,000 barrels in the season 1924–5. As wheat production increased, so also did the number of flour-mills, which were built regardless of domestic requirements in the United States, Canada and Australia. This was based on the assumption that flour could be most economically milled in the countries in which the wheat was grown.

European Milling.—In Europe, Germany and France, in particular, aimed at growing sufficient cereals for their own use, and heavy duties were levied on imported grain and flour to aid the process; in these cases, also, there was an increase in the capacity of the flour-mills to correspond with requirements. Great Britain and a few other countries placed their reliance on imported wheat, which was more suitable for breadmaking purposes than the native varieties; but here, again, they increased their capacity for the manufacture of flour, notwithstanding the same tendency in the wheat growing countries.

Active Competition.—Thus a situation arose in which the capacity of the mills in several countries exceeded the requirements of the population. Millers began to seek hungrily for trade farther afield. American, Canadian and Australian mills made unremitting efforts to supply Europe and the Far East with flour, entering alike overloaded and deficient countries. This current of trade in Europe was met by other currents flowing from England, Germany, France and other countries, the result being a swirl of competition that, however beneficial to the consuming public, engendered a certain amount of anxiety in the trade.

In the years which immediately preceded the War, a world-wide scramble for trade had begun. From 1914 to 1918, however, the feeding of the armies and the civil population was under the control of the respective governments concerned, and with the redistribution of supplies all the mills were kept going at full speed. In Great Britain additions were made to some of the plants, the aggregate peacetime capacity of which already exceeded requirements. The millers of England and Wales found themselves at the end of the War in possession of a potential manufacturing capacity of 40,000,000 sacks (280 lb.) of flour per annum, or an excess of 10,000,000 sacks over requirements. Scotland and Ireland were and had remained under-milled, but the English mills can supply their deficiency and still have several million sacks to spare.

After the state had liberated the industry from control in March 1921, British millers were compelled more than once by stress of circumstances to impose voluntary control upon their business, notably in 1921, when there was a record slump in the price of wheat, values declining by more than 40s. a quarter in a brief period.

For several years the situation was relieved by the demand for breadstuffs on the European continent. Shattered as these countries were by the four years of war, they could not, as formerly, grow or grind sufficient wheat for themselves, and one after another they relaxed or abolished their tariffs on imported cereals and flour. During this period the exports of flour from Great Britain rose to the unprecedented height of over 3,000,000 sacks.

But so soon as the grain-growers on the Continent had succeeded in increasing their production more nearly to correspond with national requirements, both they and the flour millers exerted themselves to secure the re-imposition of tariffs. In Germany there was resistance from the urban element, but in Oct. 1925 grain and flour imported to Germany were again subject to customs duties. In France, millers were compelled by law to mix rice and other cheaper flour with their wheaten flour, and these regulations were finally removed in 1925.

The growing Chinese and Japanese demand for wheaten products was met partly by American and Canadian mills. But in these Far East as in other countries at present under-milled, new flour-mills were erected to meet the increasing demands, so that further readjustments in distribution appear to be inevitable. In the U.S.A., Canada, Australia and England, the mills were unable to work at their full capacity. In New South Wales (Australia) the quantity of flour required by the population of 2,250,000 people was 225,000 tons per annum, and the mills of this State could produce exactly double that quantity. The U.S.A. and Canadian mills shared the same difficulties. In Minneapolis, the largest flour-milling centre in the world, the mills were not able to work to anything like their full capacity for several years. In Great Britain, whilst the excess capacity amounted to 10,000,000 sacks per annum, on an average 4,000,000 sacks of flour came into this country from the U.S.A., Canada, Australia and elsewhere, so that the problem in this case is intensified by imports.

The tendency generally is towards large scale production. It is estimated that 50% of the flour required by the population of Great Britain is milled at the principal ports, approximately 17% at mills in large inland centres of population, and 33% at mills in country areas. The flour-milling industry has encountered inexorable economic laws, from the authority of which there is no escape, and, unless there is a voluntary arrangement to produce flour to conform with requirements, the fittest only will survive the stress of competition.

BIBLIOGRAPHY.—Royal Commission on Wheat Supplies, *First Report*, Cmd. 2462 (1921); *Second Report*, Cmd. 1544 (1925); Departmental Committee on Distribution and Prices of Agricultural Produce—*Interim Report on Cereals, Flour and Bread*, Cmd. 1971 (1923); Royal Commission on Food Prices, Cmd. 2390 (1925).

(L. F. SH.)

FLYING, COMMERCIAL (*see* also AERIAL NAVIGATION; AERONAUTICS; AEROPLANE; AIRSHIP; etc.).—Commercial aviation may be said to embrace all forms of flying other than that carried out by the fighting forces and may be divided into the following categories: (1) Air transport; (2) Aerial survey; (3) General flying; (4) Flying schools; (5) Air racing.

I. AIR TRANSPORT

This section is confined to that particular branch of aeronautical activity described as air transport.

Air transport is an entirely modern innovation. Balloons were employed for the carriage of messages from Paris during the siege of 1870, a war measure for evading the besieging army which, in other circumstances, could not have claimed to be a practical method of carrying mails. Between 1909 and 1914 various demonstrations were made to prove the suitability of the aeroplane as a rapid conveyance for mail matter, and a considerable number of journeys by air were accomplished by private individuals; but none of these enterprises, though interesting and daring, could fairly be described as the real beginning of air transport.

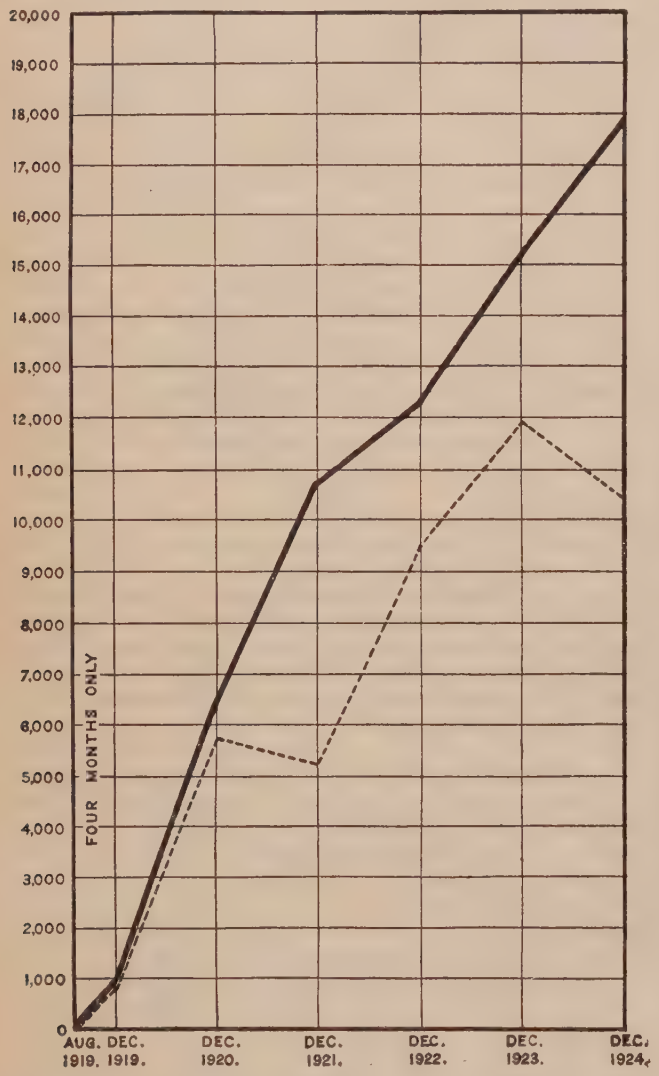
That air transport would become a practical proposition was, however, recognised, and in 1910 a conference was held in Paris at which an International Convention in regard to aerial navigation was drafted. The credit for the first genuine commercial air service lies with Germany; from March 1912 until Nov. 1913, the rigid airships "Victoria Luise," "Hansa" and "Sachsen" plied regularly between Berlin and Friedrichs-

EUROPE
AIR ROUTES
English Miles
0 250 500
Kilometres
0 250 500
Helsingfors
Oslo
Stockholm
Revel
Göteborg
Riga
Nijni Novgorod
Londonderry
Stranraer
Carlisle
Belfast
Copenhagen
Malmö
Karlshamn
Bornholm
Memel
Kovno
Moscow
Smolensk
Wangeroog
Norderney
Borkum
Hamburg
Kiel
Danzig
Königsberg
Marienburg
Warnemünde
Stettin
Amsterdam
Rotterdam
Bremen
Hanover
Berlin
Posen
Warsaw
London
Essen
Dortmund
Leipzig
Dresden
Görlitz
Cassel
Kiev
Southampton
Ostend
Brussels
Cologne
Frankfurt
Mannheim
Erfurt
Chemnitz
Breslau
Gleiwitz
Cracow
Lemberg
Kharkov
Poltava
Guernsey
Baden
Nürnburg
Prague
Košice
Paris
Villingen
Stuttgart
Munich
Vienna
Bratislava
Ekaterinoslav
Basle
Konstanz
Reichenhall
Innsbruck
Budapest
Odessa
Berne
Zurich
Geneva
Klagenfurt
Lyons
Trieste
Bordeaux
Turin
Simferopol
Belgrade
Bucharest
Marseille
Antibes
Toulouse
Perpignan
Ajaccio
Barcelona
Constantinople
Brindisi
Angora
Lemnos
Carloforte
Corfu
Alicante
Athens
Malaga
Algiers
Tunis
Tangier
Oran
Rabat
Fez
REFERENCE
Belgian
British
" proposed
French
" proposed
German Coys
" " pro.
Italian proposed
Netherlands
Polish
Russian
Swedish
Swiss

hafen, and in 881 flights, totalling 65,500 m., carried 19,105 passengers without injury and in considerable comfort.

History in Great Britain

The British Government can claim to be the first government to study the possibilities of air transport seriously. On May 22 1917 a Civil Aerial Transport Committee was appointed to advise the Air Board on the steps that should be taken for the development and regulation of aviation for civil and commercial purposes. This committee examined the possibilities of air transport from every point of view, and eventually submitted a report to the Air Council on May 11 1918.[1]



Graph showing annual air traffic on London-Continent routes. Total passengers (continuous line), and passengers carried by British aircraft (broken line).

Aeroplanes and Seaplanes.—At the conclusion of the War, the whole world began to turn its attention to the possibilities of aviation as a commercial activity. Five years of forced technical progress and intensive production had left a great heritage in aerial resources; practically every combatant nation possessed large numbers of pilots and mechanics and vast stores of surplus war aircraft. Military aircraft had been used for purely communication purposes with complete success; and the operations of war had proved clearly that flying under peace conditions should be both safe and comfortable. It was obvious that, if air transport was to accomplish even a small proportion of that which enthusiasts claimed for it, international regulations must be put into force as soon as possible, and the necessary steps were taken at the Peace Conference in Paris during 1919.

International Convention.—The Treaty of Versailles brought into being an International Convention for the Regulation of Aerial Navigation in which all the Allies participated; under the terms of this convention a permanent commission for Air Navigation was to be set up and placed under the direction of the League of Nations. In Great Britain, except for a brief period during Easter Week 1919, post-War civil aviation did not commence officially until May 1 1919. On Aug. 26 1919 international civil flying from Great Britain was first started under temporary air navigation regulations.

The International Air Convention by June 1922 had been ratified by a sufficient number of signatory states to make the introduction of its regulations practicable. It was brought into force in Great Britain by the Air Navigation Order dated June 20 1922. Accordingly the first meeting of the International Commission for Air Navigation was opened in Paris on July 11 1922.

The Start of the Service.—Air transport began its career under somewhat evil auspices. On the one hand, a large body of enthusiasts claimed the certainty of immediate commercial success, and consequent financial profits; on the other, conservative scepticism pooh-poohed the idea that aeroplanes could ever be a safe and economical means of transport, and cynically supported financial subsidies to the new industry. England led the way in accomplishment. On Aug. 25 1919 the Aircraft Transport and Travel Co. despatched the first aircraft to fly on a regular commercial service to Paris and on Nov. 10 1919 an aeroplane belonging to the same company carried the first regularly established air mail to the same destination. The British Handley-Page Air Transport Co. and the French Messageries Aériennes were quick to follow and by Jan. 1 1920 there were three British and two French companies operating on a regular time-table across the Channel. These operations were nearly all carried out by military aircraft, or by military aircraft modified to carry passengers in some degree of comfort.

Need for State Aid.—From the first it was obvious that such aircraft could not pay their way. It was, therefore, clear that air transport could not at once become self-supporting and would need some financial assistance from the state, until experience was gained and aircraft specially designed for commercial purposes were produced with the aid of that experience.

The French Government had already realised the vast possibilities of air transport and a costly and ambitious policy of financial assistance was inaugurated in 1919 and has been continued until the present day. To some extent this policy was inspired by its potential political and military influence on the countries flown over, but its ultimate object was to attain rapid communication between Paris and the French Colonies in Africa and Asia.

In England, on the other hand, there was not sufficient money allotted for even a very low standard of aerial defence, and air transport was therefore relegated to the background as an enterprise which the nation could not afford. In fact, the British Empire had as much to gain from its development as any other country in the world. Consequently the pioneers, and with them the public who had supported their new enterprises financially, walked towards inevitable ruin. The general financial crisis of the autumn of 1920 brought matters to a head, and the Aircraft Transport and Travel Company went into liquidation in Dec., whilst in Feb. 1921 the Handley-Page Transport Company suspended operations, leaving the French in unchallenged occupation of the cross-Channel routes. This disaster brought about a parliamentary and press agitation which galvanised the Government into facing facts and doing something; and from March 1921 the cross-Channel services have been subsidised in varying degrees.

Governmental Committees.—The following are the various committees and boards which were set up by the British Government from 1917 to 1923 to consider the possibilities of air transport and to make recommendations as to how it could best be supported and developed:—

[1] *Reports of Civil Aerial Transport Committee*, pub. by H.M. S.O., Cd. 9218 (1918).

FIG. 1. Vickers-Vimy Rolls-Royce Transatlantic Biplane, which, piloted by Sir John Alcock, crossed the Atlantic in June 1919 in 16 hr. 12 min. FIG. 2. Junkers 3-engined all-metal monoplane. FIG. 3. Handley-Page "Hampstead" 3-engined commercial aeroplane.

(Photos. Fig. 1, Science Museum, London. Fig. 2, Topical Press.)

TABLE I.

Name of Committee	Date of Appointment	Date of Demise	Reports
Civil Aerial Transport Committee	May 22 1917	Feb. 7 1918	"Reports of the Civil Aerial Transport Committee with Appendices," 1918. (Cd. 9218, price 9d.)
Advisory Committee on Civil Aviation (Weir Committee)	June 8 1919	Feb. 1922	1st Report: "Report on Imperial Air Routes," dated Oct. 30 1919 (Cd. 449, price 1d.). 2nd Report: "Report on Government Assistance for the Development of Civil Aviation," dated April 19 1920. (Cd. 770, price 2d.)
Commercial Airships Committee	May 5 1920	June 1 1920	Only Report dated June 1 1920. (Report not presented to Parliament.)
Cross-Channel Subsidies Committee ("Londonderry Committee")	March 2 1921	April 1921	Only Report dated April 1921. (Report not presented to Parliament.)
Conference of Prime Ministers and Representatives of the United Kingdom, the Dominions and India, held in June, July and August 1921	Conference opened June 20 1921	Conference closed Aug. 5 1921	Appendix III. to Report: "Report of the Imperial Air Communications Committee" dealing with Airships. (Cd. 1474, price 9d.)
Civil Aviation Advisory Board	Feb. 1922	July 8 1924	1st Report: "Report on Imperial Air Mail Services," dated July 25 1922. (Cd. 1739, price 1s.) 2nd Report: "Report on Aerodrome Facilities of London," dated Jan. 29 1923. (Cd. 1816, price 3d.)
Civil Air Transport Subsidies Committee ("Hambling Committee")	Jan. 2 1923	Feb. 15 1923	"Report on Government Financial Assistance to Civil Air Transport Companies," dated Feb. 15 1923. (Cd. 1811, price 6d.)
Air Mails Committee	June 1923		"Interim Report of the Air Mails Committee," dated Jan. 19 1924. (Cd. 2038, price 6d.)

From March 1921 until March 31 1922 two British companies continued limited operations between London and Paris under a system of government financial support which guaranteed them a 10% profit on the receipts obtained for traffic carried. Whilst this temporary and admittedly extravagant measure was in force, the Londonderry Committee put forward a new scheme which was accepted by the Government, and was in operation from April to Sept. 1922.

Government Aid: the Londonderry Scheme.—This new scheme comprised the provision of half the fleet of each company by the Government on a hire purchase system, and a subsidy based partly on the load carried and partly on the gross earnings of the companies. Three companies, the Handley-Page Air Transport, the Instone Air Line, and Daimler Airways, operated to Paris, and one company, the Instone Air Line, flew to Brussels. It was very soon found that the hire purchase scheme was impracticable. Moreover, the traffic available between London and Paris was not sufficient for five competing companies (three British and two French), and it was obviously unsound that British companies should be subsidised to compete against one another.

Modified Scheme.—On Oct. 1 1922, therefore, this scheme was modified on the basis of avoiding competition between British companies and extending British air transport into Europe as far as possible with the money available. On this system the approved services in operation from this date until March 31 1924 are given in table in next column.

Meanwhile, owing to the various difficulties which had arisen and the apparent wastefulness of maintaining four separate organisations for a comparatively small volume of traffic, the Hambling Committee was assembled in Jan. 1923. This committee definitely recommended the amalgamation of the four existing companies into a single national company with great freedom of action. They indicated that the company must be provided with a substantial capital, and be guaranteed a monopoly of subsidy for a term of years.

"Imperial Airways" Founded.—As a result, in March 1924, a national company, Imperial Airways, Ltd., was brought into being with a guarantee of a total subsidy of £1,000,000 spread over a period of 10 years, for regular flying carried out within Europe, the contract with the Government permitting liberty of action as to the services actually operated. The frequent modifications of system and changes of policy had naturally militated against serious progress, and when at length this new organisation came into being it encountered many setbacks and difficulties in its first 18 months of operation, but it now promises to bring air transport on to a definitely self-supporting basis before any other similar enterprise receiving a subsidy from its Government.

Firm	Service	Annual Minimum Services in Each Direction	Annual Minimum Total Mileage	Annual Maximum Subsidy
				£
Handley-Page Transport, Ltd.	London, Paris	300	....	15,000
Instone Air Line, Ltd.	London, Brussels, Cologne	300	....	25,000
Daimler Hire, Ltd.	Manchester, London, Amsterdam, Hamburg, Berlin	....	253,846	55,000
British Marine Air Navigation Co., Ltd.	Southampton, Cherbourg, Havre, and Channel Islands	....	60,000	10,000

History in Other Countries

In other parts of the British Empire, air transport generally made little progress, with the exception of Australia, where a good deal has been done.

Australian Development.—Australia has subsidised three important air lines—Western Australian Airways, Ltd., operating once a week from Perth to Derby (1,442 m.); Queensland and

Northern Territory Aerial Services, Ltd., Cloncurry to Camooweal; and the Larkin Aircraft Supply Co., Ltd., Adelaide to Cootamundra, with two branches, one from Mildura to Broken Hill and one from Hay to Melbourne.

German Activity.—Germany had entered the lists as soon as the conditions of peace permitted her and, to encourage private enterprise, offered a simple subsidy on a kilometric basis. As a result there are to-day two substantial German air transport companies—the Deutscher Aero Lloyd A.G. and the Junkers Luftverkehr A.G. in operation. The former is supported by some of the leading banks and shipping companies and utilises various types of aircraft. The latter is the property of the great Junkers engineering firm and is equipped entirely with all-metal Junkers aircraft.

The Junkers Co. has created a world-wide reputation by means of a comprehensive scheme of standardisation in manufacture. Endeavours have been made to establish subsidiary companies in various countries in Europe and in other parts of the world, over which control has been obtained by the provision of the initial fleet in exchange for shares. A scheme for the economical overhaul of all these aircraft at a flat rate at the Junkers works has also been evolved. Junkers companies exist in Switzerland, Denmark, Sweden, Austria, Hungary, Finland, Estonia, Latvia, Russia, Trans-Caucasia, Colombia and Argentina, in addition to which Junkers have created numerous subsidiary companies within Germany itself. This bold scheme is almost identical with that on which the British Air Transport and Travel Co. was embarking when it came to an untimely end through lack of Government support in 1920. Its progress has been remarkable, but its eventual success must depend on the power of the Junkers Co. to bear the heavy capital charges involved in the provision and maintenance of these fleets until such time as the subsidiary companies' shares attain a serious financial value.

French Progress.—France meanwhile has put her house in order and now has three main companies operating in different zones:—

Air Union, Paris–London.
Compagnie Internationale de Navigation Aérienne (late Franco-Roumaine), Paris–Constantinople.
Compagnie Générale d'Entreprises Aéronautiques (late Latécoère), Toulouse–Dakar.

All these companies are generously subsidised by the French Govt. and in addition Czechoslovakia, Yugoslavia and Rumania give financial support to the C.I.D.N.A., whilst the C.G.E.A. is assisted by French Morocco.

American Policy.—America did not participate in the International Commission for Air Navigation and has adopted an entirely different line of policy from the European nations. She refused all assistance to private enterprise and even neglected to bring any form of air navigation regulations into force. At the same time, she started and operated a most efficient but somewhat extravagant air mail service between New York and San Francisco. This service was equipped with old war aircraft of British design and Liberty engines, and was administered by the Post Office. Its operations were remarkable for their efficiency and regularity, and in 1924 the first regular night flying service in the world was carried out on the central section between Chicago and Cheyenne.

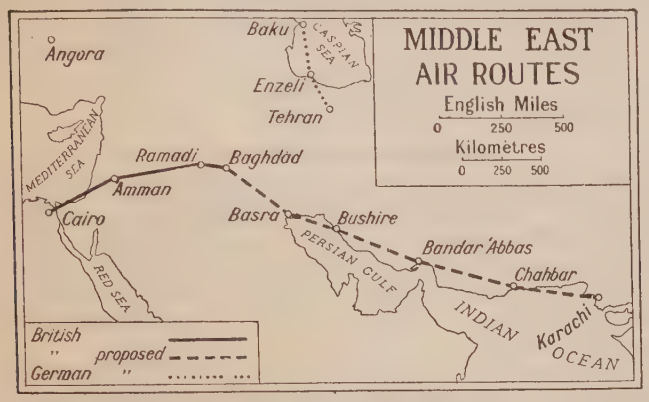
In 1925 America opened negotiations with a view to handing over the mail route to private enterprise, and is endeavouring to persuade private operating companies to undertake mail services on the other routes on a letter surcharge basis. Air Navigation Regulations have also been finally approved and prepared for promulgation. During the above period other nations were coming into the field of air transport.

Air Transportation in other Countries.—The Dutch created a subsidised company called the Koninklijke Luchtvaart Maatschappij voor Nederland en Kolonien towards the end of 1919, which has operated to London and Paris with great efficiency, equipped with Fokker aircraft and British engines. Belgium has organised a national company called the Société Anonyme Belge pour l'Exploitation de la Navigation Aérienne. In Europe it operates during the summer between Brussels and Basel, and in Africa it has established a very successful service in the Belgian Congo from near Leopoldville to Luebo and Elizabethville. Spain, Sweden, Poland, Switzerland, Denmark, Austria, Hungary, Finland, Estonia, Latvia, Norway and Russia have all established air transport companies and put them into operation. Czechoslovakia, Italy and Yugoslavia have companies which in 1926 were about to commence operations on a fairly extensive scale.

Air Service to India.—The British Govt. is at present establishing an air service operating aeroplanes between Cairo and Karachi. The section between Cairo and Baghdad has already been flown once a fortnight by military aircraft belonging to the Royal Air Force for the carriage of mails and official passengers.

It is now proposed to hand this section over to Imperial Airways and to extend it to Karachi via Basra and the coast of the Persian Gulf.

The preliminary reconnaissance of the route has been carried out and the necessary arrangements made with the governments of Egypt, Palestine, 'Iraq, Persia and India. A contract involving



the payment of a subsidy for five years has been signed, a lump sum being given for each completed stage between Cairo and Basra and between Basra and Karachi. It is probable that this service will commence operations in Nov. 1926 with aircraft of the latest type equipped with three air-cooled engines.

Construction, Cost and Service

During the years that elapsed between 1918–26 many lessons were learned and certain facts established.

Safety.—First, it has been proved that air transport when properly administered and operated is a safe means of travel.

In the British air service between May 1919 and March 1925 there were six fatal accidents, only four of which involved the death of passengers, for 3,698,000 m. flown, the equivalent of 148 times round the equator. In Australia there was only one fatal accident[1] and 570,000 m. were flown between the starting of operations in Dec. 1921 and the end of 1924.

Reliability.—A very high standard of efficiency has been reached and a standard of as much as 97% and 98% regularity in flying to a published time-table is claimed for certain air lines operating during summer weather. Three quarters of the failures to maintain perfect regularity are due to weather and failure of power-plant, 66% being due to weather and 34% to mechanical defects throughout the year. This high standard of regularity and safety in British air transport was obtained very largely through the skill and determination of the pilots; and throughout Europe it may be said that good piloting has usually been the greatest factor in any success obtained. Thus it can be claimed that by the end of 1925 much valuable experience had been gained, and a very creditable standard of security and regularity had been attained; this standard was certainly as high as could be expected with the equipment available.

Economy.—On the other hand, although some progress was made during these six years towards economical operation, air transport is still far from arriving at a point at which it can be counted on to operate commercially without artificial financial assistance.

Cost of Operating.—There are two main reasons for the high cost of air transport as compared to other means of locomotion. First, an aeroplane expends a considerable proportion of its horse-power in climbing into the air and on maintaining itself at a safe height without regard to forward speed; in all other forms of transport the vehicle can remain at a fixed level on or in its particular element without expenditure of power. Secondly, in order to obtain as great a disposable load as possible for any given horse-power, the structure of both engine and aircraft must be extremely light. Consequently the air transport vehicle is costly to construct, and through its comparative fragility involves a high rate of maintenance. The cost of operation per hour depends to a great extent on the horse-power employed; thus every endeavour is being made, not only to increase the total weight per horse-power carried, but also to ensure that the greatest possible proportion of this total load is devoted to disposable load at the expense of structural weight. Progress in this direction, however, has received certain setbacks by the proved necessity of carrying extra instruments, safety devices, heating and ventilating apparatus, etc.

As indicated above, a considerable measure of reliability and safety has already been attained, and steady progress is being made towards increasing this standard to a basis of equality with other forms of transport.[2] The problem of reducing the operating cost to really commercial rates is more difficult, and represents the most important question before the designers of commercial aircraft to-day. Progress is being made on broadly two main lines, the reduction of maintenance costs, and the increase of paying load per horse-power. Air-cooled engines are just coming into use; all-metal construction is beginning to replace wood and fabric; and a robust engine burning crude oil is promised in the near future. Each and all these innovations will appreciably reduce the cost of operation.

Design, Cost and Carrying Capacity.—England leads the way in the development of air-cooled engines and Germany in metal construction. On the other line, various mechanical developments are being applied to increase the disposable load without adding to the weight and size of the aircraft itself. The greatest load which an aircraft can carry is that with which it can take off and land safely. Once at a safe height in the air, the normal aircraft has plenty of lifting power in hand. The planes are being fitted with adjustable slots and flaps which permit of a greater load being lifted from the ground in safety, and which lower the landing speed of heavily loaded aircraft which otherwise might be dangerous. Considerable increase in horse-power is being obtained without serious additional weight by means of various systems of supercharging and "boosting" aircraft engines. Variable-pitch propellers are just emerging from the experimental stage, by the use of which much more efficient application of the horse-power available will be attained. The newly invented de la Cierva autogiro promises to be a very valuable factor in progress towards carrying greater loads.

Data regarding costs per ton-mile are not at present available from foreign nations, and in England, owing to constant changes of policy and administration, it is difficult to obtain reliable figures. It is claimed, however, that with existing aircraft it is possible to operate at a speed of 85 m. an hour at 5s. a ton-mile, of which 3s. a ton-mile represent operating costs and 2s. overhead charges, including maintenance and depreciation.

By means of various steps in technical progress, including those mentioned above, it should be possible to reduce these costs to less than 1s. a ton-mile for operating costs, and as safety and reliability are enhanced, traffic will increase and overhead charges will drop to a rate which may also be estimated at 1s. a ton-mile. With a total cost of 2s. a ton-mile, air transport should be able to pay its way on many lines of communication between the great centres of the world's commercial activity.

Summary of Conclusions.—To sum up it may be stated that by the end of 1925 air transport operated by means of aeroplanes and seaplanes has proved to be safe, and under European summer conditions very reliable. This new means of communication cannot function, however, without artificial financial assistance. Great progress is being made towards evolving aircraft which will be able to earn their costs of operation. As the receipts for traffic approximate more and more to the expense of flying, air transport activities will rapidly increase; and when air transport with aeroplanes and seaplanes eventually reaches a paying basis, it must inevitably become one of the most important means of communication between the various parts of the world.

Airships.—Since the early Zeppelin enterprise in Germany

[1] At inaugural flight of Western Airways' operations.

[2] Lee, "The Lessons of Six Years' Experience in Air Transport" in *Jour. of the Royal Aeronautical Society*, No. 179, vol. 29 (Nov. 1925).

during 1912 and 1913, no regular commercial airship service has been put into operation, with the exception of the experimental service with the "Bodensee" run by the Zeppelin Company from Aug. to Dec. 1919. Germany, the chief user and most experienced designer of rigid airships, lost practically the whole of her airship organisation under the terms of the Treaty of Versailles; the ships which were handed over by her to the Allies were not suited for commercial work; England and France had not the necessary faith in the future of airships to justify the expenditure necessary for their further development; and it was only in America that progress was continued. This general stagnation was further justified in the minds of unbelievers by the disasters which overtook the British ship R38 in Aug. 1921 and the French "Dixmude" in Dec. 1923. The finest performance by an airship since 1918 was the flight of the British-built ship R34 from England to New York and back during the summer of 1919. (Left England July 2 1919, arrived America July 6 1919: 108 hours. Left America July 10 1919, arrived England July 13 1919: 75 hours).

Airship Service.—Although America led the way by the construction of the "Shenandoah" and the demand that the ZR3, later the "Los Angeles," should be built in Germany as part of her war reparation, it was England that made the first serious step towards establishing a genuine commercial airship service.

This policy was initiated during 1923. After much discussion, towards the end of 1924 the construction of two large airships was put in hand, one to be built by Government and the other by private enterprise. In the design of these airships the orthodox type of Zeppelin girder has been departed from, and many improvements, the result of practical scientific research, will be incorporated in the structure. In connection with this scheme the existing airship station at Cardington near Bedford is being enlarged and a terminal airship station is being erected in India at Karachi. A temporary refuelling station has been established at Ismailia on the Suez Canal. The contract for the privately built ship includes a satisfactory flight to India along this route.

The following data are given to indicate the progress in rigid airship construction attained during the last few years:—

	Description	Horse-power	Speed m.p.h.	Extreme radius at this speed (without paying load)	Disposable load
				Miles	Tons
R34	Old British ship built in England during the War . .	1,250	Max. 63·5 = Cruising 45 =	3,286 4,905	26·55
ZR3	Zeppelin ship built in Germany for U.S.A. . . .	2,000	Max. 79 = Cruising 68 =	5,490 7,937	46
R101	Ship under construction by British Govt.	3,500	Max. 78 = Cruising 65 =	7,900 13,000	85

Use of Helium.—America has introduced helium gas to replace hydrogen as a lifting agent. Helium (*q.v.*) has the advantage over hydrogen that it is totally non-inflammable, but its production is extremely costly, and its lifting power 15% less than that of hydrogen, which facts will prove a very serious handicap in the commercial development of the airship in America, if this policy is continued. In England, it is the intention to fit crude oil engines to the big ships and so eliminate the element of danger incurred by carrying petrol. No dependable data exist from which the cost of operating an airship can be estimated, but there is little doubt that if the constructional and handling difficulties which have been connected with airships up to date can be overcome, the operating cost per ton-mile will be very much less than in heavier-than-air craft, although the initial capital cost involved is very much greater. The possibilities of the airship as a means of communication over long distances and across the great oceans are therefore enormous.

Co-operation with Aeroplanes.—It seems certain that in the future airships and aeroplanes will work in co-operation. As existing schemes develop, traffic for 'Iraq will reach Egypt by airship and proceed thence by aeroplane to Baghdad; for India, to Colombo by airship and thence to various great cities by aeroplane; for Australia, to Perth by airship and onwards to the northern and eastern cities by aeroplane.

International Agreements

Air transport is the most truly international of the transport industries; international laws and regulations are necessary for the operation of ships at sea and of trains across great continents. But the scope of these two activities is strictly limited, whereas aircraft can penetrate anywhere and fly over the territories of several different nations in a journey of a few hours' duration (*see* Aerial Law).

It has always been evident, therefore, that international air navigation regulations were of vital importance, and during 1922, on ratification of the International Air Convention, to which reference has already been made, the International Commission for Air Navigation (known as the I.C.A.N. in England and as the C.I.N.A. on the continent of Europe) came into being. The following states are parties to the convention and send representatives to this Commission:—

1. Belgium.
2. Great Britain and Northern Ireland.
3. Canada.
4. Australia.
5. Union of South Africa.
6. New Zealand.
7. Irish Free State.
8. India.
9. Bulgaria.
10. Chile.
11. France.
12. Greece.
13. Italy.
14. Japan.
15. Persia.
16. Poland.
17. Portugal.
18. Rumania.
19. Kingdom of the Serbs, Croats and Slovenes.
20. Siam.
21. Czechoslovakia.
22. Uruguay.

The general principles laid down by the Convention are as follows:—

1. Innocent passage of commercial aircraft of the members over the territories of all.
2. Designation of customs aerodromes at suitable points at which aircraft must land.
3. Issue of licences to all members of the crew and airworthy certificates to all aircraft engaged in international commerce. The forms of these licences and certificates and the qualifications and tests to be demanded have been agreed by the Commission.
4. The establishment of a wireless and meteorological organisation and a lighting system along air routes authorised by the nation over whose territory they lie.

The full Commission now meets twice every year, the place of meeting being decided on the invitation of one of the Governments represented. Meetings have taken place, so far, during 1922 in Paris and London; during 1923 in Brussels, London and Rome; during 1924 two meetings in Paris, and during 1925 in London and Brussels. The Commission has appointed standing subcommissions for the detailed study of operational, technical, medical and legal problems, and these meet as convenient at various dates between the meetings of the full Commission. Most European nations who are not members of the International Commission have drawn up regulations of their own, approximating to those of the International Commission, and many of them have entered into agreements of various classes and duration with one another and with members of the International Commission in order to facilitate the operation of international air transport.

Since its creation the Commission has taken steps to modify two articles of the Convention which were unacceptable to certain ex-neutral and ex-enemy countries. These modifications will come into force in the near future on the completion of ratification, when it is likely that several other European nations will join the Convention. As already stated, America,

although a signatory to the Convention originally, has never deposited her ratification and is considering Federal legislation for the administration of inter-state air transport.

Each country through its national legislature gives effect to the International Air Convention and to the decisions of the International Commission. In Great Britain this is done by the Air Navigation Act, 1920, and by the air navigation orders and air navigation directions issued by the authorities from time to time thereunder.

II. AERIAL SURVEYS

Aerial survey came into existence during the World War. The necessity of photographing trench-lines and hostile positions became more and more vital as operations progressed, and by 1918, military aerial photography had reached a high pitch of efficiency. It was only in a few cases, however, that it was necessary to employ aerial photography as a means of measuring distances on the ground; as a rule, comparatively accurate maps were available, and the photographs were required for filling in details of natural features, buildings, roads, etc., and for disclosing the dispositions of the enemy.

At the end of the War, it was clear that aerial photography must provide a very valuable aid to ordinary survey, and from that date onwards aerial survey has been very successfully developed in various parts of the world.

Aerial Survey Problems.—The greatest problems of aerial survey activities are:—

1. To correct for the errors which must obviously result from photographing tracts of country in which considerably different height levels exist.
2. To ensure that photographs are taken with the camera axis as near as possible vertical and to correct the results of deviations from this ideal.
3. To fly straight and level and at a constant height so as to ensure regular overlap of all negatives obtained, and as near as may be a constant scale.
4. To reduce operation costs to a standard at which aerial survey can compete financially with other forms of survey.

Canadian Progress.—Canada has been the pioneer of this new industry. Her vast and comparatively flat northern regions offered an ideal field for the young enterprise to prove its commercial value. Operations have for the most part been carried out by flying boats working from the numerous lakes and waterways which intersect large expanses of unsurveyed and unexploited forest land.

Two systems have been employed; vertical photography aided by certain points previously fixed by triangulation; and oblique photography along a line already traversed by means of ground survey.

Combined with aerial survey, a system of forest fire patrol has been established. During the forest fire seasons, constant air patrols are maintained over important areas, and all fires reported by wireless to fire-fighting stations; in some cases, the fire-fighting parties and apparatus are actually carried to the site of the fire in aircraft. Enormous tracts of timber have been saved by this means. In 1923, it was calculated that 2,120,000 acres of forest were destroyed in Ontario; in 1924 the total destruction was reduced to 140,000 acres, and the saving in labour totalled 50,000 man-days. The *United States* has followed Canada in aerial survey progress. Her operations have included oil surveys, coast-line and river surveys, the alignment of new roads and railways, and municipal surveys and town planning.

France and Germany.—In France, a new law demanding accurate plans of all fair-sized municipalities has led to much activity in the survey of towns. In Germany, forest survey has been carried out extensively and successfully, and great progress has been made in solving the scientific problems connected with stereoscopic plotting and the aerial photography of mountain tracts.

English Experience.—In England, owing to the fact that very accurate surveys everywhere exist, operations have been confined to experimental work and research, together with a great deal of commercial photography of estates, factories, etc. British aerial survey expeditions have, however, carried out most successful work in British Guiana, Burma and Borneo. Experience has enabled fairly reliable estimates of cost to be prepared, and it seems certain that complete and accurate aerial photographs of any normal area can be produced for from £3 to £10 a square mile, depending on the position and extent of the area to be surveyed. Triangulation on the ground is necessary for both air and ground surveys, but this price compares very favourably with any other method of filling in the topography of all except the most open type of country, while at the same time it gives considerably greater details with all necessary accuracy. It is likely that aerial survey operations will develop rapidly in the near future. One of the difficulties of the operator at present is that a single aeroplane can cover large areas so quickly that it is almost impossible to find employment for an aerial survey unit throughout the year, and so be able to distribute overhead charges over a really large area of operations.

III. GENERAL FLYING

Immediately after the World War, a large number of very cheap aircraft were thrown on the market. In several countries, but particularly in Great Britain and America, demobilised pilots purchased one or two aeroplanes and set out to make their living by giving the general public short flights in the neighbourhood of their landing place. The following figures show the measure of this activity in Great Britain:—

	Flights	Passengers		Flights	Passengers
1919–20	37,067	66,785	1922–3	13,578	25,253
1920– 1	23,513	36,694	1923–4	22,842	39,227
1921– 2	21,767	36,048	1924–5	23,519	43,766

This purely local flying was in some cases extended to the maintenance of aircraft plying for hire to carry passengers at a mileage rate to any required destination. The demand for this useful activity has proved small in England, but is likely to increase as operational costs are reduced. Joy-riding has served a useful purpose both in England and America in educating the public as to the possibilities of aviation.

In England an original use for aviation was devised in the introduction of sky-writing. A British company was formed shortly after the War and proceeded to advertise various commodities by means of writing their titles with smoke at a height of about 12,000 ft. in the air. This British company also obtained a large contract for advertising in the United States during 1922 and 1923.

IV. CIVIL FLYING SCHOOLS

Owing to the heavy cost involved, flying instruction to the general public has been very limited. In most of the greater countries, however, civil flying schools exist which depend largely on government assistance for their existence. In England there are five civil flying schools which undertake the annual training of officers. At these schools a private individual can obtain a very good grounding in the art of flying for about £100.

In France there are 11 civil flying training schools at Buc, Le Crotoy, Mourmelun, Orly, Angers, Nîmes, Orléans, Bordeaux Lyon, Clermont-Ferrand, Châlon-sur-Seine.

Pilots are trained for military purposes in these schools and it is from those who have had that military training that the civil aviation companies draw for their pilots.

In Germany there are three types of schools where the training of civil pilots is carried out:—

(1) Schools conducted by aircraft constructors; (2) schools conducted as an independent enterprise; (3) schools conducted by associations. In addition, there is an organisation known as the " Sportsflug " which has started six of its own schools.

In England a movement has just been started which will also give the private individual an opportunity of learning to fly. Private flying clubs have been formed which charge entrance fees and annual subscriptions to all members; at these clubs tuition on small aeroplanes can be obtained at low rates. The Gov-

ernment has guaranteed a certain measure of financial assistance to five of these clubs.

V. AIR RACING

The first form of air racing to come into being consisted of competitions between free balloons, the prize being given to the balloon which eventually landed at the greatest distance from the starting point.

The first recorded race of this class was the Grand Prix which took place in France in 1905. In 1906 the Gordon Bennett Challenge Cup was instituted and has been competed for ever since, with the following results:—

Gordon Bennett Balloon Cup Winners

Paris—1906. Sept. 30—Oct. 1 1906.—*America*, Frank S. Lahm. Balloon, "United States" (2,080 cm.). Paris—Fylingdales, Yorkshire. Distance, 647·098 km. Duration, 22 hr. 5 minutes.

St. Louis, U.S.A.—1907. Oct. 21–23 1907.—*Germany*, Oscar Erbsloh. Balloon, "Pommern" (2,200 cm.). St. Louis—Bradley Beach, New Jersey. Distance, 1,403·559 km. Duration, 40 hours.

Berlin—1908. Oct. 11–14 1908.—*Switzerland*. Col. Schaeck. Balloon, "Helvetia" (2,200 cm.). Berlin—Bergest, nr. Bud. Norway. Distance, 1,212 km. Duration, 73 hours.

Zurich—1909. Oct. 3–4 1909.—*America*, E. W. Mix. Balloon, "America II." Zurich—Ostrolenka, Poland. Distance, 1,121·110 km. Duration, 35 hours.

St. Louis—1910. Oct. 17–19 1910.—*America*, Alan R. Hawley. Balloon "America II." St. Louis—Peribonka River, nr. Chicoutimi, Quebec, Canada. Distance, 1,884 km. Duration, 44 hr. 25 minutes.

Kansas City, U.S.A.—1911. Oct. 9 1911.—*Germany*, Lieut. Hans Gericke. Balloon, "Berlin II." (2,200 cm.). Kansas City—Halcombe, Wis. Distance, 758 km. Duration, 12 hr. 28 minutes.

Stuttgart—1912. Oct. 27–29 1912.—*France*, Maurice Bienaime. Balloon, "Picardie" (2,200 cm.). Stuttgart—Riga. Distance, 2,191 km. Duration, 46 hours.

Paris—1913. Oct. 12–14 1913.—*America*, Ralph H. Upson, Balloon, "Goodyear" (2,200 cm.). Paris—Bempton, nr. Bridlington. Distance, 618 km. Duration, 43 hr. 10 minutes.

1914 to 1919, inclusive—No contest.

Birmingham, U.S.A.—1920. Oct. 23 1920.—*Belgium*, Ernest Demuyter. Balloon, "Belgica" (2,200 cm.). Birmingham—North Hero Island, Vermont, U.S.A. Distance, 1,760 km. Duration, 40 hr. 15 minutes.

Brussels—1921. Sept. 18–19 1921.—*Switzerland*, Capt. Paul Armbruster. Balloon, "Zurich" (2,200 cm.). Brussels—Lambay Island, Ireland. Distance, 766 km. Duration, 27 hr. 23 minutes.

Geneva—1922. Aug. 6–7 1922.—*Belgium*, Ernest Demuyter. Balloon, "Belgica" (2,200 cm.). Brussels—Skollersta., Sweden. Distance, 1,115 km. Duration, 21 hours.

Brussels—1924. June 15–17 1924. *Belgium*, Ernest Demuyter. Balloon, "Belgica" (2,200 cm.). Brussels—St. Abbs Head, Berwickshire. Distance, 714 km. Duration, 43 hr. 16 minutes.

Won outright by Belgium; replaced by *second* Gordon Bennett Balloon Cup.

Second Gordon Bennett Balloon Cup

Brussels—1925. June 7–9 1925.—*Belgium*, A. Veenstra. Balloon, "Prince Leopold." Brussels—Cap Torrina, Spain. Distance, 1,345 km. (840 m.). Duration, 47 hr. 30 minutes.

In 1905, the French Aero Club founded the Fédération Aéronautique Internationale to control all international sporting aviation. This body has laid down and published a code of rules for air racing. The aero club of each country appoints delegates to the Fédération, which meets once a year, discusses modifications to the regulations, decides on conditions for current international competitions and investigates and ratifies claims for world's records.

The first aeroplane races ever held took place at an international meeting at Reims in Aug. 1909. At this meeting an international challenge cup for speed was presented by Mr. Gordon Bennett to be won outright by the country which was victorious three times running. Below are given the principal international competitions for aeroplanes and seaplanes with the results up to date:—

Gordon Bennett Aviation Cup
(Speed Contest)

Reims—1909.—*America* (Representative, G. H. Curtiss). Distance 20 km. (12·4 m.). Time, 15 min. 50⅗ sec. Curtiss biplane, 30 H.P. Curtiss engine.

Belmont Park, New York—1910.—*United Kingdom* (Representative, C. Grahame-White). Distance 100 km. (62·1 m.). Time, 1 hr. 1 min. 4·74 sec. Bleriot monoplane, 50 H.P. Gnome engine.

Eastchurch, Sheppey, England—1911.—*America* (Representative C. T. Weyman). Distance, 150 km. (94 m.). Time, 1 hr. 11 min. 36½ sec. Nieuport monoplane, 100 H.P. Gnome engine.

Chicago, U.S.A.—1912.—*France* (Representative, J. Vedrines). Distance, 200 km. (124·8 m.). Time, 1 hr. 10 min. 56 sec. Deperdussin monoplane, 140 H.P. Gnome engine.

Reims—1913.—*France* (Representative M. Prevost). Distance, 200 km. (124·8 m.). Time, 59 min. 45 sec. Deperdussin monoplane, 160 H.P. Gnome engine.

1914 to 1919, inclusive—No contest.

Étampes—1920.—*France* (Representative, Sadi Lecointe). Distance, 300 km. (186·5 m.). Time, 1 hr. 6 min. 17⅕ sec. Nieuport biplane, 300 H.P. Hispano-Suiza engine.

Won outright by France; replaced by Deutsch de la Meurthe Cup.

Henry Deutsch de la Meurthe Cup
(To be won outright after two victories running)

1921—*France*.—Société Nieuport-Astra. Pilot: Georges Kirsch. Villesauvage, Oct. 1 1921. Nieuport-Delage, 300 H.P. Hispano-Suiza engine. Distance, 300 km. Time, 1 hr. 11 min. 39⅘ seconds.

1922—*France*.—Société Nieuport-Astra. Pilot: Fernand Lasne. Villesauvage. Sept. 30 1922. Nieuport-Delage, 300 H.P. Hispano-Suiza engine. Distance, 300 km. Time, 1 hr. 2 min. 11⅘ seconds.

Won outright by France; replaced by Beaumont Cup.

Beaumont Cup
(To be won outright by two victories running)

1923—No contest.

1924—*Istres*. June 22 1924.—Sadi Lacointe. Nieuport-Delage monoplane, 450 H.P. Hispano-Suiza engine. Distance, 300 km. Time, 57 min. 50 sec. Speed, 311 km. (193·2 m.) per hour.

1925—*Istres*. Oct. 18 1925.—Sadi Lacointe. Nieuport-Delage monoplane, 600 H.P. Hispano-Suiza engine. Distance, 300 km. Time, 57 min. 36⅖ sec. Speed, 312·5 km. (194 m.) per hour.

Won outright by France.

Pulitzer Trophy
(Speed Contest)

1920—*Mineola, Long Island*. Nov. 25 1920.—Lieut. C. C. Mosley, U.S. Army. Verville machine, 600 H.P. Packard engine. Course, 132 m. Time, 44 min. 29·57 seconds.

1921—*Omaha*. Nov. 3 1921.—N. Acosta, Curtiss Navy biplane, 400 H.P. Curtiss C.D. 12 engine. Speed, 176·7 m. per hour.

1922—*Detroit*. Oct. 14 1922.—Lieut. R. L. Maugham, U.S. Army. Army Curtiss Racer, 375 H.P. Curtiss D. 12 engine. Triangular course of 160 m. Speed, 206 m. per hour.

1923—*St. Louis*. Oct. 6 1923.—Lieut. J. A. Williams, U.S. Navy. Curtiss R.2.C.1, 460 H.P. Curtiss D. 12 engine. Course, 124·28 m. Time, 30 min. 36 sec. Speed, 243·67 m. per hour.

1924—*Dayton, Ohio*. Oct. 4 1924.—Lieut. H. H. Mills, U.S. Army. Verville-Sperry cantilever monoplane, 500 H.P. Curtiss D. 12 A. engine. Course, 124·7 m. Speed, 215·72 m. per hour.

1925—*Mitchel Field, Long Island*. Oct. 12 1925. Lieut. Cyrus Bettis, U.S. Army Air Service. Army Curtiss Racer, 619 H.P. Curtiss V. 1,400 engine. Course, 124·27 m. (200 km.). Time, 29 min. 56·9 sec. Speed, 248·99 m. per hour.

The Jacques Schneider Maritime Cup
(List of Winners)

Monaco, 1913.—M. Prevost (France) on a Deperdussin float seaplane, 160 H.P. Gnome. 150 nautical m. in 3 hr. 48 min. 22 sec. (45·25 land m. per hour).

Monaco, 1914.—Mr. Howard Pixton (Great Britain) on Sopwith float seaplane, 100 H.P. Monosoupape Gnome. 150 nautical m. in 2 hr. 0 min. 16 sec. (86 land m. per hour).

1915 to 1918, inclusive.—No contest.

Bournemouth, 1919.—Race annulled because, owing to fog, no competitor covered the correct course; but as the Italian aviator, Signor Janello, on a Savoia flying boat came nearest to covering the correct course, the competition was held the following year in Italy.

Venice, 1920.—Signor Luigi Bologna (Italy) on a Savoia S. 19 flying boat with 550 H.P. Ansaldo engine. 202 nautical m. in 2 hr. 10 min. 35 sec. (106·7 land m. per hour).

No English machines competed.

Venice, 1921.—Signor Giovanni de Briganti (Italy) on a Macchi 7 flying boat with 260 H.P. Isotta-Fraschini engine. 200 nautical m. in 2 hr. 4 min. 29 sec. (110·9 land m. per hour).

Naples, 1922.—Mr. H. C. Biard (Great Britain) on Supermarine Sea Lion flying boat with 450 Napier Lion engine. 200·2 nautical m. in 1 hr. 34 min. 51⅘ sec. (145·7 land m. per hour).

Cowes, 1923.—Lieut. David Rittenhouse (U.S. Navy) on Curtiss float seaplane C.R.3 with 465 H.P. Curtiss D.R.A. engine. 186 nautical m. in 1 hr. 12 min. 24⅘ sec. (177·38 land m. per hour).

1924.—British and Italian machines entered for the competition which should have been held at Baltimore. Italian entry did not mature and British machine crashed just before it was due to leave for U.S.A. Thus, if the American competitor had simply flown over the course, he could have claimed a win. As it was, the Americans declared "no competition."

Baltimore, 1925.—Lieut. Doolittle (U.S. Army) on Curtiss R.3 C.2 with Curtiss V. 400 engine. 191·4 nautical m. in 56 min. 6·37 sec. (232·57 land m. per hour).

Air racing has done much as an incentive towards attaining very high speeds, and although the actual racing machines are usually of small practical use, it has proved comparatively easy to develop from them aircraft of great military value.

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(W. S. B.)

FLYING CORPS: *see* AIR FORCES.

FOCH, FERDINAND (1851–), French marshal, was born at Tarbes Oct. 2 1851. His father's family had long been settled in the south of France, leaving the district of Ariège in the 17th century to establish themselves as woollen manufacturers in the small town of Valentine where they took a prominent part in municipal affairs. On his mother's side, Marshal Foch came of a race of soldiers, his maternal grandfather having been a gallant officer of the Grand Army. His father was a lawyer at Tarbes (Hautes-Pyrénées) who later became a revenue official; and he was frequently transferred from place to place, taking his son with him. The future marshal thus received his education successively at the Lycées at Tarbes and Rodez, the seminary at Polignan and the Jesuit college at St. Etienne.

It was not long before his teachers were struck with his "geometrical mind" and it was decided that he should enter the École Polytechnique, to prepare for which he was sent to St. Clément's College at Metz. After a few months there, however, the war of 1870 interrupted his studies. He enlisted in the infantry but the armistice came before he saw any fighting, and he returned to Metz to finish preparing for his examination. One of his fellow-students has described how, in the midst of a lesson, they learned, on March 11 1871, by the booming of the German guns, that the treaty of peace had made Metz a city of the German empire. None could foresee that the young student was destined, as marshal, to restore the city to France.

He sat for his examinations at Nancy, which was still occupied by Manteuffel's troops, and was admitted to the École Polytechnique, where he made his mark. In 1873 he was commissioned, and served successively at Fontainebleau, Tarbes and Rennes. He then passed into the École Supérieure de Guerre where, after a tour of duty on the general staff, he was appointed a professor on Oct. 31 1894. His lectures soon made a sensation, both by the evident soundness of the matter and the originality of the form. Even thus soon his pupils bore witness to the excellent qualities of their professor, who presently became one of the leaders in military doctrine. The lessons given between 1894 and 1900, collected in volumes, constitute the chapters of Foch's great works: *De la conduite de la guerre* and *Des principes de la guerre*, which appeared in 1897 and 1899.

In teaching six batches of staff college students Foch fortified his own military science as well; his years of Paris were in fact of capital importance in the higher development of his intellect. When he vacated his post no one doubted that he would return ere long in another capacity. After holding two regimental commands of artillery and spending a year on the staff of the V. Corps, he was, so to say, imposed on the Government by the opinion of the whole army as the fittest selection for the command of the École de Guerre that he had made famous. It was Clemenceau—at that time Prime Minister—who made the appointment, giving him the rank of general, and from that day began the cordial relations between the great statesman and the great soldier which were to be revived later under memorable conditions.

The general held his post as head of the École for four years, during which time he threw himself with untiring zeal into the work of this famous centre for military study, giving it a permanent stamp and forming a whole new generation of picked officers. When, in 1911, he was nominated to the command of the 13th Div. at Chaumont, Foch was one of the very few outstanding figures of the army and it was not surprising that, after a brief period in command of the VIII. Corps, the wish of everyone acquainted with the higher military personnel brought him to the head of the splendid XX. Corps, stationed about Nancy, which was accounted one of the best elements of the "Couverture." Thus, in 1913, he entered, to the sound of trumpets, the town where he had passed his examinations to the tune of the German army fifes and whence, before long, he was to march out for the War.

General Foch, who had married Mademoiselle Julie Bienvenue, had at that time three children— two married daughters and a young son who was destined to be one of the first to fall in the War. Although still attached to his Pyrenean home, the general spent his holidays on a small estate that he had acquired at Trofeunteniou in Brittany. In the summer of 1914 France was so far removed from any idea of attacking Germany that Foch had left Nancy to spend a month in far-away Brittany. A week later events led to his recall and he went into harness.

The Outbreak of War.—He was then a man of 63, but his rare moral, intellectual and physical vigour kept him singularly young. Foch was a man of thought and also, above all, a man of action. Gifted with an intelligence which was never allowed to be idle, ever widening the scope of his knowledge, reflective and delighting—to use his own striking phrase—to "phosphoresce," the great soldier is even stronger in will than in intellect. "Victory = *Will* . . . . Victory goes always to those who deserve it by the greater force of *will* . . . . A battle won is a battle in which one *will* not acknowledge oneself beaten"—these are but a few of the maxims found in his books, in which the word *will* occurs on every page. And in truth, although his grey eyes sparkle with intelligence, the forehead and, even more, the mouth reveal that will which he was able to communicate to all those who came in contact with him in the course of war. It is this will which gives such solidity to his character and protects it from all weaknesses. What is more, it stimulates both conscience and intelligence. He speaks of "these natures, hungry for responsibility, which alone turn out great men," and his own is one of these natures, that no sentimental considerations can either divert or check. For the rest, his clarity of mind translates itself by a realist and somewhat ironic common sense. "What is it about?" is a favourite phrase of his in all circumstances, for he believes in clear vision before direct action.

The XX. Corps formed part of the II. Army and Foch was therefore one of the commanders of Castelnau's army, which, on Aug. 19 1914, was thrown into annexed Lorraine. It will be remembered that this army, after some successes, came up against a formidable resistance in the region of Morhange and failed with heavy losses. Foch had had no part in forming the plan, which met with so cruel a check; he was but one of the executants. He had thrown his army corps resolutely at Morhange and, when repulsed, was still able to organise with perfect coolness its retreat on the solid positions of the Couronné de Nancy. Not content to await the enemy there, he resumed the offensive and, on Aug. 20, threw himself on the German regiments which were waiting to attack in the "gap of Charmes," and in overthrowing them prepared the victory in Lorraine. He was preparing to take his part there when he was called to the Grand Quartier Général, where Joffre entrusted him with the command of an army.

At that time the French were retiring in good order from Belgium and the Ardennes towards the region of the Marne. As a gap tended to open between the IV. and V. Armies, Joffre gave Foch the mission of forming a new army (the IX.) between them, co-ordinating his action with theirs. He was on the ground before the corps entrusted to him had arrived. In a few days he forged out of them a solid and supple little army which was

already well in hand when the celebrated order of Sept. 4 arrested the retreat and prescribed the battle which was to lead to the victory of the Marne.

Foch, after passing the marshes of St. Gond, established himself on the heights which dominate the Petit Morin and of which Fère Champenoise marks the crest. It was thought that his rôle would be limited to supporting Franchet d'Esperey's army on his left. But when the German armies, which, instead of turning the left of the French armies as they had expected, were themselves turned on the right, they tried to penetrate the allied centre precisely in this region of Fère Champenoise and Foch had therefore suddenly to support the main strain of the battle, and that with troops inferior in number. The heights were for a moment carried by the Germans from Mondemont to Fère Champenoise. It was then that, by a clever manoeuvre, Foch rapidly transferred the 42nd Div. from his left to his centre and thus was able to gain the upper hand and force the enemy back. The extreme fatigue of his troops prevented him from pushing his successes, but he hung on to the retreating Germans and entered Châlons-sur-Marne behind them. His part in the victory of the Marne was capital and it was recognised by a glorious citation in general orders.

His reputation was so increased after this great crisis that Joffre immediately entrusted him with a new mission—this time one without parallel. Scarcely had the operations of the Marne terminated when, the two armies mutually trying to outflank one another, the " race to the sea " set in from the Oise to the Flemish coast which was only to be closed by the arrival of the Belgian Army and the formation of a continuous front right to Nieuport. The British corps, for their part, had been moved into the region of Ypres, while Joffre detached from the now stable front between the Oise and the Vosges all the forces that he could spare to meet a great attack between the Oise and the sea.

To co-ordinate the action of the heterogeneous troops hurriedly thrown into these regions, a leader of great authority was wanted at once to take the higher direction of the operations of the French armies and to co-operate harmoniously with the Allied armies so as to assure the co-ordination necessary to victory. On Oct. 4 Foch was sent to the Nord to fulfil this mission with the title of " deputy to the commander-in-chief."

He did not limit himself to giving the French armies, from Picardy to Flanders, the most energetic orders but put himself in close and cordial relations with Field-Marshal Sir John French and King Albert I., and established the essential liaison between the Allied armies. Ceaselessly finding the necessary reinforcements and dispatching them to the aid of the hard-pressed British and Belgian corps, he was able by his friendly and generous activity to impose his own resolute ideas and so make himself the soul of the battle of Flanders that, after the fierce fighting of the Yser and of Ypres, ended in mid-Nov. by the definitive check of the German invasion for the year 1914. In all this Foch had not merely confirmed his prestige as a strategist, but had won for himself the friendly admiration of his Allies so completely that, even then, it could be foreseen that if, one day, circumstances required unity of command there could be no better choice for it than Foch. Did not Mr. Lloyd George say: " He could not have done more for us had he been one of our own generals."

Foch was left therefore in contact with the British and Belgian corps in the capacity of general commanding the Group of Armies of the North. He held the post for two years and thus presided over the two Artois offensives of May and Sept. 1915 and the battle of the Somme in the summer of 1916 which the German attack on Verdun prevented from assuming the amplitude and decisive character that had been intended.

After brilliant initial successes the Somme battle seemed to sink in the autumn mud. The disappointment that it caused led to a movement of dissatisfaction with the higher leaders who had presided over it. Joffre having been relieved of his command, Foch was deprived of his also and relegated to Senlis for a mission of inspection. The story was that he was fatigued. This was hardly the case, but he accepted this semi-disgrace with resignation and his valuable advice was always at the disposal of General Lyautey, who had become Minister of War.

When, in May 1917, Gen. Pétain was called to the chief command, he himself suggested to the Government that Foch could be usefully employed in the post of chief of the general staff. Having been sent into Italy on the morrow of Caporetto to establish a much-needed understanding with Gen. Cadorna's headquarters, and having remained in constant and cordial relations with Field-Marshal Haig, there was little doubt that when the time came Foch would appear as the single commander that so many people desired by the end of 1917. When, in March 1918, the Germans launched their first grand offensive and the Allied line threatened to break, the necessity of this command became obvious to everybody. It was at Doullens that Foch, on March 29, received from the representatives of the French and British Govts. that mission of higher co-ordination that on April 14 became more precise in the form of the chief command of all the Allied armies fighting in France. Already he had grasped this command with a firm hand. Thanks to the close co-operation of the Allies he stopped the Germans at the gates of Amiens, and thereby brought about the final failure of their attempt to break the Anglo-French front and penetrate to the Channel.

Henceforward his whole energies were directed towards assuring this fruitful co-operation. Thus he brought strong French reinforcements to help the British armies, attacked in March and April, and engaged British and American divisions in the battle of the Aisne in May, thus twice checking German offensives that, for a moment, were triumphant. And when the Germans came to a standstill in the pockets that they had driven into our front, he prepared the counter-offensives which, when the hour struck, were to shake and crumple the German front.

The counter-offensive was on the point of being launched against the flanks of these pockets, from the Aisne to the Marne, when, on July 15, a new German offensive took place. This met with a partial check which, as we know, had the effect of deepening the pocket in which Foch intended to grip the enemy. The victorious attack of July 18 on the enemy's flanks forced him to retire and gave the signal for the grand Allied offensives.

Foch was now determined to halt no more. He realised that the German armies were beginning to be exhausted but that if they were to be overthrown, the blows must fall thick and fast. The great offensive of Aug. 8 in the region of the Somme which, as it gradually spread and became more violent, forced the Germans to retire on to the Hindenburg Line, was almost immediately followed by the new offensive against that strong position where French and English vied with each other in valour. Once the line had been forced, Foch launched his famous " directive " of Sept. 3 which was in fact the programme of the general attack. The stages of this semi-concentric attack are well known. It stretched from the Meuse into Flanders and was designed to draw the enemy from all parts back on to the region of the Ardennes, where Foch hoped to pin them and grasp them. The " directives," which issued from the headquarters of Bombon (and later, Senlis) are clear, resolute and pitiless. At this point Pétain, Haig and Pershing worked in closest harmony with their French colleague. The directives of Oct. 10 and 19 were followed by successes—hard won and unequal, it is true, but which on Nov. 5 culminated in the general retreat of the beaten and exhausted German armies.

Foch, following them closely, had already prepared an operation on a large scale to make an end of them. While the Germans were to be thrown back into the difficult Ardennes region, a huge group of armies under the orders of Castelnau with Mangin as principal executant, were to attack on the Moselle and the Sarre and, reaching the Rhine, were to bar the line of retreat from the encircled Germans. It was at this point that the Germans asked for the Armistice. On Nov. 8 Foch, who had been engaged in drawing up the conditions for three weeks past, received the German plenipotentiaries at Rethondes and, by his masterful attitude, brought them to accept all conditions on Nov. 11,

obtaining with the occupation of the left bank of the Rhine the results which he had expected to gain from the supreme battle.

The career of Foch was not at an end. Europe acclaimed him as the leader who had secured the victory. Marshal of France since Aug. 7, he now became a British field-marshal and later a marshal of Poland. He was elected a member of the *Académie française*, which body, emulating the *Académie des sciences*, gave him a wonderful reception, and at Paris, on July 14 1919, he passed under the *Arc de triomphe de l'Etoile* at the head of the victorious troops. From New York to London and from Brussels to Warsaw he passed from triumph to triumph. He was not, however, content with a parade rôle, and, as president of the Inter-Allied military commission, he was repeatedly called upon to take measures in support of the action of the Allied Governments. This presidency he still retains—the last vestige of that single command of the armies led by him to the common triumph, the triumph which was the outcome of that " will " always regarded by him as the great and essential mainspring of victory.

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FOERSTER, JOSEF BOHUSLAV (1859–), Czech composer, was born Dec. 30 1859 in Prague, and studied under Fibich. He became an organist and a writer on musical subjects; later he was appointed professor at the Conservatoire in Hamburg and eventually, in 1918, professor at the Conservatoire in Prague. As a composer he developed from symphonic and chamber music to opera, which formed the most important part of his work. Foerster was a type of cultured musician, deeply emotional in his resources, who replaced the vagueness of expression which marked his early period by purity and technical perfection. His operas *Deborah* (1891), *Eve* (1897), *Jessica* (1904), *The Unconquered* (1906), *The Heart* (1922) are distinguished by psychological depth and by the subjectivity of their artistic understanding. Of his other compositions, the most important are a symphony entitled *From my Youth* and a number of suites.

FOGAZZARO, ANTONIO (1842–1911), Italian novelist and poet (*see* 10.590), died at Vicenza March 7 1911.

See Eugenio Donadoni, *Antonio Fogazzaro* (1913); L. Gennari, *Fogazzaro* (1918); and F. Crispolti, *Antonio Fogazzaro; Discorso Commemorativo* (1911).

FOKKER, ANTHONY HERMAN GERARD (1890–), Dutch aeronaut and aeroplane constructor, was born April 6 1890 at Kediri, Java. He obtained his international pilot certificate in 1911 and in the following year he established an aeroplane factory at Johannesthal, near Berlin. In 1913 he founded another factory at Schwerin in Mecklenburg and during the World War supplied the German Army with flying material, notably the Fokker biplane. After the War he returned to Holland and established the Fokker Aircraft Works in that country. In 1924 the Atlantic Aircraft Corporation was founded in the United States, Mr. Fokker being a director; and a factory was started at Hasbrouck Heights, New Jersey. Meanwhile he had set up a plant in Madrid, which was already producing machines for the Spanish Government. He devoted much of his time to researches in the field of commercial aircraft development, one of his latest designs being the Fokker triplane. His early experiments with regard to gliding with motorless machines, of which he gave a demonstration in England in 1922, did not meet with very much success.

FOLKESTONE, England (*see* 10.600b), with a population of 37,511, has been improved as a seaport. Before the World War the harbour pier was lengthened to 1,480 ft., so that it now has berths for eight steamers, a railway platform and raised promenade along the whole length, and a lighthouse at the end. The area of the inner and outer harbours is a little over 12 acres. In 1915 there was a large landslip in the Warren; the railway line between Folkestone and Dover, which was buried or damaged for a distance of nearly two miles, was closed and was not reopened until Aug. 1919. In 1920 the Earl of Radnor presented the Warren and East Cliff to the town. A zigzag path has been built between the Undercliff and the Leas. In 1921 the foundation stone of an addition to the Royal Victoria Hospital was laid. In 1924 remains of a large Roman villa were excavated near the East Cliff, and the corporation undertook the roofing of a portion of the site, which contains a mosaic pavement.

Folkestone was an important embarkation point during the World War and one of the ports permitted to civilians. Many Belgian refugees passed through in the early days; it was estimated that 64,500 destitute Belgians arrived between Sept. 1914 and March 1915, besides about 44,600 who had sufficient money to pay railway fares for themselves. There were later large numbers of Canadian troops at Shorncliffe Camp near the town and also camps for American troops and for Chinese and Zulu labourers. On May 25 1917, during an air raid, a bomb fell in a crowded street, killing 33 people.

FOLKLORE (*see* 10.601).—Folklore, the science of popular beliefs, traditions and customs, has made great progress since 1910, especially in countries which till then remained more or less outside general scientific movements. Unfortunately scholars in countries like the Balkan States, Finland, Czechoslovakia, Yugoslavia, now publish the results of their work in their national language, thus adding to the difficulties of comparative study. This scientific decentralisation may perhaps culminate in concentration and standardisation, as has been effected in physical anthropology. The need for some such measures is evident. The scope of folklore needs to be defined. Its methods must be organised and, where necessary, renovated.

Scope of the Science.—Early students of folklore limited their studies to beliefs, tales, legends, myths, songs and games—that is to a great extent to " literary traditions." Early in the 20th century folklore was only a section of comparative literary history and of comparative mythology. But in some countries, as those under Habsburg rule and Slavonic areas, investigations covered the details of dress and ornaments, of houses and villages, of arts and crafts, as well as literary material. In these countries folklore was thus inevitably associated directly with ethnography.

While such conditions obtained, it was true that folklore was the ethnography of European peoples, and ethnography the folklore of the non-European peoples. Such indeed, but only as regards beliefs and popular literature, was the attitude of the Folklore Society of London, which in its publications has always granted equality of place to " primitive or half-civilised " savages, as to the peasants of Europe. Again, Sir James Frazer in his *Golden Bough* and in *Folklore of the Old Testament* has included all popular documents without geographical or chronological distinction. For him, as for the majority of folklorists of the older school, the term folklore referred only to intellectual, not to material, culture. Obviously the variations of dress, houses and implements have not, in Great Britain and the Central States of Europe, the same importance as in eastern and southern Europe, although certain areas, such as Scotland, the Alps, the Pyrenees and parts of Germany, have preserved vestiges of very ancient cultures.

Rütimeyer has discovered in Switzerland many prehistoric survivals, instruments, decorations, even modes of life. The Spanish Anthropological Society has started investigations in Spain into local fashions of dress, which have already yielded interesting results. In eastern and northern Europe the varieties of material culture and survivals of the Stone, Bronze and Iron ages are even more numerous and better preserved. In these countries, therefore, folklore has gathered in more such data than in those where it was first organised. The scope of folklore needs enlargement, so as to include the study of varieties of types of houses, villages, utensils of every sort, furniture, jewels, dress and every expression of popular art. Since the War, a movement

in this direction has been started in England and in France by the publication of numerous monographs on country houses, too often in a purely utilitarian, rather than in a scientific spirit, because conditioned by the exodus of people in towns towards the country. But the investigations of Bancalari, Meringer and the school of students in Finland, Russia, Bulgaria, Rumania, Serbo-Croatia and Czechoslovakia into the material culture of those areas have been undertaken in strict accordance with the scientific rules of folklore.

Methods of Investigation.—The ampler the scope of folklore and the wider its domain, the more rigorously must its rules be determined. No single method of approach is adequate. The historical method is necessary—so also is the comparative method necessary; for in distinction from the historical method it does not put chronology into the first place, but compares the data according to their intrinsic nature, according to their technique and their external forms, without note of conditions of time and place. Frazer, Lang, Hartland and Westermarck in England, de Basset, Sebillot, Cosquin, Gaidoz in France, Mannhardt and his followers in Germany used this method, which had the advantage of bringing to light the gaps in the historical method of which the older philological method was but a secondary variation. A new philological method was founded by Edmond and Gilliéron, who published the great linguistic Atlas of France. Their study of words such as *Scier* forced them and their fellow workers to investigate things as well, such as *faux, faucille, segue, scie*, etc. Thus came into being a new scientific department, in which folklore and linguistics were united. So great was its success in Germany that Meringer and his pupils founded a review, *Wörter und Sachen*, in order to exhibit the scientific advantages of this combination. And so useful is it that modern folklorists are obliged to give heed to this class of investigations.

Human Geography.—Under the name of anthropo-geography or human geography (*q.v.*), the science of geography lends valuable aid to folklore. While the comparative method eliminated all conditions of place, geography regards them as essential. The union of the two has produced a new method which, so long as it holds a just balance, will continue to produce valuable results. As in modern linguistics, distribution maps are now essential in folklore studies. By this means the easy generalisations of the comparative school can be rectified, as has been done by Van Gennep for the Savoy area, where more than 630 parishes were examined, with the result that the generalisations of Mannhardt and Frazer, etc., were found to be not valid in the areas studied. There are local variations, and even disappearances of customs, which the older, comparative method failed to explain.

Not only must the data be strictly localised but they must also be related to all their concomitant conditions. In addition to the historical, linguistic and geographic qualities already mentioned, note has to be made of the psychological, economic and political conditions. In short, to make due progress, folklore must adapt the psychological method to its needs, as well as the sociological method, by which all elements in the social life are classified. Folklore is concerned with social and collective, not individual and isolated, phenomena—its very derivation proves this. A tale, a myth, a ritual act, a dance, a ballad, a mode of dress, a type of house, are collective expressions.

The Individual in Invention.—This does not mean that these are collective inventions. Every study of the growth of an element of this nature reveals an individual act as the origin or moment of borrowing—never the act of a large group. A small and limited group behaves as an individual just as the admirers of a popular poet, the followers of a prophet or the pupils of a painter or a sculptor form a school. Thus a new end is given to folklore. The comparative method has disclosed to us the dominant and constant elements for all mankind. This was necessary to ascertain the conditions in which these dominant and constant elements came into existence, by whom, how and why, variations in them are effected in distribution of place and time. In short, it is its business to discover the action of individuals, or of small groups of individuals, as well as the mental and material evolution of collectivities.

Collection and Preservation of Data.—The wider the scope of folklore, the more delicate become its methods of interpretation and the more necessary is it to gather its data in a strictly scientific manner. At the outset, complicated questionnaires were used almost at random. They are now prepared on a less ambitious scale and with more precise terminology. Personal experience goes to show that questionnaires are useful only if used by an investigator who has an adequate general knowledge of manuals and comparative studies.

Folklore Material.—The data of folklore fall into two series, intellectual and material. No great dictionary or encyclopaedia as yet exists to cover the first group of topics, as has been accomplished for other sciences. The only attempt in this direction in Europe is the *Folklore of France* by Paul Sebillot, in four volumes, which, but for the untimely death of this great pioneer, would have been followed by four other volumes; and in America the two volumes of the *Handbook of the American Indians* by Hodge (Bureau of Ethnology). In most countries recourse must be had to collections of monographs, such as those published by the Folklore Society of London, by Pitre in Italy, and by Machado y Alvárez in Spain. The work that has to be done in this direction could, and should, be accomplished by international co-operation. The Finnish authority, Antti Aarne, has drawn up a list of catch-words which, with items supplied by his co-adjutators, contains more than 3,000 items concerning specially the themes of tales and legends.

Museums.—The material data, implements, dress, etc., find their place in museums. But it is still rare to find a museum specially devoted to folklore, properly termed. Such are the Nordic Museum at Stockholm, the finest of all, then the Museum of Völkerkunde at Berlin; the folklore museums at Hamburg and Basel, the Museum of Popular Traditions at Paris (Trocadero), the national museums at Prague, at Bucharest, Cluj Klausenburg at Zakopane, at Warsaw and Cracow and at Budapest. In almost all big towns where there is an archaeological museum, there is a section set apart in it for folklore material, specially of historical and artistic nature. Of peculiar interest are sections of this kind at South Kensington, at the German Museum in Nuremberg, at the Landes Museum at Zurich, the Natural History Museum, Vienna, the Polytechnic Museum, Moscow, and the Alsatian Museum, Strasbourg. In most large provincial towns in England, France, Germany, Switzerland and Austria there are local museums which contain folklore objects, such as exhibits of ancient costumes, as well as coins, pictures and historic objects of every kind.

Nevertheless, the scientific organisation of folklore museums has not yet been founded. We are still at the simple stage of curiosity and rarity. The historical point of view in general overrules the special aspect of folklore interest according to which specimens should be collected and classified in technological and evolutionary series. The folklore material of non-European peoples is naturally much better represented, for it is ethnography pure and simple. The number of ethnographic museums has increased greatly in this period and their organisation improved, notably in the United States, Switzerland and The Netherlands.

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(*c*) Periodicals and Collections. *Portugal.—Revista Lusitana*, the review of the Geographical Society of Lisbon and the Reports of Oporto University, edited by Mendes Correa.

Spain.—Acts and *Memoirs* of the Spanish Society for Anthropology, Ethnography and Prehistory, with a bibliography of works in Spanish dealing with all humanistic science, including folklore.

Basque Folklore.—Revue des Études Basques (Bayonne), the annual review and monthly bulletin of *Notes and Queries* by the Society of Euske-Folklore founded by José Miguel de Baran in 1921 at Vittoria: also memoirs on the Basques by C. Schuchardt of Graz, N. Densusianu of Bucharest, and M. Haberlandt of Vienna.

France.—On the death of Paul Sebillot, in 1918, the Société des Traditions populaires was amalgamated with the Société française d'Ethnographie et des Traditions populaires which has published a review since 1919. The review *Melusine* has not appeared regularly since the death of Eugène Rolland. Volume 13 appeared in 1912. Regional reviews and the publications of academies and local learned societies contain much material. In the *Revue de folklore*, to appear in 1926 under the direction of A. Van Gennep, provincial researches will be centralised.

The folklore of Northern Africa is dealt with in the *Revue tunisienne*, and the *Revue africaine;* Western African folklore in the *Bulletins* published at St. Louis and at Brazzaville. In the *Revue indochinoise* and the *Bulletin de l'École française d'Extrême-Orient* will be found material dealing with the folklore of India and China. The *Bulletin de la Société des Études océaniennes* has articles on folklore.

British Empire.—Folklore, published by the Folklore Society of London, is both comparative and descriptive. The society also publishes a collection of monographs dealing with the folklore of England under various headings. There are no special folklore reviews for Scotland or Ireland, or, for the most part, of the Dominions; Canadian folklore finds a place in the *Journal of American Folklore;* Asiatic folklore, especially Indian, is dealt with in the *Journal of the Asiatic Society of Bengal;* and Chinese folklore is also recorded in the *Journal* of the North China Branch. The Chinese Society also deals with such material from time to time. There are also local reviews and publications in the African territories which are not, however, centralised. As regards Australia, the publications of the local geographic societies must be consulted.

Belgium.—The publication of *la revue Volkskund*, interrupted by the War, has now been resumed under the direction of A. de Cock, Victor de Meijère and J. Vercoulie. In Walloon Belgium *Folklore brabançon* has now commenced to appear in both languages under the direction of A. Marinus. The Belgian Folklore Society proposes to publish a centralised bulletin dealing with folklore in both portions of Belgium.

Switzerland.—In spite of the War, La Société Suisse des Traditions populaires has continued the publication of archives and separate memoirs and monthly bulletins dealing with Swiss folklore. Much information has been collected and classified in the *Glossaire des Patois de la Suisse romande* now appearing in instalments. The Dictionary of patois suisse-italien has commenced publication, and includes a description of material, objects, customs, etc., and distribution maps covering northern Italy as well.

Italy.—For central and southern Italy, and especially Sicily, see the *Archivio italiano Tradizioni popolari* and the review, *Il Folklore italiano.* The review *Augusta Praetoria* deals with the valley of Aosta and neighbouring regions, and, from time to time, local or general papers publish folklore material.

Germany.—All German folklore societies are united in the Verband deutscher Vereine für Volkskunde which publishes *Mitteilungen* (reports). The Swiss society is a member, and the Scandinavian, Dutch and Czech-German societies also form part of this league. Its reports deal with the activities of various societies under the various headings of folklore. The best folklore reviews are:—Berlin, *Zeitschrift für Volkskunde;* Munich, two reviews, *Bayerische Hefte* and *Bayerische Blätter für Volkskunde;* Giessen, *Hessische Blätter für Volkskunde;* Leipzig, *Mitteilungen des Ver. für sächische Volkskunde;* Breslau, *Mitteilungen der Schlesischen Gesellschaft für Volkskunde.* Further folklore articles, essays and bibliographies will be found in *Anzeiger für deutsches Altertum; Archiv für das Studium der neueren Sprachen; Archiv für Religionswissenschaft; Wörter und Sachen; Zeitschrift für Ethnologie.* The German output of folklore is by far the most important in the whole world because it is recognised to constitute an element in German nationality, and because the German country people are very conservative in their manners and customs.

Scandinavian Countries.—Most periodicals in Scandinavian countries publish folklore articles, such as, the *Danske Studier a Copenhague, Ymer* at Stockholm, etc. There are special reviews, such as, *Norsk Folkekultur* at Christiania; *Folkminnen och Folktankar* at Stockholm, and for Finnish Swedes *Folkloristiska och etnografiska.*

Finland and the Baltic Countries.—The Finnish-Ugrian Society publishes an excellent journal. The academy of Helsingfors publishes memoirs relating to the Ugrians, the Mongols, the Manchus, the Votiaks Voguls, the Tcheremisses and the Estonians. The Society of Folklore Fellows publishes at Helsingfors the well-known *Communications comparatives*, under the editorship of Antti Aarne. There are also folklore societies at Dorpat, in Latvia and in Lithuania.

Russia.—Nearly all periodical publications came to an end during the War and the revolution. Among them were *Zhiva 'ia Starina*, published by the Geographical Society of St. Petersburg, and *Etnografitcheskoye Obozrienie*, published by the Polytechnic Museum of Moscow. At Kieff, however, a laboratory of Anthropology and Ethnology has been founded by the Academy of Science of the Ukraine, which publishes a bulletin in Ukrainian, in which folklore is dealt with. In Manchuria a periodical appears, published by the local historical and archaeological society, and deals with Russian, Mongol, Manchu and Chinese folklore.

Poland.—While the review, *Wisla*, has ceased to appear, the Academy of Science at Cracow continues the publication of much material. The principal centre of activity is, however, at Lemberg, the headquarters of the Polish Society for Ethnology and Folklore. Its publication, *Lud*, is in its 23rd year, and appears simultaneously at Warsaw, Cracow, Posen and Vilna under the editorship of A. Fischer.

Czechoslovakia.—On the death of Zibert, the review, *Cesky Lid*, ceased to appear, but the *Narodopisny Vestnik Cesko-Slovansky* is still published under the editorship of G. Polivka. Other local reviews, notably in Slovakia, deal with folklore.

Austria.—On the break-up of the Habsburg Empire the scope of the Societies which publish journals of folklore has diminished; each element in the population prefers its own language as a means of publication so that there are local reviews in the Tirol, Styria, etc. Much folklore material is published by the Museum of Volkskunde and the Anthropological Institute in their publications.

Hungary.—Folklore material is centralised by the Academy of Science at Budapest, by the *Revue Ethnographique*, and in the reports of the Ethnographic Museum.

Bulgaria.—The Academy of Science publishes an important series of volumes on the popular manners and customs of Bulgaria.

Rumania.—The Bucharest Academy has already published some 50 vol. on Rumanian manners and customs. Then N. Densusianu has founded the review, *Grai si Suflet*, devoted to linguistics and to folklore. Local material is also published by the Universities of Jassy and Klausenburg.

Yugoslavia.—There are three important centres for folklore work in the country; the first at Belgrade where the Academy of Science and the university publish important memoirs from time to time; secondly, at Zagreb, where the review *Narodna Starina* (National Antiquities) is published under the editorship of Josip Matasovic; and thirdly, at Lubljana, where *Carniola* and *Mitteilungen des Museum-Vereines für Krain* are published. It may be indeed that Yugoslavia is one of the countries richest in folklore materials.

Greece.—The Hellenic Folklore Society founded by Politis at Athens, in 1910, publishes a review *Laographia*, to which also it has published as supplementary a collection of the complete works of Politis himself.

America.—In North America a distinct division of labour is observable. Indian folklore is centralised with the Bureau of Ethnology and the Smithsonian Institution and the *American Anthropologist.* The folklore of peoples of European and African origin falls to the *Journal of American Folklore* on behalf of the American Folklore Society, which also publishes memoirs. This society deals only with popular literature, tales, legends, songs, and not with popular material culture. Mention must be made here of the important investigations of Marius Barbeau on French Canada, and of Elsie Clews Parsons on the Bahamas.

Central America.—Gamio, in Mexico, deals with the folklore of the Indians in the publications of the Ministerio del Fomento. In Cuba, Fernando Ortiz has commenced publication of *Archivos del Folklore Cubano* (San Ignacio del Habana). Venezuela, Brazil and Chile are commencing publication of their folklore material, both of Indian and European origin. An annual bibliography of a complete nature, dealing with the folklore of North, Central and South America, has been published since 1917 by G. Rivet, of the Society of Americanists of Paris. (M. A. VAN G.)

FOLKSONG: *see* SINGING.

FOOCHOW, China (*see* 11.271), a treaty port, had an estimated population, according to the Chinese maritime customs; of 320,900 in 1923. The streets have been widened and paved,

the steps leading to the Long Bridge have been removed, and the road between it and the city planted with trees. Electric light has been installed, and also an ice-making plant to supply the fishing boats. In 1921 the Fukien Christian University was established on a site of 50 ac. below Kushan Point. The trade of Foochow has declined with the decline of the tea trade. The timber resources of the country are waning, and the trade in camphor is small. The demand for and the output of lacquer ware has increased. Ships discharge and load at the Pagoda anchorage, 10 m. below Foochow, since above this the Min river, divided into a number of channels, is obstructed by shoals and bars. A conservancy board was formed in 1919, and plans were worked out for directing the river into one channel, and permitting navigation by vessels drawing 17 ft. up to Nantai, the harbour of Foochow. The work was almost completed in the first and third sections in 1925, and the second section only required improvement by dredging.

FOOD, PURE (*see* ADULTERATION, 1.218).—It is only within recent years that the transfer of the manufacture of food from the home to the factory, and the transportation of food for greater and greater distances, have made it necessary for governments to promote systematically and scientifically the purity and truthful labelling of food products.

The purity of foods, drugs and other commodities was everywhere adversely affected by the conditions prevailing during the World War. There was a great increase in the practice of adulteration, and a marked falling off in the quality of manufactured foods. The use of substitutes and inferior products in times of shortage is a necessity; the subsequent restoration of higher standards is slow. Borax, formaldehyde and other food preservatives were tolerated to an almost unlimited extent in some European countries during the troubled period attending the War, and the users of these substances, after a few years of unmolested privilege, have been unwilling to give way.

Scientific Developments.—One phase of the movement for pure food was a proposal by the newly organised International Union of Pure and Applied Chemistry to study the practice of conserving foods by chemical means—a subject extensively investigated in the United States between 1904 and 1912. A report upon the laws governing the use of chemical preservatives in foods was presented at the fourth meeting of the International Union of Pure and Applied Chemistry at Cambridge, England, in June 1923 (Comptes-rendus de la quatrième Conférence Internationale de la Chimie, p. 133–6). The trend of public and scientific opinion at the present time is toward the complete elimination of chemical preservatives from foods. In addition to their own injurious action, food preservatives disguise the effects of putrefaction, and their use in many cases has put a premium upon the unsanitary handling of foods. Certain advocates, notably Prof. E. Paterno of the University of Rome, have defended the use of preservatives. It has been asserted that the extensive consumption of meats, preserved by boric acid or formaldehyde, as an exigency of war, produced no injurious effects. The lack of cold-storage facilities, such as are everywhere provided in the United States, has been advanced in many countries as an argument for the use of chemicals in preserving perishable foods. Legislation to exclude completely all foreign chemicals from foods has been held to be inconsistent so long as copper compounds, arsenates and other substances are permitted in agriculture as insecticides, fungicides and disinfectants, since traces of these nearly always occur in the fruits and vegetables so treated. Nevertheless opinion among hygienists, manufacturers and the general public is decidedly adverse to the use of chemical preservatives. It has been suggested that an important factor in the increase of certain diseases is the presence of chemical preservatives and metallic poisons in foods.

British Committee on Preservatives.—In England the Minister of Health appointed on July 7 1923 a Committee on the Use of Preservatives and Colouring Matters in Food. In accordance with their recommendations the Minister of Health announced on Feb. 17 1925 a Draft of Rules and Orders that completely excludes from foods boric acid, salicylic acid, formaldehyde, fluorides and all other chemical preservatives except benzoic acid and sulphur dioxide, which are permitted in minimum amounts for preserving a limited number of foods and beverages. According to these regulations a food preservative is defined as:—

> any substance which is capable of inhibiting, retarding or arresting the process of fermentation, acidification, or other decomposition of food or of masking any of the evidences of any such process or of neutralising the acid generated by any such process; but does not include common salt (sodium chloride), saltpetre (sodium or potassium nitrate), sugars, acetic acid or vinegar, alcohol or potable spirits, spices, essential oils or any substance added to food by the process of curing known as smoking.

It was objected that the new rules would operate to the detriment of both the trade and the general public on account of storage difficulties and of the increased price at which it would be necessary to sell food under the changed conditions. The new British Public Health (Preservatives, etc., in Food) Regulations of 1925 are to come into operation on Jan. 1 1927 with slight extensions of this date in the case of butter, cream and a few other products.

Standardisation.—A basic requirement in pure food control is the establishment of official standards of purity. The differences of opinion which prevail with regard to what constitutes pure sausage, marmalade, chocolate, catsup, ice cream and numerous other foods would make the task of the analyst an impossible one unless he had available certain recognised standards which are accepted as just by the trade and by regulatory officials. In Germany, Great Britain and the British colonies much valuable pioneer work has been done by the public analysts toward establishing standards of composition for many articles of food. In the United States a joint committee of nine experts selected equally from the U.S. Bureau of Chemistry, the Association of Official Agricultural Chemists and the Association of Dairy, Food and Drug Officials, by joint conferences with the trade, has established definitions and standards for a large variety of foods.

Food Laws in the United States

In the United States the control of foods is exercised by the Federal Govt. of the United States under the Federal Food and Drugs Act, the Meat Inspection Act, the Tea Inspection Act and certain Acts relating to specific products such as filled cheese, filled milk, butter and mixed flour. Forty-seven of the 48 states of the Union have some form of food control legislation. A number of states have laws which follow the general principles of the Federal Food and Drugs Act, but other states have laws differing very materially from that Act. In some states foods are controlled under the general provisions of one Act, in other states they are controlled under a number of Acts relating to specific food products. Each state has complete control of the foods produced and consumed within that state. The Federal Govt. has control of foods shipped into interstate or foreign commerce.

The Federal Food and Drugs Act, approved on June 30 1906 and amended in 1912, 1913 and 1919, provides in general that all foods coming within its jurisdiction be prepared in a cleanly manner from pure and wholesome materials; free from any added substances which might render them injurious to health; not labelled or sold under representations which are in any manner deceptive. Food packages must bear a plain and conspicuous statement of the quantity of the contents.

The Meat Inspection Act, approved on June 30 1906, provides that every establishment in which cattle, sheep, swine or goats are slaughtered or their carcasses are wholly or in part canned, cured, smoked, salted, packed, rendered or otherwise prepared for transportation or sale as articles of interstate or foreign commerce shall be inspected under the Act. The inspection begins when live animals are received for slaughter, and includes a thorough ante-mortem and post-mortem examination, a rigid inspection of products such as smoked or cured meats, lard and by-products, and a final inspection when meats and their products leave the inspected establishments.

The Tea Inspection Act of March 2 1897, amended on May 16 1908, provides that all shipments of tea offered for entry into the United States shall be inspected to see that they comply with the standards of quality and purity adopted each year by a board of tea experts appointed by the Secretary of Agriculture. Every consignment of tea offered for entry into the United States is inspected, and only such tea admitted as complies with the standards.

The Bureau of Chemistry in the enforcement of the Federal Food and Drugs Act endeavours to see that out of the great volume and variety of foods coming from other countries only such as comply with the Act are allowed to enter the United States. Shipments in violation of the Food and Drugs Act are denied entry into the United States, and if not exported within three months are destroyed. If the violation is a form of misbranding that can be entirely corrected by relabelling, the importer is permitted to relabel the shipment, after which it may be admitted to the country, if the relabelling is correct. Foods that are harmful to health, however, are not admitted to the United States and must be exported or destroyed.

For the control of interstate commerce two forms of action are provided by the Federal Food and Drugs Act—criminal prosecution against the party responsible for the violation, and seizure of any shipments of adulterated or misbranded foods or drugs found in interstate or foreign commerce. Both actions may be invoked when necessary. Under the Federal Food and Drugs Act more than 14,000 cases, including both criminal prosecutions and seizures, have been terminated in the Federal courts and the results published in the form of notices of judgment. This number represents only those instances of flagrant misbranding or adulteration in which court action was necessary to check the practice. Countless minor violations have been corrected by serving notices on the firms responsible without recourse to formal legal action.

Most of the grosser forms of adulteration and misbranding which prevailed at the time of the enactment of the Federal Food and Drugs Act and Meat Inspection Act in 1906 have been eliminated as general trade practices. Occasional sporadic instances on the part of widely scattered dealers to adulterate and misbrand in the old way are still detected at intervals, but such practices are no longer general. New and more subtle forms of adulteration, however, are being detected. As a result of the effects of pure food legislation by the Federal and State Governments, and by the application of the principles of sanitary science in the food industries, very great improvement was made in the purity of food in the markets of the United States between 1910 and 1925. No other classes of merchandise are to-day, on the whole, so free from adulteration and misbranding as foods.

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(C. A. BR.)

FOOD POISONING (*see* 18.29).—The term food poisoning as used by public-health workers and bacteriologists does not include the deliberate addition to food of poisonous substances with criminal intent, nor yet individual idiosyncrasy or sensitisation to certain proteins such as those contained in strawberries, eggs, milk or shellfish. Food idiosyncrasy depends primarily on a peculiar condition of the human body rather than on any dangerous quality in the food itself. The various "deficiency diseases," such as *beri-beri* (*see* 3.774d), *scurvy* (*see* 24.517b) and perhaps *pellagra* (*see* 21.69b) and *goitre* (*see* 12.191d), which are due to the lack of some essential element in the diet, are also not usually considered as types of food poisoning.

The manifestations ordinarily grouped as food poisoning at the present time are those due to:—(1) the presence of poisonous substances in healthy, untreated plant or animal tissues; (2) the introduction into food by accident, or design, of more or less familiar organic and inorganic poisons; (3) the presence in the food of living pathogenic bacteria or other parasites;(4) the presence in the food of poisonous substances elaborated by the growth of various micro-organisms.

Poisons in Plants and Animals.—Certain normal plant and animal tissues contain substances poisonous to man, and when eaten may cause illness and death; such are poisonous mushrooms and certain fish found in tropical waters. Fatal cases of oxalic poisoning from eating the leaves of the common rhubarb have occurred. Horses and cattle grazing free on the western ranges are frequently poisoned when forage is scanty and they resort to weeds and plants generally left untouched, such as the larkspur, the lupins, the water hemlock and the death Camas. Poisonous weeds eaten by cattle may indirectly produce poisoning in man. The disease known to the pioneer settlers in parts of the United States as *milk sickness* was early recognised to be connected with the occurrence of *trembles* in milch cows, but its origin long remained obscure. It is now believed that both *trembles* and *milk sickness* were due to a poisonous substance in the white snakeroot (*Eupatorium*) which was eaten by the cows when other pasturage failed.

Mineral Poisons.—Occasionally mineral poisons like arsenic and lead find their way by accident into food in the process of manufacture, as in the famous outbreak of *peripheral neuritis* (*see* 2.654) in several of the Midland countries in England in 1900, involving at least 6,000 persons and causing about 70 deaths. This was traced to the presence of considerable quantities of arsenic in the beer coming from certain breweries; it was found that the brewing sugars had been impregnated with arsenic by the sulphuric acid used in their preparation, the arsenic itself being derived from the iron pyrites used in making the sulphuric acid. More recently the cocoa sold by an English firm contained a small amount of arsenic derived from the potassium carbonate employed in its manufacture.

Long-continued action of food on containers may dissolve harmful metals such as lead, copper or tin. Tin poisoning from canned foods, although theoretically possible, is so rare as to have little practical significance, doubtless partly because such tin as is dissolved is largely fixed in an insoluble form by the solid portions of the canned food and eliminated directly from the body. Copper, although not a violent irritant, may have a highly injurious effect when absorbed during many years, as in the constant use of distilled liquors containing copper derived from the copper worm of the condenser; cirrhosis of the liver (*see* 16.803) may be caused in this way. Lead, owing to its well-known cumulative effect on the human body, is an undesirable substance to come in contact with food or drink. As long ago as 1767 the local malady of *Devonshire colic* was shown by Baker to be due to the action of cider on lead vessels. Lead poisoning has also resulted from the frequent use of acid beverages in bottles with lead stoppers. When lead was generally used in glazes and enamels for cooking vessels, recognised poisoning from these sources sometimes occurred; the enamelled ware at present in common use in England and the United States is lead-free.

Food Preservatives.—The use of food preservatives constitutes a very difficult and important phase of the problem of the addition of poisonous substances to food. Numerous substances have been added to food intentionally for the purpose of preventing the growth of micro-organisms and consequent spoiling. Some food preservatives (*see* 10.612) once widely used are now known to be poisonous for man as well as antiseptic for microbes and have been generally discarded or prohibited. Such are formaldehyde and hydrofluoric acid and their derivatives. Regarding some other preservative substances there is great diversity of opinion among those who have given the matter most study. The use of boron and salicylic acid compounds is generally, but not universally, disapproved. Benzoic acid, sulphurous acid and sulphites are regarded by many hygienists as permissible in certain foods under controlled conditions. The differences of opinion emphasise the insufficiency of our knowledge. Until information commanding the respect of all competent experts is available, it is well to err on the side of caution and minimise the use of preservatives.

The practice of adding poisonous substances to food merely for the sake of altering colour or appearance has nothing to recommend it. At the present time any danger of actual poisoning

from colouring matter added to candy, pastries and the like is slight. In most countries the health authorities maintain a list of the substances, such as certain coal-tar dyes, which are permitted, and prohibitory regulation is strictly enforced. In the United States no colours and no preservatives in foods are permitted unless they are deemed harmless. (*See* FOOD, PURE.)

Bacterial Poisoning.—Food may serve as the vehicle for certain kinds of disease-producing bacteria and other parasites. In some instances the bacteria are exclusively of human origin and occur in or upon the food as the result of contact with sewage-contaminated water or through handling by a *carrier* of disease germs, *e.g.*, the contamination of oysters with typhoid bacilli present in polluted water and the contamination of milk by a typhoid carrier on a dairy farm. In other instances the bacteria present in the food are derived from an infection of the food animal. This second class of infections is especially important in any survey of food poisoning since the gastro-intestinal symptoms produced are often sudden and violent; many of the most typical and best known mass outbreaks of food poisoning belong to this group. The nausea, vomiting and diarrhoea that characterise these attacks usually attract attention to some article of food eaten shortly before. An attack of this kind rarely terminates fatally, and the symptoms pass off within 24 to 48 hours, having little after effect. Often a history of illness in the slaughtered animal can be secured. Some of the most extensive outbreaks of meat poisoning in European countries have been traced to the use of meat from an animal noticed to be ailing and promptly killed by the thrifty peasant as an emergency measure.

The bacteria that cause this typical form of food poisoning belong for the most part to the group of *paratyphoid* bacilli, organisms closely related biologically to the typhoid bacillus, but distinguishable by laboratory tests. Within the group of paratyphoid bacilli there are several different species (*e.g.*, *B. enteritidis*, *B. aertrycke*, *B. suipestifer*) that primarily cause disease in various domestic animals, but secondarily and occasionally give rise to food poisoning in man. Food poisoning from paratyphoid bacilli would probably be much more common than it is if foods were not usually cooked. These bacteria are killed by boiling, and the history of many attacks shows that, while parts of an animal eaten raw or partly cooked have given rise to illness, other portions cooked before being eaten have been quite innocuous. Sausages made from uncooked meat or internal organs (liver sausage, blood sausage, etc.) have been the cause of food poisoning in a disproportionately large number of cases. Unfortunately inspection of the meat before sale may fail to reveal any evidence of infection, so that protection against this form of food poisoning depends chiefly on (*a*) the selection of healthy animals for slaughter and (*b*) thorough cooking of all foods of animal origin.

Foods may be also contaminated with paratyphoid bacilli by the agency of rats and mice. These rodents suffer from natural infections with these bacteria and can become carriers. Rodent contamination must always be reckoned a possibility in investigating outbreaks of this type.

Certain of the higher animal parasites occasionally enter the human body in contaminated food. The small roundworm (*Trichinella*) that causes trichinosis is one of the best known. Thorough cooking is an effective safeguard.

Ergotism.—One of the earliest established instances of poisoning due to the products formed by the growth of micro-organisms in food substances is the disease of *ergotism* (*St. Anthony's Fire*) (*see* 9.738) so prevalent in the Middle Ages. Ergot is the poison formed by a fungus that grows on rye; in times of famine the enforced use of rye that would not otherwise have been eaten led to much suffering and many thousands of deaths.

Ptomaines.—It was long believed that many instances of gastro-intestinal disturbance—the typical food poisoning of the layman—were due to the products of various micro-organisms found in partly spoiled or decomposed food. Definite chemical substances—*ptomaines* (*see* 3.174)—were incriminated, and the expression *ptomaine poisoning* (*see* 22.629) came for a time to play as large a part in popular self-diagnosis as "influenza" or "the grip." In point of fact ptomaine poisoning, if it occurs at all, must be exceedingly rare. Ptomaines appear in food substances in the later stages only of putrefaction—after about a week! Alleged instances of "ptomaine poisoning" when investigated by modern methods may almost always be traced with greater plausibility to some other form of food poisoning. "Ptomaine poisoning" may be a convenient refuge from aetiological uncertainty; it is not a satisfactory diagnosis for illness or death.

The products of paratyphoid bacilli that have grown in food may in some instances be the cause of food poisoning, even when the bacteria themselves have been killed. The determination of this question presents great technical difficulties and has not yet been settled.

Botulism.—The most conspicuous and definite example of poisoning from a microbic product formed in food is *botulism* (*see* 18.30). The chief symptoms of botulism are nervous rather than gastro-intestinal. Disturbance of vision (double vision), great weakness and difficulty in swallowing, are common signs; there is little or no fever and the temperature may be subnormal; there is rarely any pain and the mentality remains clear; the disease is always serious, over 60% of the cases resulting fatally. From 1899 to 1924 in the United States 129 outbreaks occurred, affecting 435 people and causing 290 deaths. In the only outbreak known to have occurred in Great Britain (Loch Maree, 1922), eight persons were affected and all died. Botulism is due to a specific germ (*Clostridium botulinum*) which has great heat resistance and is also able to grow in the absence of oxygen. Under favourable conditions it elaborates a toxin which is one of the most poisonous substances known. Although the germ is widely distributed in soil in many parts of the world, the conditions necessary for its development in foodstuffs are so seldom present that botulism is one of the rarest of human affections. The lack of a suitable temperature, a certain degree of acidity of the culture medium, an over-abundant supply of oxygen, the presence of certain other micro-organisms are factors that may interfere with the growth of this organism and prevent toxin formation. Nevertheless scattered cases of botulism have occurred at intervals in Europe and America for over 100 years. The first cases to be described were caused by sausage, hence the name botulism. Meat pickled in brine has also been known to contain botulism toxin. In recent years canned foods of various kinds, vegetables as well as meats, have been implicated.

The majority of the cells of *Cl. botulinum* are killed by temperatures slightly above boiling, but a very small number may survive prolonged exposure to 115° C. or even higher.

The most obvious mode of protection against this form of food poisoning is to ensure cleanliness in all foods subjected to preservative processes and, in the case of heat-preserved foods, to use so far as practicable temperatures high enough to destroy the most resistant spores of *Cl. botulinum*.[1] The majority of canned foods proved to contain botulism toxin give sensible evidence of spoilage. The botulism toxin, unlike the organism that produces it, is readily destroyed by boiling. The immediate rejection, without tasting, of any food showing signs of spoilage, and the re-cooking of canned foods before serving, constitute a second line of defence. If these precautions are followed, botulism already rare should become practically unknown.

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[1] Temperature and time of exposure must be considered and also the difference in heat penetration, the degree of acidity of the food substance, the extent to which the appearance, and consequent marketability, is affected by the treatment, and other factors

Public Health Reports, Washington, and the *American Journal of Public Health*, New York; also the monograph *Botulism*, by Ernest C. Dickson, Monographs of the Rockefeller Institute for Medical Research, No. 8, New York (1918). (E. O. J.)

FOOD PRESERVING: *see* CANNING.

FOOD SERVICE.—In the United States there has been, since 1910, an increasing tendency on the part of Americans to take their meals outside of their homes, *i.e.*, the growth of the community kitchen and its corollary the community dining room.

Community Kitchens and Dining Rooms.—Many reasons may be assigned for this movement. In the first place it was a natural step in view of the changes in the home itself: the urban home had become smaller, for every square inch of floor area, every cubic inch of space, cost money in rent, and consequently the functions of the home were limited so as to effect a reduction of space. The home kitchen shrank first to the kitchenette and is now in process of vanishing entirely. Even where the space for an elaborate kitchen is available, the problem of getting suitable servants is so troublesome as to induce many to get along with a minimum of domestic service, and, as the mistress of the house is herself less willing to be a kitchen drudge than formerly, many meals are taken outside the home, particularly those of an elaborate nature. Private hospitality is more and more offered in hired hotel space in preference to the home. Banquets and other special functions are easily handled in public dining rooms and involve little responsibility on the part of the host and hostess. The emancipation of women is another factor. Many women have succeeded in establishing themselves, professionally or commercially, before marriage. They prefer financial independence to keeping house. The small, compact, efficiently arranged apartment is the result, with meals away from the home.

These factors are intensified by the constantly rising standards of living and by the greatly improved marketing technique which has stimulated a demand for many possessions previously non-existent or rare. Demands upon the family income have advanced, encroaching upon the former budget allotment for rent and servants. Small and servantless homes come as a natural sequence. If even then the income is too meagre, the modern woman has no hesitation in aiding her husband to double it by taking a position herself. Another blow to the home as the chief or sole source of prepared food has been dealt by the automobile and touring habit. It is estimated that in 1910 there were in the United States less than 350,000 automobiles; in 1925 over 17,000,000 were registered. Such an increase in the use of a personal means of conveyance with a day's travel radius of, say, 200 m. could not but have its effect on the food habits of the nation. " Automobile " business is considered a substantial part of the total business of hotels and restaurants.

The hotel kitchen, like its domestic counterpart, has had its troubles with its personnel, and for similar reasons. Working, however, on a larger scale and increasingly on standardised products, it can make readier use of machines as a substitute for labour. The modern quantity kitchen is thinly staffed but splendidly equipped. Washing-machines for dishes, glassware and silver, each adapted to the task in hand, enable two men to do the work of ten and to do it better. There is less breakage, the silver bears an enhanced sheen, and the bacteria count is reduced 90 per cent. Dirt and filth, once the bugbears of any but the most expensive dining places, are now perhaps more rare in hotels than in the home. There are also the great mixers which, for example, beat up a bushel of mashed potatoes or a gallon of cream with equal facility, the steam-cookers, the potato-peelers and a host of smaller indispensables that save time, labour and space where food is cooked on a wholesale scale. Electricity has helped in cookery and is now applied to refrigeration.

The Cafeteria System.—The service side of the problem has also advanced. The use of the steam-table has solved one of the problems of public service by keeping dishes hot and food tasty during the minutes or even hours that elapse between preparation and eating. The modern coffee-urn makes possible the preparation of five gallons at one time, a difficult feat under the old procedure. The newer methods of service bring the consumer and his food together without delay. The cafeteria system, under which all the dishes in the menu are displayed before the customer, who helps himself, has made quick service possible and cheap. Whatever losses there may be aesthetically, and these need be few, are broadly balanced by the pleasure of being able to make a direct selection of food. Incidentally, the cafeteria system has placed a premium on attractive, neatly arranged dishes. Another development, exclusively metropolitan, for those who want only a little food quickly, is that of the sandwich shop, luncheonette or expanded soda-fountain counter, where light refreshments are dispensed under conditions that permit high speed. Frequently these places are operated in chains, so that large numbers of sandwiches, for instance, are prepared in a locality where rent is low and trucked to small luncheon counters crowded into nooks that tap main streams of city workers. Such places appeal to the clerical worker or office girl who has little to spend and who seeks only a light lunch.

A closely related development is the delicatessen store, which sells prepared food but does not serve it. These, located in territories of concentrated population, present still another solution to the consumer's problems of limited space and few and high-priced servants. They eliminate much of the work and annoyance of cooking food in small, ill-ventilated apartments, while permitting the enjoyment of family privacy in consuming it. Similarly, in the large apartment hotels recently erected in the big cities, provision is usually made for extensive " room service." The kitchens of the hotel make it a part of their business to prepare meals which will be served in the rooms of the apartment dwellers. Special elevators and floor pantries assist, and special dishes and equipment have been devised to help keep the food in its best condition. Such a combination of wholesale cookery with individual service is practicable only in large, high-grade apartment hotels, but it has distinct advantages where conditions permit its use.

The conditions described are evident to all observers. Accurate statistics on the subject are lacking, however. Difficulties in the definitions of hotels, restaurants, boarding-houses and other eating places make current figures unreliable, and even less reliable the figures of 1910. Two estimates may be mentioned. The *Hotel Monthly* calculates that nearly 5,000,000 persons in the United States take a majority of their meals in public eating places and that they spend therein over 1,250 million dollars a year for a total of 4,000 million meals. *Hotel Management*, on the other hand, estimates that about 8,000 million meals per year are served outside homes and, taking a somewhat higher average amount spent (50 cents as compared with 35), reaches a figure of 4,000 million dollars of annual expenditure in public dining-rooms. This wide divergence between two competent authorities illustrates the difficulty of accurate estimate in hotel and restaurant statistics. It is evident, however, that the nation's restaurant bill might conservatively be estimated at over 1,000 million dollars a year. If the value of the food eaten by the employees and managers themselves and that sold for immediate consumption is included, but the canned and package-prepared foods omitted, a figure of 2,000 millions was probably too low rather than too high in 1925. (H. B. M.)

FOOD SUPPLY.—War influences the food supply in belligerent countries directly, and in neutral countries indirectly, through deterioration or distortion of agriculture, disorganisation of shipping, disintegration of finance and changes in consumption. During post-war reconstruction the abnormalities persist in modified form, broadly proportional to the severity and duration of the struggle, often attended by new disturbances contingent on inherent developments or proceeding from misdirected efforts at restoration of the *status quo ante bellum*. Sooner or later, a new equilibrium is established between agriculture, industry, transportation and finance.

During a war of large extent and long duration, agriculture suffers heavily in the belligerent countries and prospers seemingly in unadjacent neutral countries. After the war, agriculture recovers in the belligerent countries, but in the neutral countries undergoes liquidation. The governmental restraint of competi-

tion, effectual during war, is likely to be followed by excessive competition. It is from this panoramic viewpoint that a scrutiny of the results of the World War on the food supply of the world is to be undertaken.

I. THE WAR AND AGRICULTURE

Shortage of Men, Horses and Fertilisers.—No matter how categorically agriculture is classified as an essential industry in a country at war, the labouring forces of the land are drawn on by the military authorities. Landowners, tenants and hired workers are mobilised for military service. Horses are requisitioned. In the World War this recruiting of rural workers continued intermittently until the farm work was done largely by males past middle age and under 16, and by women. The working forces suffered in number, in skill and experience. Some replacement was effected by stationing prisoners of war on the land, but the agricultural result was everywhere inconsiderable. The requisitioning of horses made it necessary to use cattle as work animals, to the direct injury of the milk supply.

Only a partial picture of the effect of military recruiting is obtained by contrasting with the rural population the number of soldiers drawn from the land. The effect was more than the numerical ratio, and worsened progressively as the War continued. It was only by the redoubled and heroic efforts of old men, women and children that agriculture was kept going. Not alone human and animal forces were reduced, but material forces also. After the second year of the War there was practically no upkeep of implements. Deterioration of equipment rendered cultivation of the soil ineffective and imposed undue hardship on the workers, and agricultural practice became primitive and manual.

Pre-War European agriculture was heavily dependent on the use of chemical fertilisers, the supply of which declined rapidly. The United Kingdom drew saltpetre from Chile, phosphates from the United States and potash from Germany; under scarcity of tonnage and the munition demand for nitrogen, Chile saltpetre as a fertiliser became practically as scarce in the United Kingdom as was potash from Germany, and imports of phosphate declined. Despite huge domestic deposits of potash, Germany was unable to maintain the pre-War use of potash, though large amounts were applied to certain areas for particular crops in the vain hope of making good the lack of nitrate and phosphate. Since no imported phosphate rock was available to Germany, a grossly inadequate volume of Thomas slag remained her only source of phosphate. In France, the use of phosphate rock, saltpetre and potash declined to insignificant amounts.

In all belligerent countries, the by-product ammonia, previously largely used as fertiliser, went into munitions. Deprived of German potash, the agriculture of the United States was limited to the petty amounts of potash produced in War-born plants. Phosphate the United States had in abundance, until transportation became too congested to permit of normal movement. Saltpetre continued to be used on the soil in that country, though to a reduced extent. Sugar-producing areas, such as the West Indies, the Hawaiian Is. and Java, found their supplies of nitrate and ammonia greatly reduced. The neutral countries of Europe were little better off than the belligerents. Germany did, indeed, furnish potash to Holland and Scandinavia, as deliveries in blockade bargainings, but the amounts were small. Everywhere in Europe the prices of nitrate, ammonia, phosphate and potash became excessive for agriculture, when contrasted with the returned increments in crop yields.

The cumulative results of withdrawal of men and horses, deterioration of farm implements and lack of fertilisers operated in belligerent countries, so far as field crops were concerned, in four directions, mainly: (1) Acreage was reduced. (2) Yields per acre were lowered. (3) Weeds, pests and diseases had free run with corresponding deterioration of farm products. (4) The losses attending unfavourable weather were accentuated.

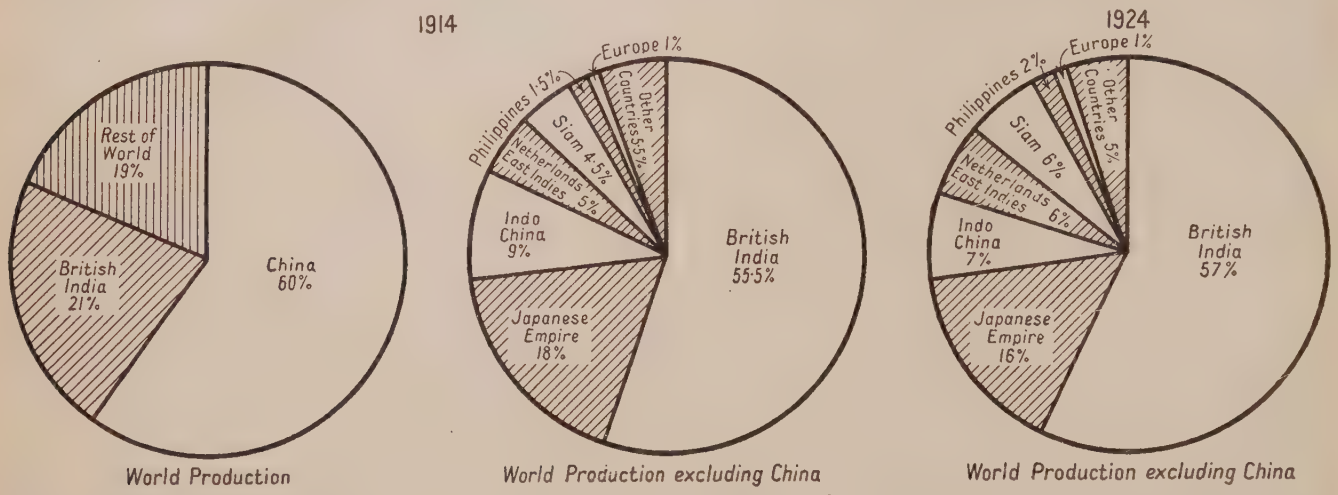


FIG. 1.—The total world production of rice in 1914 was estimated at 2,000,000,000 quintals. The total annual production of countries for which returns were obtained averaged 769,496,000 quintals for the period 1909–10 to 1913–4, and 849,415,000 quintals for 1924–5. The world's total production in 1924–5 was estimated at 1,300,000,000 quintals. (NOTE.—Percentages are necessarily approximate owing to incomplete data. No data is available for China after 1914.)

In general, the same situation held to some extent in the neutral countries of Europe. Men left the farms to take advantage of higher wages in industries. Horses were taken from the farms to be used in urban work or sold to belligerents. Farm implements were allowed to deteriorate, because the factories found it more profitable to manufacture war tools than to make replacement parts. Fertilisers were unavailable or expensive. Finally, the agriculture of neutral countries suffered inordinately from disorganisation of natural markets through the operations of blockades. For the reduction in acreage and yield of the principal crops and the reduction in cattle, sheep and horses (*see* AGRICULTURE; GRAIN PRODUCTION AND TRADE).

Preference to Primary Foodstuffs.—It became a necessary War policy of agriculture in belligerent countries to use land for primary foodstuffs in place of raising feeding stuffs out of which meat and dairy products might be produced. According to common European practice, an acre of land devoted to bread grains would produce more than four times as many calories for human food in the form of flour as could be secured in the form of meat and dairy products if the land were devoted to animal husbandry. In the case of potatoes, the economy in land was still greater. Contrasting beef cattle, hogs and dairy cows, the greatest waste of land occurred in the production of beef, the ratio of return being much greater in the form of pork or milk. On the other hand, cattle subsisted largely on forage not suitable for human food, while hogs were raised to a considerable extent on cereals adapted to human use or on special fodders grown on land that could produce cereals, potatoes or sugar. In order to make the best use of the land in terms of human nutrients, belligerent countries were compelled to reduce heavily the herds of swine and beef cattle. The count of dairy cattle was somewhat reduced, though efforts were made to conserve the milk supply.

As a result of these operations, some performed voluntarily by the

peasants and others executed under governmental orders, the count of cattle in Europe was reduced probably by 20–25% and of swine 30–40%. Despite the fact that sheep stood somewhat apart from cattle and swine, the general result was much the same, though some countries like Germany increased the number of sheep and goats. Sheep competed little with human beings for products of the soil or in the use of acreage, subsisting largely on feeding stuffs inappropriate to human use and grown on terrain unadapted to cultivation. In addition, wool was highly valuable; nevertheless, some countries showed a heavy reduction in the count of sheep.

The yield of meat and fat per animal was reduced owing to scarcity of feeding stuffs and to an abnormally high percentage of slaughter of immature animals. On the other hand, peasants concealed animals from the authorities, reporting fewer animals than they had and delivering less of products that they produced. This duplicity on the part of the peasants was due partly to predilection for animal husbandry, partly to the greater profits of animal products as against cereals or other primary foodstuffs. The evasion thus described was least in evidence in Great Britain. In every country one found after the War widely contrasting areas, some in which animal husbandry was most deplorably reduced, while in others the conditions were practically normal.

It is difficult to compare estimates of acreage under cultivation and counts of domesticated animals with those of the pre-War period on account of the changes in the map of Europe. It seems probable, regarding Europe (excluding Russia) as a whole, that the acreage under cultivation and the count of domesticated animals has been restored generally to the pre-War level. The restoration of cultivated acreage has not been accompanied by restoration of pre-War yields, since there is still shortage of fertilisers. Also, the yield of meat and dairy products per head of animals is below the pre-War level, due to shortage of imported feeding stuffs. It is difficult to accomplish a restoration of animal husbandry in Europe until feeding stuffs from Russia are again freely available. Broadly considered, the recovery of European agriculture in the seven years after the World War was more rapid than was to have been expected, in consideration of the extent and duration of the struggle.

Adaptive Devices of Agriculture.—Efforts were quite generally made in the belligerent countries, following agricultural policies that varied in accordance with the characteristics of the region, to raise the maximum volume of foodstuffs in terms of calories. The agrarian class everywhere had two motives: patriotism and price, though patriotism was perhaps less effective than price as a stimulant to production. In many countries peasants would give their sons without question, but not their crops, particularly not their animals. In order to stimulate production, farm prices were advanced, costs of distribution were reduced by establishing control of middlemen, and prices to consumers fixed at the lowest relative level possible; but the systems adopted worked out less well in some countries than in others. As the burdens and costs of agriculture rose, the price demands of peasants increased. In every country the rural population believed there was profiteering by urban industries, a belief which led to reprisals by agrarian classes in the form of pressing demands for higher prices for farm products. Governments everywhere were trying to satisfy the city with lower prices and the country with higher prices, usually failing in both directions. In some countries, farm prices of produce rose to four or five times pre-War figures.

In the neutral countries of Europe the situation was much the same. These countries were exporting farm produce to the belligerents. Usually the warring groups were bidding against each other. Each belligerent group used the power of the blockade to coerce the neutral countries of northwestern Europe. The governments of these neutral countries were concerned with keeping the urban cost of living down; but they had an interest in permitting the peasants to exploit the belligerents as much as possible. The peasants in neutral countries had valid grounds for high prices, since the costs of agriculture and of consumers' goods had risen. They demanded coverage prices, then still more. Under these circumstances, in the neutral countries of Europe, as well as in belligerent countries, wherever transportation permitted movements of foodstuffs and feeding stuffs, there was a continuous trend towards higher prices for farm products, restrained or directed by governmental control, though practically unrestrained by competition between producers.

All growers of cane sugar were at the mercy of the Allies, and sugar prices were definitely restrained; nevertheless, War prices were substantially higher than those prevalent before the War. In belligerent Canada and Australasia, prices of essential foodstuffs rose gradually throughout the War, particularly those destined for shipment to Europe. The neutral countries of South America were able to secure relatively higher prices for essential foodstuffs, though the prices of some unessential foodstuffs declined. Raising wheat in Argentina was a better business than raising coffee and chocolate in tropical America.

The markets of the Central Powers were closed to neutral overseas countries by blockade; shipments from neutral overseas countries to the markets of neutral European countries were restricted by allocations by the Allies. Entrance to the markets of the Allies was restricted by governmental control over imports, attempting to separate essentials from non-essentials (*see* CONTROL), with the result that necessaries were able to command higher prices, while the prices of non-essentials declined heavily in the countries of origin.

II. EFFECT OF THE WAR ON CONSUMPTION

The *per-capita* intake of food was relatively reduced all over Europe, and absolutely reduced in the belligerent countries. Nevertheless, the *per-capita* food needs were higher in war than in peace; Europeans worked harder, wore poorer clothing, and heated their houses sparingly, all of which meant increase in food requirements.

In many belligerent countries it was impossible to secure a balanced diet with the requisite quantities of proteins and vitamins, and the situation became worse with each year of the War. With increased heat requirements, *per-capita* shortage of calories resulted in loss of body weight. Scarcity in the indispensable factors of the diet, together with a low intake of protein, resulted in retardation of growth of children, and in the development of marasmus and dyscrasias. Despite a quite general lowering of the birth-rate, in many countries morbidity and mortality were increased in children below the 10th year. Stunted growth was frequently observed between the 10th and 15th years; and the physical structure of many European children has been permanently injured by the nutritional disturbances of the War diet. The course of tuberculosis was intensified and the decline of the aged accelerated. Mere loss in body weight, quite generally observed in healthy adults in the countries of the Central Powers, was probably on the whole not an injury.

The pre-War level of consumption of food, in quality and in quantity, was not restored with peace. Indeed, in many parts of Europe, despite extensive relief operations conducted by the American Relief Administration (extending practically through three years following the Armistice), malnutrition and subnutrition persisted for years. Even in Jan. 1926 the diet of Europe in the comparative pre-War sense was, perhaps, normal only in Scandinavia, Spain, Portugal and Holland. The *per-capita* diet of the former belligerent countries is still probably somewhat subnormal in quantity and abnormal in respect of certain components, especially the relations of primary and secondary foodstuffs. Europe, as a continent, has to-day a notably heavier vegetarian diet than before the War, and this may be expected to persist for some time to come.

The diet of Europe is still probably deficient in fats. The supply of animal fats was reduced by slaughter of animals. Furthermore, the animals were insufficiently fed, and gave less milk-fat and less carcass-fat. Before the War Europe imported large supplies of vegetable oils. Russian export of vegetable oils ceased in 1915, and the blockade prevented edible oils from reaching the Central Powers from overseas. Scarcity of tonnage and marine warfare reduced the importation of edible vegetable oils to the allied countries. Importations into the neutral countries of Europe were reduced by blockade rationing. The effect was to lower the ratio between the fat and starch components of the diet of each country. Shortage of fat was more severely felt than shortage of sugar, and intensified the effects of shortage of milk.

The War induced modifications of the diet in many countries in Europe as the result of peasant reactions to governmental control. Illicit trade in foodstuffs, inevitable under any system of war control, became worse as the War continued and the technique of evasion was developed. (National pyschologies differed; there was comparatively little illicit food trade in England; in Germany it was rampant.) Food smuggling became a profession. As the War proceeded and the difference in price-returns between cereals and animal products became more extreme, the peasants concealed animals, delivered to market at the fixed price as little of animals and animal products as possible, sold as much as possible at high prices through illicit traffic, and increased the farm-household consumption. Milk, the most important single food for the urban population, suffered most because butter was the favourite article of illicit traffic. There was in most countries, therefore, a substantial degree of justice in the contention of urban Socialists, that the country districts were treasonably enriching the rural diet at the expense of the urban working classes.

This situation did not terminate with the War. Even after seven years of peace in many countries of Europe, of which perhaps Russia is the most notable illustration, the diet of the rural classes is richer in animal products than it was before the War; the diet of the urban classes is poorer. With deterioration of the buying power of urban workers since the War, this has had the result of increasing rural consumption of animal products; the town diet has become more vegetarian.

III. LIQUIDATION OF WAR CONDITIONS

The abnormalities in the production, marketing and consumption of foodstuffs during the reconstruction period were due to a

variety of factors. Manufacturers who enlarged plants, making goods usable during peace as well as war, but subject to particular wastage during war, foresaw the dangers of such war expansion as would represent over-extension after the War, and in a variety of ways sought to evade the losses of post-War liquidations. The world still has unliquidated War expansions in flour-milling, sugar-refining, milk-condensing, food-canning, copper-smelting and leather-making, to mention only a few illustrations. Agriculture was generally urged to expand, with the result (naturally with exceptions in different countries and to different extents in different regions) that at the close of the War agriculture was over-extended by comparison with the pre-War position, and particularly with respect to the purchasing power of the world.

Over Europe the emphasis on the extension of primary foodstuffs, the reduction in the herds of domesticated animals, the scarcity of fertilisers and the deterioration of farm implements, together with the pressure to produce food stuffs to the maximum extent, led to the ploughing up of grass lands, to be used for the raising of primary foodstuffs. Agricultural authorities foresaw clearly the inevitable future repercussion of this movement. The policy of turning pasture to tillage reached its highest expression in the United Kingdom, and the deplorable post-War results are most clearly seen there, though observed to a lesser extent on the Continent.

Since the War, the agriculture of the United Kingdom has experienced a crisis as severe as that which characterised the period of agitation over the Corn Laws. British farmers have found that the enlarged area of tillage cannot be remuneratively cultivated; operative costs have been high, and the country has been deluged by agricultural produce flowing from overseas countries also suffering from War-expansion of agriculture. Throughout Europe, one of the results of agrarian distress, proceeding more or less from War over-expansion in the different countries, has been the revival of agrarian protectionist movements. This is not to be interpreted to suggest that Europe contemplates de-industrialisation in favour of agriculture; it represents merely a grasping at what seems to be an instrument of first aid. In part, it is a beggar-your-neighbour movement.

Cereals.—Europe may be expected slowly to recover her pre-War output of primary and secondary foodstuffs. This has been practically attained for cereals, and will soon be accomplished for sugar. In Russia, the recovery of agriculture has been most delayed, and the period of reconstruction may be notably prolonged. The recovery of agriculture is more rapid in western Europe than in the central countries between the Baltic and the Adriatic seas, on account of the higher natural position of agriculture, better railways, sounder fiscal policies and superior governments. Since the World War, western Europe has been compelled to secure a larger proportion of her imports of cereals from overseas, so that overseas countries have temporarily replaced Russia and the Danubian and Balkan States.

Sooner or later (probably sooner for the Danubian and Balkan States and later for Russia), these States will return to their natural position as preferred primary sources of supply of cereals for western Europe—for the one main reason, in addition to others, that these exporting countries must pay for necessary manufactured goods from western Europe with exports of cereals. During this time of readjustment the over-extended surplus-producing countries of North America, South America and Australasia face a gradual reduction in the scale of this agriculture, in so far as they may not be able to find new markets in the expanding population of the world.

The average acreage of the staple cereals in the United States during the years 1918, 1919 and 1920, was 230,000,000; the acreage in 1924 was 218,000,000. But for wheat the extent of liquidation represents a reduction of something near 20,000,000 acres. In the case of Canada, Argentina and Australia, there has been no such decline in wheat-growing. Indeed, the combined acreage in these three countries suggests continued expansion rather than contraction. When the definitive restoration of wheat-growing occurs in Eastern Europe, wheat-growers in Canada, Argentina and Australia will face liquidation with the development of a diversified agriculture, as has happened in the United States, or new markets for wheat must be acquired. The outcome will depend, among other things, upon development in the standard of living in the world, the penetration of industrialisation into Russia and Asia, and the competition between wheat, rice, millet and maize.

Sugar.—A good illustration of the disturbance in a staple foodstuff as a result of war is to be observed in sugar. Before the

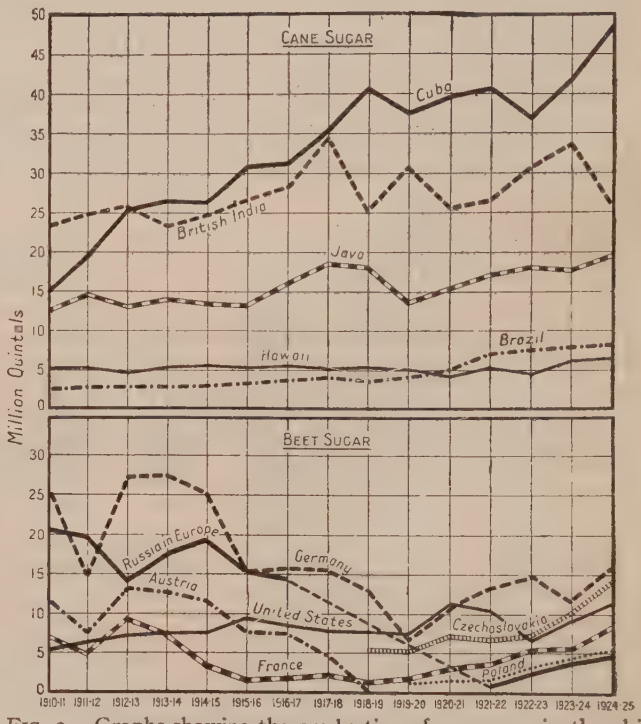


FIG. 2.—Graphs showing the production of raw sugar in the chief sugar-producing countries, for each year from 1910–1 to 1924–5.

War, beet sugar and cane sugar competed internationally. Beet sugar was grown little outside Europe and Russia; cane sugar was grown in practically all tropical countries, and could readily be expanded. The production of beet sugar was greatly reduced during the War. The countries of western Europe replaced the beet sugar they had previously purchased from central and eastern Europe in part with cane sugar from overseas. A widespread expansion of sugar-cane growing followed. In some of the sugar-cane countries the planting is annual; in others the cane is cut, without replanting, over a number of years. When a new stand of sugar cane has been set and provided with transportation and refinery, this culture tends to persist, since sugar-growing is a form of agriculture associated with large capital.

In 1909–13 the world crop of beet sugar was about 8,000,000 short tons and of cane sugar about 10,000,000 short tons. In 1920–1 the world crop of cane sugar was over 13,000,000 short tons and of beet sugar only 5,000,000 short tons. Since then the production of cane sugar has continued to increase; at the same time, the beet-sugar areas are being restored. The sugar crop of the present season is over 17,000,000 short tons of cane sugar and over 9,000,000 short tons of beet sugar. When beet-sugar cultivation in Europe and Russia has been fully restored, unless there is some diminution in the output of cane sugar, the whole crop will be something like 18,000,000 short tons of cane sugar and 10,000,000 short tons of beet sugar. Can the world absorb this sugar? Certainly—at a price. Whether, with the restoration of the beet-sugar yields, the expanded cane-sugar acreage can be maintained or must be reduced, remains to be seen. In the meantime, the result for the world is a large supply of sugar at a beneficent price. Recent complicating developments are governmental restriction of cane-sugar production in Cuba and governmental bounty on beet-sugar production in Great Britain.

Other illustrations of agricultural expansions that became

transformed into problems of liquidation are cattle-raising in the United States and Argentina and sheep-raising in Australasia. The expansion in cattle-raising in the United States was relative rather than absolute; none the less, the difficulties of American cattlemen have been due in good part to an increase in export of beef products from something like 150,000,000 lb. per annum just before the War to over half a billion lb. in 1918–9, with subsequent recession to the pre-War level. This restriction of outlet, together with other factors, has necessitated a heavy liquidation. In the case of Argentina, the volume of the War market for chilled, frozen and packed meats resulted in over-expansion of the industry, followed by a post-War crisis so severe as to have prompted governmental action in price-fixing and subsidy. This also holds true of animal husbandry in Australasia, which, despite the distance, was led to over-expansion as a result of heavy demand for chilled and frozen meats during the War. In Australia also, the crisis of liquidation found expression in the use of public funds for the purpose of stabilising prices and minimising losses.

There is scarcely a country in the world in which some particular form of agricultural production was not over-stimulated during the War. Hence, post-War problems of liquidation of varying extent and severity have everywhere arisen—writing-off of inventories and absorption of losses, liquidations imperative for the safe conduct of future business. Students of world agriculture may agree that producers exploited the belligerent countries during the War. They will also probably agree, a decade from now, that the gains of such profiteering have already been lost, or more than lost, to the agriculturists as a whole, if not to particular individuals. And high food prices imposed on consumers between 1915 and 1920 have since been requited by dumping foodstuffs at less than the cost of production.

In particular countries, certain crops did not share in the World War expansion but have nevertheless suffered in the post-War liquidation. Of these, illustrations are wheat-growing in Australia and sugar-raising in Java. Australia was too far from Europe to have much call on ocean tonnage for shipment of wheat, and wheat accumulated in Australia during the War. These accumulations were exposed to heavy losses; grain is marketed in Australia in bags, storage capacity is limited, and large amounts of grain were exposed to vermin and the elements. Australia had no opportunity remuneratively to unload wheat on the world before the collapse of the wheat price in 1920. The situation thus created was one of unusual gravity for the small population of the Commonwealth, and has found expression in more or less continuous pooling and price regulation. In the case of Java, western European needs for sugar could be covered with sugar purchased on money borrowed from the United States and with a much shorter ocean haul. Thus the sugar industry of Java was stagnant during the War, and although it enjoyed a short period of high prosperity just after the War, this was soon terminated by the collapse of sugar prices.

The history of sugar prices during and since the War furnishes a good illustration of the contrast between correct statistics and incorrect opinions. Following decontrol of sugar, with the failure of purchase of the Cuban crop for the season 1919–20, the public, including sugar-producers, American importers, refiners, wholesalers, fruit-packers and candy-makers, assumed that the supplies available to the United States were short and inadequate to her needs, that demand for sugar in that country would prove to be quite inelastic, that sugar-hungry Europe would expand her importations, and that the rest of the world contained no visible or invisible stocks of moment. On the basis of these assumptions, a veritable trade hysteria resulted, culminating finally in a sugar price of some 23 cents. These stated assumptions were all more or less unfounded, and as the facts became revealed the price of sugar declined precipitously. The Cuban supply proved larger than anticipated; consumers' demand in the United States was found to be relatively elastic; sugar-hungry Europe did not demand more sugar at high prices. Instead of a shortage of sugar stocks throughout the world, sugar poured in from every conceivable direction. Hoarding was replaced by dumping. The huge gains in the spectacular rise of price (some realised, but mostly paper profits) were replaced by huge real losses that fell on producers, refiners and traders. Since sugar-beet growing in Europe is a long-view proposition, the recovery of this branch of agriculture was aided little by the price rise and has been retarded little by the price decline.

IV. CONSIDERATIONS BEARING ON MOVEMENT OF FOODSTUFFS

Despite the fact that the food supply is classed as the prime necessity of society, demand for foodstuffs is somewhat elastic and there is considerable variability contingent on adaptations and substitutions provoked by price relations. To a considerable extent, also, the distribution of foodstuffs is contingent on fluidity of finance; abundance or scarcity of credits has exerted considerable influence on the distribution of staples since the War. Credits from the United States, as well as the foreign investments of American nationals, tourist expenditures and immigrant remittances, have directly and indirectly facilitated the export of surplus agricultural produce from the United States, to some extent to the detriment of corresponding exports from Canada, Australia and Argentina. Public money has been used in Argentina and Australia in furtherance of the marketing of agricultural produce, and this, we may infer, to the injury of exportable produce from the United States. If surplus-producing countries employ public funds in furtherance of exports, the international movement of foodstuffs will be different from what would be expected if purely competitive relations obtain. It is difficult in surplus-producing countries to resist the political influence of agrarian blocs in their insistence on some form of relief through the use of public funds.

One post-War difficulty of agriculture, more or less general the world over, that finds expression in the food supply, has been the increased cost of labour. Without entering into the reasons for this advance in wages, it is sufficient to state that in most countries, both importing and exporting, the level of wages has risen substantially above the pre-War plane. To a considerable extent also labour costs have risen, since in many directions the efficiency of labour has not increased proportionately to the increase in the wage scale.

For many countries the position has been accentuated by the trend of movement of workers from country to city. Enlargement of wages of farm workers has resulted in increase in cost of production of farm produce. Since increase in wages of industrial workers has, at least to some extent, and in many directions, resulted in notable elevation in prices of industrial goods, this has had the effect of lowering the purchasing power of agricultural products in terms of goods and services. The measure for each year since the War in the different producing countries of the world of the purchasing power of staple foodstuffs—for example: wheat, corn, sugar, cattle, hogs, wool and coffee—amply confirms the broad fact. Only under special circumstances has the purchasing power of agricultural produce been raised relatively above the pre-War level. There is considerable readjustment in this direction to be expected the world over, since if such readjustment does not occur, this would imply a lower standard of living on the farm than in the town. This readjustment may be expected to include, from the side of agriculture, the elimination of submarginal areas and increase in efficiency of cultivation and management over the remainder; and, on the part of industry, increase in the efficiency of labour and improvement in mechanical operations, with resulting lowering of production costs.

A survey of the total commerce of the world in successive years since the War shows a relative overproduction of agricultural produce and a relative underproduction of industrial goods, though the margin is being gradually reduced. This has had the effect of lowering the purchasing power of agricultural produce in terms of industrial goods, which was relatively low at the beginning of the century and notably higher just before the War. After the War this relationship again became comparable to that existing at the beginning of the century.

The food supply of the world is modified by conditions of transportation, since both fluidity and cost of movement have influence on distribution and marketing. Transportation has been a limiting factor in the export of grains and oil seeds from Russia since the War. The railways of western Europe have been largely restored to their pre-War efficiency, except in the Danubian and Balkan States, whose crippled facilities still impose limitations on the movement of farm produce. The effective service of railways has been one of the outstanding features of the post-War situation in the United States and Canada. Ocean shipping rates have been low since the War, and this has facilitated movement to importing countries of surplus supplies from exporting countries the world over.

V. PROSPECTS OF THE NEAR FUTURE

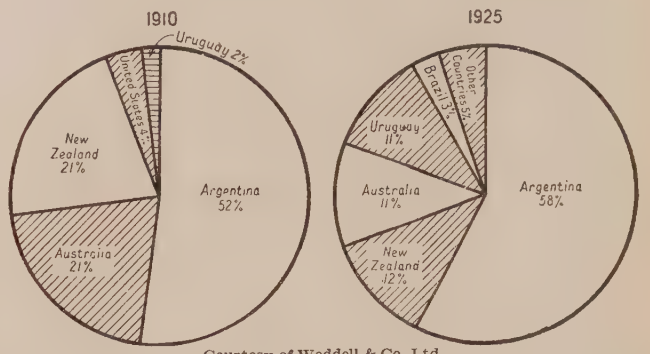
Changes in the food supply of the world will depend to some extent upon developments in industry as well as in agriculture. During the period 1915 to 1925 numerous backward countries of the world increased their manufacturing facilities and thus rendered themselves less dependent on European goods. If these new industries maintain themselves, the retardation of recovery of European industries (whose output as a whole is still considerably below normal) will be prolonged, unless new markets and a higher standard of living in the world result in a general expansion of demand for manufactured goods. A point of particular importance is Russia. If the present low standard of living is continued in Russia, this will have an indirect effect on the food supply and manufacturing activity of Europe. The degree to which goods from manufacturing industries in India, China and the British dominions are able to supplant the products of corresponding industries in the United Kingdom, is another point of importance.

It is probable that the food supply of the world during the next 10 years (1926–36) will be relatively below the pre-War level and more vegetarian. It would be an error to expect the world to direct the first energies solely toward the restoration of the pre-War food supply, leaving the restoration of the standard of living in the matter of other goods and services to be deferred. Various groups of demands will compete in their claims on income, and the demand for food will not be able to secure a proportion of the income so large as to insure in the near future the restoration of the pre-War diet. The best that can be hoped for, so far as Europe is concerned, is to secure a diet competent in the nutritional sense; but a cheaper diet, less diversified, and less luxurious than was the case before the War. The agriculture of the surplus-producing countries will necessarily have to adapt itself to these developments.

We are accustomed in world trade to view manufactures from the standpoint of the international division of labour. If the food supply of the world is to be correctly appraised, it must be considered from the same standpoint. The world faces during the next decade the necessity of establishing a new equilibrium in the demand and supply of foodstuffs, representing a new equation between effective demand and remuneratively produced supply, a revised international distribution of labour in agriculture and manufacture, distorted, however, to an unforeseeable extent, by artificial controls, bounties and protective tariffs.

Since the War, Europe has been financing the importation of foodstuffs largely with borrowed money, credits, tourist expenditures and immigrant remittances. Before the War, Russia was a borrowing country; but, with Russia excluded, Europe was a lending continent. Outside of the United Kingdom, which remains a lending country, Europe, as a result of the War, has become a borrowing continent. With each year since the War, European governments, industries and even agricultures contract new loans at relatively high interest rates. Disregarding entirely European payments of War debts to the United States, the service charges on post-War European borrowings will represent a growing burden on the continent, a burden certain to be reflected in international trade, since the difficulties of transfers of international payments find their ultimate expression in the commerce of goods and services.

Ultimately, Europe must pay her international obligations with goods and services; but this is not to be expected during the next five or 10 years, during which time we expect adjustments to occur largely through the invisible items in the international accounts. But the time approaches when Europe must raise a larger proportion of her food supply or pay for a larger proportion of it with goods and services. The necessary adjustments contingent on these developments form part of the new equilibrium between demand and supply of foodstuffs toward which the world is inevitably trending. (A. E. T.)



Courtesy of Weddell & Co. Ltd.

FIG. 3.—World exports of refrigerated Beef, Mutton and Lamb. The increasing importance of South America in the supply of meat products is clearly seen by these diagrams, in which exports for 1910 and 1925 from each country are shown as a percentage of total world exports. (See Table.) The chief importing country is Great Britain, which takes some 60% of the world's available supply.

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The accompanying diagrams and tables illustrate the principal sources of food supplies, except wheat, maize, oats, rye and barley, which are dealt with in the article on GRAIN PRODUCTION AND TRADE, during the period 1910 to 1925.

Sugar.—The production of both cane and beet sugar greatly increased after 1910. The following table gives the exports of sugar in *short tons* from the chief exporting countries for the average of the period 1909–13 and for 1922.

Country	Average 1909–13	1922
Cane Sugar		
Cuba	2,009,899	5,581,376
Dutch East Indies	1,412,555	1,582,691
Mauritius	226,255	322,692
Brazil	38,284	277,903
Peru	146,736	302,447
Philippine Islands	179,432	399,112
Dominican Republic	92,351	189,195
Beet Sugar		
Germany	873,161	13,915
Austria-Hungary	848,830	..
Czechoslovakia	..	350,366
Netherlands	200,490	219,477
Russia	293,514	..
Poland	..	65,344
Belgium	154,476	177,594

The production of sugar in the chief producing countries for each year from 1910–1 to 1924–5 is shown in the chart below, based on figures given in *The International Year-book of Agricultural Statistics*. The total world production in the pre-War period and in 1924–5 was:

Average	Beet Sugar quintals	Cane Sugar quintals
1909–10 to 1913–4	83,990,000	95,668,000
1924–5	81,690,000	150,845,000

Meat Products.—The table below shows world exports of refrigerated beef, mutton and lamb for 1910, 1913, 1917 and for each year from 1920 to 1925. Of particular interest is the great increase in exports owing to war demands, the growing importance of Argentina,

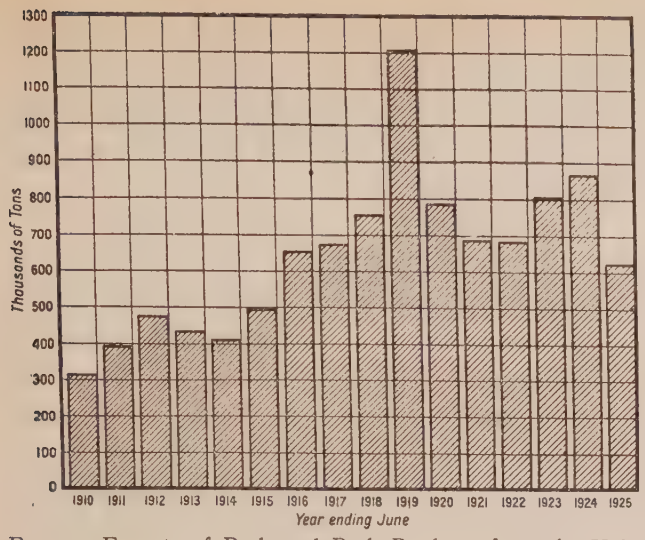

FIG. 4.—Exports of Pork and Pork Products from the United States. The United States is the source of over two-thirds of the world supply of pork products. This diagram shows the export of fresh, canned and pickled pork, cured hams and shoulders, bacon, lard and neutral lard for each year from 1909–10 to 1924–5. The chief importing countries are the United Kingdom and Germany.

Brazil and Uruguay, and the decline in exports from the United States. Exports from the chief exporting countries are shown in fig. 3 as a percentage of the total. The importance of the United States as a source of pork products is clearly shown in fig. 4.

FOOT AND MOUTH DISEASE: *see* VETERINARY SCIENCE.

FOOTBALL, ASSOCIATION (*see* 10.621).—The Football Assn. of England, having helped materially in the development of the game in Europe, made a departure in 1910 when, at the invitation of the South African Assn., a team of amateurs and professionals was sent in May to that Dominion. A successful tour carried forward the work of the Corinthians, who visited South Africa in 1897, 1903 and 1907. In 1920 another mixed team was dispatched to Cape Town. After years of preparation the Commonwealth Football Assn. of Australia arranged with the English Football Assn. to send out in 1925 a party of players, who were mostly professionals. The results of these excursions may be tabulated thus:—

		Matches	Won	Goals For	Goals Against
1910.	South Africa . .	23	23	143	16
1920.	South Africa . .	14	14	64	10
1925.	Australia . .	25	25	139	13

Such enterprises were a continuation of the policy of the Football Assn. to popularise the game, the Dominion organisations paying the expenses and retaining all revenue. In 1917 the parent body in England presented a shield to Japan to foster the game in the schools of that country, and in the years immediately following the World War it gave challenge cups for competition to South Africa, Australia, New Zealand and Canada. To stimulate the game and to encourage English amateurism, the Assn. also entered teams for the Assn. football tournaments at the Olympic Games of 1908, 1912 and 1920, but withdrew from participation after the Antwerp Olympiad, as the definition of an amateur in England and the practice in some other competing countries were not in unison.

In 1910 the Football Assn. took another important step, as in April the rule regulating the maximum wages which could be paid to professionals by English clubs was removed. Such financial matters were deputed to the executives of the leagues, which thus became the controllers of all payments to professionals. The Football Assn. celebrated the jubilee of its existence in Oct. 1913 by a banquet, and to mark the occasion endowed a benevolent fund with £5,000.

During the season of 1913–4 a schism which had afflicted the game was brought to an end. As amateurs declined to co-operate in the government of all football, including professional clubs, a rupture had occurred in 1907–8. The Amateur Football Assn. was established and carried on a separate organisation until Feb. 2 1914, when representatives of the older universities and the Corinthians met the Football Assn. in conference and settled the dispute. The Amateur Football Assn. became affiliated to the Football Assn. under the same conditions as the Army Football Assn. and other auxiliary bodies. A momentous season was closed, King George V. attending the final match for the Assn. Cup at the Crystal Palace, London, on April 25 1914 and presenting the trophy to Burnley, who had beaten Liverpool.

Effect of the War.—In spite of the outbreak of the World War, the season of 1914–5 was carried through by league clubs employing professionals and therefore having legal contracts and commitments, but all the national associations cancelled their international matches, and in the spring of 1915 the Football Assn. took powers to suspend professionalism and all its cup competitions, although local tournaments for amateurs, for munition workers and soldiers on leave, were arranged by the

Exports, in Tons, of Refrigerated Beef, Mutton and Lamb, 1910 to 1925

Year	Australia	New Zealand	Canada	South Africa	Argentine	Uruguay	Brazil	U.S.A.	Other Countries	Total
1910 . .	134,300	132,200	nil	nil	328,800	9,900	nil	23,900	nil	629,100
1913 . .	178,500	122,400	nil	nil	412,200	30,100	nil	100	21,600	764,900
1917 . .	116,500	120,100	55,000	21,100	448,700	72,300	66,400	97,900	37,500	1,035,500
1920 . .	109,400	228,200	6,100	5,600	480,800	110,000	63,600	42,000	31,000	1,076,700
1921 . .	95,200	212,200	4,300	1,000	456,400	82,700	61,000	12,500	45,000	970,300
1922 . .	134,800	172,600	4,200	300	493,200	85,200	32,900	3,300	22,100	948,600
1923 . .	114,200	149,200	4,000	400	683,800	115,200	39,500	4,100	30,400	1,140,800
1924 . .	95,900	156,300	3,200	3,800	831,300	141,500	63,800	4,000	28,300	1,328,100
1925 . .	148,800	165,300	4,700	9,700	775,900	147,400	44,800	700	42,600	1,339,900

Dairy Produce.—The exportable surplus of butter, cheese and condensed milk for the average pre-War year and 1921 and 1924 is shown below:—

Exports of Dairy Produce
(In metric tons of 2,204 lb.)

Country	Average 1909–13	1921	1924
Butter			
Denmark . . .	88,692	92,059	123,193
New Zealand . .	17,582	45,644	64,491
Netherlands . .	34,080	20,198	34,732
Russia . . .	68,172	..	22,436[1]
Australia . . .	35,175	41,921	29,683
Argentina . . .	3,145	25,812	29,682
Hungary . . .	3,472[2]	..	23,232
Canada . . .	1,720	4,142	10,135
Cheese			
New Zealand . .	25,202	69,537	81,003
Netherlands . .	57,779	52,280	77,271
Canada . . .	75,867	62,224	61,707
Switzerland . .	31,912	4,806	19,856
Italy	27,470	7,559	33,616
Condensed Milk			
Netherlands[3] . .	..	77,225	113,549
United States . .	7,349	131,416	93,446
Denmark[4] . . .	2,143	17,020	32,696
Switzerland[4] . .	36,532	21,239	26,411
Canada . . .	2,075	17,020	20,448

[1] Through European boundaries.
[2] Surplus mainly absorbed in former Austrian Empire.
[3] Average 1910–3.
[4] Including sterilised milk.

Football League. The Football Assn. imposed rigid conditions, and monetary inducements for men to play football were strictly forbidden. The Football Assn. and the league did much to assist the Red Cross Society, to provide comforts for the troops, and to help refugees in England. A football national war fund was founded in Dec. 1917 to relieve those connected with the game who had been stricken by the misfortunes of war, either on active service or in munition work.

Post-War Progress.—In the spring of 1919 the work of reorganisation was commenced and victory international matches were played. The season was lengthened by the addition of the last Saturday in Aug. in one year and the first Saturday in May of the year following, and a boom in the game was experienced in 1919–20. King George V. attended a league match for the first time at the Manchester City ground on March 27 1920 and witnessed the final match for the Assn. Cup at Chelsea, on April 23 1921, presenting the trophy to Tottenham Hotspur. In the next month the Football Assn. entered into an agreement with the British Empire Exhibition to play the final tie for a term of years in the stadium at Wembley.

The cup competition of 1922–3 is memorable for the first entry of the Corinthians and the first final played at Wembley. This match between Bolton Wanderers, who won the cup, and West Ham United attracted at least 150,000 people, the receipts being £27,776. The Football Assn. has also a cup which is restricted to amateur teams, and each year plays a charity shield match, which is quite apart from the £20,000 per annum that the clubs contribute to local charities. Receipts from the practice matches in Aug. are earmarked for this purpose by the Football Association.

Changes in Laws.—The International Football Assn. Board, which was established in June 1886 by the Football Assn., the Scottish Football Assn., the Football Assn. of Wales and the Irish Football Assn., have continuously revised the laws of the game at their annual meeting in June of each year. Gradually, but surely, forwards have been given more scope. In 1907 the board decided that a player is not out of play "when he himself is within his own half of the field of play at the moment the ball is played, or thrown in from touch by any player of the same side." At the meeting in 1920 it was resolved that "no one shall be offside when a throw-in is taken." In 1925 the board relaxed the fundamental law relating to off-side so that a player would be on-side if only two opponents were nearer their own goal than himself when the ball was last played by one of his own side. The board determined, in 1924, that a goal may be scored from a corner kick, and a year later the player, throwing-in from touch, was ordered to stand with both feet on the ground outside the touch line and facing the field of play, so as to throw the ball in over his head with both hands in any direction.

Football Leagues.—The Football League, founded by 12 clubs in 1888, expanded greatly after the World War. When the league considered the revival of the two competitions, on March 10 1919, the clubs in divisions I. and II. were increased to 22 in each section. On May 31 1920 the Southern League was, at its own request, absorbed by the Football League and became division III. in associate membership but without the right to vote at the annual general meetings of the league. On the same day a projected northern group, a part of division III., was sanctioned, but its formation was deferred until March 8 1921, so as to give clubs the opportunity to strengthen their playing power and secure financial stability. Thus the league had, for the season 1921–2, not only divisions I. and II., but both sections of division III., north and south each with 22 clubs. Thus the original membership of 12 clubs had increased to 88 clubs—a powerful alliance with authority to devise rules for their domestic affairs, although these must be in conformity with the rules and by-laws of the Football Assn. and sanctioned by the supreme body.

A Welsh National League, with northern and southern groups, was inaugurated in 1921–2. The Scottish League, which remained active during the War, had a moribund second division, but in 1923–4 this was galvanised into life by the adoption of the system of promotion and relegation. The first division was therefore no longer a closed corporation. The invigorated second division was supplemented by a third division, so that the clubs of England, Scotland and Wales became classified into groups for the first time. The Irish Football Assn. had not the same opportunity, being limited to Northern Ireland. The Irish Free State founded a governing association body and created its own cup and league competitions.

International Football Associations

La Fédération Internationale de Football Association, which is composed solely of the governing body of each country playing the game, was formed at Paris on May 21 1904, with the object of developing and controlling association international football. It grew so rapidly that, in 1910, the members included Austria, Belgium, Denmark, England, Finland, France, Germany, Hungary, Italy, Luxemburg, Sweden and Switzerland. During 1911, Ireland, Wales and Scotland joined, and the secretary's report stated that all European countries with a governing body were members except Rumania. In 1912, with the Argentine Football Assn., and the pan-Russian Football Assn. included, the Federation was recognised officially by the International Olympic Committee, although Spain, Portugal and the Balkan states were not properly organised. In this year, English became the official language for minutes and correspondence, and it was decided to adhere to the laws of the game as passed by the International Board of Great Britain. The Federation was admitted to this board with the right to send two delegates. During 1913, Canada and Chile were affiliated, and when the World War broke out the Federation had 26 members, including the United States.

The Federation was dormant during hostilities, and when it was restored to activity the British nations withdrew from membership, as they declined to sit with the representatives of those countries which had been their enemies. In 1924 they rejoined on their own conditions, which were that the articles of the Federation should not affect the inter-relations of the various parts of the British Isles and their own autonomy. By Aug. 26 1925 the Federation had affiliated the governing bodies of the following: Argentina, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, Czechoslovakia, Denmark, Dutch East Indies, Ecuador, Egypt, England, Estonia, Finland, France, Germany, Hungary, Ireland, Irish Free State, Italy, Latvia, Lithuania, Luxemburg, Netherlands, Norway, Paraguay, Peru, Poland, Portugal, Rumania, Russia, Scotland, Siam, South Africa, Spain, Sweden, Switzerland, Turkey, Uruguay, United States, Wales and Yugoslavia, with headquarters at Amsterdam. At a congress held in Prague in May 1925 the following resolution was passed: "The congress of the Fédération Internationale de Football Assn. declares that it considers the Fédération Internationale de Football Assn. the highest authority on all football matters, and that it cannot accept the interference or guidance of anybody else in such matters." At a conference between representatives of the four associations of the British Isles at Liverpool on Sept. 5 1925 it was decided that the Fédération be informed that if this resolution were confirmed the conference would have no alternative but to advise the associations of the United Kingdom to withdraw from the Fédération. In Nov. the president and secretary of the Fédération officially explained that by Article 34 of its Constitution the authority and competence of the International Board were recognised and that the resolution applied only to "some powers strangers to football."

It is clear that association football has become a world game. In 1906 South Africa visited South America, and in 1923 and 1924 Chinese University students and a Canadian combination went to Australia. At the Olympiad of 1908 in London and of 1912 in Stockholm, England won the international tournament. In 1920, at Antwerp, England was defeated and Belgium won, while in 1924, at Paris, the representatives of Uruguay were the victors. It has been difficult to organise comprehensive government in countries of large area, but South Africa founded an association in 1892, Canada in 1912, the United States in 1913 and the Commonwealth of Australia in 1921.

In the United States there has been much activity to make this code pre-eminent as the fall and winter game. During 1920 an American-born team from St. Louis visited Scandinavia, while a Scottish set of players, under the auspices of the Third Lanark Club of Glasgow, toured in Canada and the United States in 1920–1. The sequel in the United States was the formation of the American Soccer League with a higher standard of play than had previously obtained in that country.

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FOOTBALL, RUGBY (*see* 10.618).—The history of the game of Rugby since 1910, not only in Great Britain and Ireland, but in the British Dominions overseas and also in France, has been one of steady development. Rugby is the national game in New Zealand and in South Africa, and to a less extent in Australia, while in a somewhat different way it is played in America. In France it has obtained the official recognition of the government, so that it is now played over the entire country. France possesses more clubs and more players than any other nation. In England many public schools, which have for years been devoted to the Assn. game, now play Rugby. Since the World War there has been a marked increase in the number of Rugby clubs in England, and the game is now played in many districts where at one time its very name was almost unknown. In the northern counties, which suffered so severely from the inroads of professionalism, Rugby is rapidly regaining its old popularity and prestige, and for some years now they have been able to provide valuable members of the English team. The number of old boy clubs, particularly in London, has been greatly increased.

I. THE BRITISH EMPIRE AND FRANCE

The year 1910 was an *annus mirabilis* for England, since it saw the opening of the national ground at Twickenham, Middlesex, with a brilliant victory over Wales. The revival of English Rugby may fairly be said to date from this year, for England won the championship for the first time since 1892, and from then till 1925 has won it outright on five occasions, besides dividing the honours twice. The visit of the All Blacks in 1905 had demonstrated the weakness of the game in England, and for some seasons players had been endeavouring to improve both their tactics and their physical condition.

Much of the credit must go to A. D. Stoop, who persevered amid much discouragement in developing the open style of play, and who without doubt had his reward. He gathered round him a band of brilliant halves and three-quarters, and after a few years had the satisfaction of seeing his principles generally adopted and England gaining victory after victory. Next in importance to these tactics was the improvement in English forward play. For many years now the English selectors have aimed at discovering an all-round type of forward, clever with hands and feet and able to hold his own in the rough and tumble of international matches. Forwards are no longer content to be mere pushing machines, their duties do not nowadays finish with the breaking up of the scrummage, rather do they then begin. From 1910 to the end of 1925 England won 9 out of 11 matches with Scotland; 9 out of 11 with Ireland, the other 2 being drawn; 8 out of 11 with Wales; and 10 out of 11 with France. That is to say, out of 44 matches England won 36, drew 3 and lost 5, a record probably without parallel.

Scottish Rugby.—In Scotland Rugby continues to flourish, new clubs are springing up and old ones are showing a decided increase in power and in the standard of their play. The national side has achieved a very fair record since the World War, though it had to wait a long time for its first victory over England and for its first actual championship triumph since 1907. During the last few seasons Scotland has had to come south, especially to Oxford, for her three-quarters. Scottish forwards are as formidable as ever, the halves are sound, and, unlike England, Scotland has been fortunate in the possession of a succession of really first-class full-backs. The chief blots on the Scottish escutcheon since the World War are the three defeats by France, one of which was inflicted at Inverleith, where in 1921 France won by a try to nil. There are signs that Scottish Rugby is now at the beginning of a new era of prosperity.

Irish Rugby.—Irish Rugby naturally suffered severely during the World War, and also after it, owing to the disturbed state of the country generally. Indeed the wonder is, not that Irish teams have been defeated, but that they have been able to exist at all. But now old-established clubs are regaining their normal strength, and new ones are making good. During the last few seasons several international matches have been won, and the prospects for the future are bright. A number of young and promising players have been discovered, and Irish back play is developing well. The forwards too are recovering their old dash and are again a force to be reckoned with.

Welsh Rugby.—In 1910 Wales lost a sensational match to England, the first English victory since 1898, but they were still a formidable side, and in 1911 secured the international championship once more. Gradually Welsh Rugby began to lose its force, and triumph no longer automatically followed triumph. The World War dealt Welsh Rugby a very heavy blow, and although Wales gained a brilliant victory over England at Swansea in 1920, and carried off the championship in 1922, the Welsh game has not been up to its former standard. The curious point is that Welsh club football is practically as good as ever, or at any rate is still superior to English club Rugby, and Saxon victories over the great Welsh organisations are still few and far between. Yet the national side is no longer the force it once was, and the natural conclusion is that something is wrong with the principle of selection. Defections to the professional game now and again deprive Wales of potential international players, but not to an extent sufficient to explain the decadence of the Welsh fifteen.

French Rugby.—In France the game prospers amazingly. Reference has already been made to the three victories gained over Scotland. Ireland has also been beaten three times, but England and Wales have so far escaped defeat. England, it is true, had a very narrow escape in 1922, when the match at Twickenham ended in a draw, of which it is only fair to say that France had very much the better and were unlucky not to win. Tours in France are very popular nowadays with British clubs and they do an immense amount of good in more ways than one. French Rugby has suffered a good deal from the indiscriminate praise lavished on it in the early days, when it really needed constructive criticism, but the French authorities themselves were never misled, and always recognised the necessity of interchanging visits with British clubs and also of strict and adequate refereeing.

South African Rugby.—Since 1910 only two teams from the Colonies have visited this country. In 1912 a South African side, under W. A. Millar's captaincy, paid a visit which was remarkably successful. Of the 27 matches played, 24 were won and only three lost. A record was set up by their defeat of all the five countries, a feat no other touring side has rivalled. The matches lost were with Newport, London and Swansea. The strength of the team lay in the forwards, who were exceptionally powerful and fast, but the backs, if not as effective as those of the 1906 contingent, were by no means negligible.

In 1910 Dr. T. Smith, an Irish international, captained a British side in South Africa. It met with moderate success, winning 13 matches out of 24, and losing eight. Of the three test matches one was won and two were lost. About 12 international players took part, but the team was, of course, very far from representative of the full strength of Great Britain and Ireland. R. Cove-Smith led the fifth British team to tour in South Africa, but with rather unsatisfactory results. Of the 21 matches played nine were won and nine lost. Three of the four test matches ended in defeat, the other being drawn.

Persistent ill-luck followed the team in the matter of casualties, and the side, none too powerful to start with, was hardly ever at full strength. Indeed, toward the end it was difficult to find fifteen men sound enough to play. Most of the defeats were by comparatively moderate margins, but there is little doubt that the team was not strong enough for the task it undertook.

New Zealand Rugby.—In Sept. 1924 the second New Zealand team, captained by C. G. Porter, began a wonderfully successful tour. They actually won all their 28 matches in England, Ireland and Wales, no fixtures having been arranged in Scotland. Their triumphs were due to their splendid physical condition, and to their marvellous and intensive combination. Nothing finer has ever been seen in Rugby than the way in which the men supported one another; there was always somebody at hand to carry on and drive home an attack. They were naturally hardly at home in their first few matches, and they had a very narrow escape from defeat by Newport. But they steadily improved and in due course developed into a very fine side indeed, though in the opinion of many they were never quite the equals of Gallaher's men.

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II. THE GAME IN THE UNITED STATES

The rules that govern American Rugby football were drastically changed in the winter of 1906 by a combined Rules Committee, six of whom represented the newly formed National Collegiate Athletic Assn., the other six being members of the old Rules Committee. This amalgamated committee was the outgrowth of a conference of representatives of a large number of colleges and universities which, because of the large and increasing number of deaths and serious injuries, was called for the purpose of doing away with football, or of radically changing the rules. This conference was a direct result of the football season of 1905 which had been marked by 21 deaths and by many serious injuries.

Changes in the Rules.—Vital changes in the rules were made at the meeting of this combined committee, these being on the following lines: (1) Doing away with heavy mass play, (*a*) by making it impossible for tackles and guards to be used as battering rams to precede the runner with the ball; (*b*) by doing away with "chain interference" and (*c*) by abolishing pushing and pulling of the runner with the ball. (2) Encouraging attempts to advance by throwing the ball forward, provided it was thrown across the line of scrimmage not nearer than five yards to the point where it was put in play. (This has since been changed to allow the ball to be thrown anywhere over the line of scrimmage.) (3) Stimulating kicking by making all players on the kicking side, except the centre, eligible to receive the ball as soon as it touched the ground. (This rule has since been rescinded.) (4) Encouraging the offensive team to take chances in free running, forward passing and on side kicking, by compelling the offensive team to make 10 yards instead of five in three trials. (5) Shortening the playing period of each half from 35 min. to 30 min., thereby reducing the strain. In 1912, each half was divided into two 15-min. periods, with a 2-min. interval to permit time to change goals. The above changes proved to be effective in doing away with serious injuries; also in opening up the game. Since then, comparatively few changes of importance have been made in the rules.

One of the most important changes occurred when the forward pass was allowed to be thrown anywhere over the line of scrimmage and at any time, provided the passer was at least five yards behind the line. This change, together with one allowing the man who first received the ball from centre to cross the lines of scrimmage at any point, permitted the doing away with the checker-board marking of the field, thereby reverting to the gridiron or cross marking that was in vogue preceding 1903. Another important change adopted in 1910 required seven men of the offensive side to be on the line of scrimmage. The development of the forward pass brought about a change in the shortening of the field between the goal lines from 330 ft. to 300 ft., with end zones of 30 ft. beyond each goal line in which forward passes could be completed. With the shortening of the field, the kick-off was moved from the centre of the field to the 40-yd. line of the kicking side. The value of a touch-down has gone through a series of changes, in which it has counted four, five and finally six points. In the same way, a goal from the field, whether from a drop kick or a place kick, has had a similar variation, but downward from five to four and finally to three points. Four trials instead of three are now allowed to gain 10 yards.

Development of the Game.—The game itself has developed in a most interesting way. Previous to 1915, it was rare to see a team which did not play its quarter-back close up behind centre to receive the ball and pass it to the runner, or carry the ball himself. Nowadays, however, none of the men in the backfield need play in specified positions all the time. The quarter-back calls the signals, but arranges the backfield in one of a variety of formations from which the center makes a direct pass to one of the backs. Probably the most common arrangement of the linemen is to have four on one side of the centre and two on the other, creating what is called the "unbalanced" line with a strong and a weak side. Some coaches instruct their players to assume these positions deliberately, the strong side being on the right or left according to the signal. Others have a preliminary arrangement of the guards or tackles lined up behind the centre and jump into position either to the right or left, thus forming a strong side.

A favourite backfield formation is to line one back, known as the wing back, slightly outside and a yard behind the end man on the strong side, while the other three men form a diagonal tandem, the back man assuming a position four to five yards behind centre. Sometimes one of the other two men forms a wing back in a similar position on the short side. Some teams play a "solid line"; others direct the end man on the long side to play out from one to two yards, while the end on the short side lines out from two to four feet, in which case the wing back on the strong side usually lines behind the opening. Another favourite formation is known as the punt formation, in which two backs usually arrange themselves in tandem from three to four yards back of the line of scrimmage on the right, while a single man stands about three yards back in a corresponding position on the left, and the fourth man from six to ten yards directly back of centre.

This formation lends itself peculiarly well to what is termed the "triple threat" style of play, in which the man farthest back may run, make a forward pass or punt. Shift plays are being used by many coaches; in these usually four line men assume a preliminary position from one to two yards behind the line of scrimmage and then jump into balanced lines or into lines with one man over or two men over, while the four men in the backfield adjust themselves in various ways according to the plan of the coach. Owing to the tremendous noise attending games, at some of which there are as many as 80,000, or 90,000 spectators, some of the teams use what is called the "huddle system." Instead of the quarter-back calling out a string of numbers with the players in their regular positions, he gathers the team around him and tells them the play. The team then quickly springs into position, and the play begins, either with or without a further signal.

Offence and Defence.—The offence in football has now reached a certain degree of standardisation after many years of experimentation of the widest divergence. Fortunately, offensive football will never be completely standardised, because the possibilities of manoeuvring the players are so many that coaches of inventive genius are constantly lured into the multifarious forms of strategy always possible to the clever tactician.

In defence, the general usage is to employ either a six or seven man line. If a six man line is used, the centre and four other men are arranged in what is called the 2–2–1 formation;

that is, two men backing up the line two or three yards behind it and separated from each other by three or four yards, while two others line up about 10 yards back of the defensive ends, and the safety man plays from 15 to 30 yards back. Another favourite style is known as the " box " defence, in which seven men play in the line with two men backing up the line from two to four yards back and three to five yards apart, while two other men play at points from 12 to 18 yards back and behind their respective ends. Many coaches still favour the " diamond " defence, in which seven men play on the line of scrimmage, while one man plays from three to five yards behind centre and two backs line up 10 to 12 yards behind the defensive ends, the safety man lining up 20 to 30 yards from the scrimmage. The above three defensive formations have become quite standardised. Some teams employ all three kinds, according to the part of the field they are in and according to the number of the " down," the number of yards to be gained, also the type of formation the opponents are using.

Until 1926, the use of the forward pass has been encouraged because it has made possible the playing of games between small and large institutions. In 1926 a new rule came into effect that a penalty of five yards is to be inflicted for every uncompleted forward pass, after the first one.

Formerly, all school and college teams were coached by graduates without salary. Later, paid seasonal coaches were employed. In 1925, most coaches were members of the athletic department. Since the World War, football in the United States has had an unprecedented public interest. An era of stadia building has swept over the country, most colleges and universities having built or planned to build one. Many high schools also have them, and several cities have erected stadia holding 100,000 people. (A. A. St.)

FORAKER, JOSEPH BENSON (1846–1917), American politician (*see* 10.628), died in Cincinnati May 10 1917. In 1916 he published *Notes of a Busy Life*.

FORCED LABOUR: *see* SLAVERY AND FORCED LABOUR.

FORD, HENRY (1863–), American manufacturer, was born on a farm near Dearborn, Mich., nine miles west of Detroit, of William and Mary Litogot Ford. William Ford was of English descent but born near Cork, Ireland, whence the Ford family emigrated to America in 1847, settling near Dearborn. Mary Litogot was born in the United States of Dutch parents. Mrs. Ford died when her son was 12. Henry Ford went to school until he was about 15, but worked on the farm after school hours and during vacations. He began early to develop an intense interest in mechanics. He was attracted first to watches, and at 13 he took a watch apart and put it together again. In a little while he was repairing watches and clocks throughout the surrounding country, not for pay but because he had a burning curiosity to see how watches and clocks were made. His only tools were a screwdriver made from a knitting needle and a pair of tweezers fashioned from an old watch spring. All this work was done at night; later it was done secretly, because William Ford objected to the son giving his services free. Also, he wanted the boy to be a farmer, while the boy wanted to be a mechanic.

At 16 Henry could no longer tolerate farm work. He left home, walked to Detroit, and apprenticed himself in a machine shop at a weekly wage of $2.50, working 10 hours a day. His board and lodging cost him $3.50 a week. In order to make up the deficit he took employment with a jeweler from 7 to 11 in the evening, for which he received $2.00 a week. In about a year he turned from machine shop to an engine shop to learn something of the building of engines. There he stayed two years. A company manufacturing small steam engines for farm use needed a man to install them; Ford took the place and for two years more set up and repaired these engines. He had gone back to the farm to live; there he spent all of his spare time in a little workshop trying to build a farm tractor—for his experience with the portable engines, as well as his own farm experience, had convinced him that power should be put to work on the farm and that it was a waste to keep horses.

Eventually he built a single-cylinder engine steam tractor, but he could not devise a boiler to provide pressure enough to keep the tractor at work ploughing and yet be light enough for his requirements. For the time being he gave up his tractor until he could discover a more suitable boiler. Large steam tractors were already in use, but Ford's thought even then was in the direction of inexpensive, simple apparatus which could be bought by everyone.

In 1884 Ford's father offered him 40 ac. of land in order to draw him away from his mechanics. The land was mostly wooded. Henry cut the timber, set up a sawmill and sold lumber. In the summer he repaired farm engines. In 1887 he married Clara Bryant, who lived in the neighbourhood. He sawed the lumber for his house, which he built himself on his plot of ground, and having done this he moved his workshop from his father's farm to his new home.

Securing a job with the Detroit Edison Co. as an engineer and machinist he moved from the farm to Detroit, where he set up his shop in a shed at the back of his house. After hours he worked on the building of a gasolene motor car. In 1892 he completed it—although it did not run properly until the following year. This, his first car, had two cylinders with a $2\frac{1}{2}$-in. bore and a 6-in. stroke, set side by side over the rear axle, and developed about 4 H.P., which was transmitted from the motor to the countershaft by a belt and from the countershaft to the rear wheel by a chain. He ran this car about 1,000 m. and then sold it for $200, in order to start the building of another car which would be lighter and stronger.

In 1899, feeling that he had the experience he needed, Ford left his job with the electric light company and went into the making of automobiles as a business, with a company, of which he was the chief engineer, known as the Detroit Automobile Company. He held only a small portion of the stock, and the company would not follow the lines of manufacturing to which he had committed himself. The directors wanted to make cars to order only; Ford had in his mind a universal car which could be made in quantities. In 1902 he resigned in order to go into business for himself—when the opportunity arose. In the meantime he rented a one-story brick shed and continued his experiments. He built several cars, two of them solely for speed. One he called the " 999 " and the other the " Arrow." Each had a four-cylinder engine giving 80 horsepower. The " 999 " won every race it entered, and in 1903, on the reputation of this speed car, Ford formed the Ford Motor Co., with a capitalisation of $100,000. Actually only $28,000 in stock was ever subscribed, and of this only about one-half was in actual cash. The company in 1926 had assets of about $1,000,000,000. It is the largest motor car company in the world and the third largest industry in the United States, comprising in itself about 50 other industries and employing some 200,000 people directly and an equal number indirectly. It has been built up entirely by turning back profits into construction. The company has never issued bonds or borrowed money; nor has it issued stock otherwise than to enlarge the original capitalisation so as to have it more nearly correspond with values.

The company is entirely owned by Henry Ford and his son, Edsel B. Ford, they having bought out the minority stockholders in 1919 for $70,000,000.

During its first year the company built a two-cylinder, 8 H.P. car with a chain drive, and of these 1,708 were produced and sold. In the second year the company made three models and for five years the company made various models of four-and six-cylinder cars. The automobile at that time was considered a pleasure vehicle, but Ford had conceived of it as a universal method of individual transportation and he was working to produce a light car of great strength, which would require a minimum of care and cost in upkeep. What delayed him was finding a steel sufficiently strong for his purpose, and it was quite by accident that he came upon a piece of vanadium steel, which was not then made in the United States. With that steel he designed Model T—which is what is known today as the " Ford car." In 1909 Mr. Ford announced that thereafter the

company would build only one type of chassis, that it would be Model T, and that "Any customer can have a car painted any colour that he wants, so long as it is black."

The principles upon which the Ford industries are founded, as Mr. Ford has stated them, are:—

1. An absence of fear of the future or veneration for the past. One who fears the future, who fears failure, limits his activities. Failure is only the opportunity more intelligently to begin again. There is no disgrace in honest failure; there is disgrace in fearing to fail. What is past is useful only as it suggests ways and means for progress.
2. A disregard of competition. Whoever does a thing best ought to be the one to do it. It is criminal to try to get business away from another man—criminal because one is then trying to lower for personal gain the condition of one's fellowmen—to rule by force instead of by intelligence.
3. The putting of service before profit. Without a profit, business cannot extend. There is nothing inherently wrong about making a profit. Well-conducted business enterprise cannot fail to return a profit, but profit must and inevitably will come as a reward for good service. It cannot be the basis—it must be the result of service.
4. Manufacturing is not buying low and selling high. It is the process of buying materials fairly and, with the smallest possible addition of cost, transforming those materials into a consumable product and giving it to the consumer. Gambling, speculating and sharp dealing tend only to clog this progression.

In the Ford practice the cycle of production starts with the consumer. Mr. Ford holds that a commodity must first of all be designed to fit the needs of the largest possible number of consumers both in quality and price, and that the number of consumers will be continuously increased by constantly lowering the price of the article. At the same time, by paying the highest possible wages to those engaged in the production and distribution of the article, he creates a high buying power. In Jan. 1914 Mr. Ford raised all wages in his industries to a minimum of $5.00 for an eight-hour day. The average wage throughout his industries at that time was $2.40 for a nine-hour day. The minimum wage in 1926 was $6.00 a day, with an average of $8.00. Model T (the touring car), which in the beginning cost $850, in 1926, with the average wage about four times larger than then and with materials costing at least double, sold for $310, with a self-starter and many improvements. From the introduction of Model T on Oct. 1 1908 it took the company until Dec. 10 1915 to produce 1,000,000 cars, but under the new wage programme and the constant lowering of prices the company was in 1926 producing at the rate of 2,000,000 cars a year.

The general theory of production in the Ford plants is that everything must be kept moving and that the work must go to the man instead of the man to the work. For example, the cylinder block is cast on a moving platform in a mould made on a moving platform. Thereafter it passes, without stopping, through a series of machines which perform all the necessary operations, and then, still moving, it passes into assembly, where to it are added, one by one, the hundreds of parts to create a complete motor. Then it moves into the final assembly, where it is joined by other parts until eventually an automobile leaves the final assembly line under its own power. Every part of the motor car has a similar train of construction and assembly, all converging either into the final assembly or into boxes or freight cars for shipment. No man uses more than one tool, all the work comes waist high, a man never has to stoop or to move his feet to get anything, and the speed of the work is controlled not by the worker's will but by the pace of the conveyer.

The Ford industries have been steadily reaching back to sources in order to cut out intermediate profits. The industries have their own iron mines, coal mines and forests, their own railway, and an extensive fleet of lake- and ocean-going steamships, all of which are operated on the principle of high wages, high production and low cost. In the forests no tree is permitted to be cut under 10 inches. The logs are taken directly to the sawmill and, instead of being first converted into lumber and the parts sawed from the lumber, the parts are sawed directly from the log. All the wood-working is done at the forest mill, the waste goes to a wood distillation plant, and there is no waste whatsoever in shipment. At the River Rouge plant, the iron from the furnace goes directly into the foundries and is poured without reheating. The slag from the furnaces goes to a cement plant. A combination of electric furnaces and a large rolling mill converts all of the steel scrap. In every direction the pressure is toward preventing the waste of time, men or material.

As the business developed, it became apparent that it was a waste to assemble the cars at the factory and ship them complete. The manufacturing plants then ceased in effect to manufacture automobiles; instead, they make parts, and these are shipped to 35 branches in the United States, where they are assembled into complete motor cars. Similar branches or associated companies are located in nearly every part of the world, and these branches also manufacture if the costs permit. Foreign branches, under the theory of building consumption, employ only natives of the country in which they are located. All the branches use the same methods and pay the same wages as the home plants. The industry does not use a single warehouse—everything is in transit.

The centre of the industry is at Detroit, Mich., and at River Rouge, Mich., on the outskirts of Detroit; but with the method of assembling cars at the point of use, a decentralising of manufacturing is taking place and comparatively small plants are being located out in the country wherever proper water-power sites are available. Each of these plants makes only a single part; the thought behind their establishment is to strike a balance between industry and agriculture. None of these plants employs more than 500 men, and in most cases the men divide their time between agriculture and industry. This is one of the most important developments.

Mr. Ford is firmly against paternalism in any form. He believes charity greatly harms those who receive it. Carrying out this thought, he has a trade school for the education of boys with dependents, in which the boys make useful articles. They earn an average of about $15 a week while receiving their education. The Henry Ford hospital in Detroit, which is open to any one, is conceived on the theory that a hospital should be self-supporting. All its rooms are precisely alike, all have baths attached, all the fees and services are at a scheduled rate, which is the same to everyone, and all the surgeons, physicians and nurses are on salary and have no financial relations with the patients. The Ford Motor Co. also builds a light farm tractor under the same methods and principles as the motor car, and in 1926 was building experimentally all-metal airplanes and maintaining for experimental purposes a number of air routes with the eventual aim of putting the Ford principles into aeronautics.

Henry Ford has taken no active part in politics, although he was nominated in 1918 for United States Senator from Michigan; at the election he was defeated by a small margin. He took no part whatsoever in the campaign. In 1915 he was convinced by certain peace advocates of foreign extraction that it might be possible to end the World War if a sufficient gesture were made. He thereupon chartered a ship and proceeded to Christiania, Norway. Then, convinced that the mission was futile, he returned home. Mr. Ford does not believe in war, but he is not an active pacificist. For this *Encyclopaedia* he wrote the article MASS PRODUCTION.

A full account of the origins, theories and practices of the Ford industries is contained in *My Life and Work* (1922), and *Today and Tomorrow* (1926), both by Henry Ford in collaboration with Samuel Crowther. (S. CR.)

FOREIGN LANGUAGES, TEACHING OF.—The revolution that has taken place in the methods of teaching modern languages may be said to date from Viëtor's pamphlet *Der Sprachunterricht muss umkehren* (1886). His doctrines were largely adopted in the Frankfurter Reformschulen, but it was not till after 1900 that the movement became widespread in England and France. Broadly speaking, the idea of the reformers was to substitute direct comprehension and acquisition of the foreign language for mere knowledge attained through the medium of the mother tongue.

They insisted on oral study at the outset of the language, involving explanations in the foreign tongue itself, on inductive

methods of learning grammar and on the use of reading and of free composition in place of formal grammar and translation from or into the foreign language. Hence the introduction of the phonetic script and chart; the employment of gesture; the utilisation of pictures, postcards, coins and other *Realien;* and the stress laid on the teacher and not the text-book being the centre of the instruction—the whole idea being to render the classroom a sort of French or German *enclave*, and to make the pupil think as far as possible in the language.

Some of these doctrines were pushed to excess. Certain teachers attempted to exclude the mother tongue entirely from the classroom; others devoted an inordinate time to phonetics or conversation on pictures, and exalted the oral side as the goal of all teaching. Others again neglected the grammar or interpreted their new-won liberty as a right to teach as they pleased, irrespective of their colleagues. To-day, while phonetics (*q.v.*) have been generally accepted in England (though not in France), it is seen that the extent of their use (apart from the chart) may be left to the choice of the teacher. Again, new grammar points should be learnt inductively, but the grammar must be systematised and codified. With most pupils grammatical points are more safely explained in English. Due co-ordination of method can usually be secured by the appointment of a head of department. Translation from or into the foreign language is often begun two years before the final examination and not often earlier. As regards the exclusion of the mother tongue, we may take it as an axiom that the cleverer the child the more direct the teaching. Hence with the duller child the aim should probably be to concentrate rather on reading and translation than on composition (free or otherwise). At the extreme end of the scale there are, in the opinion of some experts, a few non-linguistic pupils who would be more profitably engaged in confining themselves to the mother tongue.

It is probable that the earlier reformers laid insufficient stress on the rapid acquisition of vocabulary, possibly from their dread of rote-work. To-day there is a fruitful tendency to learn by heart, not merely poems but duly prepared prose passages, a practice that is at the back of much of the mastery attained by the French in their own language. Of course such passages need occasional revision. Again, the principle of private reading, which has made such strides in English, has been promoted by the formation of class and school libraries, and the practice has been further fostered by the introduction of free study periods in certain schools. Such are the main features of the teaching in English secondary schools, up to the first school examination.

In the central schools, which often prepare their fifth-year pupils for similar examinations, the methods are largely the same, except that in the first year the classes, which are larger, are sometimes divided for conversation, with excellent results. In the advanced courses of the secondary schools, the methods of reading and *lecture expliquée* without translation are largely followed, and essays on literature are written in the foreign language. A burning point is that the universities which conduct the higher certificate examinations appear to prefer answers in English in the literature papers. A possible solution would be the award of extra marks for one question to be answered in the foreign tongue. In the evening schools methods have been modernised, but the need of covering the ground more quickly necessarily limits the employment of the more leisurely practices of the direct method. (C. Bre.)

In the United States

The attempt to make general the employment of the "direct method" in the teaching of the foreign modern languages in the United States had begun to subside before 1909, when it became clear that the method was looked on askance in the best high schools and preparatory schools, and especially in the colleges and universities. Many teachers were well acquainted with foreign languages by ancestry and study abroad; but some could not speak such languages with ease. Also, the increasing desire for travel in Europe, now so manifest, was only beginning to develop. In the universities and colleges, the professors laughed the method out of court. An anecdote is told about a professor of French in a certain university, who, when asked if he spoke French, answered: "I don't speak French, I teach it." When we consider, however, that at present no teacher of French in the United States would answer in this way, we see that the agitation over the direct method has borne fruit. Indeed, nearly all the text-books in modern languages bear an imprint, however faint, of the direct method, whose influence has been beneficial. It is true, furthermore, that the War gave a strong and perhaps lasting impulse to the study of the spoken language. It is said that when the United States entered the War, the accredited newspaper reporters sent to Europe were remarkable in only one regard: their inability to say the slightest thing in French. This would no longer be the case.

Much of the improvement in the teaching of the modern languages came from another source: the introduction of Phonetics. This study made its way under two forms: formal or theoretical Phonetics and experimental Phonetics. The first came from both France and Germany, as well as from the English school of Bell and Sweet; the latter came from France. The French influence was seen in the steady extension through the universities and high schools of the International Phonetic Alphabet, which is now the only one used in teaching the foreign spoken languages. This alphabet was contrived by Paul Passy (who took hints from Ellis, Bell, Sweet and others) and commenced to be known in the early 'nineties. Its use has become so general that it forms the basis of instruction in diction, music and phonetics, as is seen in the brilliant work being done in New York by such teachers and authors as Adele Baldwin, Marguerite DeWitt, May Laird-Brown and William Tilly.

Experimental Phonetics came from the indefatigable zeal of its founder, the Abbé Rousselot, whose laboratory at first was in the Institut Catholique, Paris, then in the Collège de France. Two or three Americans had begun experimental research at about the same time as Rousselot, but they did not have laboratories at their disposal. None the less, their example prepared the way for the introduction of Rousselot's methods, which have left a permanent impress on the teaching of the modern languages in the United States.

The War favoured the extension of French. Combined reports from about 76% of the elementary schools, public and private, and the high schools and academies and from about 89% of the colleges and universities indicate an enrolment during the year 1923–4 of 629,000 students of French, 392,000 of Spanish, and 65,000 of German. (R. We.*)

FORESTRY (*see* 10.645).—No summary of the timber resources of the world can be described in any sense as accurate or reliable. The facts available are insufficient, the statistics on which estimates are based are often incomparable and even the sources of information are not always above suspicion; overstatements by government departments to attract capital or to justify increased exploitation are as common as understatements by foresters or traders to insure conservation of resources or enhanced prices.

The British Empire contains not less than 1,100 million acres of woodlands, but has under 1,100 forest officers—that is to say, taking the Empire as a whole, less than an average of one forest officer for every 1,000,000 acres. Brazil with 1,000 million acres of tropical and semi-tropical forests has in the European sense no organised forest service at all. The information about the Russian forests, said to be 1,200 to 1,500 million acres in extent, even before the War, was unsatisfactory, especially as regards the virgin softwood forests in Asia and northern Europe. Since the War little authoritative information is obtainable, and such information as there is, is, therefore, for the most part, too old to be of any real utility.

The World's Timber Resources

For purposes of comparison the timber resources of the world may be divided into hardwoods and softwoods, the former being, generally speaking, broad-leaved and, in the temperate

zone, deciduous trees; the latter coniferous and non-deciduous. The hardwoods themselves fall naturally into two classes—hardwoods of the temperate zone, some 1,200 million acres in extent, and tropical hardwoods, estimated at 3,600 million acres. The softwoods of the world cover a much smaller area, just over 2,500 million acres. These forests, with the exception of the Paraná pine forests of Brazil, Chile, India and Australasia, are situated in the Northern Hemisphere, over 80% of the total being found between the 45th and 70th parallel north. The more important commercial timbers of the world, the softwoods and temperate hardwoods (calculated on an acreage basis), are situated to the extent of 95% and 89% respectively in the Northern Hemisphere, where 75% of the population exists. While, as a means of estimating timber resources, a calculation by acreage is unsatisfactory, the stand of timber to the acre varying with species, soil and climatic conditions, no unit of measurement can be given which more accurately gives a picture of forest wealth.

Only about 10 to 15% of the world's forests are worked under systematic management, and about these forests alone is reliable information available as to stocks, annual growth, fellings or losses by pests, etc. Of the other forests, 15 to 20% may be classed as commercial forests either in process of exploitation or about to be exploited. About these forests some general trade information is usually available. The balance 65 to 75%, is virgin forest not utilised for commercial purposes, and about which information is non-existent or unreliable. The estimates of acreage have, in the main, been taken from the work of Messrs. Zon and Sparhawk entitled *Forest Resources of the World*. These two distinguished members of the United States Forest Service have succeeded in making a more or less coherent picture of the available data about the forests of the world, supplemented by personal investigations and inquiry where full information was not previously available.

Hardwood Supplies

The hardwood timber supply of the world need give little real cause for anxiety. There will be in the future, as in the past, shortages of supplies of individual species. The hardwood forests, however, are so vast in extent, and include so many different types of timber, that the increase of information about recently developed countries, and the advance in the science of timber testing, seasoning and wood technology, should make the substitution of new species for old a more simple and certain proceeding than has formerly been the case. The solution of the hardwood supply question would therefore appear to lie not only in the conservation of existing resources, but also in the ordered investigation of new sources of supply, together with the initiation of such steps as are necessary to make such supplies available as and when they are found in quantities that make their exploitation commercially possible.

United States.—The United States has taken the lead in this matter. Owing to the wholesale clearances of their more accessible hardwood forests by uncontrolled felling, and the almost complete destruction of their valuable chestnut forests by the chestnut bark disease (*Endothia parasitica*), the Federal U.S. Department of Agriculture has for some time been inquiring through its Forest Products Laboratory, Madison, Wis., about the potential supplies of hardwood timber outside the States. Important results have already been obtained in Central and South America.

British Empire.—Inside the British Empire equally good work has been and is being done; at Dehra Dūn in India, at Montreal in Canada and in England under the aegis of the Forest Products Research Board, at Kew, as well as at the Imperial Institute, timbers are being tested and new species identified. In this section of Imperial development it is necessary to insist on one point that has been passed over, viz., that it is not only necessary to educate and indeed to persuade the consumer by scientific and practical tests of the possibilities of a given substitute species, it is also necessary to prove to the satisfaction of wood merchants that that substitute is available on a commercial scale and that the forests in which it is found are suitably situated for exploitation. An Imperial Forestry Bureau advocated by two consecutive Imperial Forestry Conferences is a necessary link between the consumer and the merchant on the one hand, and the systematic botanist, the timber testing centre and the producing units of the Empire overseas on the other.

Softwood Supplies

The future supply of softwood timber is disquieting, the most unsatisfactory feature being the rapidity with which the accessible virgin forests are being destroyed. In the more progressive and industrially developed countries timber, other than firewood, is used in the proportion of 80% of softwood to 20% of hardwood. Great Britain, the greatest importing country in the world, brings in softwood in the proportion of nine to one hardwood. According to the latest figure available, Finland and Siberia are the only two "net" exporting countries in the world where the resources of softwood timber are not being reduced by annual felling at a greater rate than is made good by annual growth.

United States.—The United States, which consumes nearly one-half the converted timber of the world, is using up its softwood timber reserves at about four times their rate of growth. Only 137,000,000 ac. of virgin forest remain. These are being felled at the rate of 5,500,000 ac. per annum. The situation has caused such general anxiety that the President himself made the following statement in 1924: "Expressed roughly we have left about 745 billion cu. ft. of timber. From this the annual drain is 25 billion cu. feet. This total drain is most significant when we reflect that towards offsetting it we have an annual growth of only six billion cu. ft., and even in our young forests where this growth is taking place cutting has already outstripped growth. We must face the situation that at this rate we are not far from timber exhaustion."

The course of timber denudation in the United States is interesting. First the New England states, then the Lake states and now the South Atlantic states have been cut out in rapid succession. In the Southern states the departmental report of 1920 states that of the 5,400 mills owning or controlling practically the entire remaining virgin stand in the South, 4,419 mills will be cut out in five years or less, and that a further 800 mills will cut out their timber in the next ten years, *i.e.*, by the end of 1930 or thereabouts.

When this last forest reserve on the eastern freeboard is exhausted, the export trade of softwood timber will be concentrated almost entirely in the Pacific states, distant from the main commercial centres by 2,000 m. of railroad or 4,000 m. by sea. This fact is important from two points of view—(*a*) the price of timber must rise very considerably in the Eastern states, where four-fifths of the population are centred; (*b*) that, consequent on a rise in prices due to the lack of local supplies, sea freight and canal charges, America may come into the European market for construction timber, just as she does to-day into the Canadian and European markets for her pulp-wood. In a statement made by Col. W. B. Greeley, Chief of the United States Forest Service, at the British Empire Forestry Conference in 1923, the virgin softwood forests of the United States at the then rate of destruction would be cut out in 25 years, and after that date the industry would have to depend on "cut-over" woods and the less accessible of the Federal reserves.

Canada.—The position in Canada is but little more satisfactory. According to Mr. Craig, the Canadian statistical officer (report of 1923), the total amount of softwood in Canada amounts to 198,000 million cu. ft., one-half of which can be profitably operated under existing conditions. The amount of softwood used annually for all purposes is about 900,000,000 cu. ft., but owing to the method of exploitation this entails the destruction of 1,700,000,000 cu. ft. of standing timber. In five years the annual loss of merchantable timber from fire had amounted to 790,000,000 cu. ft., and in 10 years destruction by the spruce bud worm had averaged 1,300,000,000 cu. feet. Other insects and forest diseases have also caused serious loss in the forest, so that the annual drain on the resources of the Dominion is probably

not less than 4,000,000,000 cu. feet. At this rate the accessible stands of virgin forest would last 25 years.

Europe.—In Europe the softwood position is by no means satisfactory. The demand of industrial life for an adequate timber supply increases in volume much more quickly than the growth of the population, yet there is no margin for increased production outside Russia, and the estimates of Russian reserves are founded on quite insufficient data.

Three of the principal softwood exporting countries in Europe are Norway, Sweden and Finland. Norway has been living on her forest capital for many years, and her softwood timber consumption exceeds growth by about 51,000,000 cu. feet. Sweden until recently was supposed to be living well within her forest means. A recent survey has shown that the annual growth, especially in the north, is less than was previously calculated, and consumption exceeds growth by 100,000,000 cu. feet. Finland is reported to be using 140,000,000 cu. ft., less than the annual growth. Two facts must be borne in mind—(*a*) that her calculation of annual growth will probably have to be revised, (*b*) that the extension of her saw-milling industry is rapid.

Russia.—To what extent the virgin forests of Russia can come to the aid of Europe and America is difficult to estimate. Apart from political questions there are certain limiting factors which are bound to affect continuous production.

1. The main group of softwood forests is situated north of the 50th parallel. The rate of growth is necessarily slow; on the Finnish and Swedish analogy, probably not more than 20 cu. ft. per ac. per annum. In the extreme north the rate of growth is probably only half that rate, while owing to the infrequency of seed years restocking must necessarily be a slow process.
2. The extent of land over which Russian forests are spread is so great and the communications so poor that only a relatively small portion is accessible under existing conditions and at present day lumber prices.

Mr. Fraser Story in his review of the softwood resources of Europe estimates that 90,000,000 ac. of the Russian forests are merchantable as opposed to 243,000,000 ac. unmerchantable. He includes as unmerchantable all woods in which the cost of extraction is prohibitive, or on which the land is so poorly stocked or the timber of such a character of growth as to be unsuitable for commercial use. The merchantable area includes the areas which before the War could have been exploited without undue commercial risk with the means of extraction and utilisation then available.

3. Russia has a population nearly as large as the United States. She is already an importer of timber in her southern states. Her consumption of hardwoods and softwoods before the War was calculated at only 66 cu. ft. per capita per annum. It is not improbable that with the relaxation of forest regulations her per capita consumption has materially increased and may approach that of Norway and Sweden, 130 cu. ft. per annum.
4. It is calculated that before the War Russia was living on her capital, *i.e.*, that her consumption exceeded her annual growth by 1,851 million cu. ft. per annum.

Siberia.—The productive Russian forests in Asia probably amount to 500 to 600,000,000 acres. Only one-fifth of this area has ever been surveyed. The Pacific slopes and the forests tributary to the Amur and other small coastal rivers are the only areas capable of exploitation under existing trade conditions, and may amount to 40,000,000 acres of softwood and hardwood forests, only one-tenth of which has been surveyed. The main supplies of Central Siberia will only be available when political conditions are such as to permit of the investment of capital, the creation of railways and the establishment of banks and credit institutions. Even in the more easily developed area an export trade will have to be built up from its very foundations. Before the War there were said to be only 74 producing saw-mills in Siberia; since the War exports of timber to Japan and China have increased; but even to-day, considering the size of the country, they are relatively unimportant.

Other Areas.—The remaining virgin softwood forests of the world can be dismissed in a very few words. In Japan consumption is rapidly overtaking production. Japan has for long been anxious about future supplies, and has embarked on the largest planting programme of any country in the world. The recent survey by the United States Forest Service in Alaska has proved disappointing. While the hinterland contains important reserves of pulp wood, the milling timber is confined to a strip of land on the coast averaging, it is said, only a few miles in width. Australia and New Zealand, despite their softwood supplies, are importing countries. The Paraná pine forests of Brazil, once considered as an important timber reserve for the southern hemisphere, are being rapidly cut out and no system of reforestation has yet been adopted.

Conclusion.—It would appear that while information about the softwood forests of the world leaves much to be desired, there are sufficient data to warrant certain conclusions:—

1. That except in Russia—an unknown quantity—the main softwood virgin timber reserves will be exhausted before very long, and producers will have to depend more and more on "cut-over" forests or woods raised or restocked by the agency of man.
2. That the United States shortage is likely to come more quickly than the European one.
3. That the more the American supply becomes centred in the Pacific Coast States the greater is the probability of the industrial States of North-eastern America coming into the European market for saw-timber in the same way as they do now for pulp of wood.
4. That as the United States consumes 13,750 million cu. ft. of softwoods as opposed to a total European consumption of 9,120 million cu. ft., the United States advent into European markets will have an important bearing on European prices.

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FORMOSA (*see* 10.669).—The island of Formosa (Taiwan) has an area of 13,839 sq. m. and on Oct. 1 1920 the population was 3,655,308, representing a density per sq. m. of 264 inhabitants. The population was estimated at 3,758,900 on Oct. 1 1923. The chief towns are Taihoku, Tainan, Kagi and Taichu. The Hokoto Is. (Pescadores) are included in Taiwan.

Administration and Finance.—Taiwan was placed under a civil administration in April 1896, and legislative steps were taken in the following year to put the finances of the island on an independent footing. Meanwhile a grant was made from the Imperial Treasury, but the subvention was withdrawn in 1906 owing to the satisfactory financial condition of the island. Furthermore, with the development of its industry and the increase of various public establishments, finance was greatly expanded and the total revenue and expenditure in the Budget for 1924–5 are put at 91,553,193 yen (excluding the extraordinary budget).

Government Monopolies.—The Government monopoly undertakings on the island are opium, salt, camphor and tobacco, the importation of opium and the manufacture and smoking of the drug being strictly prohibited since 1896, except by licence in the case of confirmed smokers. The number of licensed smokers had decreased from 117,000 in 1900 to 38,673 at the end of 1923.

In May 1899 the Government took steps to improve the quality and increase the quantity of salt produced, which had hitherto suffered from the fluctuations due to irregular and sporadic private enterprise. The total area of the salt-fields is now over 2,348 kō (about 4,500 ac.); the quality of the salt has decidedly improved, and the annual output has been steadily increasing, having risen to 404,000,000 kin (242,400 metric tons) in 1923, sufficient to satisfy local requirements and also for export to Japan, Chosen, Karafuto, etc. In 1899 the production of camphor was also controlled, and in 1905 the monopoly system was extended to Taiwan-cut tobacco, in both cases with beneficial results.

Trade.—The chief commodities exported from Taiwan are tea, rice, sugar, camphor, turmeric, flax, hemp, jute and coal. Foreign trade, consisting of oversea trade and trade with the homeland (Japan proper), has grown year by year. The development of Taiwan trade with foreign countries was affected adversely by the duties which have been increased frequently since the revision of customs tariffs in 1899, but its trade with the homeland has made steady progress with the development of various industries,

stimulated by the growing perfection of banking and communication facilities in the island.

In 1907 the volume of trade with Japan and overseas trade was 58,340,000 yen, while in 1910 it was 108,880,000 yen (largely owing to the development of the sugar industry). In 1923 the total trade reached 308,720,000 yen. Of this the exports to foreign countries were valued at 29,150,000 yen, and the exports to Japan proper at 169,440,000 yen, a total of 198,590,000 yen. The imports amounted to 39,110,000 yen from foreign countries, and 71,010,000 yen from the homeland, totalling 110,120,000 yen. Thus the excess of total exports over total imports for 1923 amounted to 88,460,000 yen.

Agriculture and Industry.—Almost the whole of Taiwan is a rice-growing country, yielding two crops a year. In 1923 the rice crops amounted to 4,866,087 koku (24,102,639 bu.), though in that year they suffered from the worst drought ever known. The oolong and souchong teas, produced in the north of the island, are important exports to foreign countries; the value of the oolong exported abroad in 1923 was 5,160,965 yen.

The sugar industry enjoyed great prosperity in 1916 and 1917, the value of exports being 11,317,643 yen and 15,775,205 yen respectively. The area under sugar-cane cultivation in 1923 was 114,710 kō (1 kō = 2·45 ac.) which, owing to the satisfactory growth of the plant, yielded raw sugar amounting to 6,192,040,773 kin (1 kin = 1·323 lb.). There were operating 44 plants of the latest style with a capacity of 34,650 English tons, 11 improved-style factories with a capacity of 820 English tons and 101 old-style factories, which altogether produced 521,501,144 kin of centrifugals, 59,878,831 kin of refined sugar and 10,860,026 kin of brown sugar, aggregating 592,240,001 kin.

Gold, alluvial gold, silver, copper, coal, petroleum and sulphur are all found in the northern part of the island. The total value of mineral products in 1923 was 12,915,908 yen, being an increase of a little over 210% over the 1913 figure. The gold produced in 1923 was 411,649 grammes; placer gold, 8,306 grammes; silver, 569,576 grammes; coal, 1,445,000 metric tons; and petroleum, 25,289 hectolitres.

The fishing industry of Taiwan owes much of its present prosperity to Government encouragement, although owing to the favourable ocean currents, fishing can be carried on all around the island. Artificial rearing of oysters, prawns, carp, etc., is accomplished both in salt and brackish waters, and it is a characteristic of the Formosan fisheries that whilst the natural produce is valued at about 4,000,000 yen, the value of the products of fish culture is 2,000,000 yen.

Banking.—The Bank of Taiwan (est. 1897) is the central bank of the island, and has an authorised capital of 45,000,000 yen and a paid-up capital of 39,375,000 yen. The bank is empowered to issue bank-notes, and to transact ordinary banking and foreign exchange business. There are several ordinary banks and many credit associations.

A great increase in the business of the Post-Office Savings Bank took place during 1910–23, the number of depositors having risen from 90,893 in 1909–10 to 457,869 in 1922–3, the deposits increasing from 1,900,700 yen to 8,171,201 yen.

In 1899 the Government commenced planning out a trunk line from north to south of the island, connecting the ports of Keelung and Taku and passing through Taihoku, Taichu and Tainan. Branch lines, further opening up the rice, sugar, tea and mining districts, were gradually completed, so that at the end of the financial year 1922–3 there were 468·70 m. of railway open to traffic. In the same year over 13,000,000 passengers and more than 3,000,000 tons of goods were carried, the receipts being over 12,000,000 yen. In addition to the state railways, there were at the end of 1922 1,242 m. of railway belonging principally to sugar factories and 547 m. of track for hand-propelled cars, an important means of local transport peculiar to the island. (H. SA.; K. M.)

FORREST, JOHN FORREST, 1ST BARON (1847–1918), Australian statesman and explorer (*see* 10.672), was acting premier of Australia in 1907 during the absence of Mr. Deakin in London. He took office again as treasurer in Mr. Hughes's "National" Cabinet of 1917, but resigned owing to ill-health early in 1918, when he was raised to the peerage, being the first Australian to be so honoured. He died at sea on his way to London to take his seat in the House of Lords, Sept. 3 1918.

FORSTER, EDWARD MORGAN (1879–), British novelist, was educated at Tonbridge School and King's College, Cambridge. His first novel, *Where Angels Fear to Tread* (1905) was followed by *The Longest Journey* (1907) and *A Room with a View* (1908). Wider attention was won by *Howards End* (1910), but thereafter, except for some short stories, *The Celestial Omnibus* (1911), he published little until 1924, when *A Passage to India* appeared. This was a fruit of first hand observation of modern Indian life and with it Forster entered into a fuller public recognition of his powers as a writer with a gift for keen analysis of social character and relationships. Wartime work in Egypt enabled him to write a useful book on *Alexandria: A History and a Guide* (1922), from which came the material for the short studies of Alexandrian history, ancient and modern, in *Pharos and Pharillon* (1923).

FORSYTH, PETER TAYLOR (1848–1921), British Nonconformist divine (*see* 10.677), died in London Nov. 11 1921. Among his later works were *The Person and Place of Christ* (1909); *The Principle of Authority* (1912) and *This Life and the Next* (1918).

FORTIFICATION: *see* SIEGECRAFT.

FORT WORTH, Tex., U.S.A. (*see* 10.728), entered on a period of rapid development after the establishment of Camp Bowie (1917) and three flying fields for the training of Canadian and American aviators, and the erection (1918) of the army and navy helium plant. With the discovery of the Ranger and Burkburnett and other important new oilfields, it became the geographical centre of the oil-producing region of the southwest, and by 1925 was the greatest petroleum pipe-line centre in the world. Its refineries had a daily crude capacity of 75,000 barrels. Natural gas was brought in from 15 fields. Beginning about 1920, the transition in western Texas from ranching to stock-farming and diversified agriculture (especially cotton, wheat and feed crops) added a large and prosperous population to Fort Worth's trading territory, supplied raw materials for new industries, stimulated meat-packing and flour-and-feed-mills and enlarged its grain and livestock markets. A textile mill was established in 1924; a cement plant in 1925. Bank deposits were $15,425,000 in 1910; $78,540,000 in 1925. The value of manufactured products was $8,661,000 in 1909; $38,160,000 in 1919; $75,163,236 in 1923. In 1922 the area of the city was more than doubled by the annexation of 22 sq. m., including Niles Polytechnic, and a large suburban territory. The population in 1920 was 106,482, of whom 15,896 were negroes and 7,502 foreign-born; in 1925, 185,000 according to a local estimate, taking into account the suburban territory annexed in 1922.

A new charter, adopted in April 1925, established the Council-manager form of government and created a city plan board. Plans were under way (1925) for the construction of a Union passenger station and an interchange belt railway, and for a great project of water conservation, flood control and irrigation, by Tarrant County Water Improvement District Number 1. The leading educational institutions include Texas Christian University, Southwestern Baptist Theological Seminary and Texas Woman's College, established in 1914, with which the older Polytechnic College was merged.

FOSDICK, HARRY EMERSON (1878–), American divine, was born at Buffalo, N.Y., May 24 1878. He graduated from Colgate University in 1900, proceeding thence to Union Theological Seminary, New York City. Ordained into the Baptist ministry in 1903, he was pastor of the First Baptist Church, Montclair, N.J., 1904–15. He rapidly acquired a high reputation as a preacher, especially among the universities. Becoming instructor in homiletics at Union Theological Seminary in 1908, he was appointed Morris K. Jesup professor of practical theology in 1915. In 1918 the First Presbyterian Church of New York City was founded by amalgamation of The Old First, Madison Square and University Place churches, and Dr. Fosdick became its associate minister and permanent preacher Dec. 29 1918.

On May 21 1922 he preached a sermon entitled "Shall the Fundamentalists Win?" making a wide plea for tolerance in religion and asking that the door of Christian fellowship be left open to all who sincerely desired to follow Christ, regardless of specific credal belief. The Presbytery of Philadelphia formally brought the matter of Dr. Fosdick's teaching before the General Assembly of the Presbyterian Church at Indianapolis in 1923, stigmatising it as heretical and demanding action. The New

York Presbytery, acting on the request of the Assembly, appointed an investigating committee which reported to the General Assembly of 1924 that they found Dr. Fosdick's teaching and preaching to be in accordance with Presbyterian standards. This report was vehemently attacked by the Fundamentalist element in the Assembly and was referred to the Judicial Commission of the church, which, after hearing evidence, decided that Dr. Fosdick must take the vows of a Presbyterian minister (implying acceptance of the Westminster Confession) or vacate his pulpit. He thereupon tendered his resignation, Oct. 6 1924, which was accepted and took effect March 1 1925. Immediately thereafter the Park Avenue Baptist Church of New York called Dr. Fosdick to its pastorate, agreeing to open its membership to all Christians without insisting on its traditional ordinance of baptism and also to remove from its present site and build an amply equipped church on Morningside Heights—the educational centre of the city.

His works include *The Second Mile* (1909); *The Manhood of the Master* (1913); *The Assurance of Immortality* (1913); *The Meaning of Prayer* (1915); *The Challenge of the Present Crisis* (1917); *The Meaning of Faith* (1918); *The Meaning of Service* (1920); *Christianity and Progress* (1922); *The Modern Use of the Bible* (Yale lectures, 1924).

FOSTER, SIR GEORGE EULAS (1847–), Canadian statesman, was born in New Brunswick Sept. 3 1847. Educated in New Brunswick, Edinburgh and Heidelberg, he took up teaching in Canada. In 1882 he became Conservative member in the Canadian Parliament, representing New Brunswick, and in 1885 became Minister of Marine and Fisheries. From 1888–1896 he was Minister of Finance. In the Borden Administration of 1911 he was Minister of Trade and Commerce, retaining the portfolio in the Union Govt. of 1917. In 1917 Foster was summoned to the Senate of Canada. He was a great advocate of preferential trade within the Empire, and in 1903 he made a series of speeches in England in support of Mr. Chamberlain's policy. Sworn of the Imperial Privy Council in 1916, he was in the same year appointed one of Great Britain's four representatives at the Economic Conference at Paris. In 1918 Foster was created K.C.M.G., and he represented Canada at the Peace Conference, 1919, and at the first assembly of the League of Nations in 1921. He was later elected a vice-president of the assembly.

FOUILLÉE, ALFRED JULES ÉMILE (1838–1912), French philosopher (*see* 10.737 and 18.250), died at Lyons July 16 1912.

FOURTEEN POINTS, THE.—During the winter of 1917–8 talk of peace was prevalent throughout the world. Between Russia and Germany actual peace negotiations were in progress during the opening months of 1918; and on Jan. 5 1918 the British Premier outlined the terms upon which Great Britain and her Allies would be prepared to negotiate for peace.

On Jan. 8, three days after Lloyd George's speech, President Woodrow Wilson, in his address to the joint session of Congress, formulated under 14 separate heads his ideas as to the essential nature of a post-War settlement. Before the delivery of his address he had received from a committee of inquiry, set up by Col. House in Sept. 1917, a report upon the territorial settlement that should follow the conclusion of the War. It has been stated that no fewer than six, and these the territorial points, of Wilson's Fourteen Points were "directly framed" upon the recommendations contained in the report. It has also been stated that the report was drawn up by Dr. S. Mezes, D. H. Miller, and Walter Lippmann.[1]

In any consideration of the Fourteen Points it must be borne in mind that in drafting the Points, especially the first five, regard was had not merely to the future, but also to the fact that they could be used as a diplomatic weapon in the present.[2] In drafting Point 4 the President was probably inspired by the example of the United States, where each State has only a militia for the preservation of internal order; the safety of all from external attack being guarded by the Federal Army.

The Fourteen Points were:—

1. Open covenants of peace openly arrived at, after which there shall be no private international understandings of any kind, but diplomacy shall proceed always frankly and in the public view.
2. Absolute freedom of navigation upon the seas outside territorial waters alike in peace and in war, except as the seas may be closed in whole or in part by international action for the enforcement of international covenants.
3. The removal, so far as possible, of all economic barriers and the establishment of an equality of trade conditions among all the nations consenting to the peace and associating themselves for its maintenance.
4. Adequate guarantees given and taken that national armaments will be reduced to the lowest point consistent with domestic safety.
5. A free, open-minded and absolutely impartial adjustment of all colonial claims based upon a strict observance of the principle that in determining all such questions of sovereignty the interests of the populations concerned must have equal weight with the equitable claims of the Government whose title is to be determined.
6. The evacuation of all Russian territory, and such a settlement of all questions affecting Russia as will secure the best and freest cooperation of the other nations of the world in obtaining for her an unhampered and unembarrassed opportunity for the independent determination of her own political development and national policy, and assure her of a sincere welcome into the society of free nations under institutions of her own choosing, and more than a welcome, assistance also of every kind that she may need and may herself desire. The treatment accorded Russia by her sister nations in the months to come will be the acid test of their goodwill, of their comprehension of her needs as distinguished from their own interests, and of their intelligent and unselfish sympathy.
7. Belgium, the whole world will agree, must be evacuated and restored without any attempt to limit the sovereignty which she enjoys in common with all other free nations. No other single act will serve as this will serve to restore confidence among the nations in the laws which they have themselves set and determined for the government of their relations with one another. Without this healing act the whole structure and validity of international law is forever impaired.
8. All French territory should be freed, and the invaded portions restored, and the wrong done to France by Prussia in 1871 in the matter of Alsace-Lorraine, which has unsettled the peace of the world for nearly 50 years, should be righted in order that peace may once more be made secure in the interest of all.
9. A readjustment of the frontiers of Italy should be effected along clearly recognisable lines of nationality.
10. The peoples of Austria-Hungary, whose place among the nations we wish to see safeguarded and assured, should be accorded the freest opportunity of autonomous development.
11. Rumania, Serbia and Montenegro should be evacuated, occupied territories restored, Serbia accorded free and secure access to the sea, and the relations of the several Balkan States to one another determined by friendly counsel along historically established lines of allegiance and nationality, and international guarantees of the political and economic independence and territorial integrity of the several Balkan States should be entered into.
12. The Turkish portions of the present Ottoman Empire should be assured a secure sovereignty, but the other nationalities which are now under Turkish rule should be assured an undoubted security of life and an absolutely unmolested opportunity of autonomous development, and the Dardanelles should be permanently opened as a free passage to the ships and commerce of all nations under international guarantees.
13. An independent Polish State should be erected which should include the territories inhabited by indisputably Polish populations, which should be assured a free and secure access to the sea, and whose political and economic independence and territorial integrity should be guaranteed by international covenant.
14. A general association of nations must be formed under specific covenants for the purpose of affording mutual guarantees of political independence and territorial integrity to great and small States alike.

President Wilson developed his theories during 1918 in a series of speeches, to which reference was subsequently made during the Armistice negotiations. These are as follows:—

The Four Principles.—In the "Four Principles" speech in Congress, Feb. 11 1918, he declared:—

1. That each part of the final settlement must be based upon the essential justice of that particular case and upon such adjustments as are most likely to bring a peace that will be permanent;
2. That peoples and provinces are not to be bartered about from sovereignty to sovereignty as if they were chattels or pawns in a game, even the great game, now forever discredited, of the balance of power; but that
3. Every territorial settlement involved in this War must be made in the interest and for the benefit of the populations concerned, and not as a part of any mere adjustment or compromise of claims amongst rival States; and

[1] R. S. Baker, *Woodrow Wilson*, vol. 1, pp. 110–1.
[2] C. Seymour, *Woodrow Wilson*, pp. 235 *seq.*

4. That all well-defined national aspirations shall be accorded the utmost satisfaction that can be accorded them without introducing new or perpetuating old elements of discord and antagonism that would be likely in time to break the peace of Europe, and consequently of the world.

The Four Ends.—In the "Four Ends" speech of July 4 1918 occurs the following passage:—

These are the ends for which the associated peoples of the world are fighting and which must be conceded them before there can be peace:—

1. The destruction of every arbitrary power anywhere that can separately, secretly, and of its single choice disturb the peace of the world, or, if it cannot be presently destroyed, at the least its reduction to virtual impotence.

2. The settlement of every question, whether of territory or sovereighty, of economic arrangement, or of political relationship, upon the basis of the free acceptance of that settlement by the people immediately concerned, and not upon the basis of the material interest or advantage of any other nation or people which may desire a different settlement for the sake of its own exterior influence or mastery.

3. The consent of all nations to be governed in their conduct towards each other by the same principles of honour and of respect for the common law of civilised society that govern the individual citizens of all modern States, and in their relations with one another, to the end that all promises and covenants may be sacredly observed, no private plots or conspiracies hatched, no selfish injuries wrought with impunity, and a mutual trust established upon the handsome foundation of a mutual respect for right.

4. The establishment of an organisation of peace which shall make it certain that the combined power of free nations will check every invasion of right and serve to make peace and justice the more secure by affording a definite tribunal of opinion to which all must submit and by which every international readjustment that cannot be amicably agreed upon by the peoples directly concerned shall be sanctioned. These great objects can be put into a single sentence. *What we seek is the reign of law, based upon the consent of the governed and sustained by the organised opinion of mankind.*

The Five Particulars.—The "Five Particulars" (speech of Sept. 27 1918) were:—

1. The impartial justice meted out must involve no discrimination between those to whom we wish to be just and those to whom we do not wish to be just. It must be a justice that plays no favourites and knows no standards but the equal rights of the several peoples concerned.

2. No special or separate interest of any single nation or any group of nations can be made the basis of any part of the settlement which is not consistent with the common interest of all.

3. There can be no leagues or alliances or special covenants and understandings within the general and common family of the League of Nations.

4. And, more specifically, there can be no special selfish economic combinations within the League and no employment of any form of economic boycott or exclusion, except as the power of economic penalty, by exclusion from the markets of the world, may be vested in the League of Nations itself as a means of discipline and control.

5. All international agreements and treaties of every kind must be made known in their entirety to the rest of the world. Special alliances and economic rivalries and hostilities have been the prolific source in the modern world of the plans and passions that produce war. It would be an insincere as well as an insecure peace that did not exclude them in definite and binding terms. (*See* also EUROPE.)

BIBLIOGRAPHY.—The text of the Fourteen Points will be found in C. Seymour, *Woodrow Wilson and The World War*, vol. 3, pp. 42–5 (1921). See also R. S. Baker, *Woodrow Wilson and World Settlement*, 3 vol. (1923); H. W. V. Temperley, *History of the Peace Conference of Paris*, vol. 1, pp. 431–5 (London, 1920).

FOX-HUNTING (*see* 13.947).—The years immediately preceding the World War were in many ways the Golden Age of this great English sport. Money was plentiful and it was noticeable that newcomers to the country-side were inclined to favour hunting rather than shooting. Increased facilities for transport enabled people to hunt from towns. Horse-breeding and hound-breeding had been placed on a sound basis, and hunting, generally, had been organised and stabilised under the supreme authority of the Masters of Foxhounds Association.

War Difficulties.—Then came the War. The drain on horses was tremendous; subscription lists dropped to practically nothing; and, worst of all, at the height of the submarine menace, the feeding of hounds became an almost insoluble problem. The expense was enormous and there was a considerable outcry to the effect that hounds should be suppressed altogether as useless animals which consumed useful food. In 1917–8 hunting very nearly ceased altogether, and had it once come to an end it is extremely improbable that it would ever have been revived. The Association of M. F. H., however, in collaboration with Sir William Buxton, tackled the problem. All over the country the number of hounds was reduced, the reduction being effected partly by killing off hounds, but mainly by drafting large numbers out of the country, notably to America, and by breeding fewer.

These drastic measures had their reward. Not only was hunting saved, but it was far easier for the staffs, greatly depleted by the War, to deal efficiently with these reduced packs. Further, half a century of hound shows had given the general breeder a very sound idea at what to aim; so that, in spite of these reductions, not only was the total number of hounds in England in 1925 very nearly up to the pre-War strength, but the quality of English hounds was as high as ever. Not a single well-known hunt ceased to exist. In 1926 there were over 200 packs of foxhounds in the British Is. and 86 in the United States and the British Dominions.

Post-War Developments.—The end of the War by no means put an end to the difficulties which faced hunting. Judicious reductions, compensated for by breeding on sound lines, settled the hound difficulty. The question of horses largely answered itself by the release of an enormous number of animals from the army. After the War, too, whether as a direct result or not it is impossible to say, there was a decided improvement in the quality of the horses; this has been accentuated by the judgments given at horse shows. Before the War the showing animal and the hunter were two distinct types; the animal that won prizes was not likely to prove of much use across country and vice versa. But after the War the show animal was displaced by the real hunter, who is quite capable of winning a prize in the show ring in the summer and a point-to-point in the spring, the ideal at which to aim. The subscriber difficulty was also automatically solved by the return of the armies and, at any rate immediately after the Armistice, there were more people hunting than before the War.

Speaking generally, then, fox-hunting recovered in a surprising way from the direct consequences of the War. But an indirect consequence still had a great and adverse effect on the sport, namely, the change in the social and territorial conditions of rural England. This began before 1914, but was enormously accentuated by the War. In the old days rural England was largely in the hands of the great landowners, who were probably hunting men themselves, or at any rate supporters of hunting, and their tenant farmers, who took their cue from their landlord. Then came the extensive sales of landed property, due to the heavy taxation of the War period and after with its adverse effects on the sport. (C. L. R.)

FRACTURES.—The treatment of fractures has received considerable attention during the 15 years 1910–25, with a corresponding improvement in the general level of results. The development of radiography (*see* RADIOTHERAPY) and its more general application have produced a greater knowledge of the displacements which occur and may remain after a fracture, and a more critical spirit toward the results of these injuries has developed.

Normal Form.—The restoration of the normal form of the broken bone is an important factor if the best result is to be obtained. After the fracture of a long bone of the lower extremity, correctness of alignment is undoubtedly of the greatest importance; in the upper extremity, however, good functional results may be obtained when the position of the bone deviates considerably from the normal. The demand for accurate reposition of fragments has been met by wider use of open operations, whereby replacements of the fragments can be carried out under the eye of the surgeon, and fixation secured by the insertion of metal or bone plates, or suture material. With the precision of modern surgical technique, such intervention is possible without the risk of infection which held back the older surgeons from undertaking such procedures save in exceptional cases.

Function.—The restoration of function in the injured limb after a bone has been broken has received increasing notice. The

problem is recognised as a complicated one, each aspect of which must receive consideration. Restoration of the normal line of the bone is of the first importance, but the repair of the soft structures overlying the fracture has an equal influence on the final result. Moreover, stiffness in joints near the fracture may develop in cases immobilised for too long, and, if persistent, is a source of serious disability. These complications have been avoided or minimised by modified splint treatment, early massage and controlled movements. Various forms of electrical treatment have also been found helpful.

War Experience.—The intensive experience in the treatment of fractures afforded by the World War came during the development of methods on the above lines, and yielded a store of improvements in technique, while it tended to crystallise opinion on the relative value of various methods of treatment for the individual case. The general introduction of splints, which allow traction to be made on the injured limb, facilitated the control of bone alignment without open operation. Other mechanical improvements elaborated enable direct traction to be made on bone fragments. The transfixion of the bone with pins, and the use of metal calipers to grip the fragments, are examples of such procedures.

Present Tendency.—In general at the present time the tendency to carry out open operations on all fractures of long bones is less in evidence. This is due partly to the advance in methods of splintage, but also to the fact that operations of this character, coupled with rigid fixation by means of metal plates, delay the process of union, and may be the source of subsequent adhesions between bones and the subjacent soft structures. In America there has been a movement to employ slips of the patient's own bone for the purpose of fixation at open operations. This procedure involves a more elaborate technique, but certainly overcomes some of the disadvantages of plating with metal.

Compound or Open Fractures.—The introduction of infection into a fracture has always been a bugbear of surgeons, as, once suppuration is established in bones, it runs a slow course and is liable to lead to sequestration, or death, of some part of the bone, and slow union. War experience has shown clearly that antiseptics are of little value in the disinfection of a lacerated wound. The best method of eradicating infection in connection with wounds of this kind was found to be the excision of the track and the removal of all contaminated tissues. The application of this process of wound excision or *débridement* to the more severe types of compound fracture has greatly improved the results. Once the infection has been avoided or overcome, a compound fracture offers no more serious problem in treatment than does a simple one.

Un-united Fractures.—Though delay in the process of union is common enough for several reasons, failure of bones to unite firmly in healthy individuals is rare. It is, however, met with in those cases in which a large part of the bone substance has been destroyed or damaged by the primary injury or subsequent infection. These cases are now treated with a high measure of success by bone grafting. Fresh bone taken from the patient himself gives the most reliable results. In cases in which the original broken bone ends can actually be brought together, a beef bone and preserved human bone have been employed with some measure of success. As to the degree to which the grafted bone replaces normal bone, the consensus of opinion is that the graft acts as a scaffold along which new bone grows, rather than that it becomes a part of the host skeleton. At any rate it forms a firm bond about which, under suitable conditions, new bone formation takes place. (C. M. P.*)

FRANCE, ANATOLE (1844–1924), French man of letters (*see* 10.775).—For 30 years French literature was dominated in the eyes of all the world by the fame of Anatole France. Although his influence declined in the last period of his life the value of his art was still widely recognised. His ideas were questioned, but not his style nor the services rendered by him to the language. In his old age he was revered as a genius and a patriarch. No reputation since Voltaire's has been found comparable with his.

The son of a bookseller called Thibault, this youth who was to make illustrious the pseudonym of Anatole France started his career quite humbly. He was fond of literature, he was studious and erudite, but negligently preferred reading to writing. He composed publishers' puffs and contributed a weekly article signed " Gérôme " to the *Univers Illustré*. For his own amusement he wrote verse, *Les poèmes dorés* (1875) and *Les noces Corinthiennes* (1876), which showed learning, charm and taste. In 1879 he published his first volume of stories, *Jocaste et le chat maigre*, and in 1881 his first novel, *Le crime de Sylvestre Bonnard*, which was acclaimed by the discriminating as delightful.

In 1883 he first met Madame Arman de Caillavet, with results that profoundly influenced his career. Mme. de Caillavet became his life-long friend. She was clever and active; she had a host of acquaintances and her receptions were attended by the leading figures of literature and politics. She laboured for the fame of Anatole France, and she forced him out of his inertia into composition. The extracts from her correspondence with him prove the important share she took in his writings, and in the dedication of *Crainquebille* (1904) Anatole France could say: " To Madame de Caillavet, this book which I should not have written without her help, for without her help I should write no books."

For 40 years Anatole France poured out a series of lively, solid, graceful and profound works. There are the pungent and mischievous short stories, *Balthazar* (1889), *L'étui de nacre* (1892), *Le puits de Sainte-Claire* (1895); the meditative and critical books, *Les opinions de Jérôme Coignard* (1893), *La vie littéraire* (4 vol. 1883–92); a philosophical novel, *La rôtisserie de la Reine Pédauque* (1893); an historico-philosophic novel, *Thaïs* (1890), describing Alexandria at the beginning of our era and contrasting the ideals of dying paganism with those of nascent Christianity; an admirable novel on the French Revolution and the Terror, *Les dieux ont soif* (1912); a society novel, *Le lys rouge* (1894), a powerful study of jealousy set amid the artistic treasures and lovely vistas of Florence; then the series of political satires, the four volumes of *L'histoire contemporaine—L'orme du mail* (1897), *Le mannequin d'osier* (1897), *L'anneau d'améthyste* (1899), *M. Bergeret à Paris* (1901), where Anatole France creates the legendary figure of M. Bergeret and portrays society before and during the Dreyfus affair; novels of a revolutionary tendency, *Sur la pierre blanche* (1903), *L'île des Pingouins* (1908), *La révolte des anges* (1914), a biography of Joan of Arc (1909–10); lastly the reminiscences, *Le petit Pierre* (1918), *La vie en fleur* (1922). Such is the sum of this work admirable in its wealth and variety.

The philosophy of Anatole France developed during the course of his career. Until 1900 he was primarily a sceptic. As Voltaire's spiritual son, he delighted in the play of ideas and observed without pity the stupidity and the silliness of men. He probed the past and the present and spared no example of human inconsistency, error or weakness. *Les opinions de Jérôme Coignard* gives the reader much pleasure, so witty and mischievous is the author, and gives him, too, a complete lesson in scepticism. The same remark may be passed on *Les dieux ont soif*, where Anatole France considers almost exclusively the failures of the French Revolution. At this time the author seems to have kept respect for beauty alone, the beauty of natural or artistic forms or of such superior intelligence as was shown in the great Greek and Latin writers. Meanwhile he beamed indulgently upon an imperfect universe. As he believed in nothing, he did not believe in a better or a worse. In the writings prior to 1900 may even be found conservative and aristocratic maxims. A supreme indifference inclined him to accept what is rather than risk what might be.

On the outbreak of the political crisis of 1900, his temper changed. He was then seen to show a preference for the progressive parties, and little by little went on to the revolutionary parties which became honoured by his support. He was no orator; words came slowly, and neither his mind nor his phrases were of the kind likely to be popular. The part taken by him at public meetings was undistinguished, being limited to signing manifestos and applauding resolutions, especially those with an

international objective. He was more powerful with his pen. An opponent of Church and State, he seemed to put his faith in the people and to expect the world to be renewed by some kind of revolution. On this point his ideas remained rather vague. In one of his books, *Sur la pierre blanche*, he ends the description of future society with a dreadful cataclysm that destroys everything, and here he is nearer to nihilism than to socialism. The World War changed the trend of his thoughts. As he was too old to serve in the field he wanted at least to show his good will and asked to be employed in a Tours office. This great upheaval left him uncertain concerning the destinies of humanity. Perhaps extreme scepticism is not for long tolerable, and Anatole France felt the need of escape into a revolutionary faith which he refused to define, leaving it a mere aspiration.

What is indisputable is the quality of Anatole France's art. The younger generations, tried by war, and witnessing the consequent political difficulties, ill comprehend the detachment of dilettante M. Bergeret. They need more moral discipline, they believe more in virtue and action. But they do not deny the master who charmed their elders with his graceful wit and magic phrases. As a storyteller, in lucidity of thought and form, Anatole France is incomparable. In his style, too, there is a sweetness, an almost voluptuous grace, which distinguishes his phrases from those of any other writer. He owed much to Voltaire, much to Renan, much to the old French romances, to memoirs and to chronicles. He had read and remembered much; but what he borrowed he made his own; all was changed, and for the better, by his style and interpretation. He translated into a pungent idiom all that could delight or stimulate the intelligence of his cultured contemporaries. He was a deep admirer of classicism, and to the end of his life, when he mentioned Molière, Racine or Stendhal his conversation or his writing attained their richest substance and most pleasant harmonies.

He makes another strong claim on the attention of posterity. He was the finest flower of the Latin genius. His knowledge of antiquity was great, and his work contained the essentials of Greek and Latin wisdom. He portrayed in *Thaïs* characters who distil the philosophy of the ancients. He put into the mouth of Jérôme Coignard maxims which likewise represent the sum of the meditations and arguments common to antiquity. If all the works of the Hellenic and Roman periods were lost their shadow and purpose might be found in the works of Anatole France. He knew what he owed them, and paid them the most splendid homage.

Lastly, in all periods of his career, whatever his theories, he was a deep student of human nature. He expressed in tuneful sentences most of the wisdom that may be acquired from the observation of life and the reading of history. He created characters who persist in the memory: Jérôme Coignard, Jacques Tournebroche, M. Bergeret, Madame Martin Bellème, Catherine, the lace worker, Paphmuce, Nicias, Evariste Gamelin. He described what was comic and evil in mortals. He described, too, what was august in man, sacred in man's labours and sufferings. Though he lacked enthusiasm and ardour, his critical intelligence did not prevent him from brooding over human misery, and in the story of Crainquebille he showed his heart. While humbling himself before the invincible forces of fate and lust, he dedicated his work now to irony—which brought brightness into his life—and now to pity—which at other times reminded him that life deserves a serious, a solemn attention. And so he became twice fortunate, for he was at once a subtle artist acclaimed by the critics and a universally respected publicist who influenced the simple-minded. He died at Tours, Oct. 13 1924.

The works of Anatole France have been translated and edited by Frederic Chapman and James Lewis May and published by The Bodley Head, London.

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FRANCE (*see* 10.775), a republic of Western Europe and member of the League of Nations. The area of France, increased on Nov. 11 1918 by the addition of Alsace-Lorraine, is now 212,737 sq. miles. Her domiciled population (1921) was 39,209,518.

I. POLITICAL HISTORY

The situation of France at the beginning of 1911 was difficult enough, though no acute trouble was manifest at any point to account for the general uneasiness everywhere apparent. In Nov. 1910 M. Briand, after breaking the great railway strike, reconstructed the Ministry, over which he had presided since the fall of M. Clemenceau in July 1909, to include a larger proportion of Moderate elements. As is usual in such cases, the reconstruction had disintegrated the governmental majority instead of strengthening it. The Chamber elected in 1910 leaned further to the Left than the Prime Minister, and showed its dissatisfaction by reducing the majority to 16 on a vote of confidence on the application of the Congregation Laws. M. Briand might still have remained in power had he really wished, but he preferred to resign (Feb. 20 1911) with honour rather than cling to office. Although himself sprung from the Socialist ranks, he felt the necessity of preserving public order against subversive elements, and saw that the deputies were more and more inclined to force the issue, and moreover, he saw no way of extricating himself satisfactorily from the very delicate negotiations with Germany.

The Years Before the War

The Conflict over Morocco.—Since the Algeciras Conference in 1909 French diplomacy had alternated between two courses. Confident in the Russian alliance and the Entente of April 8 1904 with England, she had effectively resisted German pressure. But she saw on all sides evidence that Germany intended to obtain by indirect means what she had failed to win by intimidation—a footing in Morocco and the disruption of the Triple Entente. The Berlin Cabinet took every opportunity of thwarting the organisation of a French protectorate in the Shereefian Empire; moreover, acting in conjunction with Vienna, they persistently insinuated in political and journalistic circles in Paris that France would enjoy greater facilities in Morocco in return for complaisance towards German expansion in the East. This alluring propaganda had its effect upon the Radicals and Socialists, while the Russian Alliance and the Entente Cordiale found favour mainly among the Conservatives, Progressives and Liberals. To the Left of these parties—whom the pacifists accused of militarism—hopes were entertained of an understanding with Germany which, by removing the risk of war, would permit of the normal development of democratic institutions. M. Pichon, Foreign Minister in the Clemenceau and Briand cabinets, did not share this view; but, inspired with a great desire for conciliation, he gave certain confidential assurances to Berlin, supplementing the Franco-German declaration of Feb. 9 1909, under which nationals of both countries were to be associated in Morocco in any transactions for which they could obtain contracts. But at the beginning of 1911 the cabinets of Paris and Berlin were in fact in complete disagreement on the application of the 1909 declaration, and it was therefore without regret that Pichon left the Quai d'Orsay.

Monis, a senator from La Gironde, formed (March 2) a Radical Ministry, giving Caillaux Finance, Berteaux War, Steeg Public Instruction, Delcassé the Navy, Messimy the Colonies and Paul-Boncour Labour. He immediately found himself in difficulties of various kinds. Himself opposed to proportional representation, he had to deal with a Chamber which favoured this method; and although he yielded to Socialist pressure on social questions he was unable to calm the effervescence of the extreme Left. In the department of Aube he was

threatened by a quasi-revolt of the vine-growers, whose right to sell their wine under the name of champagne had been disputed. The Moroccan question was again disquieting. The strongest personality in the Ministry was Caillaux, who, though he stood for better relations with Germany, cherished the ambition of "giving" Morocco to France—that is to say, releasing the protectorate in Morocco from the obligations of Algeciras by arrangement with Berlin. With the concurrence of Berteaux he pressed forward the Morocco campaign. His Foreign Minister, the lawyer Cruppi, failed to realise the risk of military initiative without diplomatic preparation. In April, when the French troops entered Fez, Germany formulated reservations, and Spain claimed her right to similar military occupations, notably at Larache. The question of calling a second conference at once arose; at the moment of this diplomatic crisis a tragic accident put an end to the Monis Ministry, for Berteaux was killed and Monis seriously wounded (May 20) by the fall of an aeroplane on the aerodrome at Issy-les-Moulineaux. For a month the Govt. struggled on. The Senate settled the Aube wine question by removing the strict definition of champagne. On June 23 the Govt. was defeated in the Chamber, and resigned.

Invited to form a ministry, Caillaux took the Interior himself, assigned Finance to Klotz, left Steeg and Delcassé at Public Instruction and the Navy, gave Messimy War and entrusted Foreign Affairs to de Selves, a senator and a successful prefect of the Seine. Caillaux's programme included a project for the "reorganisation of Africa." This scheme, previously worked out with Messimy, had formed the subject of secret negotiation with the German Govt. in the spring. At that time the proposals entailed the cession to Germany of the political administration of French Equatorial Africa under the form of railway exploitation. A document, which was to remain secret, stipulated that: "if the construction of the railway is authorised, Germany may be practically assured that sooner or later Cameroon will be able to annex the Sanga, Ubangi and Shari basins. The economic preponderance of Germany in these countries will in effect inevitably entail her political ascendancy."[1] This move, which meant disguised annexation, failed; but the German Govt., disillusioned by the failure of the agreements made with the Briand Ministry, proceeded with a definite plan. Jules Cambon, French ambassador in Berlin, went to Kissingen during the ministerial crisis to talk over matters with Kiderlen-Waechter.

The Agadir Incident.—On July 1, the day after the reading of the ministerial declaration in Parliament, the reply came. Germany's representatives abroad notified all the Powers signatory to the Act of Algeciras that in response to the appeal of German commercial firms and of German protégés for the protection of Agadir, their Government had sent a warship, the "Panther," to the Moroccan port. This brusque announcement, which meant that France must either forego the military protectorate of Morocco or compensate Germany, was made two days before the date fixed for the embarkation of the President, M. Fallières, and the Foreign Minister, M. de Selves, on a visit to the Queen of Holland. For four months the new Ministry was absorbed in extremely delicate negotiations. Confronted with the uncompromising attitude of Great Britain and Russia, Germany, whose military and naval equipment was not yet complete, did not persist in her original claims on the Congo. To hasten the issue, Caillaux ventured, unknown to de Selves, to make to Berlin secret proposals exceeding the limits conceived possible by the Foreign Minister. Disagreeable complications ensued. Finally, on Nov. 5, a treaty was signed ceding to Germany territory which gave access to the Ubangi and the Congo and organising an economic protectorate in Morocco.

The bill for the ratification of the treaty provoked stormy debates in the Chamber. It was passed at the end of Dec.; but when, some days later, M. Caillaux's secret offers were disclosed at the Commission on Foreign Affairs of the Senate, at which Léon Bourgeois presided, there was a dramatic scene which led to de Selves's resignation. Caillaux offered the Foreign Office to M. Delcassé, who hesitated; the Marine successively to Poincaré, Admiral Germinet and Pierre Baudin, who refused. Finding it impossible to complete his Cabinet, the Prime Minister resigned on Jan. 10.

The replacement of a third of the Senate on the first Sunday in Jan. 1912 produced no sensible modification in either the spirit or the composition of the Upper Chamber.

At the request of Fallières, Raymond Poincaré now quickly formed a ministry. Taking the Foreign Office himself, he made Briand Minister of Justice, gave Léon Bourgeois Labour, Steeg the Interior and Delcassé the Navy. In his declaration on Jan. 16 he announced as his programme the prompt ratification of the treaty of Nov. 4, an *entente loyale* with Spain, courteous and frank relations with Germany, loyalty to alliances and friendships, the restoration of the principle of authority, rigid repression of crime and of offences against persons or property and electoral reform. Under the influence of the Prime Minister moderate ideas began to find favour. When Henri Brisson died, Paul Deschanel was elected to succeed him as president of the Chamber. The municipal elections in May were in favour of the Moderates. A rather complicated franchise Act embodying proportional representation was passed by the Chamber. But, as in the previous year, attention was riveted primarily upon foreign affairs.

A treaty providing for the protectorate was signed by the Sultan of Morocco on March 30, and Gen. Lyautey was appointed Resident-General. There followed disturbances at Fez, negotiations with Spain and long discussions in Parliament. The Sultan Moulai-Hafid abdicated, and was replaced by Moulai-Youssef. The liquidation of the Moroccan affair was attended by a series of complications.

The Balkan Crisis.—Italy had thought it necessary to undertake a parallel enterprise in Tripoli, thus involving herself in a war with Turkey. Certain questions of neutrality arising out of this led to unpleasant incidents, one of which—that of the "Carthage" and the "Manouba"—caused acute tension between Paris and Rome. Here arbitration prevented actual conflict. But the annexation pure and simple of the whole of Libya by Italy, the closing of the Dardanelles and various other incidents aroused such excitement and such hopes in the Balkans that a Balkan League was formed for the purpose of liberating the Christian races on the peninsula. Poincaré was briefly informed of this by Izvolski on April 1, and of the details only in Aug. on the occasion of his visit to Nicholas II. at St. Petersburg. He attempted to intervene as a moderator, but the German and Austrian cabinets which had had warning from secret sources at the beginning of April, allowed events to take their course in the hope that Serbia might be crushed. During the Balkan wars Poincaré continued to urge the localisation of the conflict and the maintenance by the Great Powers of a disinterested attitude in respect of territory. At the London Conference, which opened in Dec., his thesis was: "The Balkans for the Balkan States."

The diplomatic crisis had become serious over the question of Scutari and of Serbia's access to the sea when, Fallières's tenure of office having expired, Poincaré was elected President of the Republic (Jan. 17 1913) by 483 votes against Pams with 269. He carried the day in spite of Clemenceau and the preliminary nomination of Pams by a majority of the Left groups. In his presidential address to the Chambers he made clear his intention to take a more active part than his predecessors had done in the politics of his country. "Weakening of the executive power" he said, "is no part of the creed of Chamber or Country." He insisted further on the necessity of maintaining the military power of France at its highest level, for "it is not possible for a nation to have an effectively pacific policy unless it be always prepared for war."

Briand's Cabinet of Jan. 1913 was formed in accordance with these ideas. Taking the Interior himself, he gave Foreign Affairs to Jonnart and Justice to Barthou, leaving most of the other ministers in their offices. He demanded extraordinary credits for material of war, and put forward a bill for the re-establishment of three years' service, proposing thus to counterbalance

[1] *Documents secrets*, published by A.G. Journal des Débats Jan. 11 1912.

the military measures of the German Govt., which had asked for a special grant of a milliard marks for the reorganisation of the army (*see* GERMANY). Meanwhile he was placed in a minority in the Senate on the question of proportional representation and, on March 18, gave in his resignation.

Barthou, who now became Prime Minister, with Pichon as his Foreign Minister, set himself to secure the passing of the Three Years' Service bill, considered indispensable for national security by the French general staff. Meanwhile he decided to retain with the colours the class whose term of service would expire in October. It was only after a hard struggle and in the face of violent opposition from the Socialists throughout the country that the bill was passed by the Chamber, and then only with an amendment made by Painlevé which placed recruitment a year earlier, at 20 instead of 21, so that the 1912 and 1913 classes were called up together, allowing the 1910 class to be released at the appointed time. The Senate passed the bill almost unanimously.

Barthou's ultimate success was due to the ever-growing menace of a European war. In April a petty dispute between German travellers at Nancy and the inhabitants nearly led to a diplomatic quarrel. Even when the peace of Bucharest (Aug. 10 1913) ended the second Balkan War, the air was still charged with electricity, both in Europe and the East. In France anxiety increased with the rapid growth of pan-Germanism and the concentrated pressure exercised on the Quai d'Orsay by the cabinets of Vienna and Berlin with the object of raising loans to drain French savings invested in those countries which were under the influence of the two empires. In the beginning of Nov. Pichon learned through Jules Cambon, who had been confidentially charged by the King of the Belgians to convey the warning to the French Govt., that the Kaiser had said to King Albert at his official visit to Potsdam: "War with France is inevitable and imminent. . . . . This time it must be decisive. Your Majesty can have no conception of the irresistible enthusiasm that will sweep over the entire German nation when that day comes." Other remarks, of no less grave import, were made by von Moltke, chief of the German general staff, who was in attendance.

Vigorously attacked by the Left, Barthou had to contend with strong opposition from the Radicals, led by Caillaux, and the Socialists. After the parliamentary vacation his majority collapsed on a question of finance. The floating debt, which had been increased by the expenses in Morocco, made it necessary to raise a loan. The loan proposed by Dumont, Minister of Finance, was defeated by 290 to 265. The objection to the extension of the guarantee of fiscal immunity enjoyed by the existing *rentes* to the new *rente* demanded by the minister was, however, only the nominal pretext; the real opposition of the Left was due to Dumont's refusal to impose an income tax.

Ribot and Jean Dupuy failed successively in their attempts to form a Moderate cabinet on account of Radical opposition of which Caillaux was the rallying point. Poincaré, mindful of Caillaux's diplomatic activities in 1911, was unwilling to put him into power. He therefore instructed Doumergue to form a Radical ministry in which that statesman would take Foreign Affairs. Doumergue entrusted Caillaux with Finance, René Renoult with the Interior and Viviani with Public Instruction. He obtained a vote of confidence from the Chamber (302 votes against 141) for "a policy of democratic reforms, based on republican opinion and supported by an exclusively republican majority." This new Govt. indicated a reversion to the sectarian policy known as "Combisme." It was in favour of a tax on income, which was adopted by the Chamber. The reform of the franchise was definitely rejected by the Senate in March, and the approaching elections were therefore to be on the old basis of the *scrutin d'arrondissement*.

The Menace of "Preventive" War.—Although the Ministry had promised the loyal application of the Three Years' Service law, it was known to dislike the system. But the external situation became more and more disquieting. German militarism entered upon a provocative phase. The Zabern incident (*see* ALSACE-LORRAINE) produced a deep impression throughout the country. In March the *Kölnische Zeitung* stated that the "legend" of historical Russo-German friendship had been finally exploded. The question of the "preventive" war was openly discussed in the principal Berlin papers. The *Kreuzzeitung* expressed regret that Germany, in 1905, had missed the opportunity of demanding a decisive explanation from France when the conditions were most favourable. The *Berliner Tageblatt* held the view that "in certain cases, a state surrounded by too-powerful neighbours owed it to herself not to wait for the knock-out blow to be delivered." It and other papers declared that Germany must make haste to act before the Habsburg Empire fell to pieces. For several weeks the newspapers harped on this theme. The cordial sentiments exchanged at the Elysée on April 21, when the King and Queen of England visited Paris, reassured the public for a time; but fresh signs of trouble soon disturbed its peace. A noisy campaign was organised in Germany against the Foreign Legion, and complications arose at various points in the East.

The Assassination of Gaston Calmette, and the Elections.—A sensation was caused on the eve of the elections by the assassination of Gaston Calmette, editor of the *Figaro*, by Madame Caillaux. On Caillaux's resignation Renoult became Minister of Finance, and Malvy Minister of the Interior. The elections took place a month later (April 26 and May 10). The re-election of Deschanel by 401 votes as president of the Chamber made a majority for the Radicals and Socialists seem unlikely. All the vice-presidents too were chosen from among the partisans of the Three Years' Service bill. Nevertheless the Unified Socialists carried 102 seats, and the Radicals were reinforced; their combined strength was such that no Cabinet could dispense with their support. Doumergue, deferring to custom, had resigned after the elections, and the President of the Republic appointed Viviani with instructions to maintain the Three Years' Service law. But Viviani, confronted with the opposition of the Radical-Socialists, who demanded a return to two years' service, resigned. Poincaré then called on Ribot, who completed on June 9 a Cabinet composed of Moderates and of friendly Radicals, such as Léon Bourgeois and Jean Dupuy. But this Cabinet fell at the first meeting of the Chamber on June 12, when a majority of 306 against 26 announced the resolve: "to give a vote of confidence only to a government capable of bringing about the union of the Left groups." Ribot had drawn the attention of the Chamber to the gravity of the general situation and the increase in German armaments; but the Socialist deputies, absorbed in their own affairs, maintained that these armaments were not directed against France. Viviani, summoned once more by Poincaré, now found the Radicals more accommodating, and succeeded in his task. He took Foreign Affairs himself; gave Justice to Bienvenu-Martin, the Interior to Malvy, War to Messimy and the Navy to Augagneur. The ministerial declaration announced the Government's intention of applying the Three Years' law until further notice and of carrying into effect the income-tax proposals so long held up by the Senate. The Ministry secured a vote of confidence by 370 against 137 votes.

THE EUROPEAN CRISIS

On June 28 the Archduke Francis Ferdinand and his wife were assassinated at Sarajevo by two Bosnians who were Austro-Hungarian subjects. While diplomatic and military preparations for a war of aggression were being carried on in the greatest secrecy in Vienna and Berlin, President Poincaré and Viviani were embarking for Russia on a visit to the Tsar, while the French people were passionately absorbed in the proceedings against Madame Caillaux (July 20–8) at the Seine assizes. The verdict of acquittal produced a great sensation, but at this very moment the designs of Austria and Germany were revealed in a flash. Poincaré had scarcely left Russia, on July 23, when—at a moment chosen by Vienna and Berlin to prevent the President and the Tsar from coming to any agreement—the Austro-Hungarian Foreign Minister sent Serbia an ultimatum couched in terms which were intended to make it unacceptable. In Paris, the Austrian and German ambassadors declared to Bienvenu-Martin,

acting Premier and Foreign Minister, that the conflict was to be localised to Austria and Serbia. M. de Schoen added that "any intervention by another Power would, automatically, under the existing alliances, produce incalculable results." A wireless message led Poincaré and Viviani to cut short their proposed stay in Stockholm and cancel their visits to Christiania and Copenhagen; they arrived at Dunkirk on July 29.

On resuming the direction of affairs on the night of the 29–30th, Viviani found the situation desperate On the night of the 25th Austria had broken off diplomatic relations with Serbia, and declared war on the 28th. At the Quai d'Orsay Schoen insistently demanded from Bienvenu-Martin and Philippe Berthelot a public declaration of the "political solidarity of France and Germany"—that is to say, the abandonment of Russia by France. On the 31st Graf Lichtenfeld, Bavarian Charge d'Affaires in Berlin, informed Munich that "the Prussian great general staff face war against France with the most complete confidence and count upon the complete defeat of France in four weeks."

During the presidential voyage anxious French Socialists had got in touch with German Socialists at Brussels. Jouhaux, general secretary of the *Confédération générale du travail*, inquired categorically of Legien, the Social-democrat representative, whether his party would allow themselves to be mobilised in case of aggression on the part of Germany. He received no reply. On the morning of the 31st the German Govt. declared a "state of emergency" (Kriegsgefahrzustand) preliminary to general mobilisation. On the same day the Austrian and Russian governments simultaneously ordered a general mobilisation. At 6:30 P.M., Bethmann Hollweg desired Schoen to inform Viviani that the German mobilisation inevitably meant war, and to ask him whether in a war between Russia and Germany France would remain neutral. His concluding instructions—marked "secret"—to Schoen were:

> If, as there is no reason to suppose, the French Govt. should declare that they will remain neutral, I beg your Excellency to inform the French Govt. that we should require, as pledges of their neutrality, the handing-over of the fortresses of Toul and Verdun; these we should occupy and return after the war. The reply to this question should be in our hands before 4 P.M. to-morrow.

At 7 o'clock Schoen fulfilled his mission to the Quai d'Orsay. A few minutes later, Jean Jaurès, leader of the French Socialist party, who had returned, greatly disheartened, from Brussels, was assassinated by a fanatic in a restaurant. During the day three councils were held at the Elysée. Poincaré sent King George an urgent letter, insisting on the importance of unity of diplomatic action on the part of the Triple Entente and on the moderating effect that could not fail to be produced in Vienna and Berlin by the certainty "that the Entente Cordiale would be affirmed, in case of need, even to the extent of taking the field side by side." In spite of the extreme gravity of the situation Viviani had not yet ordered general mobilisation, but only the completion of the second defence line. No moderating influence could now alter the course of events, determined by the two Central Powers. The French Govt. had concurred in all the British and Russian proposals for the prevention of a general conflagration, whether by the summoning of a conference, by arbitration by the Hague Court, or by mediation. In spite of some wavering between Vienna and Berlin at the eleventh hour the situation was so well defined that Schoen made his preparations for departure on the evening of the 31st, without waiting for the reply that Viviani was to give him the next day. With the "punishment" of Serbia as the initial pretext, the conflict insensibly assumed the form desired by the German general staff. From Austro-Serbian and Austro-Russian it became German-French, without a mistake or even the slightest imprudence having been committed at any point by the French Government.

The Declarations of War.—On Aug. 1, without awaiting replies from France and Russia, William II. approved the text of the declarations of war against these two Powers. The Federal Council assembled in Berlin took note of the two documents, and agreed to their dispatch in case the expected replies should prove unsatisfactory. At 11 A.M. Viviani replied to Schoen that France would do what her interests demanded. There was no mention of Toul and Verdun by Schoen. At 3:40 P.M. France ordered a general mobilisation. At the same hour, and before the arrival in Berlin of Schoen's telegram relating his interview with Viviani, the order for general mobilisation was given in Berlin, the public announcement following at 5 o'clock. At 5:30 Schoen went again to the Quai d'Orsay, where Viviani expressed to him his hope that, in spite of the mobilisation, negotiations would be continued on the basis of the most recent proposal put forward by England, which had the warm support of the French Cabinet. At 7 P.M. Count Pourtalès delivered Germany's declaration of war to Sazonov. At midnight Izvolski appeared at the Elysée, where a Cabinet meeting was in progress, to ask what France intended to do. The Cabinet decision was to fulfil all the obligations of the Alliance, but that France should not take the initiative in breaking off relations nor declare war. A state of siege was proclaimed, and the Chambers were convoked for the following Tuesday. During the night German detachments invaded French territory at four different points.

On the morning of Aug. 2 a French corporal was killed on the Delle road by a German lieutenant who had entered France at the head of a patrol. In Berlin the expediency of an immediate invasion of France was being discussed. After consulting the war ministers and the general staff, the Chancellor decided in the negative. "We hope," he reported to the Kaiser, "that the French will attack us." But this hope was not realised, the French troops having orders not to respond to provocation. The German Cabinet then ordered the German Minister at Brussels to carry out the instructions contained in a sealed note that had been sent with a telegram on July 29; these instructions were that the Belgian Govt. be summoned to allow the passage of the German Army. At the same time the chief of the German Admiralty informed the commander of the fleet that hostilities against France would probably commence on Aug. 3. The Belgian Govt. rejected the German summons, as also the proposal of H. Klobukowski, the French Minister, to send five French army corps to defend Belgium's neutrality. In London assurances were made to M. Cambon by Sir Edward Grey that if the German Fleet came into the Channel or through the North Sea to undertake military operations against the French coast or shipping, the British Fleet would give all the protection in its power, and that the British Govt. were considering whether they would declare in Parliament the next day that the violation of Belgium should be regarded as a *casus belli*.

On Aug. 3, France having nowhere furnished any pretext for aggression, the German authorities spread false reports of supposed invasions of German soil or German skies by French soldiers. Bethmann Hollweg telegraphed to all the European capitals that "France's action was the most serious violation of neutrality imaginable." Between 1 and 2 o'clock he ordered Schoen to deliver to the French Govt. at 6 P.M. the same day a declaration of war couched in these terms:—

> The German administrative and military authorities have established a certain number of flagrantly hostile acts committed on German territory by French military aviators. Several of these have openly violated the neutrality of Belgium by flying over the territory of that country. One has attempted to destroy buildings near Wesel; others have been seen in the district of the Eifel, one has thrown bombs on the railway near Karlsruhe and Nürnberg. I am instructed, and I have the honour to inform your Excellency that, in the presence of these acts of aggression, the German Empire considers itself in a state of war with France in consequence of the acts of this latter Power.

Viviani made vigorous protests both to Schoen and in a note sent to the representatives of the Powers in Paris. There was some brawling in the streets of the capital where German or Austro-Hungarian subjects owned shops and some of these were pillaged. But order once being restored by Viviani, no further disturbance took place in the following days. That evening he reconstructed his Cabinet to suit the circumstances, himself remaining president of the council but relinquishing Foreign Affairs, which passed to Doumergue. Augagneur succeeded Gauthier for the Navy.

On Aug. 4, amid general excitement but without disturbance anywhere, Parliament reassembled to hear the Government's communication. In his message the President of the Republic recalled the fact that for over 40 years France, resolutely putting aside her desire for legitimate reparation, had used her rejuvenated energy solely in the interest of progress and for the good of humanity; that she might be justly proud of having made supreme efforts to avert the war which had just broken out, the crushing responsibility of which would be laid upon the German Empire by history. The message, to which the two Assemblies, greatly moved, listened standing, proclaimed the "*union sacrée*" of all sons of France. Viviani then explained at length the events and negotiations that had taken place, concluding with these words: "We are without fear, we shall be without reproach." Thus invoked, the "sacred union" became a reality. Even as the army mobilisation proceeded throughout the country in perfect order, so the mobilisation of the spirit, which prepared the population to endure long and terrible trials, was effected with a quiet dignity. Parties ceased to exist. Bowing to the evidence of German aggression the Socialists stood loyally by the Government. They sought no vengeance for the murder of Jaurès, and the Viviani Cabinet, confident in their patriotism, refrained from using their discretionary powers of preventive arrest even on the most suspect in their ranks—those whose names were on "List B." The whole country, moved by one will, rose with the same enthusiasm against the invader.

By a succession of laws, passed without debate, the country was organised for a state of war. The state of siege was to be maintained for the duration of the War; commercial settlements were postponed and credits prolonged; legal proceedings against citizens called up for service were suspended, and a moratorium was decreed for bank deposits. Allowances were voted for necessitous families whose breadwinners were in the army; the Govt. was authorised to open by decree credits for the requirements of national defence. Notes on the Banque de France became compulsory currency, and the limit of emission was raised to 12 milliards. Measures were taken against alcoholism, in particular the sale of absinthe was forbidden. To avoid press indiscretions it was forbidden, under penalty of imprisonment, to publish any information regarding national defence apart from that given in official communications, or any military or any diplomatic article of a nature "favourable to the enemy or calculated to depress the minds of the army and the population." No preventive censorship was established, but a Press bureau installed at the Ministry of War received the damp proof-sheets of the newspapers and marked such passages as were not to be printed. Any paper which failed to comply was liable to be warned, and, in case of a second offence, suspended. The passages suppressed were represented by blank spaces as it was impossible to replace them at the last moment; these were known as "caviare."

In a few days the conflagration had spread from one end of Europe to the other. Austria, however—the original instigator—affected a sort of ignorance of events in her relation to France. Her ambassador continued his functions in Paris. Under pressure of public opinion, infuriated by this cynical attitude, Doumergue sent Graf Szecsen his passports on Aug. 10 and instructed Dumaine to ask for his. The British Cabinet followed the same course with regard to Count Mensdorff.

The War Period

After the loss of the battle of the frontiers (Aug. 20–4) the Ministry realised the need of reconstruction or—as Viviani phrased it—of broadening its basis. On Aug. 26 the government of National Defence was constituted, containing representatives of the Republican parties, and including for the first time two Socialists, Guesde and Sembat. Viviani remained as Prime Minister without portfolio; with Briand, Delcassé, Malvy, Millerand, Ribot, Sarraut and Doumergue. At the same time Jouhaux, together with the Archbishop of Paris, Cardinal Amette, was appointed to the National Aid committee (*Comité de l'oeuvre du secours national*), created for the assistance of refugees from the invaded departments and presided over by the head of the Paris Faculty of Science, M. Appel. No sooner was the new Govt. formed than it departed to Bordeaux (Sept. 3) unwilling to risk being shut up in Paris as in 1870. The capital was left in the hands of a military governor, Gen. Galliéni, whose short proclamation became famous: "Inhabitants of Paris, the members of the Govt. of the Republic have left Paris in order to give a new impulse to National Defence. I have received a mandate to defend Paris against the invader; this mandate I shall carry out to the end" (Sept. 3). Nevertheless more than a third of the population left the city. German aeroplanes flew over Paris daily.

The installation at Bordeaux of the Govt., the foreign missions, the principal departments of state, the most important Paris newspapers, and a multitude of pusillanimous or curious persons was not effected without some disorder at first, and even some scandals. But life in the provisional capital rapidly attained the necessary dignity. On the side of the Govt. it showed great activity. On Sept. 5 M. Delcassé obtained through M. Cambon a declaration signed in London by which the British, French and Russian governments mutually agreed to conclude no separate peace during the existing War, nor, when peace terms came to be discussed, to propose conditions without first coming to an agreement with each of the other Allies.

The victory of the Marne (Sept. 6–10) brought relief, and, indeed, gave rise to exaggerated hopes; but disillusionment was to follow. On Aug. 2 a German-Turkish alliance had been concluded, unknown to the ambassadors of the Triple Entente duped by the triumvirate Talaat-Enver-Djemal; there followed the disaster of Tannenberg, the penetration of the "Goeben" and the "Breslau" into the Sea of Marmara, and Turkey's entry into the War on the side of Germany at the end of October. Munitions became exhausted and the line of trenches now extended continuously from the Vosges to the sea. Paris was no longer in danger, but six departments had been invaded, and none could say when they would be liberated. The situation being thus stabilised, the Govt. was reinstalled in Paris in the latter half of December. The Chambers which had not sat at Bordeaux, although assembly rooms had been reserved for them, met again on Dec. 22. Thenceforward they were to be permanently in session with but few interruptions. The experience of the preceding months had shown that there were serious objections to the suppression of Parliament and of the Press. An outside stimulus was needed to correct the errors of judgment and fatal imprudences that had been committed. In the Chamber the criticisms were many and vigorous; notably these formulated with asperity by Clemenceau in his paper *l'Homme Libre* which, after being suppressed by the censor, reappeared as *l'Homme Enchaîné*. But Viviani was able to curb excessive recriminations in the Chamber and to insist on the maintenance of the *union sacrée*. He consented to the formation of big parliamentary commissions, which were to prove discreet and very useful collaborators of the Government. Certain deputies and senators were sent on missions to the armies.

Annual budgets were dispensed with. All credits were voted by douzièmes described as provisional. As taxes were not coming in well and it was considered impolitic to raise them at a time when the nation's whole resources were being strained to restrict invasion, resort was had to loans. The most successful financial resource was the issue of National Defence bonds, which had been Ribot's idea. These were actually Treasury bonds in the form of coupons bearing a fixed rate of interest, payable in advance, which could be realised at three, six or 12 months and were negotiable at sight.

The Ministry was vigorously attacked on the subject of the men—named *embusqués*—mobilised or liable to be mobilised, who shirked service at the front. In the hurry to produce munitions many factories had to be set working again and authority was given to their directors to recall such of their workpeople or staff as seemed to them indispensable. Similarly, members of the universities and specialists whose technical knowledge was indispensable to different services had to be allotted to non-combatant corps. As a result the trenches had been held, since the middle of 1915, mainly by peasants and employees. On the

initiative of Dalbiez, therefore, the Chamber passed a rigorous law (June 26), which did not however entirely remove the *embusqués* scandal. In July two under-secretaryships were created: Joseph Thierry for supply and Justin Godard for the medical services. The discussion aroused by all these complicated questions weakened Millerand's position. In the Senate, Clemenceau, as president of the Army Commission, carried on a ruthless campaign for the adaptation of the services to the needs revealed by the War.

The Intervention of Italy.—In the field of foreign politics the spring was a period of great promise followed by great disappointment. In the Dardanelles the naval expedition sent to force the Straits failed (March 18) with heavy losses. In May there was joy on hearing of Italy's intervention on the side of the Allies. A treaty between the Triple Entente and Italy, of which the tenor remained a secret for the whole of the War, had been signed on April 26 in London. Although the clauses relating to the proposed cession to Italy of territory inhabited by Slavs were not divulged, they were known in substance to the Slav peoples and created great indignation, thus strengthening Austro-Hungarian resistance. Then, too, in defiance of a formal stipulation in the Treaty of London, Sonnino declared war on Austria only. It was not until Aug. of the following year that he declared war on Germany, who benefited meanwhile by Italy's neutrality. Then again, England and France, who were already providing military material for Russia, had now to manufacture it for Italy also, although they had not enough for themselves. The crowning humiliation was Rumania's failure to come in till over a year later instead of with Italy, as the Allies had expected.

The Intervention of Bulgaria.—Yet another intervention was to follow, disconcerting the Allied Ministers and precipitating the fall of Viviani's Cabinet. When Bulgaria ordered a general mobilisation on Sept. 22, the Allies flattered themselves that it was directed against Turkey. For three days Delcassé and Millerand denied the evidence. When the truth came out, Delcassé, on being questioned in the Chamber, was subjected to such severe criticism that he had to retire. Viviani then took over the portfolio of Foreign Affairs (Oct. 13). He was still able to obtain a vote of confidence of 372 to 9; but, by the abstention of the Socialists and a large number of Radicals, the *union sacrée* was broken. Viviani was a victim of the general uneasiness caused by successive disappointments and by the non-success of the great offensive in Champagne (Sept. 15). Sensible of the disaffection of the majority, who were opposed to the secret committees instituted by the Chamber, Viviani handed in his resignation on Oct. 28.

Briand rapidly formed a new Cabinet, keeping Foreign Affairs himself. The Ministry of Justice fell to Viviani, War to Gen. Galliéni, Navy to Adm. Lacaze, Public Instruction and Invention to Painlevé; Ribot retained Finance and Malvy the Interior. Five seats in the Cabinet without portfolio were created for de Freycinet, Léon Bourgeois, Combes, Guesde and Denys Cachin, and an Under-Secretariat for Munitions for Albert Thomas, the young Socialist deputy. The Ministry, which embraced political veterans of all parties and some new men in addition, was unusually well received. Briand's speech, taking as its motto: "peace through victory," was followed by a vote of confidence in the Chamber of 516 to 1. The *union sacrée* seemed to be restored in spite of the sympathy shown by a considerable and energetic Socialist minority with the pacifist resolutions passed at the International Socialist conference at Zimmerwald early in September. This minority grew gradually bolder. At the second International Socialist Conference, held also in Switzerland at Kienthal in April 1916, three French deputies presented themselves.

Restrictions and Finance.—In spite of goodwill the Briand Cabinet had some hard knocks at home and abroad. In the hope of preventing a rise in the price of essential foods and of slowing down the increase in the cost of living, the Govt. provided the bakers with flour (at a loss) and fixed maximum prices for certain commodities. They had eventually to proceed to stricter measures and to ration each family for bread, coal and sugar. Summer time, introduced in June for the sake of economising coal, was maintained in spite of the dislike of the rural population. The prolongation of the War made it more difficult to enforce extraordinary regulations which had been accepted originally as temporary. The restrictions on the consumption of alcohol, to which the trade raised strong objections, and the prohibitions laid down by the military authorities aroused complaints which reverberated unpleasantly in the Chamber. On Feb. 1 1916 Galliéni, having been rudely interrupted, left the tribune and even the hall. Although he was brought back it was only to complain, "You force me to do work for which I am not fitted." It was not for long. Galliéni, being exhausted and threatened with appendicitis, resigned on March 16. On May 26 he died as the result of an operation. His funeral was made a national event. He was succeeded by Gen. Roques, who was thus the fourth War Minister in 20 months.

The necessity of providing the Treasury with other resources than those raised by loans compelled the Govt. to demand new sacrifices. A tax on income, passed by the Chamber before the War, but laid aside by the Senate, had already been imposed; but owing to the respite granted to mobilised men only 133,000 were found to have an income over 5,000 fr. (the minimum taxable figure), and as their total income was under three milliards, only half the expected sum was realised. Ribot hoped at least to cover the interest on new loans by the tax. He therefore proposed to double the tax on land, the tax on income, and to increase the duties on tobacco, sugar and alcohol; also to suppress the rights of vineyard proprietors to distil without paying duty on the yield of their vintage. On this latter point in particular Ribot met much opposition, and exemption on 10 litres of pure alcohol per family was conceded. The Senate accepted this condition, though objecting to the distillers' privileges. The doubling of direct taxes was rejected in favour of a tax on war profits, which from this time onward often appeared excessive. The Socialists took advantage of the national unrest to promote their cause, and internationalism made some headway in the National Council of French Socialists. Late in Aug. a vote was passed protesting against the doctrine which denied that a country had the right to defend itself when attacked, and calling for a durable peace based upon reparation of the wrong done in 1871 and the restoration of independence to oppressed nations. But the minority continued to grow and, by Dec. 28, had 1,081 votes against 1,836. Only by 1,637 votes against 1,372 was Thomas authorised by the party to return to Munitions.

Verdun and the Somme.—During the whole of 1916 military interest was concentrated on the siege of Verdun (*q.v.*). By June the general anxiety had reached such a pitch that Viviani consented to let the Chamber sit in secret committee (June 16–22). After animated discussion a resolution was passed, by 440 against 97, expressing at the same time confidence in the Govt. and the Chamber's desire "to exercise effective control of all services engaged in providing for the requirements of the army . . . while strictly abstaining from interference with the conception, direction or execution of military operations." Actually this control was carried out without serious hitches, and the committee continued to sit in secret whenever the situation was felt by the deputies to be too serious to be discussed at a public sitting.

On July 1 a Franco-British massed attack was launched against the line of the Somme. It was a brilliant performance, with heavy losses on both sides, but the result was negative; for after weeks of struggle the Allied line had only advanced some kilometres to the East. On the second anniversary of the War efforts were made to sustain the morale of the army and the population by proclamations from the President of the Republic, the Prime Minister and the army chiefs. The Govt. urged private individuals to put their gold into the Banque de France and place their realisable foreign securities at the disposal of the state. In response to these appeals some three milliards were collected, making it possible to limit depreciation of the franc to 10 or 12%.

The Eastern Campaigns.—But events in the East took a disastrous turn. The second Dardanelles expedition—no more successful than the first—was abandoned in the autumn, and the

troops thus released were sent to Salonika and placed under Gen. Sarrail, who had instructions to go to the aid of Serbia. But Sarrail, lacking adequate means and thwarted by the opposition of King Constantine, was unable to get into touch with the Serbs, whose army retreated under terrible conditions across Albania to the Adriatic. In vain did the British and French governments urge Constantine to range himself on the side of the Allies; he dismissed Veniselos and the Chamber, and persisted in an unfriendly neutrality. Briand opened negotiations with the Greek Govt., which produced nothing but irritation and disappointment to France. On Aug. 17 1916 a treaty of alliance with Rumania brought the Allies renewed hopes of an early victory. But after some success there came a fresh disaster. Rumania was attacked by Bulgaria, on whose neutrality she had relied; the Russian contingents promised to her were delayed, the promised offensive by Sarrail's army was not launched and her territory was finally invaded and occupied by the enemy as far as Moldavia. Encouraged by these events and urged on by Berlin, Constantine went so far as to attack some detachments of French marines on the outskirts of Athens and a number of Veniselists in the streets of the city. French residents had to take refuge with the fleet.

Briand and Adm. Dartige du Fourmet, commanding in Greek waters, had been doubtfully advised in their later negotiations with the Cabinet in Athens. They had in fact speculated on Constantine's goodwill. In France, where the Rumanian catastrophe had come as a surprise, these latest events made a painful impression. A secret committee of the Chamber (Nov. 28–Dec. 7) passed a resolution "taking note of the Government's declarations on the reorganisation of the command and approving its resolution to concentrate on the conduct of the War and its economic organisation." Briand thereupon reconstituted his Cabinet. He suppressed the five ministers of state, made Gen. Lyautey War Minister (replacing him in Morocco by Gen. Gouraud), promoted Thomas to be Minister of Munitions, and gave Herriot Supplies. Loucheur was made Under-Secretary of Munitions. A war committee of five ministers was formed and, at the end of the month, the reform of the high command, so long desired by the many who had lost confidence in Joffre's methods, was timidly brought about. Joffre was attached to the War Committee as technical adviser, and was made a Marshal of France. His successor was neither Foch nor Pétain, but Gen. Nivelle, who was appointed commander of the armies of the north and northeast. But Briand's authority was now seriously impaired. In the Chamber he was subjected to wearisome criticism and recrimination, and the deputies refused him the necessary powers to deal by administrative order with questions affecting national defence. Even the Senate's vote of confidence was only passed by 190 votes against 37. With each successive vote his majority decreased while the number of abstentions steadily increased. At last, during a session in which certain deputies demanded a secret committee on military questions, Gen. Lyautey retorted bluntly that there were some things which could not be said even in secret committee. This suggestion of possible indiscretions—there had been leakages—was greeted with angry murmurs, and Lyautey decided to resign. As Painlevé refused to take his place, Briand tendered the resignation of the whole Cabinet on March 17 1917.

Peace Offers.—One of the last acts of the Cabinet had been the rejection of a disputable offer from the four enemy governments "to enter upon peace negotiations." This proposition, couched in grandiloquent phrases and enhanced by sensational addresses from the heads of the governments in Berlin, Vienna and Sofia, lacked precision. As M. Briand said, speaking on Dec. 1 1916, it was a proposition to "*d'avoir a négocier la paix.*" The Russian, Italian and British ministers denounced its insincerity. About the same time, too, a note from Mr. Lansing invited the belligerents in the name of President Wilson to "take soundings." It was a profound shock to France to see all the belligerents—aggressors and victims—put thus on the same footing. Two days later the Swiss Govt. made a similar move. On Dec. 23 the French Senate announced its determination "to carry on the War which has been imposed upon us to a victorious conclusion." The governments of the other Allies expressed their determination with equal force. On Dec. 30 they sent collective and identical notes to the neutral states charged with the protection of their interests in enemy countries, stating that the conclusion of peace was contingent upon the restoration of rights and liberties that had been violated and recognition of the complete independence of the small states. Wilson still pleaded for "peace without victory" at the Senate on Jan. 22; but, Germany having declared for unrestricted submarine warfare, (Feb. 1) he broke off diplomatic relations with that country on Feb. 3.

Paul Deschanel, the president of the Chamber, having declined to undertake to form the new Ministry, it fell to Ribot to accomplish this task in 24 hours. Taking Foreign Affairs himself, he gave War to Painlevé, Labour to Léon Bourgeois, and retained several of the former Ministers—notably Malvy as Minister of the Interior. Lyautey returned to Morocco. The ministerial declaration, of considerable substance and detail, was approved by 440 votes against 61 abstentions. Ribot was confronted with some extremely important problems. The Russian Revolution, the forced abdication of the Tsar, and the installation of the weak provisional Govt.—soon to be succeeded by the Bolsheviks—upset all the military combinations of the Allies on the eve of a great offensive for which minute preparations had been in progress for months. At the same moment (March 17–24) the Germans effected a strategic retreat on the Somme front, leaving a desert behind them. A formidable problem presented itself: should the offensive, prepared in conjunction with the British, be carried out in spite of the modification in the general conditions unfavourable to the Allies? To what extent should the Govt. interfere in the direction of military operations? Intimate discussions took place between the ministers and Gen. Nivelle. The declaration of war on Germany by the United States (April 6) served, it is true, to restore the equilibrium destroyed by the Russian Revolution, but it would be many months before it could have any effect on the military situation. As the Govt. still hesitated Nivelle offered his resignation, but withdrew it on receiving definite assurance that the offensive would take place as arranged. On April 16 the French troops, who had been magnificent in launching their attack, were brought up against insurmountable obstacles and came to a standstill after heavy losses. The depression felt by the army and the public led, among other changes, to the replacement of Nivelle by Pétain, with Foch as chief of the general staff.

Side by side with military operations, secret negotiations were proceeding between Paris and Vienna. In Jan. and Feb. the Emperor Charles I. commissioned his brother-in-law Prince Sixtus of Bourbon to communicate his desire for peace to President Poincaré. After several journeys Prince Sixtus of Bourbon presented Austria's peace conditions (May 5) at the Elysée. They were the conditions of a conqueror, and the alliance with Germany, Bulgaria and Turkey was again affirmed. After another journey to Vienna, Prince Sixtus returned to the Elysée with a personal letter from the Emperor, who expressed his willingness "to forward in every possible way the just claims of France to Alsace-Lorraine and to use his personal influence with his Allies to that end." Although these conditions were unacceptable to the Allies of France, Poincaré and Ribot did not reject them offhand. On April 19 Ribot went to St. Jean-de-Maurienne with Lloyd George, who had been fully informed, to meet Sonnino. Lloyd George offered Sonnino Smyrna if he would give up Trieste; but the Italian Minister insisted that the conditions of the Treaty of London had represented a minimum and that any concession would provoke risings in Italy which would place the Govt. in danger. Subsequent conversations only attested the impotent vacillation of the Austro-Hungarian Government. Other secret proposals were exchanged during the summer at Fribourg in Switzerland between Count Revertera, for Austria, and Count Armand for the French general staff. But these emphasized the inconsistency of proposals which proved abortive.

French Action in Athens.—It was thought that only by force of arms could the enemy be checkmated. Ribot therefore decided, after consulting the British Govt. in London, to settle the Greek question by expelling Constantine and freeing the Salonika Expeditionary Force from the risk of attack by the Germanophil Greek forces. He gave full powers to Senator Jonnart, appointed High Commissioner of the Allied Powers for the occasion. Jonnart left for Brindisi on June 2 and appeared before the Piraeus at the head of a fleet on the 5th. In spite of strong protests from the British, Italian and Russian Ministers at Athens, all of whom were opposed to the expulsion of the King, Jonnart demanded and obtained Constantine's capitulation, after having had Thessaly and the Isthmus of Corinth occupied by Allied troops. On June 13 King Constantine left Athens with his family. Jonnart then recalled Veniselos, who had constituted a provisional government at Salonika, and the King's second son, Prince Alexander, was called to the throne with the title of King Alexander I., his elder brother George being passed over because of his German sympathies.

The Socialist Movement.—This success was warmly approved in Paris inside and outside Parliament. It helped to consolidate the Cabinet, which, however, was soon to be shaken by the Socialist manoeuvres. At a plenary session of the party held in May, the Socialists had decided to attend the International Congress at Stockholm which had been called with the object of stopping the War. The Govt. refused their passports, and the Chamber, after a secret session, passed a resolution of approval by 467 votes against 52, and with a further resolution on the conditions of peace that:—

The Chamber, while countersigning the unanimous protest made to the National Assembly in 1871 by the representatives of Alsace-Lorraine, forcibly torn from France, announces that it expects, as the result of the War imposed upon Europe by the aggression of Imperialist Germany, not only the liberation of invaded territory, but the restoration of Alsace-Lorraine to the mother-country and just reparation for damages.

The Chamber further declared itself to be " far from any idea of conquest or of the subjection of foreign populations," and defined the goal towards which the armies of the republic were striving as " the laying down of permanent guarantees of peace and independence for great and little nations by an organisation of which the basis is now being prepared by the League of Nations." On June 7 a similar motion was passed unanimously in the Senate, which in addition requested the Govt. to take all necessary precautions at home and abroad for the safety of the nation, in view of the number of recent strikes of a suspicious nature in which undesirable foreigners had taken part.

These transient troubles, which yielded to firm handling, coincided with a peace move staged in Berlin (*see* EUROPE), and rumours on the subject of a journey to Leningrad (Petrograd) undertaken by Doumergue and Castelnau under the late Ministry. As regards the latter, Ribot stated in the Chamber on July 31 that Doumergue had made a note of the Tsar's promise to support the re-annexation of Alsace-Lorraine to France and " to leave France free to seek guarantees against renewed aggression, not by annexing the territories on the left bank of the Rhine, but by creating if necessary an autonomous state out of these territories, which would protect us, as well as Belgium, from invasion from beyond the Rhine." Meanwhile disturbances stirred up by Teutonic influences with the aim of depressing French opinion and bringing into power in Paris men who would be willing to take the initiative in peace proposals, provoked a governmental crisis. In view of the anti-patriotic propaganda that was being carried on by means of pamphlets and the revolutionary paper *Le Bonnet Rouge*, the Senate held a secret committee (July 19–20). Clemenceau took Malvy, Minister of the Interior, vigorously to task on the matter of his relations with Almereyda, an adventurer who edited *Le Bonnet Rouge*. This episode marks an epoch in the internal history of France during the War, for it created the schism between the Socialists and the Government.

The Senate and the Chamber successively passed votes of confidence, in spite of the resignation of Adm. Lacaze and Denys Cochin. The Socialist group allowed Albert Thomas to remain in the Cabinet; but the rupture took place, following on the action brought against *Le Bonnet Rouge*. Almereyda, who had been arrested on Aug. 6, was found dead in his cell on the 14th. He had been strangled with one of his bootlaces. The official experts gave a verdict of suicide, but such a suicide was at lowest a singular reflection on the supervision exercised, and public opinion was up in arms. Malvy had been away a few days for his health, but he now resumed his functions. Meanwhile it was learnt that a cheque of suspicious origin which had been seized at the frontier from the director of *Le Bonnet Rouge* had been restored to him by the favour of Leymarie, Director of Public Safety, and at the same time director of the bureau of the minister. Leymarie declared he had acted without consulting the minister, and resigned. On Aug. 31 Malvy, accused of having relations with Almereyda, resigned. It was first thought that the Ministry might be simply reconstituted, but the attempt failed, and the Cabinet resigned on Sept. 7. Ribot, charged with the task of forming a new Ministry, failed, because the Socialists refused to collaborate with him, while Painlevé refused to remain in the Cabinet unless the Socialists came back. The Socialists could not forgive Ribot for refusing passports to Stockholm, and Painlevé was being pushed into power by friends who regarded him as the man of the hour.

Thus it fell to Painlevé to form a Cabinet which, by a curious contradiction, did not include a single Socialist. He was his own War Minister; Ribot retained Foreign Affairs, and Loucheur became Minister of Munitions. On Sept. 18 Painlevé secured a vote of confidence, unanimous but for the abstention of the Socialists and some Radicals (among them Caillaux). The Ministerial Declaration contained nothing new in general policy, but promised that justice would take its course, unhesitatingly and without any respect of persons, in the judicial inquiries then proceeding or about to be opened. This promise the Ministry was almost immediately called upon to fulfil. On Oct. 7 Turmel, a deputy, was arrested for having received money of suspicious origin. Then came the Bolo scandal. It was discovered that Bolo—known as Bolo Pasha, that title having been conferred on him by the former Khedive, now dethroned and an instrument of the Central Powers—had received 10,000,000 fr. in the United States from Von Bernstorff, the German ambassador. With this sum he had bought 1,100 shares in the *Journal*, the editor of which, Senator Charles Humbert, had made himself known by a noisy campaign demanding " guns and munitions." Bolo was arrested on Sept. 29. On Oct. 4 Malvy himself appeared in the dock. The former Minister of the Interior was accused of treason by Léon Daudet, editor of the *Action Française*, in a letter addressed to the President of the Republic, which was read out in the Chamber. After a judicial inquiry the Govt. announced, on Oct. 15, that there was no foundation for Daudet's accusations. The Govt. obtained only 246 votes against 89 in the Chamber on an interpellation on the subject. It was shaken; an outside incident brought about its fall.

The Lancken-Briand Incident.—Meanwhile the Berlin Cabinet, itself torn by internal dissensions, was trying to implicate certain Frenchmen in its *défaitist* negotiations. M. de Lancken, German civil commissioner in Brussels, conveyed proposals to Briand by means of Belgian intermediaries—notably Baron Coppée and his son. He told him that William II. was ready to make peace and to send a qualified personage to Switzerland to confer with the former Prime Minister. Briand wrote to inform Ribot, and suggested the conditions under which conversations might be initiated; but Ribot strongly opposed conversations which might be exploited by the Germans. Lancken therefore waited in vain for Briand at Ouchy, and the matter dropped. But a legend grew in the lobbies of the Chamber to the effect that Ribot had turned down peace feelers which held some promise of the return of Alsace-Lorraine to France. On Oct. 12, when Georges Leygues made an interpellation in the Chamber on the personnel and action of the diplomatic body, Ribot took the opportunity to denounce in veiled language Austria's manoeuvre to separate France from Italy and the pitfalls laid by Germany,

" who only the other day, caused perfidious suggestions to be whispered in the ear of a man of high standing." The concluding words of this sentence caused a commotion at the Palais Bourbon, and were therefore suppressed in the official records. On the 16th, the Socialist deputy Mayeras moved to discuss the discrepancy between the words spoken in Parliament and the text as printed. The motion was discussed in a stormy secret committee which gave the Govt. a small majority. Briand's friends, displeased with the allusion of Oct. 12, voted with the Socialists, who were still full of resentment over the refusal of the Stockholm passports. The Cabinet were so badly hit that Painlevé contemplated resignation. Poincaré would not accept his resignation, but Ribot and his other colleagues handed in theirs collectively so as to give the Prime Minister a free hand to reconstruct his Cabinet. On Oct. 28 the Ministry was reconstituted, Painlevé contenting himself with replacing Ribot by Barthou; but far from consolidating the Govt. the substitution only weakened it. The ministerial majority, which had stood at 362 on the 12th and 316 on the 19th, fell to 288 after Painlevé's and Barthou's speeches on the 25th.

Nevertheless, Painlevé took the same attitude as Ribot towards Stockholm, and refused passports for the Congress then in progress. He hoped to appease the Socialists by an investigation of the *Action Française* affair, but the Court found no cause to prosecute. Meanwhile *Le Bonnet Rouge* and the *Journal* scandals grew more serious, and Caillaux himself was attacked in *l'Homme Enchaîné* for his conduct when travelling in Italy. Then came the Italian disaster of Caporetto and the advent of the Bolsheviks in Russia, which made it necessary to hold an inter-Allied conference at Rapallo for the co-ordination of military effort.

The Rapallo conference over, a troubled period set in for France. M. Paix-Séailles, who had formerly been attached to Painlevé's bureau, was accused of divulging information from documents dealing with national defence. Caillaux was brought before the juge d'instruction to give an account of his relations with Bolo Pasha, and had an exchange of letters with Clemenceau which caused a sensation. On Nov. 13 Painlevé announced in the Chamber the results of the Rapallo conference. These were, an extension of the British front, Franco-British economic co-operation, the strengthening of the blockade and the creation of an Inter-Allied Supreme War Council. Only 250 votes were recorded in approval against 192, a further diminution of the Government majority. This was speedily transformed into a minority when the Prime Minister demanded the postponement of motions relating to internal order until after the Inter-Allied Conference to be held at the Quai d'Orsay at the end of the month. The Chamber voted against the postponement by 277 against 186, and at the close of the sitting Painlevé handed his resignation to Poincaré: his authority in Parliament was at an end.

The Clemenceau Ministry.—Public opinion indicated Clemenceau as Prime Minister, the Senate supported the choice, and the Chamber was prepared to acquiesce, little as it liked the remorseless controversialist who criticised ministers and even the President of the Republic so fiercely in *l'Homme Enchaîné*. In spite of his 76 years, Clemenceau was universally regarded as the incarnation of the determination to " fight to a finish," to punish weakness or faltering, whatever their origin, and to subordinate everything to the pursuit of final victory. The great majority of Frenchmen felt that such a man was needed at the head of the Government. Ignoring all other considerations, Poincaré therefore called upon Clemenceau (Nov. 15) to form the new Cabinet. Clemenceau accepted, and completed his mission the next day. He took War himself, confiding Foreign Affairs to Pichon, the Interior to Pams, Navy to Leygues, Munitions to Loucheur, Finance to Klotz; and divided the war services between five under-secretaries. The Ministerial Declaration announced the intention—

to carry on the War, to punish crime and faltering: weakness would be complicity. Accused persons to be tried by court-martial. No more pacifist campaigns, no more German conspiracies; neither treason nor demi-treason; but the War and nothing but the War. Our armies shall not be caught between two fires. Law shall prevail. The country shall know that its defence is sure.

In the debate on the declaration Clemenceau spoke in the same tone. There were to be no more party men, himself not excepted.

Who has been more of a party man than I? I have been only too much of one, as I see to-day. . . I shared—and perhaps still share—many of your prejudices, but where I differ from you, deputies of the extreme Left, is that you want to introduce purely intellectual conceptions into the domain of realities—and that is impossible.

The vote of confidence was passed by 418 against 65. Clemenceau was as good as his word. Turmel, a deputy, was tried by court-martial on Nov. 22; parliamentary impunity was suspended by the Senate in the case of Humbert; and Malvy asked the Chamber to appoint a commission to inquire into the grounds for his accusation. Although the accusation had no legal basis, and the rules of the Chamber did not prescribe the procedure in such a case, the Chamber, greatly embarrassed, sent him before the Senate, which, having reinstituted a procedure in disuse since 1875, constituted itself a high court and ordered a supplementary inquiry (Jan. 28). On Dec. 22, at the request of Gen. Dubail, military governor of Paris, the Chamber voted for the suspension of parliamentary immunity for Caillaux by 396 against two votes and 100 abstentions. The accusation of intelligence with the enemy and of a criminal attempt against national security was founded on documents seized during the Bolo case, indicating a singular intimacy between Caillaux and Bolo and Almereyda. The official reports of the French naval and military attachés in Rome also drew attention to the attitude and the defeatist proposals of the former Prime Minister.

On Jan. 14 Caillaux was arrested. Inquiry conducted in the United States had revealed relations with the German Legation at Buenos Aires, at the time of his mission in the Argentine; and from various telegrams sent by Von Bernstorff, German ambassador in Washington (deciphered by the State Cryptographic Dept.) it seemed that Caillaux had spoken contemptuously of the members of the Govt.—Briand excepted. When reporting Caillaux's remarks to Berlin, Von Bernstorff asked his Govt. to instruct the German cruisers to take precautions with regard to the ship on which the French statesman was returning. Finally, in the safe of a Florentine bank rented by Caillaux there was found among the securities a packet labelled " Rubicon," which contained the outline of a scheme to be carried out when Caillaux should again become Prime Minister. This scheme resembles the constitution of the consulate.

These events were discussed in the Chamber, together with the royalist escapades of the *Action Française*, and the resolution passed stigmatised " all proceedings, royalist or other, which tend to divide the country in the face of the enemy." The Socialists and Caillautists voted against the words " or other," assuming that they referred to the " Rubicon." Bolo's trial by court-martial (Feb. 4–14) ended in sentence of death for the ex-pasha for his dealings with the enemy, which included relations with the former Khedive, transactions in America with Von Bernstorff and the payment of German moneys intended for the purchase of French newspapers. He was executed at Vincennes on April 17. To all attacks, direct or indirect, by the Socialists, Clemenceau presented an unmoved front, and claims of every kind—economic, financial and military—were met with the same imperturbability. By a bill passed on Dec. 24 the election was postponed on account of the mobilisation of several million electors. A loan of 10 milliards was liberally supported. Very severe restrictions on the consumption of bread were imposed, and the 1919 class was called up prematurely.

The Russian Defection.—This last measure was necessitated by the defection of the Russians and by Austrian arrogance. Count Czernin, in his elation over Caporetto, boasted that he was fighting as much for the defence of Germany as for the Austro-Hungarian frontiers—" We are fighting for Alsace-Lorraine just as Germany fought for Lemberg and Trieste. I make no distinction between Trieste and Strasbourg." At Brest-Litovsk the Bolsheviks concluded an armistice with Germany,

in spite of Russia's undertaking, on Sept. 4 1914, not to negotiate or conclude a separate peace; they also intimated their intention not to honour the financial engagements of the Tsarist government. The French Govt. sent a note of protest, stating that "financial engagements entered into previously in the name of Russia were independent of the changes of government which had occurred since and might occur again in that country, and that, consequently, they were and would continue to be binding upon those by whom Russia was represented." The Socialists now asked for passports for Leningrad (Petrograd) to attempt to dissuade Russia from making a separate peace; but Clemenceau refused them, because he regarded such a step as useless, dangerous and even unseemly. The signing of the Treaty of Brest-Litovsk on March 3 definitely broke the Russian alliance.

From the end of Jan. 1918 the bombing of Paris by aeroplanes ("Gothas," as they were called) recommenced with fresh vigour after a long respite. The raid of Jan. 31 took a toll of 45 killed (31 in Paris and 14 in the suburbs) and 207 wounded; that on March 9, carried out by a dozen squadrons, left 13 dead and 50 wounded. Life in Paris was seriously inconvenienced by the precautions imposed—as the reduction of street lighting, closed shutters and the warnings given by sirens. But it was quite another matter when, on March 23, shell, fired from colossal guns more than 100 km. distant, fell direct on Paris, without there being at first any clue to their place of origin. Monuments situated in the danger zones had to be protected by sandbags. On March 29 (Good Friday) a shell fell on the church of St. Gervais, at 4 P.M., just as a sacred concert was beginning, killing 75 people and wounding 90 others, of whom several afterward succumbed. Terrible bombardments at Dunkirk, Calais and Rheims simultaneously drove the inhabitants into the cellars. The motive behind these attacks was that of terrorising the country at the moment when the German general staff was launching (March 21) a mass offensive against the British front which was intended to be decisive. But the morale of the country was not shaken, any more than was the spirit of the high command. Although there were days of acute strain in March and April Clemenceau never faltered. At the end of March he obtained consent from the Allies for Foch's nomination as generalissimo of the armies on the Western Front. He then proceeded to tighten food restrictions, ordered three meatless days a week, reduced the consumption of paper, etc.

The Czernin Incident.—During these troubled times Teutonic intrigues followed fast upon each other. The most sensational of these was that launched by Czernin (April 2), when he boldly asserted in a speech delivered to the municipal representatives in Vienna that Clemenceau had asked him, shortly before the beginning of the Western offensive, if he were "prepared to enter into negotiations and on what basis." He went on to insist on Austria's loyalty to Germany, and vowed "a terrible vengeance" upon the enemies of the Central Powers. Clemenceau's reply was simply, "Count Czernin lied." By way of retort Czernin recalled the *pourparlers* between Count Nicholas Revertera and Count Armand in Feb. 1918. On April 8 Clemenceau exposed Revertera's "attempt to decoy us into a German peace," and announced "another attempt of the same sort by a person of much higher rank." Czernin in reply accused Clemenceau of having wrecked this effort by refusing to enter into negotiations based on the renunciation of the re-annexation of Alsace-Lorraine. Clemenceau thereupon disclosed the fact that the Austrian Emperor had with his own hand recorded his willingness to agree to "the just claims of France on Alsace-Lorraine."

At this point the Emperor Charles himself intervened with a telegram to William II., in which he declared Clemenceau's statement to be untrue and proclaimed the "perfect solidarity" between the two Central Empires. An official communiqué from Vienna followed, emphasising this denial. On April 12 Clemenceau published the Emperor Charles' letter to Prince Sixtus. After some sharp dispute with the Emperor and Empress, Czernin announced that the text of the letter, which had been entirely private and personal, had been published in Paris in a garbled version. He maintained that the Emperor had written: "I would have used all my personal influence in favour of the French claims with respect to Alsace-Lorraine had they been just claims; but this they are not." Clemenceau again stated the facts, and denounced "les consciences pourris." An embarrassed note from the Ballhansplatz on the 15th then declared the incident closed.

The Decisive Days.—A fortnight later the *Bonnet Rouge* trial opened before the court-martial. Although Almereyda, the principal conspirator, was dead, the evidence revealed by the inquiry was sufficiently serious for sentence of death to be passed on Duval—who had received over 1,000,000 fr. from a Mannheim banker named Marx—and for several of his associates to be sent to penal servitude. The Socialist party, of which the anti-war section had won a majority in the national council of the party, agitated in vain for a "white peace"; the threat to refuse military credits left Clemenceau unmoved. Only for an instant at the end of May, when a new offensive brought the Germans up to the Marne from Château-Thierry to Dormans, did he consider the idea of evacuating the Government and a portion of the population from Paris. He had become as military-minded as—if not more so than—the soldiers themselves. Paris was a city like any other, and it seemed to him a wise precaution to abandon the capital as in 1914. But the circumstances were very different. After four years of fierce fighting the occupation of Paris by the enemy would have appeared as a German triumph in the eyes of the world at large, and the consequences, both material and moral, would have been incalculable. The evacuation project, which had been kept secret, was therefore opposed by the President of the Republic and the presidents of both Chambers. In a special council at the Elysée, at which other persons besides ministers were present, it was finally decided that the Govt. should stay in Paris and that the decisive battles should take place in front of and not behind the capital. On June 11 a successful counter-attack by Mangin's army threw back the Germans some kilometres, and, on July 18, Foch opened the great offensive which was to continue until the Armistice. Czechoslovak and Polish legions, formed of deserters and volunteers, fought side by side with French troops.

On July 16, before the Senate, sitting as a high court, Malvy was accused of complicity "in treason which threatened the very existence of the country." The Senate, however, rejected the charge of treason, on Aug. 6, unanimously but for two votes, and that of complicity in communicating with the enemy by 125 votes against 36. Senator Etienne Flandin then made the subsidiary charge: "Is Malvy guilty of having committed the crime of *forfaiture* while residing in the territory of the Republic and during the discharge of his ministerial functions within the last 10 years?" At the following session this accusation was definitely formulated. It was directed against the minister's attitude towards Almereyda and certain other anarchists. On Aug. 6 the Senate declared Malvy guilty of *forfaiture* by 101 votes against 81, and condemned him to five years' banishment, but without civic degradation. There remained the Caillaux affair—by far the most serious. Was Caillaux to come before a court-martial or the High Court? The Govt. decided that if the case were one of intelligence with the enemy the court-martial should deal with it, but if it were that of crime against the security of the state it should come before the High Court. The latter solution was adopted, and the Senate met for the purpose on Oct. 29 and found that there were grounds for instituting an "instruction," the affair being thereby indefinitely adjourned.

The Armistices.—Beaten by the Govt., the Socialists confined themselves to protests. At their National Congress in Oct. the advanced group, headed by Longuet, carried the day by 1,528 votes against 1,212 and 181. Cachin was made editor of *l'Humanité* in place of Renaudel. But the people remained indifferent, being concerned only with the retreat of the German armies, the crumbling of the Bulgarian front, the abdication and flight of the Tsar Ferdinand, the progressive reoccupation of the devastated departments and the entry of the Belgian Army into Bruges. Under these auspices was launched on Oct. 20 the

fourth great loan, the Liberation Loan, which realised 22 milliards. On the night of Oct. 30–31 Turkish plenipotentiaries signed an armistice with Adm. Calthrop at Mudros; on Nov. 3 the Austro-Hungarian armies signed an armistice; the break-up of the old Dual Monarchy was already far advanced.

A far-reaching problem now confronted the Allies. Was it wiser to conclude with Germany the Armistice which her desperate Govt. had asked from President Wilson, or to force the German armies to capitulate, and so enter Berlin? French ruling spirits were divided. Foch held that " war is only waged for its results, and, if these results are obtained by the Armistice, no one has the right—the aim being achieved—to cause one more drop of blood to be shed." The generalissimo knowing nothing of the developments of the revolution overshadowing Germany believed that it would still take several months to throw back the enemy across the Rhine. The conditions of the Armistice were therefore discussed, first at Senlis by the military delegates, then in Paris and Versailles among the heads of the Govt. and the foreign ministers of the Allied and Associated Powers, the discussions being based exclusively on military considerations. The statesmen agreed unreservedly to the proposals of the military council at Versailles. Many of them, at that moment, were so far from thinking the proposed conditions too mild that they feared the German plenipotentiaries would refuse certain exceptionally severe clauses, such as the surrender of the fleet and the fortresses of Alsace-Lorraine. The Germans, however, terrified by the prospect of invading enemy armies who would be tempted to avenge themselves for the abominations committed in Belgium and France, signed all the conditions on Nov. 11.

The proclamation of the Armistice, accompanied by the ringing of bells, led to scenes of enthusiasm that day in the streets and in Parliament. The two Chambers proclaimed that " Citizen Clemenceau and Marshal Foch have deserved well of their country." On the following day Foch was elected a member of the Academy of Sciences, and on the 21st the *Académie Française* elected Foch and Clemenceau, having previously elected Joffre (Feb. 14). Clemenceau, a doctor of medicine, was elected a member of the Academy of Medicine on Dec. 3. Finally the *Académie des Sciences Morales* opened its doors to Marshal Pétain, and the Beaux Arts elected Gen. Castelnau. Only the Socialists, while joining in the general rejoicings, professed an interest in the Russian revolution which was hardly justified in view of Russia's behaviour at the end of the War. The motion drawn up by the " Permanent Administrative Commission " of the party was disavowed by members of the minority, who announced their determination not to allow the methods even of revolutionary socialism to be confounded with Bolshevik practices, which did not allow universal suffrage to function. The French authorities now took possession of Alsace-Lorraine. On Nov. 17, in front of the statue of Strasbourg on the Place de La Concorde, from which the emblems of mourning had at last been removed, a magnificent ceremony was staged. At Metz Pétain was presented with his marshal's bâton, and on Nov. 25 the victorious troops entered Strasbourg amid scenes of frenzied enthusiasm. The War was over; it remained to " win the peace."

The Peace

The Armistice of Nov. 11 contained no political clause. It was assumed that, as was customary, some of the essential political conditions would be settled in peace preliminaries before the final treaty was signed. Had preliminaries been so arranged as to coincide with one of the three renewals of the Armistice, it should have been possible to take immediate measures for ensuring the position of those regions whose lot was to be changed—notably Poland, Upper Silesia and the Baltic States—where such measures were of the first importance. Certain opinion in France urged that this should be done. But for reasons that are still unexplained, no steps were taken to arrange such preliminaries, which, if arranged a few weeks after the military capitulation—so it was agreed—would have enabled the Allies to insist on all the points that seemed to them advisable. The end of the year was spent in rejoicings. The King of the Belgians and the King of England paid official visits to Paris, and President Wilson, before settling in Paris for the conference, visited England and Italy. When the conference opened on Jan. 18, Germany was more or less reassured, and on vital points Clemenceau was no longer in position to impose his views. He had to consult with President Wilson and Lloyd George. Indeed, in consenting to the form of procedure—Council of Ten, Council of Five, Council of Four, absolute secrecy, rigorous censorhsip of diplomatic indiscretions—he automatically forfeited the support which would have been gladly accorded to him by the representatives of the smaller powers, by Parliament and by influential publicists. Although both the President of the Republic and the presidents of the two Chambers disapproved of these " cellar negotiations," the system was maintained till the end. The conference only met in full open session to register preconcerted decisions. Thus Clemenceau, although he made spasmodic attempts at resistance, saw himself forced to concur in certain solutions that were contrary to his intentions.

This was particularly the case with the Rhine frontier. In common with the military authorities, many university men and several publicists, Clemenceau would have constituted the Rhine France's military frontier and formed the German countries lying between that river and the political frontier into an autonomous state. He was not even able to obtain the restitution of Saarlouis and Landau which had been severed from France by the Allies of 1815, in spite of their formal engagement (signed on March 13 1815, after Napoleon's return from Elba) to preserve intact France's frontiers of May 30 1814. He committed the imprudence of offending President Wilson by scoffing at the projected League of Nations, and prevented M. Bourgeois from bringing forward the plan of a league drawn up by French specialists. Surrounded by colleagues chosen from among his immediate circle, he was not amenable to any advice or suggestion and was neither wise enough to limit his original demands to what might be accepted nor to exact effective compensation for his successive concessions. To crown his misfortunes, he was wounded (Feb. 18) by three shots from a revolver by an anarchist named Cottin. When negotiations were resumed on March 14, after his recovery, decisions, contrary to his wishes, had been taken. France was only to have Alsace-Lorraine; the Inter-Allied military occupation of the left bank of the Rhine was fixed for 5, 10 or 15 years according to the zone; Germany was to renounce all rights in Morocco; power was taken to regulate the zones of Savoy; and Great Britain and the United States were to give a military guarantee against unprovoked German aggression, Britain's guarantee being dependent upon the ratification of that of the United States by the Senate in Washington.

The amount to be exacted for reparations for the terrible damages caused by the enemy was not fixed; a Reparations Committee was set up to settle it and to draw up the conditions of payment. Germany was to pay down on reparations account a sum of 20 milliard gold marks before May 1 1921. It was assumed in France—and Mr. Lloyd George's speeches in England appeared to justify the assumption—that Germany would pay for everything. Clemenceau and Klotz were under that illusion, for they brought in a bill passed on April 17 1919 by which those who had suffered damages were enabled not only to claim the price of their possessions at a pre-War valuation, but also the cost of reinstalment or reconstruction, taking into account the rise in prices since 1914. This arrangement was fated to bring about a financial catastrophe. Some hundred milliards had to be paid out on this score, and (in the event) Germany was to go bankrupt to evade payment. It was the same with similarly lavish promises of demobilisation premiums, pensions and allowances to the military victims of the War and their dependants; these had been made on the conviction that Germany would pay, but they made another deep hole in the budget. Other holes were made by the extravagant decision to

buy in at the rate of 1·25 fr. all German marks left in Alsace-Lorraine (quoted then at 0·70 fr.) and buy back in dollars for a large sum the American war stores which, if sold direct by the American stores department, could have been usefully absorbed by the population without involving the Treasury. These rash measures were to react disastrously on the whole of the national life.

The Socialist Movement.—The propaganda carried on by German Socialists infected their French comrades, who had been roused by the acquittal of the assassin of Jaurès on March 29 1919 at the assize court of the Seine, and were to be appeased neither by the passing of the Eight-hours' Day bill by both Chambers at the end of April nor by the maintenance of the price of bread below cost price. On May 1 they proclaimed a strike, and proceeded to demonstrations which led to the dismissal of several Socialist leaders holding government posts. The disturbances lasted all through the spring. The *confédération Générale du travail* itself was powerless to maintain discipline among its adherents; it alternately curbed their turbulence and yielded to their demands. When the peace treaty was being discussed with the German plenipotentiaries and the Allied military intervention against the Bolsheviks was proceeding, labour troubles became more marked. But the public faced the situation with such firmness that the general strike arranged for July 21 miscarried. Clemenceau was nevertheless awkwardly situated in the Chamber and had to replace the Food Controller Boret by Noulens.

The Versailles Treaty.—After several crises, particularly with respect to the question of the Adriatic and Danzig, the peace conditions, comprising 440 articles and numerous annexes, were ceremoniously presented to Graf von Brockdorff-Rantzau, the German plenipotentiary. The counter-proposals made by the German delegation provoked lively discussion among the Allies, several important modifications being supported by the British Government. Towards the middle of June the Allies at last came to an agreement to maintain almost in its integrity the text of May 7, the only really significant modification being the substitution of a plebiscite in Upper Silesia for the annexation pure and simple of that province to Poland. On June 16 the final text was submitted to Brockdorff-Rantzau with the warning that it must be accepted without reservation within five days. He resigned, and an extension of two days was granted. On the 23rd a new German Cabinet with Gustav Bauer at its head declared itself willing to sign, and on the 28th—the anniversary of the Serajevo murders—MM. Hermann Müller, Bell and von Haniel, the German plenipotentiaries, in the Hall of Mirrors at Versailles in which the German Empire had been proclaimed in 1871, signed the treaty of peace which established the territorial integrity of France, celebrated the triumph of right over might and destroyed Germany's supreme effort to achieve a world hegemony. The treaty by which England and the United States agreed to assist France in case of unprovoked attack was signed by Lloyd George and President Wilson the same day.

The treaties, taken as a whole, certainly were imposing, and marked an epoch in history. All the same, the French nation experienced a shiver when the clauses became known in detail. It was realised, as Poincaré said, that the peace was to be *une création continue*. Many serious problems were left unsettled. Several plebiscites, which would normally have been taken between peace preliminaries and the conclusion of the treaty, were adjourned until a time when—the demobilisation of the Allied armies having been effected—there would be no means of ensuring a true ballot. No precise sanctions had been stipulated in the event of the non-execution of the treaty by Germany. The League of Nations Covenant, was held by French opinion to be vague as to the principal obligations of its members. The terms were drawn in language permitting the contracting Governments to interpret it in favour of evading liabilities. In short, it became plain to the French that the Versailles Treaty would be carried out to their advantage only if the Allies, especially Great Britain, wished it. Except for Alsace-Lorraine they had received nothing but promises; their right to exact the fulfilment of Germany's engagements without the assent of all the Allies, was contested. The ratification of the treaty (Aug.-Sept.) therefore aroused violent opposition in the Chamber. Men like Louis Marin and Franklin-Bouillon called for its rejection. To reassure the deputies the Finance Minister announced, on Sept. 5, that Germany would put down a round sum of 450 milliards. In the end the ratification was agreed by only 372 votes against 52, with 73 abstentions. By the Senate, in Oct., it was approved without difficulty. But very soon it became known that the American Senate refused to ratify the Treaty of Versailles and the Treaty of Guarantee, and that, in consequence, the British guarantee disappeared. The most stupefying discovery was, however, that during the peace year of 1919 military expenditure exceeded that of 1918 with its fierce fighting, and that the National Debt had risen during the 12 months of peace from 170 to 218 millards. Under the shock of these affairs the country embarked on the election.

The Elections.—It was indeed time to return to normal constitutional life. All the elective assemblies had to be renewed, having outlived their legal term. The parliamentary elections took place on Nov. 16 according to the system adopted by the Act of July 12 1919: *scrutin de liste* according to department, with proportional representation in cases where none of the lists showed an absolute majority, together with the support of 25% of the electors on the roll. It was at first intended to maintain the political *union sacrée* by including Clemencistes, Liberal, Radical, Radical-Socialist and Moderate Socialist candidates on the same list; but the unified Socialists repudiated the union, and the Moderates—such as Herriot, Viviani, and Painlevé—separated from the Coalition after agreeing to it. Lists were accordingly framed as follows: the *Bloc national* including all moderate candidates—as, for instance, from Millerand to Maurice Barrès in Paris; and lists for the Unified Socialists, Radical Socialists and Independents of different categories.

The *Bloc national* had as its programme Millerand's Paris speech of Nov. 7 at the Ba-ta-clan hall. This speech denounced the class struggles, indicated the need of strengthening the Executive, of adopting a broader basis for the nomination of the President of the Republic, and for the constitution of the Senate. Clemenceau for his part made a great anti-Bolshevist speech at Strasbourg. At that moment, when demobilisation was complete and the opinions of the soldiers an unknown quantity, Bolshevism was thought to be the chief danger. In the beginning of Nov. a general strike was attempted. The newspapers were especially affected and, from Nov. 11, they ceased to appear; but they agreed between themselves to publish one organ in common, the *Presse de Paris*, in which space was reserved for a brief political article from each paper. This expedient was well received by the public. Soon the *Presse de Paris* appeared twice a day, corresponding to the morning and evening issues. The *Bloc* won the elections, and the new Chamber was made up of 56 Unified Socialists, 5 dissenting Socialists, 28 Republican Socialists, 129 Radicals and Radical-Socialists, 114 Republicans of the Left, 138 Progressives, 15 Liberals, 74 Conservatives and 3 adherents of the *Action Française*. The Bolshevist candidates were swept away; even in a suburb of Paris the list containing the names of Longuet and Sadoul was lost.

The municipal elections of Nov. 30 gave the same results. From the outset the Moderate elements carried all before them, not only in Paris but in many towns where they had formerly been in a minority as, for instance, at Toulouse. The check to the revolutionary parties was emphasized by the end of the newspaper strike on the same day. On Dec. 14 *conseils généraux* and *conseils d'arrondissement* were elected. Here the Left was more successful in holding its seats, based as it was on solid local organisations, and was able to recover lost ground on the senatorial elections (Jan 12), in which the prefects exercise considerable influence. Only 26 seats were lost by the Radicals, and Léon Bourgeois was elected president of the Senate by 147 votes against Antonin Dubost (with 125), the retiring president, of much the same political tendency.

The Presidency of the Republic.—Opening on Dec. 8, the Chamber had no important affairs to deal with before proceeding to elect a successor to Poincaré, whose seven years' tenure expired on Feb. 17 1920. The only outstanding event of its short session was the declaration of the Alsace-Lorraine deputies, whose entry into the Palais-Bourbon had been made an impressive ceremony. After recalling the protests of their ancestors against the Treaty of Frankfurt the representatives of the two reannexed provinces recorded the fact that no protest had been raised during the elections against the Treaty of Versailles. "France," they said, "has obtained a unanimous vote at the genuinely plebiscitary elections of Nov. 16."

On the choice of the future President of the Republic opinion was divided. Though he desired election, Clemenceau had not come forward openly. Deschanel stood as candidate. In spite of Clemenceau's disturbing antecedents, his popularity as victor was so great that the choice would have fallen upon him out of gratitude rather than from confidence in his political wisdom, had he not wounded the sensibilities of a large number of the *bloc national*. He had steadily refused them the satisfaction of re-establishing diplomatic relations with the Vatican, although they had pledged themselves to their constituencies to demand it. Moreover, while declaring that he would in no case remain Prime Minister, he showed a marked preference for former ministers ousted by the *bloc*. He also retained among his most intimate colleagues certain men who inspired justifiable suspicion. Unmoved by the insistence of the deputies, who were bent on seeing him rewarded by the supreme magistrature of the state, he refused to make any concession. Indeed, he openly announced his intention of reigning at the Elysée as the head of the Govt. and not as the Constitutional head of the state, and thus alienated many of the electors. On the eve of the Congress at a preliminary meeting, Clemenceau obtained only 389 votes against Deschanel's 408. Consequently he refused to stand, and Deschanel was elected by 734 votes out of 888 (Jan. 17 1920). The Cabinet resigned next day.

As leader of the *bloc national* Millerand was called upon to form the new Cabinet, which was constituted (Jan. 19) as follows: Millerand, Foreign Affairs; Interior, Steeg; Public Works, Le Trocquer; François-Marsal (a banker, not a member of Parliament), Finance. Poincaré was appointed President of the Reparations Commission. On Jan. 22 the Chamber passed a vote of confidence by only 272 votes against 23, half the members having abstained from voting in token of their resentment at having a Radical (Steeg) appointed to the Interior. But the majority rose to 481 against 70 on the 30th, after explanations by the Prime Minister.

Strikes and the Caillaux Case.—The internal situation did not realise the expectations inspired by the happy ending of the War. The *confédération générale du travail*, carried away by the masses it was supposed to control, instigated a strike of railwaymen in the spring, which was followed by miners', dockers' and seamen's strikes. None of these were successful, but they served to aggravate the industrial crisis caused by the rise in prices. That communist ideas were gaining ground in the Labour world was apparent at the Socialist Federal Congress of the Seine (Feb. 22), when the extremist motion put by Loriot, after an exchange of recriminations, was carried by an enormous majority. It looked as if the wave of revolution would sweep all before it. The disturbances coincided, not fortuitously, with the Caillaux case, which took its course before the Senate, constituted a high court, from Feb. 20 to April 23. Caillaux was condemned to three years' imprisonment and ten years' loss of civic rights; for five years his place of residence would be strictly that indicated by the Govt., and he was ordered to pay the costs of the trial. He was found guilty of corresponding with the subjects of an enemy country since the declaration of war, and notably in 1914, 1915, 1916 and 1917, both in France (especially in Paris) and abroad, the said correspondence having furnished the enemies of France with information detrimental to the military or political situation of France or her Allies—(Article 78 of the Penal Code). The high court admitted extenuating circumstances, and dismissed the charge of high treason. As Caillaux had already been detained in preventive arrest for two years and four months, he was released.

Relations with the Vatican.—Relations with the Vatican, which had been suspended since 1904, were now re-established in accordance with the wishes of the majority in the Chamber and in the country, by a bill granting the necessary credit for setting up an embassy to the Holy See. Without waiting for the passage of the bill Millerand sent a *chargé d'affaires* to the Vatican to prepare for the resumption of relations (March 23 1920). The bill was not actually passed until Nov. 30 by the Chamber (379 votes against 109) and not until Dec. 16 1921 by the Senate (174 against 129). The Senate, with its Radical majority and anti-clerical traditions, bristled instinctively at any projects which looked like an infringement of laicisation, and the situation was further complicated by the problem of voluntary parochial corporations (*cultuelles*), which dated from the Act of Separation between Church and State (1905). The Holy See, having refused to acknowledge the separation, had forbidden the creation of *cultuelles*. Even the simple mutual ecclesiastical associations which several of the bishops desired to found as retreats for aged priests came under the ban.

The position of the French Church was therefore ill-defined and precarious, and Benedict XV. was as anxious to put an end to it as was the French Government. Since 1905, however, all the bishops had been nominated in Rome from among candidates intransigent towards the civil power, and the Pope was surprised to find, on the occasion of the Joan of Arc canonisation festival (May 16 1920) when Hanotaux represented the French Govt., that they were strongly opposed to the bill. Those of them who had come to Rome delivered a collective letter to this effect to the Pope. But as Jonnart had been appointed ambassador to the Vatican on May 16 1921, the papacy responded by the appointment of a Nuncio, Mgr. Cerretti, who arrived in Paris on Aug. 6. In spite of all efforts on both sides the question was still unsettled at the time of the Pope's death (Jan. 23 1922). Two years later, Pius XI., his successor, promulgated the Encyclical of Jan. 18 1924, by which permission was given to organise, by way of an experiment, "diocesan" corporations—that being the name chosen in place of *cultuelle*, as placing emphasis on the absolute power of the bishop over the corporation.

Execution of the Versailles Treaty.—The application of the treaty, both at home and abroad, was the chief concern of Millerand's Cabinet. The reconstruction of the devastated regions swallowed up vast sums which Germany—contrary to public expectation—failed to produce. Considerable sums also went in restocking the country with essential materials, above all, coal. The British Govt. exacted payment for British coal at a decidedly higher rate than the home prices. Since 1919, too, it had done away with common accounts. During 1920 France had to borrow nearly 38 milliard francs, thus raising the budget to close on 20 milliard (as against 5 milliards in 1913). These sacrifices were not compensated by other facilities from the Allies. In successive conferences—held in London in Feb., at San Remo in April, at Hythe in May and at Spain in July—Millerand obtained nothing but verbal expressions of sympathy although he gave way on some points of the treaty to the advantage of Germany. At San Remo, in return for the definite abandonment of Mosul, which came into the sphere of French influence as defined by the convention of May 16 1916 (Sykes-Picot Agreement, *see* EUROPE; INTER-ALLIED DIPLOMACY), France was presented with those shares in the Turkish Petroleum Co. (25%), which had formerly belonged to the German Government. Lloyd George felt obliged to devote himself principally to the economic recovery of Germany, which he assumed to be a necessary condition for the development of English markets in that country, and for the maintenance of European peace. Millerand had to fight some hard diplomatic battles on this subject with the Cabinet in London. He found himself in collision with Lloyd George on the Polish question when the Bolsheviks invaded the young republic in August. Lloyd George wanted the Polish Govt. to abandon Warsaw;

Millerand retaliated by recognising Gen. Wrangel's government in South Russia, and by sending a group of French officers to Warsaw under Gen. Weygand's orders. The friction thus caused was not dispelled by the retreat of the Bolshevik armies, for while London was pessimistic as to Poland's future, Paris regarded Poland's independence as the keystone of the new Europe. France complained that, in taking up her mandate over Syria according to agreement, she was thwarted by British agents.

A deplorable accident occurred to complicate the situation. On the night of May 24, when making an official journey, the President of the Republic fell from his sleeping-car on to the railway line. Although not seriously injured he was so badly shaken that he was forced to rest from his work, and resigned on Sept. 16, bidding farewell to the Chamber in a moving speech. On Sept. 23 Millerand was elected President of the Republic by 695 out of 892 votes. In offering himself as a candidate he had announced his intention of making more effective use than his predecessors had done of the prerogative assigned to the head of the state by the constitution. After election he defined his views with greater emphasis, and, once installed at the Elysée, he acted in conformity with his programme.

The Leygues Cabinet.—The changes in the Ministry necessitated by Millerand's election as First Magistrate were reduced to a minimum. Georges Leygues became president of the Council and Minister of Foreign Affairs and the other Ministers retained their portfolios. This Cabinet had a brief and troubled life. The *Bloc national* adopted an even more exacting and defiant attitude towards it than towards the preceding one. André Lefèvre, Minister of War, resigned on Dec. 6 because he was not allowed a free hand in securing German disarmament. On Jan. 12 1921, on the eve of a London conference and in consequence of an interpellation by Bonnevay, the Chamber overthrew Leygues by 447 votes against 116 on the pretext that it wanted no "negotiations in the dark." Nevertheless Leygues was in no way to blame; on the contrary, he had re-established the friendly relations with the states of the Little Entente which had been upset by the action of the Quai d'Orsay the year before.

Briand's Cabinet.—Briand now formed a Cabinet in which he held Foreign Affairs, giving Justice to Bonnevay, War to Barthou, Finance to Doumer and the Liberated Provinces to Loucheur. He was well received by the Chamber on Jan. 20 and obtained a vote of confidence by 462 votes against 77. The inter-Allied conference for the settlement of reparations, which had been planned in London, was held in Paris on Jan. 24–8. It was with difficulty that an agreement was reached; Germany's payments were spread over a period of 42 years, the sanctions to be applied in case of non-payment being left vague.

They were to be as those securing German disarmament—*i.e.*, prolongation if necessary of the occupation of the Rhineland; the seizure of German customs; the occupation of new territory, including the Ruhr; the application in Rhineland of customs duties or others. In any case, as these sanctions were not to function automatically, negotiations would be necessary each time they were to be applied. From Feb. 3 to 9 these questions were discussed by the Chamber which finally approved the Government's action by 363 against 114. Germany having by this time announced her inability to meet her immediate obligations, a conference was held in London on Feb. 20, as the result of which an ultimatum was sent to Germany (March 3) stipulating for: the occupation of Duisburg, Ruhrort and Düsseldorf, a levy on the sales of German goods in the Allied countries and the establishment of a customs frontier on the Rhine if Germany should persist in her opposition. These sanctions were to be applied automatically if Germany did not send a favourable reply by March 7. The reply was not forthcoming, and the Allied troops proceeded to a joint occupation of the three towns named. These events were discussed in the Chamber on March 15–7 and a vote of confidence was passed by 490 votes against 69. Meanwhile, the vote on the budget of 1921 had at last been taken, on April 30, after four *douzièmes provisoires*. This time the budget exceeded 21 milliard francs.

On April 30 a new conference was called in London to study "the situation created by the total failure of Germany to fulfil the dispositions of the Versailles Treaty as regards disarmament, the punishment of guilty persons and the reparations." The Reparations Commission had fixed Germany's total payment at 132 milliards of gold marks. A sum of 12 milliards was due and could be exacted on May 1. It was not paid. The conference agreed to warn Germany to meet the obligations named by the commission within 12 days, failing which the Ruhr would be occupied. There was nevertheless great opposition to this form of sanction in England; the French Govt., on the contrary, was acting under the pressure of public opinion. It was decided, on May 3, to mobilise the 1919 class, recently authorised, and the *Conseils généraux*, then sitting, voted for the most part in approval of this attitude. On May 5 there appeared the official text of the Allied declaration, which announced the occupation of the Ruhr on the 12th, failing the submission of Germany. But on the 11th Germany capitulated. The Chamber, on its return from recess on May 19, held a debate on this whole affair, the upshot of which was a fresh vote of confidence (390 votes against 162). The governmental majority was even larger on June 3, when a debate was held on the advances made for damages in the liberated regions (457 votes against 67). When the Chambers rose on July 12 the Inter-Allied Conversations were resumed, taking place in Paris (Aug. 16) for the settlement of Belgian priority and the costs of occupation and at Wiesbaden (Aug. 27) on deliveries in kind. The Conversations coincided with important negotiations of another description.

The Angora Convention.—With respect to Turkey, Briand held views which were not shared by observers of the Eastern question. He believed Turkey to be both powerful and sympathetic to France, and instead of endeavouring to consolidate the Treaty of Sèvres (Aug. 10 1920), by which Eastern affairs had been settled with due regard to the just claims of the Christian populations affected, he listened to the Kemalists. Acting under the influence of the Hellenophobes and of the unfavourable impression he had formed of British agents, whether in Syria or the neighbouring provinces, he sent out Franklin Bouillon—a pro-Turk and anti-English deputy—to Angora with instructions to make a special convention designed to put an end to disputes on the Turco-Syrian frontier. On Oct. 20 Bouillon signed an agreement at Angora which made exorbitant territorial and political concessions to the Turks, and contained additional clauses which were even more questionable. The text was kept secret. It leaked out nevertheless that France stood committed by one of the annexed clauses "to endeavour to solve in a friendly spirit (*esprit de cordiale entente*) all questions dealing with the independence and sovereignty of Turkey." Yielding to his Turcophil obsession, Bouillon had concluded something in the nature of an alliance rather than agreement of liquidation. He had even promised the Turks war material, which he requested the high commissioner in Syria to deliver to them; but this called forth such vigorous protests from those who were *au fait* with Eastern affairs in Paris that the material was stopped. Briand hastened to have the Angora agreement ratified by the President of the Republic without submitting it to the Chambers, which had met again on Oct. 18. On Oct. 28 he left for the conference on naval disarmament that was about to open in Washington.

The Washington Conference.—In spite of repeated warnings from well-informed personages, Briand insisted on going himself to Washington as France's representative, his idea being to act as arbitrator between Britain and the United States—assumed to be divided on the question of reducing naval armaments. He made one great public speech which for a moment gave him the illusion of success; but, as might have been foreseen, the British delegation came to an agreement with the American Govt. without considering French interests and even using arguments against them which were strongly challenged.

By the Washington Convention the French Navy, reduced by the War to a position in the third rank, was condemned to be placed on a still lower level. Although the state of her shattered finances prevented France from resuming her former position

as a naval power, public opinion was hurt by an agreement which gave an official seal to the naval preponderance of friendly Powers which had profited by circumstances to assert their dominion over the seas. Briand's authority was undermined, and it was not long before another negotiation compromised it still more.

The Cannes Conference.—Returning from Washington in Dec., Briand departed almost immediately for London, where he was to confer with Lloyd George on the subject of the payments due on Jan. 15 and Feb. 15 1922 which Germany declared herself unable to meet in full. But instead of insisting on the settlement of this particular matter he allowed himself to be persuaded into calling a meeting of the Supreme Council at Cannes for Jan. 6. In the interval he found himself placed in an awkward position in the Chamber with regard to the Industrial Bank of China, a concern which was in difficulties and had been guilty of irregular transactions. One of the administrators, Senator André Berthelot, was the brother of Philippe Berthelot, secretary-general of the Ministry for Foreign Affairs. At first Briand tried to exonerate Philippe Berthelot, who was accused of having improperly used his influence to shield the bank; but he finally gave up the attempt and, on Dec. 27 1921, accepted his resignation. On the following day his majority in the Chamber was only 361 against 238.

His fall was brought about by differences over the conference at Cannes. As Premier, Briand was aware that President Millerand, with a majority of the public behind him, was profoundly opposed to the recognition of the Soviet Republic and to the modification of the French claim on Russia for the repayment of loans. But at Cannes, Briand agreed to a European Conference at Genoa, with a wide programme, to which Russian representatives were invited. Simultaneously, he was negotiating with Lloyd George the scheme for a pact designed to replace the stillborn convention of June 28 1919, which had been made void by nonratification in the United States. In Paris, the British guarantee, though almost identical with the former treaty, was regarded with suspicion because first, it contained no military convention, and secondly, it was accompanied by a memorandum which laid down a common policy for Britain and France, so limiting French liberty of action in Europe. Briand was bitterly accused of yielding to Lloyd George's persuasions and his policy was denounced as "cinematographic." The treaty made Great Britain responsible for resisting, with France, any violation by Germany of the military and naval safeguards of the treaty of Versailles but it was held that these guarantees were insufficient. Feeling ran high, in the Senate particularly. The Commission on Foreign Affairs, over which Poincaré presided, dispatched a telegram to Briand, reminding him of the indispensable conditions of an agreement, and the President of the Republic took the further step of requesting his urgent return to Paris. After a conversation at the Elysée and without waiting for a motion by the Chamber, to which he offered vague explanations, he gave in his resignation on Jan. 12 1922.

The Poincaré Ministry

In response to an almost universal public demand President Millerand appealed to Mr. Raymond Poincaré to deal with the crisis. He formed a Ministry on the 15th. He took Foreign Affairs, giving Justice to Barthou, Finance to de Lasteyrie, War to Maginot and Public Works to Le Trocquer. The heads of the Radical party had refused to join the new Ministry. Warmly welcomed by the public, Poincaré gained a vote of 434 against 84 in the Chamber on his ministerial declaration which was unusually firm in tone. He had to take a firm stand at Genoa without delay. He might have stopped the meetings and dissociated himself from the policy agreed upon by his predecessor without the government's consent. This would have meant a quarrel with Lloyd George. He preferred, however, to let the meetings fixed for the 10th April proceed, and went over to Boulogne for a talk with Lloyd George on Feb. 25. The only result of this somewhat chilly interview was a banal communiqué affirming the Entente between the two Governments.

The Genoa Conference.—At Genoa, where Barthou was in charge of the French delegation the Entente was only preserved with difficulty. Lloyd George who had, at the time of the Peace Conference, talked of inviting the Bolshevik delegates to Prinkipo, now made marked advances to them on the pretext that Russia's collaboration was necessary to the restoration of normal life in Europe. But the inopportune publication of a Russo-German treaty, concluded at Rapallo under the very nose of the conference, made it plain to all that the Germans and the Bolsheviks were also concerned with their own interests, whatever the rest of the world might think about it. At the General Council of the Meuse, Poincaré, who was president, made a speech in which he reiterated his intention to allow no reduction or limitation of the claims and guarantees of France recognised by the Treaty of Versailles. The Genoa Conference, which had been marked by various tragic-comic incidents, ended its futile existence on May 19. The Chamber signified its approval of the Government by 436 votes against 96. During the Conference the President of the Republic had made an extended tour in Morocco and Algeria.

Meanwhile the Chamber had been working at the reorganisation of military service to meet post-War conditions. After lengthy debates a bill was passed (June 29) by 365 votes against 205, reducing the period of active service to 18 months and prescribing the incorporation of the 20-year-old recruits in two contingents so that there would always be at least two half-classes with the colours. This bill was not passed by the Senate until the following winter. It came into force on April 1 1923.

The Eastern Conflict and Reparations.—In Aug. a fresh conference held in London failed to reconcile the English view that Germany should be allowed a moratorium without corresponding compensation, and the French view that this should only be granted in return for a share of 60% in certain German industries, the establishment of customs depôts at the exits from the Ruhr, the collection of taxes in the occupied territories and the exploitation of forests, and of the Ruhr mines. At this moment an Eastern tragedy broke in upon the situation. The reorganised Turkish Army, set free on the Syrian side, broke the exhausted and badly led Greek Army on the Afiun Qarahisar front on Aug. 26, reconquered Asia Minor, took Smyrna on Sept. 8 and advanced on the Straits, occupied at Chanaq by Anglo-French contingents. Poincaré, unwilling to expose the French contingent to conflict with the Turks, gave orders for it to cross to the European side—to the surprise and indignation of many Frenchmen. A sharp crisis with Lloyd George ensued; he had sympathized with the desire of Greece to achieve a national destiny in the near east.

Lord Curzon went to Paris Sept. 19 to smooth the trouble. On Sept. 23 the lines of a new treaty of peace with Turkey were agreed, with the participation of Count Sforza, and after a second visit to Paris by Lord Curzon an armistice was signed at Mudanya (Oct. 11), when it was agreed that the plenipotentiaries authorised to settle the Eastern question should meet at the end of November. But the differences of opinion between the Cabinets of Paris and London, both on the measures to be adopted with regard to Turkey and on the subject of reparations, persisted in spite of the resignation of Lloyd George and the advent of the Bonar Law Cabinet at the end of October.

French politics were at this time entirely dominated by the question of reparations, that is to say the execution of the "scale of payments" fixed in London in May 1921. Opinion became more and more irritated at seeing Germany devote the sums which she was under obligation to pay to the Reparations Commission to the completion of her industrial equipment, the extension and improvement of her communications, and extravagant domestic expenditure. Poincaré's protests were formally approved by the Chamber (with nearly 500 votes) and by an almost unanimous Senate. In London, on the contrary, the first consideration was that Germany's internal economy should not be disturbed. Bonar Law's attitude towards France was more amicable than that of Lloyd George, but the solutions which he proposed were hardly more favourable. In short, he

sought rather to pursuade Poincaré to renounce for an indefinite period his claim for payment than to force Germany to pay. Then again the old spirit of rivalry between the chancelleries persisted, diplomacy being untouched by the fraternity of arms. France's efforts to secure the execution of the peace treaties were put down to imperialism. The London proposals were impregnated with distrust of France. Thus, at the Lausanne negotiations as in the Paris meetings, friction continued.

The Ruhr.—On Nov. 14 Wirth, the German Chancellor, announced Germany's inability to pay for an indefinite period, a declaration repeated by his successor Dr. Cuno. Outrages were committed at Stettin, Passau and Ingolstadt against Allied officers. On Dec. 9 Bonar Law, Poincaré, Theunis and Mussolini met in London to discuss a new note from Cuno, while Lloyd George, at the same moment, made a violent attack on France in the United Press. Unable to reach agreement, the Conference broke up, and another meeting was arranged for Jan. 2 in Paris. Poincaré secured the approval of the Chamber on Dec. 15 by 562 votes against 76, and of the Senate (carried unanimously) on Dec. 21. On the 27th the Reparations Commission[1] took note of two intentional defaults by Germany, and notified the Powers concerned. The Inter-Allied Conference opened at the Quai d'Orsay on Jan. 2 1923 when Bonar Law submitted the following scheme: a four years' moratorium; the Reparations Commission to be replaced by a Foreign Council for German finance, a German Minister presiding; the reduction of deliveries in kind; reduction of the German debt to 30 milliard gold marks; compensation for Inter-Allied European debts by allotting to England the milliard of French gold and the Italian bonds held as a guarantee by Great Britain; the first series of German bonds to be allotted to France by priority. This somewhat complicated scheme deviated completely from those of France, Belgium and Italy. If it abolished Inter-Allied debts it did away with any serious expectation of payments except to Great Britain.

On Jan. 3 after a ministerial council and consultation with Theunis and Della Torretta, Poincaré declared Bonar Law's scheme to be quite unacceptable. The conference closed down on the 4th, in view of the impossibility of agreement. While refusing to subscribe to the French propositions, the British delegates declared that the friendly sentiments of the British Govt. and people remained unchanged. On the 9th the Reparations Commission, having heard the German delegates, made a statement (Great Britian dissenting) that Germany had "deliberately failed" to deliver coke and coal. Poincaré then informed the German Govt. (Jan. 10) of the sanctions which he was going to apply, viz.: control of industrial production in the Ruhr by French engineers under the protection of an adequate military force. President Ebert protested, and the industrial workers in the Ruhr refused to carry out the deliveries of coal by order of their Government. The Franco-Belgian occupation was accordingly established from Essen to Bochum and Dortmund. On the German side passive resistance was organised.

Such were the facts, the consequences of which were to be felt throughout the year. In proportion as passive resistance became more stubborn French control became firmer and more extended. With Poincaré, everything else was subordinated to the success of the undertaking. Disturbing incidents followed in quick succession. On Jan. 18 for instance, the Chamber passed a resolution by 371 votes against 143 for the suspension of parliamentary immunity for Marcel Cachin who had been charged before the High Court with conspiring against the security of the state. But the Senate declined on May 24, and the Cabinet tendered its resignation to the President of the Republic, who refused to accept it. On this occasion (June 14) Poincaré furnished explanations on his internal policy long awaited by the *Bloc national*, who supported him consistently without having any share in the administration. "Leave the extreme parties isolated," he said; "republicans who wish to belong to the majority should not risk their alliances and their friendships among them." His majority was only 376 against 207, neither Radical-Socialists nor Socialists being included in it. Poincaré did not change his methods, however, but relied on the Right for his foreign and on the Left for his home policy. He kept the Chamber busy by devoting over 20 sittings to academical debates on teaching reforms, particularly on the reintroduction of compulsory Latin.

Meanwhile the Lausanne negotiations were concluded. To the great regret of many of their compatriots the French plenipotentiaries missed the opportunity of joining hands with Lord Curzon on the Eastern question. They showed considerable complaisance to the Turks, and sacrificed the interests of Christian populations and of institutions under the traditional protection of France. A portion of the Paris Press expressed disapproval of the treaty, which was finally signed on July 24.

In Aug. a change took place in Germany. In face of the slow but sure effect of the measures taken in the Rhineland, the Cuno Cabinet had to resign and was replaced by a Stresemann Govt. more inclined to submission. On Sept. 24 passive resistance came to an end, announced by President Ebert in a proclamation which called the people to submit, while indulging in violent recriminations against France. At this point Poincaré, under the influence of the more extreme Nationalists, took the serious step of acquiescing in, if not encouraging, a separatist movement in the Rhineland, whereas he had, up till then, proclaimed himself in favour of pure autonomy. German opinion was once more exasperated. Mr. Baldwin, who had been assured of Poincaré's moderate views when visiting Paris on his way from Aix-les-Bains, was taken by surprise, and foreign opinion in general, at first favourably impressed by French success in the Ruhr move, now turned against France. The franc fell, and the cost of living rose. Poincaré then withdrew his support from a movement palpably artificial; but the harm was done. The opportunity of exploiting the Ruhr victory had been lost. The anger of the separatists, the disappointment of the public and the accusations of the extreme Left disturbed opinion. Poincaré now accepted the idea of having a new scale of payments drawn up by outside experts in accordance with Germany's real capacity. On Nov. 30 the Reparations Commission decided to send two committees of experts to seek means of balancing the budget, to decide upon the measures to be taken for stabilising German currency and to "seek means of evaluating and bringing back exported capital." The execution of the Treaty of Versailles had taken a new turning.

The Financial and Internal Crisis

In vain did Poincaré defend his policy in impassioned speeches on all occasions—and particularly on Sundays; public confidence was shaken, loans became impossible, the exploitation of the franc by speculators had to be countered by a mass manoeuvre in dollars, cost of living increased and the claims of wage-earners and officials grew in proportion. On Jan. 6 1924 one-third of the Senate was replaced, but without any serious change in the composition of that Assembly. On the other hand, the elections in the Chamber, fixed for May 11, became the focus of a fierce struggle. The government scheme for straightening out the financial situation so as to avert the fall of the franc met with decisive opposition from the Left. The augmentation of taxes, particularly the *double décime* was passed with difficulty. The proposal to authorise the Government to proceed by decree with administrative reforms estimated to save a milliard was only adopted by 333 votes against 205 in the Chamber (Feb. 7) and came near being thrown out by the Senate which had approved the general financial scheme by only 151 votes (March 18). The parliamentary horizon was overcast. On March 26 the Cabinet was put in a minority in the Chamber (271 against 264) on the question of pensions, and resigned. Poincaré was charged to re-form the Ministry, which he did by giving François-Marsal Finance, de Selves the Interior, Loucheur Commerce and Henri de Jouvenal Public Instruction. Thus many radical Ministers were replaced by Moderates. The electoral law of 1919 was slightly modified to do away with certain inconsistencies and to reduce the number of deputies to 584. On Jan. 25 Poincaré had signed a Franco-Czechoslovakian alliance with Dr. Beneš.

[1] The British member dissenting (Ed. *E.B.*).

The election campaign was a heated one. Millerand's sensational speech at Evreux on Oct. 14 had really been the starting-point. The President of the Republic insisted on the necessity of confining legislative power to its proper function and of strengthening the prerogative of the head of the state. During April Poincaré made several important speeches in which he drew nearer to the *Bloc national*. The Radicals, Radical-Socialists and Socialists formed a Cartel, taking as their motto opposition to financial retrenchment and anti-Poincaréism. In several divisoins the Cartel included the Communists. When May 11 came, more than 9,000,000 voted out of 11,000,000 electors—a proportion never before attained. The results gave 277 seats to the Cartel, 267 to the *Bloc National*, 29 to the Communists and 11 to the candidates who belonged to no group. Of the Cartelist deputies 139 were Radicals and Radical-Socialists, 36 Republican-Socialists and 102 Unified Socialists. Taking the number of votes over the whole country, about half had gone to the *Bloc national*; the Republican Entente group alone accounted for 3,200,000 voters while the whole Cartel had only 3,400,000 to its credit.

Doumergue's Election.—Poincaré handed in his resignation at once, but carried on with current affairs until the opening of the new Chamber. On June 2 the Socialist Congress came to the unanimous decision not to take part in the new government, though supporting the Radical Socialists. Painlevé was elected President by the Chamber on June 4 by 296 votes against Maginot's 209. On the 5th Millerand offered to put Herriot in power, but Herriot refused to form a Cabinet so long as Millerand remained President of the Republic. He and his partisans could not forgive Millerand for having opposed them under the last Legislature. After turning in vain to friends such as Steeg, Millerand had at last to give in. He formed an interim Cabinet on June 8, under François-Marsal, for the purpose of laying before Parliament a memorandum in which he set forth his claim, to the effect that he had always respected the constitution and was still abiding by it in refusing to surrender his office without a definite vote from both Houses. The Senate refused to take action. The Chamber flatly refused to enter into relations with a government " which by reason of its composition, is the negation of parliamentary rights." On June 11 Millerand therefore resigned. The Cartel candidate for the Presidency was Painlevé, but at a preliminary meeting of the Congress 149 votes were given to Doumergue, president of the Senate, and it was he who was elected on June 13, by 515 votes against 309 for Painlevé.

Herriot's Ministry.—Herriot now proceeded to form the new Ministry, which was complete by June 14. Taking Foreign Affairs himself, he entrusted René Renoult with Justice, Clémentel with Finance and filled the remaining departments with other Radicals. The ministerial declaration marked a return to anticlericalism by announcing the suppression of the embassy to the Vatican and the intention of bringing Alsace and Lorraine within the scheme of French legislation as soon as possible, including secular education. The Chamber approved it by 313 votes against 234 (June 19); but on the same day the Senate elected de Selves as president, in place of Doumergue, by 151 votes against 134 for Bienvenu-Martin, the Cartel candidate. The two Assemblies, both Radical, were not of the same school.

The new majority made a point of reversing the work of their predecessors in every point and expressed the intention to secure for their own party " all the appointments, and that at once," as their principal organ the *Quotidien* phrased it. Some measures have therefore a symbolic importance. Gen. Sarrail was recalled for service without age-limit; the review of July 14 at Longchamps was cancelled; university reforms were dismissed with a stroke of the pen; the monopoly on matches was reinstituted; the economic and military evacuation of the Ruhr was brought under consideration; the Moscow Govt. was recognised *de jure* (Oct. 28) without any condition or guarantee for the Russian debt; an amnesty was proposed to be applicable to fiscal offences, events connected with strikes, desertion, cases of intelligence with the enemy and cases of *forfaiture*—the last two named categories including the cases of Caillaux, Malvy and the *Bonnet Rouge*. Not until the end of the year (Dec. 16) did the Senate pass this Act of Amnesty, voted by the Chamber as early as July. The anti-clerical policy of the Government produced considerable agitation. A letter was sent to the president of the council from the French cardinals denouncing the lay laws as " persecuting laws," and a " National Catholic Federation," presided over by Gen. Castelnau, was formed, which had a large following in the west and also in Alsace and Lorraine, where church schools are traditional, whereas French law recognises only lay and neutral schools. A National Republican League on parallel lines was formed by Millerand on Nov. 7 to combat " demagogy, revolution and anarchy."

The Dawes Plan.—Herriot's attitude with regard to Reparations was the reverse of Poincaré's. Instead of merely changing methods of negotiation which were open to criticism, he abandoned without resistance the positions held by his predecessors. On a visit to Ramsay MacDonald at " Chequers," he associated together the three problems, reparations, inter-allied debts and security. As a result, MacDonald felt authorised to issue a programme for the Inter-Allied Conference which allowed for concessions, hitherto regarded as inadmissible, on the part of Germany's creditors. Feeling ran so high in France that Mr. MacDonald hurried over to Paris on July 8 in order to draw up a fresh programme. It was in fact a question of accepting and applying the Dawes Plan which had been put before the Reparations Commission on April 9.

At the London Conference of July 16–Aug. 16, at which German delegates were present from Aug. 5 onward, conditions —very favourable to Germany—were adopted; attenuation of the debt; limitation of the Reparations Commissions powers; a loan of 800,000,000 gold marks; suppression of coercive measures and of Franco-Belgian *régie* in the Rhineland; a promise to evacuate the Ruhr before Aug. 15 1925; while Mr. Ramsay MacDonald undertook to seek a solution of the Inter-Allied debt problem, bearing in mind all these points. On his return to Paris Herriot was vigorously criticised in Parliament. In the Chamber, after six sittings devoted to debate, he obtained a vote of confidence by 336 votes against 204 (Aug. 23). In the Senate, on the 26th, he secured 181 votes. His task was not made easier by Ramsay MacDonald's rejection of the Treaty of Mutual Assistance which had been elaborated in agreement with Lord Cecil by a commission appointed by the League of Nations. At the fifth meeting of the League Herriot succeeded, however, in regaining a portion of his prestige, by proposing the principles of " arbitration, security, disarmament," which became the basis of the Geneva Protocol. A few weeks later, on Oct. 30, he was able to settle by arbitration the dispute over the free zones of Savoy with Switzerland (*see* SWITZERLAND).

On the reopening of the Parliament the Radicals and Socialists continued their policy of supporting the Government, with the approval of their party Congresses. The Communists adopted a hostile attitude to the Socialists. On Nov. 23, when the ashes of Jaurès were transferred to the Panthéon, they gave the ceremony the appearance of a *revue* of Communist forces in the streets of Paris, entailing an accusation of weakness against the Government. Great difficulty attached also to the preparation and discussion of the budget in view of the promises made during the election period and the demands of the Socialists. Clémentel, who represented the moderate element in the Cartel, had retained the taxes voted by his predecessors; but no sooner was the equilibrium within sight of accomplishment than it was upset by a new revision of the scale of officials' salaries. From the expected figure of 32,800 millions the budget rose to 36 milliards and the pound sterling, which stood at 70 francs during the elections, was now at 91. The programme of the Socialist Conference at Grenoble in Feb. 1925, the Communist strike (accompanied by bloodshed) at Douarnenez, the fracas on Feb. 8 at Marseilles, which resulted in the death of three and wounding of 20 people at the close of a Catholic meeting—combined to bring discredit to the Government. No less grave and significant was the Quartier Latin affair in March. An immense majority of the students protested against the nomination of an ill-qualified

candidate as lecturer in the faculty of law in Paris. The dean of the faculty was suspended by the Ministry for having refused to allow the police to enter the premises. The whole Press rang with the consequent disturbances.

The suppression of the embassy to the Vatican and the threat of lay-teaching in Alsace and Lorraine threw those two provinces into a state of growing unrest. On April 2 Clémentel resigned on account of his bad reception by the Senate. He was replaced by Monzie, who demanded of Herriot the retention of the embassy to the Vatican; but this patching up could not save the Cabinet, and on April 10 the Senate, exasperated by an inflation of four milliards concealed in the balance-sheet of the Banque de France in despite of solemn promises, threw the Government out. In February, following on a German note suggesting a pact of security in the West, confidential negotiations were opened between the Cabinets concerned. These were continued in semi-secrecy until autumn.

The Painlevé Ministry.—This particular crisis was difficult to solve, as the Socialists refused to accept portfolios, but Painlevé finally succeeded on April 17 1925. He took War and the presidency of the council, giving Foreign Affairs to Briand and Finance to Caillaux. This last appointment caused a great sensation, but as the public had, after all, faith in Caillaux's technical ability and desired principally to see the financial problem settled, his war antecedents were overlooked. The ministerial declaration was manifestly designed to relieve the strained situation. It proclaimed the retention of the embassy at the Vatican in a new form, and reassured Alsace-Lorraine against any too precipitate assimilation. The Government had a majority of 304 against 217 votes. The agitation in the Latin Quarter was allayed by the reinstallation of the dean in the faculty of law. Unfortunately, the Communist agitation ended in the shooting of four partisans of the Youthful Patriots (*jeunesses patriotes*) in the rue Damrémont at the close of a meeting. The Prime Minister and the Minister of the Interior attended their funeral at Notre-Dame. To prevent the recurrence of like incidents, May Day processions in the open street were forbidden and May 1 therefore passed in perfect calm. The Government likewise forbade all street processions on May 10, the fête of Joan of Arc, but the usual delegations made their pilgrimage to the statues of the saint, and the Prime Minister deposited a wreath in person. Herriot had been re-elected president of the Chamber by 266 votes only. On April 5 Millerand was elected Senator of the Seine by 520 out of 1,025 votes. The municipal elections (May 3 and 10) showed a slight progress towards the Left as compared with those of 1918, and at the same time a striking set-back for the Communists.

Abroad the outlook was still uncertain. The Conference of Ambassadors had decided, in conformity with the Versailles Treaty, that the Cologne zone should be evacuated only after Germany had completed her disarmament. An Inter-Allied financial conference, that was held in Paris on Jan. 14, had settled the distribution of payments to be made under the Dawes scheme and that of the profits accruing from the occupation of the Ruhr. The election of Hindenburg to the presidency of the Reich (April 26) on the sudden death of Ebert had aroused great uneasiness among the Allies. In May a considerable financial and military effort was entailed by 'Abdel-Krim's attack on the Moroccan front. Painlevé flew over to Morocco by aeroplane to review the situation. He then sent Malvy to Madrid to arrange a plan for collaborating with Spain, and Marshal Pétain to Morocco to direct the military operations. In October, after the Riffs had been thrown back on their old front, Marshal Lyautey was replaced as Résident-Général by Steeg. Monzie became Minister of Justice and Yvon Delbos took the Ministry of Public Instruction. This first reconstitution of the Ministry had no political significance, but this could not be said for the next.

Dislocation of the Cartel.—July 12 saw a rift in the Cartel. For the first time, on the subject of the budget and the sales tax, the Socialists, Radical-Socialists and a certain number of Radicals voted against the Ministry, which was saved by the votes of the Opposition who were anxious above all to find a way out of the financial predicament. The *Conseils généraux* elections (July 19 and 26) showed a slight leaning to the Left and the intransigeance of the Socialists became more marked. On Aug. 15 the Socialist Congress in Paris began by excluding Deputy Varenne from the party because of his acceptance of the post of Governor-General of Indo-China. A motion was then passed (by 2,210 against 559) against Blum's proposal to censure any support of Painlevé's Cabinet but permitted the support of a Ministry "determined to bring about the reforms demanded by the proletariat." Inclusion in the Ministry remained forbidden in any case. The ever-increasing financial difficulties intensified the dissension. Caillaux failed to justify the hopes reposed in him. Instead of holding fast to a general financial scheme he became involved in party politics. To clear up the situation by the settlement of Inter-Allied debts he left for the United States in September, but only to return in October empty-handed. The consolidated 4% gold loan, which he had launched during the summer and by which he hoped to realise some 20 milliards produced barely six. Confidence was gone. At the end of Oct. misunderstandings in the majority ranks found expression at the Radical Congress at Nice, the speeches of Herriot and Caillaux revealed a fundamental difference, and Painlevé's long speech rather served to add to the confusion. Finally the Congress, unable to decide between the levy on capital and the more practicable taxes, adopted a vague formula recommending a "special contribution payable on all kinds of income and capital."

The Second Painlevé Ministry.—The brief credit enjoyed by the Government on the conclusion of the agreements signed on Oct. 16 at Locarno—for which Briand had paved the way during the 6th meeting of the League of Nations by agreement with Chamberlain, Benes and Skrzynski—did not help them for long. For one thing, French opinion was by no means unanimous in its approval of the agreements which were designed to replace both the Geneva Protocol (never ratified), the Security Pact of June 28 1919 and certain guarantees of the Versailles Treaty. On returning from Nice, Caillaux was unable to secure his colleagues' approval of his financial projects. To get rid of him Painlevé handed in the resignation of the Cabinet collectively on the 28th, and formed a new Ministry in which he took Finance himself. But in the Chamber he obtained a majority of only 221 votes against 189, owing to the abstention of the Socialists. The Socialist National Council, for its part, voted against him by 1,431 against 1,228. At the same time Gen. Sarrail's anti-clerical sectarianism, Turkish sympathies, presumption and blunders in Syria brought about sanguinary encounters in the Jebel Druz and later in Damascus, which amounted to local disasters. Painlevé was at last obliged to recall him. When he put his financial schemes—badly conceived and co-ordinated—before the Chamber, he was already discredited. On Nov. 22 he was thrown out by 277 votes against 249. The Treasury was so hard pressed that he had to pass an emergency vote for an advance of 1,500 million francs from the Banque de France.

Another Briand Ministry.—Entrusted with the construction of a new Cabinet, Briand failed at first through the non-collaboration of the Socialists. Doumer, and after him Herriot, met with no greater success. Then, as the Socialists were meditating a *coup de force*, Briand yielded to the pressure of the President of the Republic and tried once more. He succeeded on Nov. 28, taking Foreign Affairs himself, sending Painlevé back to the War Office and, in spite of his objections, gave Finance to Loucheur who imagined he could straighten out the situation. The Ministry was still Cartellist, although Georges Leygues (Navy) and François Jourdain (Pensions) represented the Moderate elements. A change of policy was now perceptible, the developments of which appeared in December. Loucheur's scheme, once published, proved so great a disappointment that the Finance Minister had to resign. After groping a while pursued by the clamour of the extreme Left, Briand replaced Loucheur by Doumer. Several Cartellist ministers talked of resigning, but Briand unmoved stood by Doumer and gained the approval of the entire Cabinet for his schemes. The pound sterling oscillated at about 130 and the dollar at about 26 to 27 francs.

As soon as his Ministry was formed Briand went to London to sign the Locarno agreements (Dec. 1). By the end of the year foreign affairs looked more promising. The Dawes scheme functioned accurately, and the Cologne area was evacuated without incidents. In Morocco the vanquished 'Abdel-Krim saw himself abandoned by the tribes; in Syria Henry de Jouvenel, appointed high commissioner, began to restore order and confidence; in central Europe, Poland and the Little Entente (*q.v.*) were following a policy parallel to that of France. Relations with England were cordial. The one great remaining problem remained the settlement of Inter-Allied debts, the shadow of which darkened a financial horizon already heavy with clouds. (A. Gn.)

The Locarno treaties were ratified by the French Chamber on Nov. 2 1925. The chief preoccupation of ministers in the new year was the financial crisis, the solution of which was rendered more difficult by the lack of an absolute majority in the Chamber. The Govt. made the tax on payments, M. Doumer's most important proposal, a matter of confidence. They were defeated by 274 votes to 221. Their resignation (March 6) took place two days before the opening of the special session of the Assembly called to arrange for the admission of Germany to the League.

The fall of M. Briand was a calamity at this moment, and, after a fruitless invitation to M. Herriot to form a cabinet, M. Briand assembled a ministry, with M. Raoul Peret at the Finance Ministry. A Finance Bill, providing for new or increased taxation, was passed (April 29), but the franc still fell. At the end of April it stood at 147 to the pound. Money was required for Morocco, where the new offensive was begun early in May. On May 19, on M. Peret's return from London without having settled the debt, the franc fell to 171. In June M. Peret resigned, and then the whole Government. After a delay of a week, during which M. Herriot had failed to form a ministry, M Briand again took office, with M. Caillaux at the Ministry of Finance, and the latter was faced at once with the problem of protecting the franc. (Ed. *E.B.*)

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II. ECONOMIC AND SOCIAL HISTORY

In the course of the negotiations for the payment of France s debts to her Allies it has been persistently said, in particular by Americans, that France is the richest country in Europe, or at least in continental Europe. This opinion, very flattering to the French, is in some respects well founded; for since the fall or the amputation of the great empires of central Europe, France is, after Russia, the most extensive European country. Her soil is fertile. She owns the richest iron deposits in Europe, and, if her coal does not suffice for home consumption, she has by way of compensation more water power than any other European country except Norway. In addition she has a colonial empire, the second in the world and 20 times the size of the mother country. It is true that her population places her fifth in order of countries, but it is by her own choice that its increase is limited.

But the formidable damages inflicted by the War are not taken sufficiently into account. The world still remembers France's rapid recovery after the war of 1870–1, and supposes that this is a similar case. But the two situations are not in any real sense comparable.

If the national wealth of France were evaluated in gold currency or, to be exact, in the currency of 1914 (which is not the same thing, for we know that gold has lost a great deal of its value), we should arrive at a figure far below that of 1914. It is difficult to make a definite statement, but, speaking generally, the accepted pre-War figure was 300 milliard gold fr. whereas the present figure would not, we believe, reach 200 milliards, in spite of the restoration of Alsace-Lorraine.[1]

But leaving aside these general considerations let us examine, in two successive sections: (1) agriculture, mines, industry and commerce, with a comparison under each heading of the present situation with that of 1911–3; (2) the changes that have taken place in respect of workers' legislation, the social movement and population.

Production

Agriculture.—French agriculture suffered cruelly in the War; (*a*) in consequence of the occupation and of the destruction of part of its area; for certain portions of the ground—the part since known as the Red Zone (about 30,000 hectares)—were laid waste by shell to such an extent that they could no longer be cultivated in any way; (*b*) in consequence of scarcity of labour, live stock and manure, which had the effect of bringing cultivation to a standstill or of greatly impoverishing the crops for a long time after the War; (*c*) by the destruction of forests (several hundred thousand hectares) which must take 20 to 50 years or even longer, to grow again.

The area under cultivation is smaller to-day, whether we take the absolute or the relative figures, than it was before the War. From 1904 to 1913 its extent was 23,000,000 hectares (cereals, fodder, leguminous crops, vines, etc.), which represented in relation to France's total area of 52,952,000 hectares 47%. In 1923 it was only 20,432,000 hectares, although the area of France, aggrandised by Alsace-Lorraine, amounts to 54,400,000 hectares. The proportion is therefore now only 37·5%. This reduction of the cultivated areas is explained by the diminution and the high cost of agricultural labour, as the result of which landowners find it more profitable to convert their land into pasture.

It may be argued that the decrease in the areas matters little if there is a compensating increase in yield. Unfortunately this is not the case. There is certainly a general improvement in the yield per hectare, but not enough to compensate for the decrease in area. The result is that production is decreasing in the case of almost all agricultural products. The following are the figures for certain products, taken from a paper by M. Augé Laribé in the *Revue d'Economie politique*, March–April 1925.

		1904–13	1923–4
Cereals	Million quintals	88	76
Potatoes	Million quintals	133	127
Beetroot	Million quintals	58	44
Milk	Million litres	128	117
Wool	Million kilogrammes	34	20

It is only in the case of vines and fodder that production shows a small increase.

The live stock of the country, greatly reduced by the War, is still below pre-War numbers. It is evident from the following figures (*Annuaire statistique de la France*) that the deficit is still very considerable.

	1913	1924	Decrease
			%
Horses, mules, donkeys	3,222,000	2,859,000	11
Oxen and cows	14,788,000	14,025,000	5
Sheep and goats	16,131,000	10,172,000	37
Pigs	7,036,000	5,802,000	18

Nevertheless, in some directions, progress has been made. Manure is being more largely used, thanks to the work of the agricultural syndicates, but France is still far behind other countries in this respect, although she possesses very abundant supplies of phosphates in Northern Africa and, since the restoration of Alsace, a rich deposit of potash also. The employment of electric power, whether derived

[1] Mr. Harvey E. Fisk of the Bankers Trust Co., New York, concludes his exhaustive analysis of French public finance (1922) in these terms: "We believe that, notwithstanding the losses occasioned by the War, the wealth of France today, estimated on a specie basis, closely approximates or perhaps equals her pre-War wealth. This is partly due to the repatriation of Alsace and Lorraine, but it is also due to the fact that the War apparently served to intensify the normal saving habits of the people and thus enabled them to meet the burden which it brought without seriously impairing the pre-War national fortune." (Ed. *E. B.*)

from waterfalls or from coal, is beginning to spread in country districts owing to the formation of co-operative societies of consumers of power. The state has voted a credit of 600,000,000 fr. for this purpose. The shortage of labour is being compensated by the immigration of foreign workers who are mainly Italian and Spanish in the south, Polish and Belgian in the north. The southern region which lies along the Garonne had become a deserted country in consequence of the decrease in the local population, but is now being restored by the Italians, who come not merely as labourers, farmers or métayers, but also to buy land and settle on it. It is undoubtedly an anomaly, this colonisation of so ancient a country as France, and the results may be dangerous from a national point of view. But even if it be an evil, it is at the same time a remedy for that greater evil which has proved fatal to other countries, viz.: desertion of the land for lack of men to work it. The depreciation of the currency has been a blessing in so far as it has enabled most small holders to pay off their mortgages and many farmers to buy their farms outright.

Mines and Water-power.—The invaded regions were the very ones richest in mines. They produced half of France's total output of coal and three-quarters of that of iron. The coal-mines were systematically destroyed by the Germans; during the War 112 shafts and 1,910 kilometres of galleries were demolished or burnt out, and have had to be not merely repaired, but entirely reconstructed. In 1925, by dint of immense efforts, production had been brought back to the pre-War figure, but the output of 12 whole years had been lost.

It is true that, through the recovery of the Lorraine mines, France—already a large producer of iron ores—has come into the front rank among European nations in that capacity. Her production of coal, however, was always much below her consumption, and the restoration of Alsace-Lorraine has not altered this state of things.

The figures of coal production and consumption are as follows:—

Year	Production	Consumption
	tons	tons
1911	39,280,000	59,500,000
1913	40,844,000	64,800,000
1924	44,955,000	76,900,000

At first sight there would seem to have been a considerable increase both in production and consumption, but this is an illusion. As regards production, of the 45,000,000 tons produced in 1924, more than 5,000,000 are from the restored Lorraine region; deducting this amount, it will be seen that from the rest of France the output is slightly below the pre-War figure, so that there has been no progress at all in the 12 years. Similarly, as regards coal consumption, Alsace alone consumes 11,000,000 tons, so that in 1924 the consumption of France without that province was only 66,000,000, or about the same as in 1913. The deficit has in fact been augmented, for while in 1911 it amounted to 20,000,000 tons only, in 1924 it had risen to 32,000,000 tons. It is made up by the import of coal, which comes mainly from the Saar, Germany and England. If the Saar basin were to become permanently French, it would go far in redressing the insufficiency of coal; but this question is to be settled by a plebiscite in 1935, and it is probable that the decision will be in favour of Germany. In that case, however, Germany would have to pay France the value of the Saar mines, which has been fixed at 300,000,000 gold marks.

There is, however, a real and considerable increase in the production of iron and its derivatives; production is in fact nearly doubled, as may be seen from the following figures:—

Year	Iron Ore	Pig Iron	Steel
	tons	tons	tons
1911	16,600,000	4,470,000	3,837,000
1913	22,000,000	5,207,000	4,687,000
1924	29,000,000	7,693,000	6,900,000

Consumption, however, lags far behind production; even before the recovery of Lorraine, France was unable to absorb all her production, and is less able to do so now. The reason is that she produces very little coke, and coke is indispensable in the production of pig-iron. She has, therefore, no alternative but to export her surplus of ore and of manufactured iron, and even this is a matter of difficulty as, since the War, the metallurgic industry has been in a state of depression marked by underselling and falling prices. In the matter of her metallurgical wealth, therefore, France has less cause for satisfaction than is generally supposed.

As to petroleum, France had formerly none at all, but with Alsace she has now acquired a few small wells. An oil-field has just been found in the Mediterranean region (department of Hérault) but it is not yet known what the yield will be.

The insufficiency of coal-mines is to some extent counterbalanced by the abundance of waterfalls which can be used for motor power. With the Pyrenees, the Alps, and the mountains of the centre, France is at least as well equipped as Switzerland and Norway. Before the War the amount of power utilised was valued at no more than 480,000 kilowatts (640,000 H.P.). In 1924 the figure was over 1,000,000 kilowatts. Plans for the utilisation of 4,000,000 additional kilowatts are in progress, and the total utilisable energy is calculated at 8,000,000 or 10,000,000. The increase, however, though extremely rapid after the War, is now tending to diminish owing to the great rise in the cost of installation, so that coal-power once more becomes the cheaper of the two. Nevertheless, France has already found in water-power a source of considerable wealth, for in addition to the amount employed for lighting and for running railways and tramways, a large number of industries, both metallurgical and chemical, have arisen as a consequence of this new motor power.

Industry.—French industry was hit even more directly than agriculture by the War. Those regions which were invaded, and in great part devastated, represented, it is true, only 5% of the total area of France, but they accounted for more than 10% of the population, 14% of the total number of industrial workers, 29% of the textile and 53% of the metallurgical production. They were in short the focus of the nation's industrial activity. Reparation of the damage done has cost the state 84 milliard fr., and 20 milliards have still to be paid. From the financial standpoint the losses are irreparable. We are not, however, concerned here with the financial situation, but with the question of whether, from the industrial point of view, a complete recovery has been made. The answer is yes, and no.

In certain respects undoubtedly, French industry gained through the terrible experience of war. Factories reconstructed in the devastated areas made good use of the enormous indemnities that they received from the state. They are reported to have had the use of extravagant sums, but they justify their case by saying that the money was spent on installing the latest improvements and that those installations would probably not have been made but for the War. In like manner factories have learnt to renew their stock of tools and to adapt themselves to new requirements by manufacturing at home articles for which France had formerly sent abroad, particularly to Germany; these included, for instance, chemical products, dyes, magnetos for motors, Diesel engines, electrical apparatus for wireless telegraphy, optical and photographic lenses and all the industrial requirements of aviation. The motor industry has made immense strides; the pre-War figure of about 100,000 cars in use has been increased to over 450,000 in 1925. Even the oldest industries received a new impetus through the War. In the bakery trade, for instance, only half of the establishments used a mechanical kneader; and after the War it was used by 88%. It must be said that the general adoption of the eight-hour day hastened the introduction of mechanical contrivances but this itself was a result of the War.

But while admitting these points, it is none the less true that French industry, taken as a whole, has not yet recovered from the shock of war. Certainly, the losses among industrial workers —(267,000 killed and about 130,000 disabled)—were less heavy than among agricultural labourers, because the greater number of skilled workmen were withdrawn from the front to work in munition factories. The deficit was more than covered, too, by the immigration of foreign workers. Every year, since 1922 especially, there is a contingent of 200,000 to 300,000 of whom two-thirds are industrial and one-third agricultural workers. In the mines to-day, something like one-third of the personnel is made up of foreigners.

But if there is no diminution in numbers, there is nevertheless diminution of output. Not only does the foreigner, who is often inexperienced in his particular branch of employment, produce less than the Frenchman of earlier days, but the Frenchman himself produces less than before the War. It is difficult to say whether this is the result of a limited working day or of discontent connected with Socialistic ideas; in either case, the facts are incontrovertible. To take one example only, the quantity of coal produced per head in 1913 was about 660 kilogrammes; in 1925 it is 510 kilogrammes. The diminution is rather less if the calculation is based upon the underground workers who extract the coal, but even in their case the quantity extracted shows a

diminution of 5%, the present figure being 568 kilogrammes as against the earlier 595.

Then again, although the technical advance in industry has just been demonstrated, the total of horse-power used in industry, excluding transport, has not risen to any great extent (1911, 3,141,000 H.P.; 1913, 3,539,000 H.P.; 1922, 4,800,000 H.P.).

But Alsace-Lorraine accounts for a large share in the last of these figures and, if we deduct that share, the augmentation for pre-War France remains inconsiderable. It is a different matter with water-power, but that we have already discussed.

Taking the principal industries, we shall see that production has diminished, notwithstanding assertions to the contrary. The following are the figures for silk, which is pre-eminently a French industry:—

	Weight of Cocoons	Weight of Silk Yarns	Value of Silk Piece Goods
	kilos	kilos	francs
1911	5,109,000	411,000,000	414,000,000
1922	2,585,000	209,000,000	2,229,000,000
1923	4,180,000	..	2,812,000,000

It is evident that production has greatly diminished, the quantity produced being almost halved. The third column figures, taken alone, show on the contrary a septuple augmentation; but on what does it rest? Merely on the fact that the price of raw silk has been multiplied by 8, mounting from 35 fr. a kilo in 1911 to 278 fr. in 1923. We have therefore only to divide this nominal figure of 2,812,000,000 by 8 and we have left 350,000,000 gold fr., that is, a figure smaller than that of 1911.

In the case of sugar refineries the diminution amounts to one-third, as these figures show:—

1911–3 . . . . average 671,000,000 kilogrammes
1922–4 . . . . average 446,000,000 kilogrammes

Lastly, there is the building industry, that industry which supports so many others—as the French proverb has it: "When building goes well, all goes well." In the War years, it was practically non-existent; in 1924 and 1925 it was coming to life again, but only slowly. In Paris in 1911 there were 1,792 applications for permits to build houses, in 1919 only 173—not even one-tenth! But in 1925 building was resumed on a considerable scale in the capital.

Commerce.—Internal commerce has suffered but little, even during the War; it recovered immediately after the War, gaining a fresh impetus from the rise in prices caused by the depreciation of the franc, and profiting also by the influx of foreigners attracted precisely by that depreciation, which set a premium on their dollars, pounds or florins as the case might be. We have an indication of the fluctuation of the internal commerce in the special tax on sales. This tax brings in round figures 4 milliards of paper francs. As it is established at a fixed rate of 1·30%, it assumes an annual sales figure of 300 milliards—one might safely say, 400 to 500 milliards, *i.e.*, about 120 milliards of gold fr. on the basis of the exchange in 1924, for the declarations are assuredly much below the real figures. But unfortunately this tax did not exist before the War and we have therefore no basis of comparison.

Progress on the railways is, however, easier to assess; there is considerable increase in passenger traffic (35%) but less in goods (13%):—

	Goods	Passengers
1911	184,000,000 tons	511,000,000
1923	208,000,000 tons	689,000,000

In spite of a large increase in gross receipts the railway companies are losing money at the rate of 1,000,000,000 fr. a year. This is because the French charges, though they have been frequently raised, are still (on a gold basis) lower than they are in other countries.

The total length of the railway system has not been increased since the War (40,615 km. in 1911; 41,853 km. in 1923; but of these 1,250 were for Alsace), because the cost of construction is so heavy that even the old tracks have to go unrepaired. The system is, however, practically large enough to meet requirements.

In the mercantile marine, there has been a considerable increase: 1911, 1,413,000 tonnage net; 1913, 1,582,000 tonnage net; 1923, 2,145,000 tonnage net.

Sailing vessels account for only 386,000 of the total tonnage of 2,145,000. The increase since 1913 is therefore more than a third (35·6%). France lost nearly half of her merchant fleet during the War (700,000 net tonnage), but Germany was made to hand over to her an equivalent fleet. Besides, the enormous rise in freights after the War (now a thing of the past) was a great incentive to construction.

As regards international commerce, it is generally held that the position of France is excellent, better indeed than before the War. This is true, but only in part; the figures need more careful inspection. The following are the statistics of values and quantities:—

	Imports		Exports	
	Value in Millions of Francs	Weight in Millions of Quintals	Value in Millions of Francs	Weight in Millions of Quintals
1912	8,231	397	6,712	203
1913	8,421	442	6,880	221
1924	40,132	565	41,454	294
1925	43,980	474	45,413	302

It will be seen that a comparison of the mean of the years 1912 and 1913 with that of the years 1924 and 1925 shows an enormous increase in values, the imports being more than five times, the exports more than six times larger. At the mean rate of exchange in 1924 and 1925 the import figures would be 12 and 11 milliards of gold fr. respectively; the export figures 12·2 and 11·2 milliards respectively. The increase in quantities has been less: 24% on the imports, 40% on exports. It is not to be denied, moreover, that this increase is due to the depreciation of the franc to which we just now attributed the influx of foreign visitors, for this is why, despite the rise of prices in France, actual prices (gold prices), costs of production, and wages are lower in France than in foreign countries.

But the greater increase in exports and the smaller increase in imports has in fact served to turn the trade balance in favour of France. For while in 1911 and 1913 the export figures remained lower by nearly 2 millards of fr. than the average import figures, in 1924 on the contrary they exceeded the import figures by more than 1,300,000,000 (300,000,000 gold francs).

It would seem, therefore, that this favourable balance ought to improve the exchange and bring about a rise in the franc, all the more as the unknown, but considerable figure (probably more than 1 milliard gold fr.) of what are called invisible exports —that is, purchases made by passing visitors—may be added. On the other hand it must be remembered that France has almost entirely lost her credits held abroad in the shape of shares, debentures and state loans. Of this wealth, which amounted to 40 or 50 milliard gold fr., a large portion was diverted during the War. Another part, comprising Russian, Austrian and Turkish bonds, has practically melted away; and this magnificent holding of foreign credits cannot unfortunately be restored, or at least can only be restored by secret methods, because an unintelligent fiscal policy prohibits or at least handicaps heavily all kinds of investments abroad. The figures of French commerce include those of the trade done between the mother country and her colonies and these can have no effect on the exchange, the currency being the same on both sides.

It is not our intention to discuss the immense question of protection. We will only say that the War, far from having shaken Protectionism, has fortified it, not only because fiscal necessities call for the imposition of duties, but because fear of blockade leads each nation to think that she ought to be self-sufficing; and if, in those countries which appeared to be converted for good to free trade, such as England, Holland, Denmark and Switzerland, protection is gaining ground, with how much more justification will it become rooted in France? The only hope is that the breath of internationalism, which has created the League of Nations, may also bring into being economic unions between several countries. No serious progress has yet been made with those economic understandings between France and Germany which have many times been proposed on both sides of the Rhine.

Social Economy

Labour Legislation.—During the War, social questions naturally lost their interest for the public. Even the application of laws for the protection of men and women workers was set aside in the interests of national defence. Workers mobilised in muni-

tion factories, worked day and night without protest, stimulated both by the incredibly enhanced rate of pay and by the fear of being sent to the front.

Even when the War was over, the opinion of business men and economists held that this intensive labour should continue, at least until the day when the ravages of war should have been repaired on the ground that the work of restoring the devastated areas was no less urgent than that of national defence. But the workers were deaf to this appeal; indeed they clamoured for the adoption of the eight-hour day awaited for 20 years, and celebrated in anticipation on each May Day. Parliament dared not resist this pressure, and the Act of April 19 1919 established in principle the eight-hour day, leaving, however, the application of the law to be adapted to the special conditions of individual industries by technical commissions. This was a difficult task, not yet satisfactorily solved. So far the eight-hour day is only applied to some 5,000,000 workers distributed among 30 trades. The trades unions protest violently against these delays; but all business men and a fair number of economists persistently oppose the Act, in which they see one of the principal factors in the rise of prices. Its partisans argue that in the case of a number of industries productivity has been maintained and even augmented, notwithstanding the eight-hour day.

Several other laws, on the same lines as this general law, have been promulgated to secure the weekly holiday for tradespeople by compulsory closing of the shops and to forbid night work in the bakeries. These laws meet with violent opposition on the part of small traders or small bakers who, as they employ no paid labour, claim the right to work themselves when and how they please. There is also a law of June 10 1915 ensuring a minimum wage to women working at home. This is in imitation of the similar law in England. The insurance benefits against accidents, which had only been granted to industrial workers, were extended to agricultural labourers by a law of Nov. 15 1922. Another law of 1916 concerns economic life; it prohibits "illicit speculation," that is, the extravagant raising of prices. This law was, it is true, repealed in 1922, but there is an agitation for its renewal. The question leads to passionate arguments, for it opposes the idea of equitable prices to the classic law of supply and demand. There are numerous laws by which loans on state funds are granted to co-operative societies, concerned with credits, consumption or production; also to societies of artisans employed in small industry and of agricultural workers for the acquisition of land, special advantage being given to disabled ex-soldiers. We may also mention the creation of a National Economic Council composed of members elected by all the great national organisations. It has no legislative powers but aims at enlightening the Government and preparing draft legislation.

In addition there are numerous important measures under consideration, vigorously demanded by the *Confédération Générale du Travail* and by the Socialist party. The following are the principal demands:—

(*a*) The establishment of a *general social insurance*, covering all the risks in life: illness, old age, disablement, unemployment, maternity, etc. This project likewise arouses lively opposition, on account of the enormous charge entailed on industry and on the national budget at a time when the financial situation is in itself critical. Neither is it favourably regarded by the Mutual Insurance Societies, corresponding to English Friendly Societies, who depend on the voluntary contributions of their members and see themselves in danger of being eliminated by a compulsory insurance scheme. Nevertheless, it is certain that the bill will be passed, in a more or less modified form, for the Radical Socialist party has declared its intention to side with the Socialist party in supporting it.

(*b*) The establishment of a *contrôle ouvrier* which would authorise the workers—or rather the trades unions—in every factory to intervene in all questions of labour organisation, such as the workshop regulations, engagement, dismissals, discipline and so on.

(*c*) The workers' right to claim a certain number of days as holidays: this would give legal sanction to a custom which is becoming general to-day.

(*d*) The right to receive a minimum wage, increased by allowances proportionate to the number of children. Here again it is a case of legal sanction for a custom of family allowances which, though of recent introduction, is already in use in many establishments. But these allowances are at present paid actually by the employers, and the trades unions will not accept this, seeing in it a means of binding the worker on the pretext of assisting him. They claim family allowances, but on a compulsory basis.

The Social Movement.—As long as the War lasted we had, if not social peace, at least a truce from social strife as from political strife. The middle class and the working class had fraternised in the same trenches. But this truce did not last. The working classes returned from the War disappointed and irritated. They had been laden with laurels for saving their country, promised a new world, and when they had to go into harness again, life seemed harder and the wage system more intolerable than ever. The rise in prices, due to a factor of which for years the public remained ignorant, viz.: depreciation of the currency, increased that irritation. Undoubtedly a rise in wages followed the rise in prices; in the first years of the War it anticipated it indeed, but after the War, the advance in wages fell behind the advance in prices, and adjustment was frequently obtained only through fighting and strikes. The index number of wages which had (almost) caught up with the index number of prices, again lagged behind on account of the fall in the value of the franc at the end of 1925.

The two columns below show the index numbers of retail prices and those of wages at corresponding dates. The parallelism of the two ascending lines would be still clearer if shown in a graph. It should be remembered, however, that index numbers of wages are far more difficult to determine than those of prices. Instead of taking more or less arbitrary averages, we have chosen to take wages in a single industry, that for which the most definite statistics are obtainable, namely the coal-mining industry (taking underground and surface workers together) as indicative of the wage movement in general.

	1914	1920	1921	1924	1925
Retail Prices	100	390	352	401	435
Wages	100	360	349	423	437

The same parallel movement is found in the salaries of minor employees and officials, but not at all in the case of higher officials whose salaries have often not even been doubled.

It must be admitted that when the worker does obtain wages proportionate to the rise in prices, he is not satisfied, for he does not see why, with his wages quadrupled, he cannot satisfy his requirements better than before the War. He feels that he is being duped and it irritates him. Then, too, the worker's requirements—particularly those of the agricultural worker—are much greater since the War. This is due to the lavish distribution of meat, coffee, tobacco and alcohol to the soldiers, the taste for which has survived and the desire for which is stimulated by the spectacle of the scandalous fortunes that are acquired through the rise in prices and through speculation.

The people's saving-banks have had their deposits greatly augmented, but not in proportion to the rise in prices, as the following figures show:—

	National Savings Bank	Municipal or Private Savings Banks	Total
	Fr.	Fr.	Fr.
1913	1,818,000,000	4,011,000,000	5,829,000,000
1914	1,904,000,000	3,909,000,000	5,813,000,000
1924	3,306,000,000	8,814,000,000	12,120,000,000

If we convert the actual total (12 milliards) to pre-War francs on the basis of the mean exchange in 1924 it becomes less than 3 milliard fr., that is, to a figure below that of 1911. The savings-bank deposits are influenced by the degree of confidence inspired by the national credit at any given time. This applies even to the municipal or private banks, for these also put nearly all their deposits into state funds. Among the lower classes confidence is greatly shaken by the fall in value of state bonds.

It might be supposed that, given the discontent prevailing among the working class, trade unionism would show a great increase, and a study of the official statistics appears to confirm that supposition: 1911, 1,029,000 trade unionists; 1925, 1,846,000 trade unionists.

But these figures are of little value because most of the trade unionists figure only on paper, and also, since the Moscow revolution, trade unionism has been disorganised. Actually it is represented by three organisations more or less hostile to each other.

1. The oldest of all (dating from 1895)—the *Confédération Générale du Travail*, the famous C.G.T., whose secretary Jouhaux is well known. Its effective membership rose from 1,000,000 before the War to nearly 2,000,000 in 1920. As the result of an attempted general strike provoked by unemployment, of which the C.G.T. did not approve, although it dare not disavow it, and especially of the withdrawal of the Communists in 1921 which was inspired from Moscow, the number of its members fell to 400,000. It has recovered since then, mainly through the adhesion of intellectual workers and officials (among whom are 110,000 teachers) and is said to have 700,000 members at the present time. Although it was declared illegal by a legal decision, never put into execution, its programme is reformist rather than revolutionary.

2. In consequence of the schism just mentioned, another *Confédération Générale du Travail* was formed which qualified its title by the additional word *unitaire*, a strange term for dissentients. Its programme is that of Moscow: the dictatorship of the proletariat. This organisation is known as the C.G.T.U. It has not succeeded in rallying more than 200,000 to 300,000 members and will probably return before long to the older organisation.

3. Finally there is the *Fédération des syndicats catholiques* which is not much in the public eye, but is said to be growing since the War.

The co-operative movement, more favourably situated, has grown steadily since the War in France, as indeed in all countries, particularly as regards consumers' co-operation. The reason for this lies not only in the rise in prices, which has forced the middle class as well as the working class to seek means of reducing the cost of living; there is also a psychological reason—reaction against the existing economic organisation. The classic laws of political economy are no longer accepted, and there is therefore a sympathetic public for a new doctrine such as this, which claims to replace competition by co-operation, the law of supply and demand by fair prices, production for profit by production for service, thus abolishing the profiteer.

The following figures show the progress that has been made:—

	Number of Societies	Number of Members	Sales Figures
			fr.
1918	3,280	865,000	317,000,000
1922	4,300	2,330,000	1,747,000,000

It will be seen that the increase in the sales is much less than it appears, for in 1922 the franc had already fallen to 0·27; the 1,747,000,000 therefore represent only 576,000,000 of 1913 francs. But the progress of the movement is shown above all in the development of central organisations and in the growing part which co-operatives play in national and international economic life. The importance of the movement received official acknowledgment at the end of the War in 1918 when the Conseil Supérieur de la Coopération was created and its advice asked on all questions of interest not only to co-operatives, but to consumers generally, just as the Conseil Supérieur du Travail is called in to advise on questions which concern workers.

Agricultural co-operative societies for mutual credit, have also been greatly multiplied:—

1911	3,946 societies	185,000 members
1923	5,212 societies	284,000 members

but their development is to a large extent artificial, being due as it is principally to the loans granted by the state (about 600,000,000 (150,000,000 gold fr.) up to date in 1924). These funds are not taken from the budget, but from the immense profits which the state draws from its partnership in the Banque de France.

As to the industrial producers' societies, the oldest and most typical of all co-operation in France, they comprise within a small ring some 500 societies in all with 30,000 members. The most celebrated, and one which has been visited by co-operators from all countries is the *Familistère de Guise*. The friendly societies, which in their day were the elementary schools of social solidarity, are now rather out of date. Their field of activity, hedged in on the one hand by employers' institutions, on the other by the extension of compulsory state insurance, is becoming more and more limited.

Population

The demographical position of France was already bad before the War, and was bound to be aggravated by a war which robbed the country of the flower of its population. In 1911 the population was 39,605,000; in 1921 it was 39,240,000.

Thus the population has diminished in the course of these 10 years, but the diminution is even greater than it seems; for Alsace and Lorraine, which did not figure in the 1911 returns, are included in the census of 1921. Now these provinces account for 1,719,000 inhabitants, and if we deduct these from the figure of 39,209,518 we are left with a population of 37,521,000 for France as it was before the War. There is therefore a diminution of more than 2,000,000 and this diminution is only too easily explained:—(1) by the number of men killed in the War (1,400,000) and (2) by the fall of the birth-rate during the War.

The sudden rise in the number of births immediately after the War—a familiar phenomenon—was succeeded by a quick drop to the pre-War figure. Fortunately, the death-rate has sensibly diminished, with the result that the annual excess of births over deaths is greater than before the War:—

	Births	Deaths	Excess of Births over Deaths
1911–3 (3 years average) .	746,000	724,000	22,000
1922–4 (3 years average) .	758,000	679,000	79,000

It is clear that even could this natural increase be maintained over a period, it would take 26 years to replace the 2,000,000 dead or the unborn of the War. The state endeavours to stimulate the birth-rate by grants to families in proportion to the number of children. But it is hard to believe that these premiums will cause many children to be born; they are only a means of giving material aid to the parents of large families.

Happily foreign immigration goes far towards restoring the balance, for the number of immigrants is now far greater than the number of births in excess of deaths. The annual number of immigrants, taking the average over the three years 1922, 1923, 1924 is 290,000. We may suppose then that the coming census of 1926 will give France a population of 40,600,000 inhabitants. This places her fifth among the great European powers. But she has also a population—black, yellow and white—of 50,000,000 to 60,000,000 in her colonies.

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III. NATIONAL FINANCE

On the eve of the World War the public finances of France were in a relatively poor condition, a circumstance which has influenced the whole evolution of French finance since Aug. 1914, and was due solely to the indifferent way in which the finances had been handled.

The Budgetary Deficit.—For the three years 1908–10 the national budget showed a total deficit of 147,000,000 francs. In 1911, it is true, there was a surplus of 141,000,000 fr., but in the following year the deficit reappeared. Although the accounts of the year 1912 show an apparent surplus of 112,500,000 fr., this was only obtained by including 153,000,000 fr. which were extraordinary resources of the Treasury arising from the "Compte provisionnel." In reality this apparent surplus masked a deficit of 40,500,000 francs. For 1913 the budget showed the following results:—

	fr.
Receipts	5,066,900,000
Expenditure	5,038,100,000
Surplus	28,800,000

But the receipts included 172,000,000 fr. again coming for the "Compte Provisionnel," so that the real deficit on the budget was 143,000,000 francs. When the budget for 1914 was under discussion the deficit was estimated at 800,000,000 francs. In reality these deficits were even larger, as a number of items of expenditure which should have been included were withdrawn from the budget by accounting devices. A bad example had been set by the law of Feb. 17 1898, which instituted the special Treasury account for the improvement of military equipment.

On Jan. 1 1914 there were still 173,000,000 fr. of short-term bonds issued in virtue of this law, of which 11,000,000 fell due in 1914, 124,000,000 in 1915 and 38,000,000 in 1916. A subsequent law of March 30 1912 created the account for the improvement of naval equipment and, although annual sums were allotted from the budget for this purpose, the expenditure over the five years 1912–6 exceeded the allocation by 139,293,000 francs.

These extra-budget expenditures, which had become to some extent both regular and normal, were not the only ones. The diplomatic tension at the time of the Agadir incident in 1911 had drawn the attention of the French Govt. to the inadequacy of the military equipment of France, and caused it to embark on very considerable expenditure without the formal authorisation of Parliament. In 1912, 22,000,000 fr. were spent in this way but in 1913, owing to the passing of the three-year military service law, the figures rose to 300,000,000 fr., and in 1914, 488,000,000 fr. extra-budget credits were estimated for the army and 128,000,000 for the navy.

The "Compte Provisionnel."—In order to hide, at least in part, the deficit, the "Compte Provisionnel" was created by the law of Feb. 20 1912. This was a treasury device which enabled any surplus to be carried over from one financial year to the next, thus violating the fundamental rule of an annual budget. During the first year, in 1912, a sum of 159,000,000 fr. was paid into the "Compte Provisionnel," arising from the anticipated repayment by the Compagnie des Chemins de Fer de l'Est of advances made to it by the state as a guarantee of interest. In the following year it was credited with 141,000,000 fr., the surplus of the financial year 1911 and with a further 31,000,000 fr. from non-recurring sources. In 1914 it received 112,500,000 fr., the surplus of the financial year 1912.

The Reform of the Tax System.—Treasury expedients of this type, besides being inadequate, did not provide a solution, which it is clear could only be found by voting the necessary taxes, as was demanded by M. Poincaré when Minister of Finance in 1906. There were two obstacles in the way of this solution: firstly, the usual unwillingness of all politicians to impose new burdens on their electors—an unwillingness which from 1904 to 1914 prevented the French Parliament from voting more than 236,000,000 fr. of new taxes as against additional expenditure of 1,777,000,000 fr.; secondly, the political battle which raged round the question of reform of direct taxation. After prolonged controversy, which dated from the reform proposals of M. Caillaux in 1907, the law of March 29 1914 was passed, which provided for the reorganisation of the tax on property not built over and for the increase of the tax on income from securities. But this did not bring in any additional revenue, because at the same time the former tax was lowered by an amount equivalent to the yield of the new taxes on securities. On the eve of the declaration of War, however, a decisive step towards fiscal reform was taken by the creation of the general income tax. This was a slightly progressive supplementary tax on incomes levied on that part of the total income in excess of 5,000 francs. This new tax only came into force in 1915, and therefore could not help to meet the deficit at the moment it was voted.

The Treasury and the Loan of July 1914.—The whole of the current and accumulated deficits were covered by an increase of the floating debt, which amounted to about 2,100,000,000 fr. on Dec. 31 1913. While the necessity of issuing a loan to fund part of the floating debt was realised as early as 1913, the measure was delayed by a controversy over the question whether or no the interest on the new rente should be exempt from taxation. Finally, in June 1914, a law was passed authorising the issue of a loan of 805,000,000 fr. of 3½% redeemable rente subject to taxation and issued at 182 fr. for each 7 fr. of rente. The subscribers were only required to pay down 20 fr. on allotment of a nominal 200 fr. of loan, the balance being payable in three subsequent instalments. As a result of this mode of subscription the loan was chiefly subscribed by the banks, who hoped later to dispose of the shares at a profit to the public. To sum up, the following was the financial situation in July 1914, on the eve of the War: a considerable budget deficit; a relatively large floating debt; a loan recently issued and taken up by the banks but not placed with the public and involving a heavy burden on all credit institutions on the declaration of War.

French Finance During the War (1914–8)

The Declaration of War and the Credit Crisis.—The outbreak of War brought with it a very grave credit crisis, of which the first manifestation was a panic on the Stock Exchange in the last days of July 1914. The settlement of future transactions was suspended for the time being, and on Sept. 3 the Bourse was closed. Hence the funds advanced to speculators to support their forward transactions were locked up, and ceased to be available for industry and commerce. The banks were forced to rediscount bills with the Bank of France, whose holdings of commercial bills rose from 1,554,000,000 fr. on July 25 to 4,000,000,000 fr. on Aug. 4. The Bank of France raised its discount rate from 3½% to 6%, and its rate for advances from 4½% to 7%. On July 31 the settlement of all commercial liabilities was postponed, and on Aug. 1 a moratorium was proclaimed for the deposits of the banks except for small sums not exceeding 250 francs. The Bank of France never refused to rediscount bills; therefore it seems questionable whether the moratorium was really unavoidable for the other banks. The crisis, though very acute during the first weeks of the War, was not of long duration. The Bourse was reopened on Sept. 27 for spot transactions, and, with the aid of a loan of 200,000,000 fr. from the Bank of France, it proved possible by Sept. 30 1915 to liquidate all commitments carried over during the moratorium, including the loan of 805,000,000 fr. of July 1914. The commercial moratorium was of longer duration. Most of the bills of exchange, etc., maturity of which had been prolonged were taken up by the Bank of France, whose holdings of these securities reached their maximum of 3,977,000,000 fr. on Dec. 24 1914. Many of these bills were relatively quickly absorbed, and their total fell to 1,938,000,000 fr. by the end of 1915. Owing to this credit crisis it was necessary to wait till the end of 1915 before the first big consolidated loan could be issued.

War Expenditure.—The following table summarises the growth of French expenditure for the War:—

Expenditure (Millions of Francs)

	Military Charges	Public Debt	Civil Services	Recoverable Expenditure	Special Accounts	Total
1914	6,526	1,360	2,005	372	108	10,371
1915	14,712	1,818	2,479	1,914	1,197	22,120
1916	23,853	3,327	2,817	2,947	3,904	36,848
1917	28,662	4,816	4,119	4,081	2,983	44,661
1918	36,120	7,021	5,443	5,952	2,113	56,649
	109,873	18,342	16,863	15,266	10,305	170,649

The item "recoverable expenditure" covers that expenditure for which Germany was rendered liable by the Treaty of Versailles. The item "special accounts" comprises the deficits of the special services of the Treasury which were created during the War, and which include extra-budget expenditure, advances to Allied Governments, cession of material to foreign Governments, feeding of the civilian population, etc.

Taxation.—The budget revenue raised during the War amounted to 26,200 million fr., or about 15% of the total expenditure. When France is reproached with not having made a more considerable fiscal effort it must be remembered that she was deprived by invasion of about one-fifth of her tax revenue. Mobilisation caused the greater part of her labour to be called up, and withdrew many of the financial officials. Further, it is untrue to say that fresh taxes were not voted during the War; the general income tax was increased on three occasions, in 1916, 1917 and 1918, and carried from 2% to 20%; in 1917 the old direct taxes were replaced by the new system of income-tax schedules; taxes on succession, stamp duties and taxes on insurance were increased; finally, in 1916, an extraordinary tax on exceptional War profits was imposed. Additional taxation brought in about 2,800 million fr. during the War, and tax revenue rose from 4,100 million fr. in 1915 to 6,800 million fr. in 1918.

Advances of the Bank of France.—The following table shows the total of advances authorised to be made by the Bank of France and of advances actually given:—

	Total Advances Authorised (000,000 omitted)	Total Advances Made (000,000 omitted)
	fr.	fr.
Dec. 31 1914 . . .	6,000	3,900
Dec. 31 1915 . . .	9,000	5,000
Dec. 31 1916 . . .	9,000	7,400
Dec. 31 1917 . . .	15,000	12,500
Dec. 31 1918 . . .	21,000	17,150

To this total 3,750 million fr. must be added for loans granted by the French Govt. to foreign governments.

The French Exchange and Foreign Loans.—Prior to Aug. 1915 the French exchange, in spite of a deficit in the balance of trade amounting for eight months to 1,600 million fr., was kept at or very near par, thanks to the falling due of foreign coupons, to the export of small quantities of gold, to the placing of £12,000,000 of Treasury bills on the London market, and to an American advance of $10,000,000. Between April 1915 and April 1917 the total deficit of the French balance of trade rose to 27,000 million francs. This deficit was covered partly by expenditure incurred by the British Expeditionary Force in France, partly by the sale of a portion of the French holdings of foreign securities, but chiefly by British and American credits. France sent gold to London to the value of 2,840 million fr. and obtained credits in exchange to the value of 9,000 million francs. At the same time she procured credits amounting to $650,500,000 from the United States. By these means the depreciation of the franc was kept within reasonable limits. On March 31 1917 the franc was 11% below par in relation to the dollar, 13·5% in relation to the Swiss franc, and 21% in relation to the peseta and the Swedish krone.

In April 1917 the United States entered the War, and from then onwards its financial assistance was very great. Between April 1 1917 and Dec. 31 1918 the French balance of trade showed a deficit of 32,000 million fr. which was mainly covered by credit operations; £290,000,000 were placed at the disposal of France by the British Treasury, and $2,500 million by the American Treasury. Smaller loans were also contracted in other countries, *e.g.*, 100,000,000 gold pesos in Argentina, 350,000,000 pesetas in Spain, 100,000,000 yen in Japan, etc. As a result of this assistance the French exchange at its worst never fell more than 44·7% below par in relation to the Swedish kroner and 39·1% in relation to the peseta, while on Dec. 31 1918 the depreciation was not more than 9·5% and 7% respectively.

Internal Loans.—The principal medium for the transfer of funds to the Govt. for War purposes was the National Defence Bills devised by M. Ribot and issued in virtue of the decree of Sept. 13 1914. These bills were Treasury securities with a currency of one year, six months, three months and even one month after April 1918. They were repayable at par, and could be discounted at the Bank of France within three months of maturity. They could be crossed like cheques. In fact, they acted as deposits with the Treasury which could very easily be mobilised. In view of their convenience and elasticity they quickly proved a great success, and the Treasury succeeded by this means in mobilising a considerable part of the available funds of the nation for its requirements. The National Defence Bills had, however, one danger—the abnormal expansion of the floating debt. To retard the increase of the floating debt the French Treasury made successive issues of National Defence Bonds with a currency of 10, 6 and 5 years.

Finally, when the credit crisis referred to above had been overcome, the state decided to issue a series of irredeemable loans—the 5% loan of 1915 (real rate 5·73%); the 5% loan of 1916 (real rate 5·71%); the 4% loan of 1917 (real rate 5·83%); and the 4% loan of 1,18 (real rate 5·68%).

Table Showing Loans Raised by France
(In millions of francs)

	1914	1915	1916	1917	1918
Irredeemable Loans (net yield)	..	6,265	5,425	5,174	7,246
Short Term Loans	465	..	..	..	..
National Defence Bills and Bonds	1,858	10,487	12,955	13,054	16,611
Funds deposited at the Treasury	..	..	53	360	436
Total	2,323	16,752	18,433	18,588	24,293

French Finances from 1919 to 1926

At the end of the War France was faced with three very grave financial problems—the liquidation of the War; the reconstruction of the devastated regions; and the reorganisation of her fiscal system on an entirely new basis. The liquidation of the War involved heavy outgoings in respect of unexpired contracts, extraordinary civil expenditure, the progressive liquidation of the special accounts of the Treasury, etc., which were not completed till the end of 1921, and may be estimated at about 36 or 37,000 million francs. The reconstruction of the devastated regions was regulated by the law of April 17 1919. This law, which was voted at a time when everyone believed that Germany would make good the whole of the damage in accordance with the provisions of the Treaty of Versailles, was conceived in a very liberal spirit. It laid down that all those who had suffered loss were entitled to an indemnity fixed by a special *ad hoc* body, and equivalent to the pre-War value of the property. If, further, the victim undertook to reconstruct his destroyed property he had a right to the refund of additional expenses caused by the rise in prices. The total cost of reparation thus calculated is estimated at 82,000 million francs. In addition to this there must be added the permanent increase in expenditure resulting from high prices and salaries and the service of the debt.

The story of the French financial effort since 1918 falls naturally into four periods: (1) the year 1919; (2) 1920–1; (3) 1922–June 1924; (4) June 1924–Jan. 1926.

1919 and the Period of Inflation.—The events of the year 1919 weigh heavily on the financial destiny of France. At the end of Dec. 1918 the English pound stood at 29·97 fr. and the dollar at 5·45 francs. At the end of Dec. 1919 the pound sterling was valued at 41·48 fr. and the dollar at 11 francs. This fall was due to the persistent deficit in the balance of trade (24,000 million fr. in 1919). The deficit was again met in part, as in previous years, by foreign credits. But on Jan. 3 1919 the British Treasury announced that it would make no further advances to the French Treasury, and in Dec. the American Treasury followed suit. Nevertheless, the external debt of France increased in 1919 by about 11,000 million francs. The expenditure of the state, swollen by the accompanying inflation, amounted to 54,200 million fr. scarcely less than in the last year of the War. This total included 15,500 million fr. of "recoverable expenditure," comprising costs of reconstruction and War pensions. Budget revenue, on the other hand only amounted to 11,600 million francs. The Chamber of Deputies elected in 1914 could not make up its mind to impose new and heavy taxes on the eve of a new election. As a result the floating debt increased in 12 months by 27,653 million francs. The Crédit National, created specially for the finance of the devastated regions, raised a loan at the end of 1919 which brought in 3,960 million francs. Finally the Treasury borrowed 8,370 million fr. from the Bank of France—a larger sum than in any year of the War. It was this wholesale inflation which put the seal on the depreciation of the franc.

During the year 1919, which could and should have been the first year of financial reconstruction, the financial methods of the War were merely perpetuated, under the direction of the Finance Minister, M. Klotz. Financially the War did not finish till the end of 1919. In six years the Treasury had spent 224,000 million fr., which were raised in the following way:—

	fr.
Taxation	38,000,000,000
Internal Loans	112,000,000,000
Foreign Loans	44,000,000,000
Advances from the Bank of France	30,000,000,000
Total	224,000,000,000

Deflation (1920–1).—During 1920 and 1921, when MM. François Marsal and Doumer were at the Ministry of Finance, there was an effective reaction against the methods of the preceding years. On Jan. 13 1920 the estimates for the current year were laid before the newly elected Chamber. The estimates provided for 17,861 million fr. of ordinary and 7,568 million fr. of extraordinary expenditure; the former was only covered by normal revenue to the extent of 9,368 million fr. and the latter to the extent of 3,000 million fr. yielded by the sale of War stocks. To this budget deficit of 13,000 million fr. must be added the final deficits of the special accounts of the Treasury (which in 1920 amounted to 5,092 million fr.) and a further 22,000 million fr. of credits for "recoverable expenditure," which after July 1920 appeared under the heading "Special Budget of Recoverable Expenditure," and continued till 1925. In actual fact the expenditure was greater than had been anticipated, and amounted to 58,100 million francs. In June 1920 additional taxes to bring in 7,752 million fr. were voted to balance the ordinary budget, the normal revenue being thereby increased to 20,100 million francs. There still remained, however, a deficit of 38,000 million fr. which was covered by loans. A 5% long-term loan was issued in Feb.–March 1920, and a 6% loan in Oct.–November. The total subscriptions to these two loans were 43,000 million fr., of which more than 18,000 million fr. were new money, the rest consisting of conversions of former loans or of floating debt. In 1921 the financial situation was further improved. The total expenditure was reduced from 58,100 million fr. in 1920 to 51,000 million fr., and revenue rose to 23,100 million francs. The deficit fell to 28,000 million francs.

The following table summarises the Treasury operations during these two years:—

I. *Expenditure*
(In millions of francs)

	Military Charges	Debt	Civil Service	Recoverable Expenditure	Special Accounts	Refunds to Bank	Total
1920	7,600	11,700	11,400	22,300	5,100	..	58,100
1921	6,000	11,100	9,900	21,400	2,700	2,100	53,200

II. *Receipts*
(In millions of francs)

	Budget Revenue	Internal Loans	Advances from the Bank of France	Total
1920	20,100	38,400	500	59,000
1921	23,100	29,700		52,800

In the years 1920 and 1921, despite the very large deficit, the financial situation was easier. It proved possible not merely to stop inflation, but to inaugurate a systematic policy of deflation. The chief author of this courageous policy was M. François Marsal, who was Minister of Finance in 1920, and who in June 1920 carried through the imposition of 8,000 million fr. of new taxation; in addition he consolidated more than 12,000 million fr. of floating debt, and in Dec. made the agreement with the Bank of France by which the state undertook to repay 2,000 million fr. annually. The exchange also benefited by this policy. The dollar, which had risen to 17 francs in 1920, fell to 12·50 francs in June 1921, and even as low as 11 francs in April 1922. Wholesale prices fell more than 40% as compared with the spring of 1920.

The Budget Deficit and the Exchange Crisis of 1924 (Jan. 1922–May 1924).—Throughout 1922 and 1923 the franc depreciated in value, and at the end of 1923 the dollar was worth more than 19 francs. This was due to several causes, and undoubtedly questions of foreign policy—the discords amongst the Allies on the subject of reparations and the Franco-Belgian occupation of the Ruhr—played their part. But the basic reason is to be sought above all in the financial situation of France herself. State expenditure, which, though slowly decreasing, remained very large, was divided into three big groups—the general budget, to be met out of taxation; the special budget of "recoverable expenditure" (pensions and interest on reparations debt), which in theory should be met by Germany; and the costs of reconstruction, which quite properly were covered by loans. The results are shown by the following figures:—

	General Budget (in millions of francs)		Special Budget (in millions of francs)	
	1922	1923	1922	1923
Expenditure	24,688	24,163	9,905	10,382
Revenue	23,382	24,202	160	109
Balance	−1,306	+39	−9,745	−10,273

Hence the total budget deficit amounted in 1922 to 11,051 million fr. and in 1923 to 10,234 million francs. These deficits were covered by loan operations, and the state was even able to reduce the total of the advances from the Bank of France from 24,150 million fr. to 23,100 million francs. It was, however, becoming increasingly difficult to raise long-term loans. The Crédit National was alone in being able to place a loan with the public of 5,000 million francs. The rest of the expenditure was covered by an increase in the floating and short term debt. This situation was soon reflected in the movement of the foreign exchanges. There was a violent crisis at the beginning of 1924, and the pound sterling rose from 85 fr. to 117 fr. and the dollar from 19·60 fr. to 27·20 fr. on March 11. This crisis was the result of intensive speculative selling which developed in continental centres such as Vienna, Berlin, Milan, Basle and Amsterdam, and was in a large measure artificial. None the less it revealed how precarious was the financial situation of France. Under the energetic direction of M. Poincaré, the Prime Minister, a great effort was made to retrieve the position. The Govt. asked Parliament to vote 6,000 million fr. of taxes in order to cover the expenditure of the special as well as of the general budget, and it asked for powers to cut down expenditure by 1,000 million fr. by administrative decree. These measures were voted by the end of March 1924. At the same time exchange credits were raised in London and New York, and on April 20 the pound had fallen to 65 fr. and the dollar to 14·80 francs.

The Elections of May 11 1924 and the Return of Inflation.—The new elections resulted in the victory of the parties of the Left, which had refused to vote the last fiscal measures proposed by M. Poincaré. The Socialist party had a good deal of influence in the new Govt., and its revolutionary programme disquieted the propertied classes of the country. The budgetary equilibrium which had only just been restored was again destroyed, for the new Chamber voted 1,700 million fr. of supplementary credits, and suspended the realisation of the 1,000 million fr. of economies adopted by the preceding Chamber. There was thus a deficit of 3,000 million fr. on the budget of 1924. This deficit was enhanced in 1925 by the increase of 1,405 million fr. in War pensions, by the increase of the salaries of officials, and by expenditure in Morocco and Syria. The situation was aggravated by the falling due of quantities of bills and short-term bonds, of which about 8,000 million fr. had to be paid off in 1925. To this figure must be added the deficit in the subscriptions to the National Defence Bills, the amount of which reached 9,000 million francs. To meet these liabilities the Treasury issued, in Nov.–Dec. 1924, 5% Treasury bills at 150 repayable in 10 years (effective rate 9·20%), and in July–Oct. 1925 an irredeemable 4% loan with an exchange guarantee. These two loans brought into the Treasury a nominal sum of 11,000 million fr., but in fact very much less, because the greater part of the subscriptions only represented the consolidation of the floating debt.

It was under these conditions that France returned in 1925 to the *régime* of inflation, for the first time since 1919. In April 1925 the state asked the Bank of France for 4,000 million fr. of new advances, in June for a further 6,000 million fr., in Nov. for 1,500 million fr., and in Dec. 1925 for 6,000 million francs. All these credits were not in fact exhausted. Nevertheless, at the beginning of 1926 the advances from the bank to the state had risen from 22,000 to 36,000 million fr., and the total of notes in circulation from 40,500 to 52,000 million francs. Parallel with this the French exchange continued to fall, and the pound sterling, which was worth 88 fr. in Dec. 1924, exceeded 130 fr. in Dec. 1925. At the beginning of 1926 the position was as follows. The budget, with a total expenditure of 37,200 million fr. (the general budget and the special budget were amalgamated in 1925), shows a deficit of 4,500 million francs. Part of this deficit was covered by 3,000 million fr. of new exceptional revenue voted on Dec. 4 1925. All parties were agreed as to the necessity of creating a sinking fund to consolidate the floating debt. Successive Ministers of Finance, M. Doumer and M. Raoul Péret, proposed new taxes amounting to nearly 5,000 million francs.[1]

The French Debt and the Work of Reconstruction.—To have a sound understanding of the financial situation and its handling since 1918 it is desirable to relate the debt to the effort made for the reconstruction of the devastated regions. The two following tables show—(1) the situation of the French internal debt on April 30 1925; (2) the expenses devoted to the reparation of War damage to Dec. 31 1924.

I. *French Internal Debt*

	Annual Charge	Capital Debt
Perpetual and Long-term Debt	7,451,232,802	155,252,268,681
Short-term Debt	2,692,869,140	44,274,769,000
Floating Debt	2,762,584,000	86,646,656,500
Total	12,906,685,942	286,173,694,181

II. *Expenses Resulting from Reparation of War Damage*
(In millions of francs)

Damage to Persons	Private Property	Railways, Public Property, and Costs of Administration	Interest paid on Indemnities	Interest on Loans Contracted	Total
36,436	59,283	12,760	2,594	19,000	130,073

In conclusion, 45% of the internal debt of France comes from expenditure for the reparation of War damage, and one-sixth of the French budget was devoted in 1926 to the service of this debt.

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[1] The crisis in the franc was due to a loss of confidence, which showed itself in a reluctance on the part of the public to invest in the floating debt. M. Loucheur, while Minister of Finance in Dec. 1925, obtained a measure imposing a special additional income tax (non-recurrent), and steps were taken to hasten the collection of the ordinary income tax. The "heavy revenue collections" thus obtained were sufficient to meet all needs in the opening months of 1926. The At last, M. Raoul Péret, procured the passage of a budget which balanced at 37½ milliards, with a surplus of 250 millions, additional taxation to the amount of 4¼ milliards being imposed.

But meanwhile the exceptional revenue receipts of Dec. and Jan. could not continue, and a further block of three milliards of maturing bonds had to be met early in May. The exchange began to give way and rose above 140. The outbreak of the general strike in England at the beginning of May was the signal for something like an exchange panic, and after wild fluctuations, in the course of which the exchange reached 176, the French Govt. intervened with support, and brought it back for the moment almost to 140. At the beginning of June M. Péret appointed a committee of French financial experts to make recommendations for the future. (Ed. *E.B.*)

IV. DEFENCE

National defence in France underwent some material modifications after the World War. The reforms were based on the somewhat conflicting demands of national economy and of national security against aggression. In practice they resolved themselves as follows:—

(1) army and navy, in time of peace, to be limited strictly to the scale necessary for covering national mobilisation in case of aggression and allowing that mobilisation to be carried out at a speed compatible with that of the said aggression; the colonies and the communications with overseas possessions to be safeguarded; and

(2) the general organisation of the nation in war time to be minutely worked out.

Conscription.—Compulsory personal service was therefore maintained, but the duration was reduced to 18 months (Act of April 1 1923). The following tables show the effectives and the budgets of 1925 compared with those of the preceding years:—

	Aug. 1 1914 Pre-War	Aug. 15 1914 after Mobilisation	Nov. 1918 Armistice	1925
Army				
Effectives (French and Colonial)	947,000	3,850,000	4,200,000	695,000
Inf. Divs	44	87	112	32
Cav. Divs	10	10	6	5
Field Guns	2,800	4,044	5,000	1,350
Heavy Guns	250	308	5,100	1,000
Air Force				
Number of Aeroplanes	120	120	4,700	1,850
Navy				
Effectives	69,000	100,000	174,000	56,000
Battleships	26	26	10	9
Cruisers	31	31	15	18
Aeroplane-carriers	..	..	..	1
Destroyers	..	..	2	8
Torpedo-boats	83	83	51	63
Submarines	72	72	33	66

National Defence budgets (including gendarmerie, military, naval and colonial aviation, and certain expenses connected with public works undertaken in the interests of the army):—

In Millions of Gold Francs

Year	Army	Navy	Colonies	Total
1914	1,720	513	92	2,325
1925	955	308	50	1,313

General Organisation of National Defence.—The lessons of the War showed the necessity of a general organisation of the nation in readiness for war-time, the object of which should be to prepare in advance the mobilisation of civil and military forces alike to organise the nation's entire economic and industrial resources, etc. A bill to this effect was laid before Parliament on July 7 1925.

The general direction of a war devolves upon the Government. To assist the Govt. in their task, consultative and research bodies are placed at their disposal in war-time and also, for the purpose of advising upon the necessary precautions to be taken in peace-time. These are: the *Conseil Supérieur de la Défense Nationale*, composed of the appropriate ministers; the *Commission d'Études* of that council (composed of the highest functionaries of the various ministries), and the General Permanent Secretariat. The actual conduct of operations remains the exclusive province of the commanders-in-chief of the military and naval forces.

The Army

The army proper is formed by calling up the reserves. The permanent army is but the nucleus; its functions are: to train contingents as they are called up; to protect overseas possessions; to prepare for mobilisation and, in case of aggression, to protect the frontier while mobilisation is proceeding.

The recruiting Act of April 1 1923 provides for:—

(1) an active army, formed by:—

the calling-up of recruits, all young men who have reached the age of 20 being obliged to serve for 18 months; half of the contingent is called up in May, half in November;

voluntary enlistment (engagements, re-engagements, commissions) by which lower professional cadres, necessary both in peace and in war, are formed; and

auxiliary or reserve cadres.

(2) a first reinforcement (*disponibilité*) in which the citizen is reckoned for a period of two years following his term of active service; in case of need he is liable to be recalled;

(3) a first reserve, for use also on active service in which the citizen serves 16½ years, and a second reserve to which he is posted for 8 years; this reserve is designed for local services and work in industrial mobilisation.

The duration of service is reduced to one year for eldest sons of large families (minimum of 5 children). Special advantages are accorded to prospective reserve officers who have followed the military training course with success.

The 695,000 men of the fighting troops (France, countries of occupation, colonies) which constitute the army are thus distributed:—

French (1½ contingents of conscripts and professional soldiers)	457,000
Foreign Legion	14,000
North-African natives	97,000
Native colonials	82,000
Irregulars and auxiliaries	16,000
Gendarmerie and Republican Guard	29,000
	695,000

Out of this total of 695,000 men, only 395,000 are serving in France; the remainder—some 300,000 men—are engaged on the Rhine, in Algeria, Morocco, the Levant and the various colonies.

Organisation of the Army.—The Act dealing with the constitution of cadres and strengths which had passed the Chamber of Deputies but has not, at the end of 1925, been discussed by the Senate, distributed these effectives between the various arms and services. Pending the final passing of the Act, the Minister of War was authorised to proceed with re-groupings by which the army was reconstituted as follows:—

Large Units, 32 divisions of infantry of which 5 are on the Rhine; 5 divisions of cavalry of which 1 is on the Rhine.

Redistribution of Troops.—The following table gives the proportionate distribution between the various arms on mobilisation in 1914, at the Armistice, and in the army of today:—

Arms and Services	Aug. 1 1914	Nov. 1918	1925
	%	%	%
Infantry	65·6	43·7	53·8
Tanks	·0	0·6	1·8
Cavalry	9·0	3·5	8·0
Artillery	16·1	27·4	16·6
Engineers	3·0	8·0	5·2
Air Force	0·3	3·3	4·1
Transport	1·3	7·7	3·4
Administrative Services	2·3	5·2	3·0
Gendarmerie	2·4	0·6	4·1

This table shows the extent to which those arms employing principally mechanical weapons (tanks, artillery) have developed.

In accordance with the experience gained from the War, the army is being organised and trained on the basis of an increase in all arms of fire-power.

The Navy

During the War.—While hostilities were proceeding, the French Navy underwent a considerable reduction, both on account of War losses and of the obligation under which it stood to devote the greater number of its arsenals and private workshops to satisfying the needs of the army.

The tonnage of 1914 and that of 1919 are as follows: 1914, 816,000; 1919, 590,000.

The falling-off is therefore considerable and it becomes more striking if the heavy wear of the ships still in service—particularly the small vessels—be taken into account.

Since the War.—From the end of the War up to 1921 the French Navy has had to pay for a great many special expenses of its own, inevitably arising out of War-time necessities. Thus burdened, its budget rose to 1,962,000,000 gold francs in 1919 as against 515,000,000 in 1914 and a yearly average of 813,000,000 during the War. As it was impossible to put any further strain on the exchequer, the reconstruction of the fleet, which continued to decline in tonnage (falling, in 1924, to 394,000), had to be delayed. At Washington, in 1922, France consented to the proposed reductions, according to which the total tonnage of her capital ships might not exceed 175,000 tons.

The building of battleships was postponed. With a view to protecting the country's vital communications, particularly in the Mediterranean and the North Atlantic, the French Navy turned its attention to the use of submarines, aeroplanes and light vessels with protected bases. Light cruisers and submarines were laid down as follows: in 1922, 3 cruisers of 8,000 tons, 6 destroyers, 12 torpedo-boats, 12 submarines, 1 aeroplane-carrier (these units are nearly ready); in 1923, 9 submarines; in 1924, 2 cruisers of 10,000 tons, 6 torpedo-boats, 2 submarines; 1 cruiser of 10,000 tons, 3 destroyers, 4 torpedo-boats, 9 submarines (of which two are mine-layers), 1 surface mine-layer and 1 aircraft transport are to be proceeded with at once. This represents an extremely modest effort; the naval budget has not exceeded a total of 330,000,000 gold francs on an average, from 1921 to 1925.

The Future.—The schemes for the future of the French Navy have been dealt with in three bills which are still (1926) under consideration. The high-seas fleet, exclusive of special vessels, would consist of: battleships up to 175,000 tonnage, aeroplane-carrying vessels up to 60,000 tonnage, in conformity with the Washington Treaty; in addition, 360,000 tons of light vessels (cruisers, destroyers and torpedo-boats) and 90,000 tons of submarines. Age-limit: battleships and aeroplane-carriers 20 years; cruisers 17 years; destroyers and torpedo-boats 15 years; submarines 12 years. The naval air force would be composed of 50 flights of aeroplanes, of which 35 are fully equipped and aircraft of various kinds (dirigibles, captive balloons, etc.) varying in number.

For coast defence there would be coast flotillas of submarines, coast patrols, mine-sweepers, mine-layers, etc.; artillery, obstacles, detection systems, aeroplane service and, finally, troops and other means, controlled by the War Office, which will be placed at the disposal of the navy. Although no term has been fixed for the execution of this programme, the Dept. of Marine intends to have it completed within 20 years.

The Air Force

There is in France no organisation analogous to the British Air Ministry. A certain amount of centralisation has been achieved however as regards technical research, which is under the authority of the Under-Secretary of State, who is also responsible for preparing the mobilisation of aircraft industries.

A comparison of the numbers in 1914 and in 1918 shows the effort that was made in the War. During the 4 years 40,000 new aeroplanes and 92,000 engines were constructed.

Evolution of the Air Force, 1914–25

Aeronautic Section	Aug. 1 1914		Nov. 1918		1925			
	Army	Navy	Army	Navy	Army	Navy	Colonies	Civil Aviation
Aviation								
No. of flights	23	0	322	0	130	11	3	
No. of machines	120	8	3,430	1,264	1,500	389	30	700[1]
Balloon Service								
No. of captive balloons	12	0	77	190	18	21	..	..
No. of dirigibles	8	0	0	37	..	13	..	..

[1] 200 are for training purposes.

The increase in the total of the four budgets (military, naval, colonial and civil), which rises from 367,000,000 fr. in 1920 to 791,000,000 fr. in 1925, may be put down to the necessity for replacing *matériel* (some of which dates back to the War) and above all to the expenses connected with building and preparation of the aerodromes and landing grounds. This budget would, if expressed in pounds (at 120 francs) amount to £6,600,000.

Organisation of Military Air Force.—The 130 squadrons of the military air force are distributed in 14 regiments and five autonomous groups. Two regiments of the balloon service deal with captive balloons. Nine of those regiments are formed in division and constitute the two air divisions.

Organisation of the Naval Air Force.—The naval air force, a War creation, is undergoing reorganisation. Its final status is defined by a bill which was still under consideration at the end of 1925. The 11 squadrons of the naval air force were at that time distributed between different centres (Cherbourg, Brest, Saint-Raphaël, etc.).

France was spending, in 1925, 44%[1] less on national defence than in 1914. The national defence budget, in which certain expenses figure, which in many countries fall upon budgets other than those of the army and navy, represented in 1914 44% of the general budget; in 1925 it represented only 17% of it. In her deep desire for peace France reduced her military expenses to the utmost extent and only hopes to effect still greater reductions. In that spirit she has made every effort to assure safety by putting into practice the pact of the League of Nations and furthering the development of arbitration and ideas of international solidarity. See *Armaments Year Book* (League of Nations, 1926) where the references to decrees on national defence are given. (B. S.)

[1] This figure is based on the changed value of the franc.

V. INVADED REGIONS

In 1917 and 1918 when French ministers visited the Front they often wondered if it would ever prove possible to repair the dreadful ruin accumulated under their eyes. At Lens, for instance, the magnitude of the disaster was overwhelming. Not a house standing, 101 great pithead super-structures overthrown, their iron carcasses lying twisted on the ground, everywhere a terrible confusion of bricks, tiles, remnants of furniture—in one word, chaos. In the coal-mines, all the galleries flooded, the apparatus removed, the efforts of three generations completely annihilated. To-day there is hardly a trace of ruin, Lens is a city of wide streets and comfortable houses, the new arrangements of its mines are excellent; and the production of coal is equal to and even greater than that before the War. How could all this be brought about?

Extent of the Losses.—First, a few figures. When the damage was catalogued at the time of the Armistice, it was discovered that 289,000 houses had been completely destroyed and over 400,000 more or less damaged. Nearly 2,000,000 hectares of land had to be restored for cultivation. More than 6,000 factories had been destroyed or emptied of their machinery. The monetary value of these losses was about £1½ milliard; to reconstruct them (assuming the work to cost 3 times as much as before the War) 110 milliard gold francs would be required. Immediately after hostilities had ceased, M. Clemenceau abolished the Ministry of Munitions, replacing it by the Ministry of Reconstruction, of which the present writer was in charge. The new ministry first dealt as quickly as possible with those factories where the buildings and part of the machinery still remained and hastened to equip them to employ the industrial population. There were 500,000 unemployed; a year later unemployment had practically disappeared; the workmen had restored the factories, which had been hurriedly got going and were clearing away ruins and beginning reconstruction. The industrial districts thus received the first attention. This is one of the matters for which the Government has been most severely criticised; but it was the logical course, and as events showed, the right one.

In restoring the soil itself, in rebuilding the farms and enabling those fertile lands to resume the production of the wheat urgently required by the rest of France, the inhabitants themselves assisted in an amazing degree. The French peasant is deeply attached to the soil; he returned to it as soon as he could. He found it covered with shells, with strands of barbed wire, with block-houses. He found his home and farm buildings in ruins. Not for a moment did he lose heart. He set to work at once, surrounded by difficulties which would have daunted many a brave heart, even by grave dangers; so many unexploded shells remained that between 1919–24 more than one person a day, on an average, was killed in unearthing them. Nothing could stop the French peasant. The state helped by granting him little by little, as needed, financial assistance—the sums necessary to rebuild his dwelling and his farm buildings—and found him labour to clear his fields.

A year later, some 90% of the Département du Nord had been restored to cultivation, and in 1925 France's production of wheat had reached its pre-War figures, and of sugar very nearly so. The industrialists too, faced with empty or ruined factories, went bravely to work; but the farmers whose efforts saved France were even more admirable. To-day at least 90% of the farms have been reconstructed. Everywhere, thanks to the good harvests of recent years, prosperity has returned, and the zones where the havoc has so far defied restoration are growing daily smaller, and we may hope that, with rare exceptions, they will disappear altogether. Some reservation is necessary: the surroundings of Verdun are a frightful example of what is meant. As Minister of the Liberated Regions the present writer had to sign the act recording the final disappearance off the map of France of 11 villages of which nothing, hardly a heap of stones, remained. On every square metre there were so many fragments of shells that the whole of this territory might really have been exploited as an iron-mine, but it was useless to think of putting it under the plough. The signature of the act consecrated to death beyond repeal these villages where so many generations had lived, in whose defence so many good men had died.

Building Reconstruction.—The rebuilding of dwellings was a much longer task. Dr. Rathenau, with whom the reparations question was discussed at Wiesbaden, was surprised that the Ministry had not decided to rebuild the towns, not on the old sites, but near by, on virgin fields, constructing regular rows of houses and laying out the plans in the American style. Dr. Rathenau displayed ignorance of the French spirit in supposing that Frenchmen, with their profound individualism, could have adapted themselves to such a system. Each man has chosen the site of his house, he wishes to keep it, to rebuild it in its old place, different in size and shape from that of his neighbours, on his own plan, in his own style. To-day the city of Rheims, which was so completely ruined, is almost entirely restored. It has retained the mark of its old architecture, the houses are on the same spots as before. Some districts, however, of the devastated regions wanted to follow the ideas explained by Dr. Rathenau. The experiment was unsuccessful. Thus there are some large villages with roads which are too straight and too broad, which have not re-assumed their pre-War life. It is a grievous error to attempt to do violence to the psychology of a nation. The reconstruction of landed property is far advanced. In each village so-called "reconstruction co-operative societies" have been established, through which a few devoted men have set themselves to restore the homes of their fellow-citizens. They have lacked means, the parsimony of the last three annual budgets has complicated their task, but little by little, assisted by local loans, their efforts have made headway.

Finance of Reconstruction.—How has all this been paid for? From 1919–22 by loans from the state; but after 1922, financial difficulties grew more pressing and the sufferers from the devastation have been paid to a large extent by state loans redeemable in 10 years, which they have had to get taken up as they could; this has resulted in a serious fall of these bonds. To-day, since the Dawes plan has come into force, it has been possible to spread out the effort over three or four years, and should be about completed by the end of 1928. In 1926 a sum equal to about £100,000,000 still remained to be spent. The sum was not large in comparison with what had been spent up to date, but it represented a great effort.

Such are the broad outlines of the work of reconstruction of the liberated districts. It was successful, thanks above all to the united effort of French citizens and thanks to the fact that for several years the whole of France consented to burden herself in order to pay unassisted for the restoration of her ruins, for it must be admitted with regret—except in a few individual instances, France and France alone has had to shoulder her expenditure. The writer does not forget the assistance granted by various British municipalities. In many French villages and towns one may see public rooms or fountains paid for by the generosity of British towns. (L. L.)

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VI. THE COLONIAL EMPIRE

Description.—The French colonial domain appears at first sight extremely various and scattered, since there is no continent in which France cannot count her colonies. In fact, it consists of two very different parts. First the remains of the old colonies, Saint Pierre and Miquelon, on the Canadian coast; Martinique and Gaudeloupe in the West Indies, near New Orleans; Guiana in South America; five enclaves in British East India, Pondicherry being the most important; Réunion I. in the Indian Ocean near Mauritius, a relic of the match between Bougainville and Cook; a series of islands, of which the most important are New Caledonia, Tahiti and the New Hebrides, held in common with Great Britain. These are, if one likes to call them so, the aristocratic colonies. The American and Indian colonies and Réunion have their deputies and senators in the French Parliament. They are united with France by old bonds of affection. They have given her scholars, administrators and great men of letters. In certain cases they derive special importance from their situation on the great international routes, or their great resources. But, above all, their value for France is sentimental and historic; they are the outline of the first empire lost in the 18th century. The colonies of the 19th century on the other hand, form a homogeneous system. They are divided into two groups, African and Asiatic, both closely concentrated—with the exception in Africa of Jibuti and Madagascar.

The following table shows the respective importance of the three groups:—

Colony	Area in sq. km.	Population census 1920–1
I. America and Australasia (group of old colonies)	129,491	652,300
II. African group	11,516,224	35,919,405
III. Asiatic group	879,355	22,250,333
	12,525,070	58,822,038
France (for comparison)	550,985	40,000,000

The African group consists of Northern Africa (Algeria, Tunisia, Morocco); French West Africa (Senegal, Guinea, the Ivory Coast, Dahomey, Niger); French Central Africa, which stretches from the Congo to Lake Chad and the Nile Basin; Madagascar, the third largest island in the world; and the French Somali Coast, at the mouth of the Red Sea. In addition, France has mandates in Togo and Cameroons. This group, by its proximity, seems specially destined to act as an extension of the mother-country. It is naturally commanded by Northern Africa, which is only 750 km. distant from France, 20 hours' journey by sea, or six hours by air. From Northern Africa the railroads and aerial routes spread out towards the tropical and equatorial territories; it links the mother-country and the other African colonies. Algeria, lying as it does between Morocco and Tunisia, is the pivot of this system, and is rightly considered

the key position, whether judged by the number of French which inhabit it (600,000 out of 800,000 Europeans, against 5,000,000 natives) or by the loyalty of its population and their ready acceptance of French culture. Owing to its Mediterranean situation, Syria, administered by France under mandate, may also be included in this group, although lying in Asia. The Governor of Algeria and the Residents-General in Morocco and Tunisia meet every year in conference in one of the three capitals in Northern Africa alternately. In 1926, for the first time, the Governor of French West Africa attended this meeting.

The Asiatic group consists of French Indo-China, or the Indo-Chinese Union, including six colonies or protectorates—Cochin-China, Cambodia, Annam, Tongking, Laos and the territory of Kwangchow. This union was organised in 1887. A series of treaties with Siam (the most recent dated 1926) and with China have now regularised its relations with all its neighbours. Indo-China has become the base of French policy in the Far East.

Administration.—The administrative ties which unite these French colonies with the mother-country are very various. There is no central colonial body in Paris. The Conseil Supérieur des Colonies, which consists of a number of persons distinguished in politics, commerce and the arts who are competent to speak on colonial affairs, is merely an advisory body. Plans for uniting under the control of a single body all the different colonies of North Africa, or of Indo-China and the Australasian possessions, have not been realised. Algeria is administered by the Ministry of the Interior; it is divided into departments administered by prefects and sub-prefects appointed by this Ministry and belonging to the home civil service. The protectorates of Tunisia and Morocco and the mandated territory of Syria are under the Ministry of Foreign Affairs, which appoints to them sub-agents from the diplomatic or consular lists, or from a service special to these three countries. The Colonial Ministry is in charge of the other colonies, and the École Coloniale in Paris furnishes their administrators and colonial governors. In fact, even the countries directly subordinate to the Colonial Ministry enjoy a degree of autonomy, and the governors have very full discretionary powers. The reason for this liberal system of administration lies as much in the conditions under which the French colonial empire grew up as in the French temperament. At the moment when explorers or soldiers conquered these domains for France, France did not need them.

She had no surplus population requiring an outlet. Agriculturally, she was self-sufficing; industrially, her commerce, which was principally one of luxury articles, found its market in the more highly developed countries. The colonies were therefore subjected to no exploitation, and were often administered by soldiers—that is to say, by the class of ruler who is least interested in economic production. The relations between the administration and the natives were consequently marked by a particularly liberal character. Moreover, the colonies were granted financial autonomy as early as possible. The French colonial estimates have always been meagre—in 1925 only 270,000,000 francs. The financial administration of the colonies did not, therefore, concern French political life, which is essentially parliamentary. Nor was there any rivalry between the careers of the Frenchman—as soldier, official or great landowner or merchant—and the native. Things were different, for example, in Tunis, where the Italian and the native compete with one another. The colonial governors, apt, like all Frenchmen, to apply parliamentary formulae to life, and often themselves parliamentarians, were anxious to develop local councils and local assemblies, even with the power of voting taxes, in the countries which they were charged to administer. Finally, the Frenchman has little race or colour prejudice. All this contributes to give French colonisation the aspect of a friendly collaboration not dissimilar from the method of mandates.

French emigration is not due to the need for economic expansion or to divert a surplus population, but to the need of moral expansion. Missionaries, professors and soldiers form the largest contingent of emigrants. The colonies replace for them fields of action closed to them in Europe or America. Whether in India, China, Madagascar, Tunisia or Morocco, even in the Sudan, the effort of the French administrator has awakened national sentiment in these countries, after putting an end to the civil wars with which they were all torn. Certain races—for example, those of Cambodia—have been saved from a fatal torpor. Archaeologists, painters, and men of letters constitute a relatively high proportion of the French element, and in Indo-China and Morocco, for example, the artistic and intellectual regeneration of the colonised people cannot but strengthen their vitality. The colonial exhibition at Marseilles in 1922 illustrated this method. These considerations explain why France has sometimes been reproached with not having thoroughly exploited her colonial possessions.

Resources in Men and Wealth.—The War led French statesmen to take account of colonial resources in men and material wealth. First, it supported the theories of those who considered that France's military expenses might be reduced by enlisting native troops. The colonies contributed 545,000 combatant soldiers to the French Army. The strength (about 180,000) of the colonial army in 1925 rested mainly on native recruiting. The colonies are also a reservoir for the manual labour in which France is deficient. Many of the 183,928 colonial workmen brought to France during the War remained, and this immigration continues.

The various plans for exploiting colonial resources, the most complete being that put forward in the Chamber of Deputies by M. Albert Sarraut in 1921, have been inspired by a desire to lessen the dependence by France on foreign countries for raw materials. The French colonies are especially rich in minerals (phosphates, iron, coal). The production of phosphates in North Africa reached 2,600,000 tons in 1922; that of iron ore 1,800,000; Indo-China supplied Southern China with coal (900,000 tons); New Caledonia is the greatest producer of nickel after Canada, and her deposits of chrome are second only to those of Rhodesia. As regards agriculture, the production of cereals in Northern Africa in 1922 was 19,400,000 quintals of wheat, 19,200,000 quintals of barley; the production of wine was 10,900,000 hectolitres. There are 28,000,000 olive trees in Algeria and Tunisia alone; the exportation of fruits exceeded 300,000 quintals in 1922; that of early vegetables, 400,000 quintals. The live stock includes 17,650,000 sheep and 475,000 horses. French West Africa exported 153,000,000 fr. worth of ground nuts in 1922. Indo-China is the second exporting country in the world in rice—1,440,000 tons in 1922. The live stock comprises 4,000,000 oxen and buffaloes. The total area of colonial forests is 600,000,000 hectares, that is, about twice the total surface of France.

The private capital invested by France in colonial enterprises, exclusive of banks and railways, and of the milliards of francs spent by the state to pacify, organise and protect the colonies, exceeded 2,000 million fr. in 1924. The trade which France did with her colonies was 9,366 million fr. out of a total trade of 81,600 million francs. The public debt of the colonies is only three milliards. The colonies contribute a share to the central budget; in 1925 they paid 33,000,000 fr. as a contribution to military expenses, upkeep of the École Coloniale, the Institute of Colonial Agriculture, the general agency of the colonies and the colonial air service. This share is very small, but shows the assistance which they can render France.

Such are the general characteristics of this colonial domain, the possession of which has had its effect on the traditional aspect of French policy. The French colonies have 15,086 km. of railways, 49,968 km. of roads, which are excellent in Northern Africa and Indo-China; and, although the Empire has not yet found its Kipling, French imagination has succumbed to that rosary of names, so exotically appealing to the tourists, Tunis, Algeria, Fez, Marrakesh, Damas, Angkor or Timgad, which envelop with a magnetic circle the central core of France. The French mercantile marine has found its true base in the colonies. The quickest routes between South America and Europe, will eventually lie across French Africa. This is mainly due to the railway between Algeria and Dakar, which has already been traced, and the air routes or motor roads already in use. French statesmen, thanks to this fact and also to the fact that many of them have already occupied high posts as governors in Africa or Asia, are gradually recovering the habit of thinking not merely nationally but geographically, and while the first place in their watchful eye is always the security of France, they have been led to play a practical part in world problems, where their predecessors confined themselves to theory.

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VII. RAILWAYS

In 1911 the French railways consisted of five great private-owned and one state-owned line, with a combined mileage open to public traffic of 40,615 km. and a capital value of about 17 milliard francs. After the War acquisition of the Alsace-Lorraine lines, with mileage

of 2,255 km., brought the total mileage up to 42,870 km., while owing to this increase and the large amount of reconstruction effected after the War on the Nord and Est lines, their total capital value rose to about 39 milliard francs.

In 1911 the French railways carried 511,000,000 passengers, in 1924, 776,000,000; the mean annual increase has risen from 3% to 6%. In 1911 184,000,000 tons were carried by goods train; in 1924, 265,000,000, an increase of 37% in three years.

The commercial development of the railways was arrested by the War; not so their technical activity. Between 1914–8 they bore 41% more traffic than in peace time—the lines near the front, 200%. 15,400 trains were used during the period of mobilisation and concentration; between Sept. 1914 and Nov. 1918 about 100,000 troop trains carried some 6,000,000 men; besides returning empties, rations trains, munitions trains, leave trains, ambulances and a daily average of 200 trains carrying engineering material. Between March 21 and Nov. 11 1918, when traffic was densest, 50,000 military trains of all sorts were moved; counting returning empties, the traffic on the Nord system reached about 900 trains in 24 hours.

Most of this traffic fell on those parts of the Nord and Est lines not in enemy occupation; here important works had to be carried out during the campaigns. In Sept. 1914 bridges, etc., destroyed during the retreat from Belgium were reconstructed and lines and stations adapted to permit the extension of the Allied front to the Belgian coast, an operation which required 2,169 trains for the movement of troops alone. During the subsequent period of stationary warfare, single lines were doubled, railheads constructed, engineers and munitions dumps formed, whole new lines built; 13,500 km. of line were built, nearly 6,000 being behind the British front, and 28,000,000 cu. m. of embankment erected. These works, serving purely military purposes, were generally dismantled after the War.

The German Army in its retreat destroyed 2,047 km. of line (about half being double line), 600 stations, 1,100 bridges, 24 tunnels and all workshops and watering stations in its area. When these lines were reconstructed, the opportunity was seized to enlarge and improve the stations, lay the permanent way more rationally and introduce the latest electric, pneumatic or hydraulic points and signals. Especial attention was paid to the great goods yards in view of their importance for the reconstruction of the devastated areas. Lille-Délivrance station, for example, which dominates the goods traffic of Northern France, was constructed to clear 4,500 trucks daily. Its tracks are so arranged that it functions by the force of gravity, and requires only a small staff; it acts like a filter, all traffic, being passed in the same direction.

Locomotives and rolling-stock have increased in numbers and power, especially on the Nord and Est systems. There were 20,383 locomotives in 1924, compared with 13,434 in 1911; the load of the fastest passenger trains rose from 400 tons to 550 tons. Between 1920–4 the number of passenger carriages increased by 11%, of goods trucks by 20%; they are also much stronger and of increased capacity. The new all-steel one-piece carriages on the Nord line deserve especial mention. Examples of the carriages used on other lines were shown at the Exhibition of Modern Decorative Arts in 1925. Most goods trucks before the War carried a maximum load of 10 tons, few of over 20 tons. In 1925, of 525,000 goods trucks, 254,500 carried 10–20 tons; 227,000, 20–30 tons; 41,000, 30–40 tons; 2,500, 40 tons or over. The average carrying capacity of trains, especially on the main lines, has greatly increased. Many take 80 trucks, and 1,500 tons.

In the devastated areas, the railways were reconstructed earlier than the dwellings; so that the companies had to provide accommodation for their workmen on a large scale. The Nord built 11,141 houses of modern types, sometimes constructing regular towns, besides providing their employees with 6,300 other dwellings.

The problem of electrification only became urgent after the War when the altered economic conditions compelled France to utilise all her natural resources. A scheme was drawn up involving an expenditure of five milliard francs on the construction of power stations and the electrification of about 9,000 km., including 3,350 km., or nearly half, of the Paris-Orléans line; 2,300 km., or a quarter, of the P.L.M. line, and 3,200, or over three-quarters, of the Midi line.

An agreement between the state and the railway companies, made on June 28 1921, established a close financial and technical connection between the state lines of the Etat and Alsace-Lorraine and the group of the five great private companies. After satisfaction of the claims of shareholders and personnel, all proceeds are pooled; a deficit on one line is thus compensated by a surplus on another, the tariffs are fixed high enough to avoid a general deficit. Tariffs are uniform and common throughout France; rolling-stock is pooled; important purchases, as those of rails, sleepers, etc., are made in common; common are all arrangements regarding pay, promotion, employment, etc., of the 500,000 employees. All important questions of management are discussed in a committee composed of the Presidents and Directors of the seven lines; all matters affecting the employees or national interests are discussed in the Conseil Supérieur des Chemins de Fer, in which the above committee is reinforced by elected representatives of all grades of the personnel, the presidents of Chambers of Commerce and representatives of the principal national industries and of the state. The workings of this innovation have proved most satisfactory. See *Statistiques des Chemins de fer français* (annuel). (P. J.)

FRANCHET D'ESPEREY, LOUIS (1856–), French soldier, was born at Mostaganem in Algeria May 25 1856. Commissioned to the infantry in 1876, he early saw active service in Tunisia, Tongking and N. China. In 1908 he became general of brigade, and the same year a tour of the Balkans and his published studies thereon worked the beginning of an interest in that region which was to have important results. In 1913, as general of division, he carried out a vigorous campaign in Morocco, after which he was appointed to the I. Army Corps at Lille. This corps he commanded during the battle of the Frontiers, Aug. 1914, and on the eve of the battle of the Marne he succeeded Gen. Lanrezac as commander of the V. Army. In March 1916 he was advanced to command the eastern group of armies, and later the northern group. On the recall of Guillaumat in June 1918, Franchet d'Esperey was sent out to replace him as Commander-in-chief at Salonika. Adopting and developing his predecessor's plan for an offensive in the Balkans, Franchet d'Esperey ensured the success of his break-through by the skill with which he denuded the rest of the front to concentrate an overwhelming preponderence on the narrow Sokol-Dobropolye sector, west of the Vardar. Success beyond anticipation crowned the stroke; with their reserves pinned down by vigorous pressure elsewhere the Bulgarians were unable to repair the breach, and as the Serbian spearhead drove in deeper, the whole Bulgarian front collapsed, and on Sept. 29 Bulgaria capitulated—the first defection among the Central Powers. If he owed much to his predecessor, to Franchet d'Esperey was the glory of execution and realisation. Exploiting this victory, he cleared Serbia of the Austrian troops and later, on Jan. 5 1919 took prisoner the German Marshal von Mackensen, in Hungary. He afterwards commanded the Allied forces in Turkey until Nov. 1920 and was created a marshal of France on Feb. 21 1921.

FRANCIS FERDINAND (1863–1914), Archduke of Austria, was born at Graz Dec. 18 1863. The eldest son of the Archduke Charles Louis and a nephew of the Emperor Francis Joseph, he became, after the death of the Crown Prince Rudolph, the heir to the Austro-Hungarian monarchy. In 1875 he took the title of Archduke of Austria-Este, as heir to his uncle the Duke of Modena, with whose death the male line of this branch of the house became extinct, and to his possessions in Austria-Hungary and Italy.

Until the death on Jan. 30 1889 of the Crown Prince Rudolph, Francis Ferdinand was only known in limited circles and even then he was not invited by the Emperor Francis Joseph to take part in state affairs, although the Emperor frequently commissioned him to represent him abroad. On July 1 1900 he married Countess Sophie Chotek (1868–1914), after having overcome, by tenacious persistence, the obstacle due to the fact that the lady was not of royal family, and renounced a few days before the ceremony the succession rights of any children of the union. This renunciation was not only inscribed in the records of the imperial family, but ratified in the Austrian and Hungarian Parliaments and sanctioned by a law of Dec. 4 1900.

After that time the Emperor gradually allotted to him responsibilities of his own, not only in military matters but occasionally in questions of domestic politics. The difference of outlook of the two men, however, became more and more marked; for with advancing age Francis Joseph was less and less willing to consider far-reaching reforms, was anxious to avoid any conflict with the nationalities, and preferred advisers who knew how to untie a knot gently instead of hacking through it. Francis Ferdinand was convinced that the Magyar preponderance in the affairs of the dual monarchy must be broken in the interests of the monarchy and the dynasty. For some time he held that Federalism was the best solution. At another period he inclined to "Trialism." Later, influenced by the Hungarian minister Kristoffy, he inclined to strengthen unity by changing the Delegations into a Central Parliament and attaching the annexed provinces Bosnia and Hercegovina, with a state organisation of their own, to the Empire. The opposition which he met on all sides from the ruling

party in Hungary strengthened his conviction that here lay the essential obstacle to the healthy recovery of the monarchy. In the severe conflicts between the Magyars and the Crown from the beginning of the 20th century onwards he, therefore, maintained the opinion that no concession must be made, and that there should be no shrinking even from the use of armed force for the defence of the rights of the monarchy and the dynasty.

The zeal with which he sought the solution of domestic political problems by strengthening the central power is explained by his firm conviction that this was the indispensable condition of the monarchy as a Great Power, which he desired to maintain and to increase. Francis Ferdinand was not an unconditional adherent of the group which thought his aim would only be attained by force of arms. But he was firmly determined to tread this path if it was the only one by which the goal could be reached. He considered that friendly relations with Great Britain were desirable, but towards France, and still more towards Italy, his attitude was cool and negative. He was convinced that there must inevitably be a day of reckoning between the monarchy and Italy. He never adopted an anti-Slav policy. He wished to avoid conflicts with the principal representatives of the Slav nationalities, and recognised in the Tsar of Russia the strongest support against revolutionary movements in monarchical states. At the same time he expressed the decided opinion that the encroachments of the Greater Serbia movement of Austro-Hungarian soil should be resisted with all the forces of the monarchy. He stood by Germany, yet was determined that the monarchy should not fall into dependence on her powerful ally.

Francis Ferdinand was a man of more than average ability. He would immediately recognise the essential point in any business in which he was engaged. What he lacked was knowledge of men and calmness and constancy in his relations with the men who had been placed in high offices of state by his influence. He asked from the citizens of the monarchy not affection, but submission to the will of the ruler. To him the state was identified with the divinely appointed person of the monarch. He was shot June 28 1914, with his wife, by Bosnians of Serbian nationality at Serajevo. (*See* EUROPE.)

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FRANCIS JOSEPH I. (1830–1916), Emperor of Austria and King of Hungary (*see* 10.942).—In the last years of his reign Francis Joseph continued to strive to preserve peace for his realm, while maintaining the prestige of Austria-Hungary and her position as a Great Power. Perceiving that this aim was threatened by the confusion reigning in the Balkans, he agreed to the plan of his Foreign Minister, Aehrenthal, to take advantage of the Young Turk movement to annex the territories of Bosnia and Hercegovina occupied in 1878, and to embody them permanently in the monarchy. During the serious crisis following on the annexation Francis Joseph backed Aehrenthal with the whole weight of his influence, and subsequently supported him in his endeavours to restore friendly relations with the Great Powers which had been signally disturbed by the annexation, and to put an end to the risk of international conflicts. By his personal intervention he in fact repeatedly succeeded during the years 1908 to 1914 in averting dangers threatening the peace of Europe. When in 1912 the Balkan wars, which he had untiringly but unsuccessfully striven to avert, began, he thought they were the gale before the hurricane, and when, in Aug. 1913, the Peace of Bucharest provided a provisional settlement he expressed the opinion that this peace was only the breathing space before a fresh war.

The behaviour of the Serbs filled him with the greatest anxiety. When the murder of the heir to the throne, the Archduke Francis Ferdinand (June 28 1914), led the Vienna Govt. to take energetic measures against Serbia, Francis Joseph hesitated to follow, and it was with a heavy heart that he gave his consent to the dispatch of the severe ultimatum to Serbia, and, after its rejection, to the declaration of war. He did not believe that the war could be localised, as he would have wished it to be, and was pessimistic about the chances of a world war. Even then he was of the opinion that "war is beyond our strength," and said he would be glad if the monarchy escaped "with a black eye." The attitude of the rulers of Italy and Rumania offended him deeply, and strengthened his doubt of a favourable outcome of a war against an ever-increasing number of adversaries. Francis Joseph stood immovably by the alliance with Germany, to whose ruler he was bound by a friendship based on reciprocal liking; it never occurred to him to separate from his ally. He would never have agreed to a separate peace; yet he favoured and supported every endeavour to put an end to the War by a peace which should safeguard the interests of all his allies and the position of Austria-Hungary as a Great Power.

In all questions affecting the constitution of the monarchy, and in particular the relations between Austria and Hungary, Francis Joseph continued in the later years of his reign to stand by the principles of the *Ausgleich* of 1867. He would not consider the federalisation of the Empire, but stood unmoved on the basis of dualism. He went a long way to meet the efforts of the Hungarian Govt. for independence, but refused energetically during this period demands tending towards the severing of the remaining bonds between the two halves of the monarchy, especially that of the united army. In the increasingly violent conflicts between the different nationalities inhabiting the Cis-Leithan territories Francis Joseph stood above party. This was all the easier for him on account of his indifference towards all the nationalities of his vast realm, even towards the Germans, although to the end of his life he felt himself to be a German prince. As in the earlier part of his reign, so in the last decade, the separate nationalities were favoured or neglected, but always played off one against the other. The meaning of *viribus unitis* for Francis Joseph was to use all in the interests of the dynasty.

But national consciousness had grown so strong that this policy had no success. The concessions which he granted in the years just before the War to the Slav peoples increased their self-confidence, and led them to make ever greater demands, the non-fulfilment of which caused a weakening of their sentiment for the dynasty. As the differences between the national parties represented in the Austrian Parliament became in the course of years so great that there was no prospect of effective co-operation, Francis Joseph ignored parliamentary activity from 1914 onwards. Experience of the World War led the old Emperor to recognise that he had done the Austrian-Germans an injustice; but isolated attempts to alter the trend of affairs had no lasting effect, and in the end he let things take their course. When he died, severe inroads had been made on the affection of the Austrian peoples; what remained was only just sufficient to disguise the disappearance of loyalty to the dynasty.

As years went on the Emperor became more and more lonely. His son had committed suicide in 1889, his wife had been murdered in 1898; of his brothers only the youngest was still alive, and he resided at a distance and in the strictest seclusion. There had never been any cordial relationship with the heir to the throne, Francis Ferdinand; and with the years, especially after Francis Ferdinand had married Countess Sophie Chotek, the estrangement between the two men increased, so that personal intercourse became rare. Among the remaining members of the Imperial House Francis Joseph only cared to frequent the circles of his two daughters, Gisela and Marie Valerie, and their children. He was bound by ties of true friendship to Katharina Schratt, formerly an actress at the Burgtheater, and in her society he spent his sparingly measured hours of recreation. The summer he usually spent at the watering place of Ischl, and there he devoted himself to the chase, the only pleasure for which he cared passionately to the end of his life.

The Emperor had long enjoyed excellent health. It was not until he had passed his 75th year that disease of the respiratory

organs began. In 1911 this became so serious that a catastrophe was feared. All the preparations for Francis Ferdinand's accession were made. But the old Emperor recovered; and his physical as well as his mental energy improved from year to year, so that he was able in the first two years of the World War to transact fully all the business of government. It was only in the year 1916 that his faculties began to fail. He died peacefully of a fresh attack of his old malady on Nov. 21 1916.

Francis Joseph was not one of those of whom contemporaries, especially those at a distance, form any definite impression. The reserve which he observed even towards the great majority of his advisers made it more difficult to penetrate his real nature. He had a deep sense of his exalted position as a ruler. To the end of his days he remained profoundly convinced that the Empire over which he ruled was *his* empire, and the peoples *his* peoples. This conception of the majesty of the office bestowed on him by God found expression in his bearing. He always maintained a regal attitude. He showed kindliness and winning courtesy to everyone. Nothing was farther from him than posing, and no one ever heard him utter sonorous phrases; but he avoided any kind of intimacy even in his intercourse with members of the Imperial House, and, even with them, knew how to maintain his distance. His intellectual gifts were not remarkable, but he possessed sound common sense and wit. He had a strikingly good memory for persons and events. As a ruler he was a model of the sense of duty. From early morning to evening he attended to business with clocklike regularity, and dealt with all the documents laid before him with the greatest punctuality. This industry and his exact memory made him one of the best authorities in all Government affairs. He sometimes startled his ministers by his intimate knowledge of the details of the business in hand, and occasionally embarrassed them. But he went no further than details, and lacked the power of surveying the whole.

The Emperor also lacked, especially in his later years, the ability to take the initiative in important questions, to form independent resolutions and to carry them to their logical conclusions. In an ever-increasing degree he left the decision to his responsible ministers. He was not without skill in the choice of his advisers, but had an instinctive dislike for men whom he felt to be his intellectual superiors. He also disliked people of proud and upright character, and even within the family circle he preferred those who were more subservient. He was essentially cold in temperament, with great self-control increased by practice. Among the European rulers he enjoyed, during the last decades of his reign, great respect, which he owed to his age, experience, personal amiability, blameless conduct, and above all the fact that his word could always be relied upon. He was a faithful son of the Catholic Church, and looked up with reverence to the Holy Father; but, quite in the spirit of the traditions of his House, he guarded the rights of the dynasty and of the State with the utmost tenacity, even against the Pope. He took no interest in the arts and sciences, being in this respect more of a Lorrainer than a Habsburg; but whenever he expressed an opinion on these subjects, he showed a decided aversion from the modern tendencies. (A. F. Pr.)

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FRANKFORT-ON-MAIN, Germany (*see* 11.17), has changed little outwardly since 1910, though the area of the city is now 33,277 ac., and the population according to the census of 1919 is 433,002. The life of the place still centres in the ancient and picturesque city, though in recent years blocks of old buildings round the cathedral have been swept away, and garden cities have arisen on the outskirts.

Frankfort is now an important inland port; heavy barges can navigate the Main as far as Aschaffenburg, and canalisation is being carried as far as Würzburg. The Rhine-Main-Danube canal is under construction, and a scheme has been prepared for a waterway to the Weser, which will link Frankfort with Bremen. Considering the difficulties of the process, the famous banking houses weathered the period of inflation well, and have led the way to the restoration of Germany's economic position in the world. The metal, chemical and electrical industries of the district are improving, and the old trade fair was revived in 1919. In 1914 a university was founded, and in connection with it is an academy of labour, designed to provide a new class of leaders for the labour movement. During the World War Frankfort was several times bombed, and it was occupied for a short time by the French in 1920 during the invasion of the Ruhr area by German militarists.

FRASER, ALEXANDER CAMPBELL (1819–1914), British philosopher (*see* 11.38), died at Edinburgh, Dec. 2 1914.

FRASER, CLAUD LOVAT (1890–1921), British artist and designer, was born in London, May 15 1890, and was educated at Brighton and Charterhouse. He began to follow his father's profession as a solicitor in 1908, but abandoned this three years later for art. After working with Walter Sickert for a time, he exhibited in 1913, being responsible in the same year for the decoration of the *Flying Fame* chapbooks and broadsheets. He served in France with the Durham Light Infantry during 1915–6, but was gassed and invalided home. His gift for spirited design and lively colour, based to a great extent on 18th century conventions, developed rapidly, and he not only illustrated successfully many books, but exercised a rejuvenating influence on English stage designs by his production of *The Beggar's Opera* (1920), *As You Like It* (1920) and *If* (1921). A career of great promise was cut short by his death, June 18 1921, at Sandgate, Kent. See John Drinkwater and Albert Rutherston, *Claud Lovat Fraser* (1923).

FRAZER, SIR JAMES GEORGE (1854–), British anthropologist, was born at Glasgow, Jan. 1 1854. Educated at Helensburgh, Glasgow University and Trinity College, Cambridge, he was elected a fellow of the latter college in 1879 and called to the Bar in the same year. He was knighted in 1914, received the O.M. in 1925 and became Commander of the Legion of Honour in 1926. A prolific writer, he is famous as the author of *The Golden Bough*, first published in 1890 and re-issued in 12 volumes under seven titles between 1907 and 1915. In 1922 appeared an abridged edition under the original title. This work is an elaborate study of ancient cults and folk lore and covers a vast field of anthropological research. In 1926 he issued vol. 1 of *The Worship of Nature*, dealing with the worship of the sky and of the earth. Among his many other publications are: *Totemism* (1887); *Adonis, Attis, Osiris, Studies in the History of Oriental Religion* (1906, 2nd ed. 1907, 3rd ed. 1914); *Totemism and Exogamy* (1910).

FREDERICK VIII. (1843–1912), king of Denmark (*see* 11.52), died at Hamburg May 14 1912.

FREEMASONRY (*see* 11.78).—The total membership has at least doubled since 1910 and, according to the Masonic Year Book, Chicago, is (1926) about 3,922,318. In addition there are at least 1,000,000 "unrecognised" masons, the most important group being the "Negro" masons of the United States of America. Of the "regular" masons, all save 208,388 belong to the various Grand Lodges of the U.S.A. and of the British Empire, which indicates that freemasonry is essentially an Anglo-Saxon institution.

Social Work.—In the U.S.A. and Holland the most noticeable change has been a tendency to take an active part in the social betterment of the nation. While avoiding controversial political questions, the aim is to increase the interest of members in the well-being of their fellow citizens outside the door of the lodge. This tendency is less marked in the British Grand Lodges, owing to their anxiety to avoid any appearance of interfering *as Masons* in politics, although in the field of charity they are particularly active.

Anthropological School of Research.—Among British masons one of the most notable changes has been the rise of a new school of masonic research, which aims at tracing the history of Freemasonry anterior to 1717. Faced by the paucity of documentary evidence, due to the nature of the obligations taken by medieval masons, this school has adopted the principles used in the study of anthropology and of comparative religions. It has discovered that figures carved,

or painted, by medieval masons, are often depicted making certain signs still known to Freemasons, and that in the scenes represented these clearly convey the same inner meaning as to-day.

Examples of such secret messages have been found in medieval and Comacine work and also in that done by members of the Roman Collegia. There also exists documentary evidence connecting these three groups of builders. A similar use of signs in Ancient Egypt, in the Hung Society of China and among savage races when initiating a boy into manhood, has also been demonstrated. On the basis of these facts, which are unquestionable, the theory is being developed that Speculative Freemasonry is descended via the Comacines, the Roman Collegia and the Mysteries from primitive rites, once universal in the dawn of history, survivals of which are to be found to this day in Central Africa and Australia. Concurrent with this work has been the careful study of the modern rituals, and the comparison of certain peculiar features in them with similar incidents in the ancient mysteries and in savage rites. The facts so far disclosed suggest that in modern freemasonry we may have an intellectualised survival of the cult of the Dying God and of the Fertility rites. Although this school has produced much interesting data, its conclusions are not yet universally accepted by the older or "documentary" school, the members of which consider that coincidence may explain the similarities to which their attention has been directed. If, however, the views of the Anthropological School are ultimately accepted, the result will be that the origin of freemasonry will be pushed back thousands of years.

The Mystical School.—Quite as important has been the rise of a distinctly spiritual school of thought, which endeavours to interpret the meaning of the ceremonies, and considers that in the rituals of the various degrees we have an allegory of the quest of the soul after mystic union with the Supreme Being. While often differing in detail, since they approach the subject from different angles, all the exponents of this school agree in the main principles, although in historical research they are often sharply divided, some belonging to the documentary school and others to the anthropological. Perhaps, however, the most important fact is the ever increasing interest among the rank and file in a subject which, even a few years ago, would have been treated with complete indifference.

Masonic Relations.—Since 1910 events have proved that the breach between Latin and Anglo-Saxon masonry was based on a fundamental divergence of opinion as to the basic principles on which the order rests, and this breach tends to grow wider year by year. The disastrous results of interfering in politics has been shown by the fact that the Italian and Hungarian Govts. have declared Freemasonry to be a danger to the State, and have suppressed it within their jurisdictions. In France opposition to the political activities of the Grand Orient culminated in 1914 in the formation of a new body, "Grande Loge Nationale Indépendante et Regulière pour la France," which avoids politics, and insists on belief in God. This body, which has increased rapidly in numbers, is recognised by the Grand Lodge of England. At the same time, one by one, most of the American Grand Lodges which were still in fraternal relations with the Grand Orient have felt compelled to sever relations.

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Mystical: A. E. Waite, *The Secret Tradition in Freemasonry* (1911); W. L. Wilmshurst, *The Meaning of Masonry* (1922); J. S. M. Ward, *The E. A.'s and the F. C.'s Handbooks and the M. M.'s Books* (1923); *Freemasonry: Its Aims and Ideals* (1923); *An Interpretation of Our Masonic Symbols* (1924); W. L. Wilmshurst, *The Masonic Initiation* (1924); A. E. Waite, *Emblematic Freemasonry* (1925); J. S. M. Ward, *An Explanation of the Royal Arch Degree* (1925).

(J. S. M. W.)

United States.—Since 1920 freemasonry in the United States has grown with amazing rapidity, and in 1926 had a membership of nearly 4,000,000 men, organised in 50 grand lodges. While in many ways gratifying, the influx of new members raised many problems, to meet which two movements were started.

First, the National Masonic Research Society was organised in 1914, under the sanction of the Grand Lodge of Iowa, to encourage the education of Freemasons in the history, symbolism and philosophy of freemasonry. Its headquarters are in St. Louis, where its journal, *The Builder*, is edited. Second, the Masonic Service Assn. of the United States organised in 1919 more than 30 grand lodges—the first great co-operative movement in American freemasonry. It grew out of the service of the fraternity in the War, and had two objects, as stated in its constitution; firstly relief in time of nation-wide calamity, whether it be war, pestilence or other disaster; secondly education—the teaching of freemasonry as it has to do with the daily lives of citizens and the problems of the nation.

The educational programme of the association is based upon the doctrines of the fatherhood of God and the brotherhood of man, under five heads: religious liberty, equality before the law, equality of opportunity, the dignity of labour and charity. Its work is carried on by means of short talk bulletins read in the lodges of member jurisdictions, speaker's bulletins, lectures illustrated by films and moving pictures, books, and its journal *The Master Mason*, edited from its headquarters in Washington. The association is managed by an executive commission, composed of one member from each group of states into which the country is divided. As a result of these movements a better kind of masonic literature has been created, at once more accurate and more popular—a national masonic library of nine volumes, and a little masonic library of 20 volumes. The whole intent of the movement is to know more about freemasonry and to do more with freemasonry for the service of mankind.

Recent years have witnessed the building of great temples of freemasonry in many of the chief cities of the country, and also a remarkable growth of philanthropic activity—the building of homes for the aged and indigent, orphanages and hospitals and the organisation of the national masonic tubercular sanitoria association. Since the World War there have been tentative attempts to form an International Masonic Assn. but they have been largely abortive, so far as American freemasons are concerned, owing to the refusal of freemasons in the United States to affiliate with foreign bodies which remove the Bible from the lodge and do not require faith in a supreme being as a requisite of membership.

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(J. F. N.)

FRÉMIET, EMMANUEL (1824–1910), French sculptor (*see* 11.96), died Sept. 11 1910.

FRENCH, DANIEL CHESTER (1850–), American sculptor (*see* 11.98), numbers among his more notable recent works the four groups representing Europe, America, Asia and Africa for the New York Custom House; the Melvin Memorial at Concord, Mass. (1916); the 1st Division War Memorial, Washington, D.C. (1924), and the statue "Memory" (1911), which was purchased by Henry Walters and given to the Metropolitan Museum of Art. His statue of Abraham Lincoln, executed for the Lincoln Memorial, Washington, D.C. (1920), portraying Lincoln seated and in a meditative mood, occupies a superb though simple setting and is considered the crowning work of French's life.

FRENCH AFRICAN LITERATURE.—The enormous continent, of Africa on account of its geographical configuration, is apt to appear as a single unit. But this could only be if all negroes were of the same race; whereas, ethnically speaking, owing to the intermingling of blood and the differences of latitude and longitude, there are as many races of negroes as there are African tribes. An Englishman differs less from a Russian than an Ourlaf from a Haoussa, and a Haoussa from a Kaffir.

The outbreak of the World War brought home to France her need for man power, and she then began to turn her attention towards a race which sent her its men by thousands. In the midst of the madness and destruction that overwhelmed Europe, she realised that she had to do with men who were like children and whose virgin minds required cultivation. She was forced to recognise that, in spite of solid, imposing and well-documented volumes, the theories with regard to the natural superiority of the Aryan races, set forth by Count Gobineau in his *Essai sur l'inégalité des races humaines* (1853–5), had received an unpleasant shock. Moreover, the ideas which Dr. Cureau, a former Governor of French Equatorial Africa, and a follower of Gobineau, expressed in his learned and interesting *Sociétés primitives de l'Afrique equatoriale* (1912) have, after much dis-

cussion, been strongly attacked, first by Jean Finot, whose work *Le préjugé des races* (1905) has attained world circulation, and later by Doctor Huot, in " L'âme noire."[1]

The soul of the negro, as compared with that of the white man, is emotional, unstable, variable and incomprehensible. It cannot be fathomed either in the tales of the old navigators—they dealt too much in fable and fantasy—or in the journals of contemporary explorers. Those who have lived long enough with the negro have learned to hold him in affection, which, according to Stendhal, is nothing but the crystallisation of feelings and inclinations.

We cannot number among the initiated either Pierre Loti, impassioned admirer of the exotic—the poet and magician who was inclined to bewitch himself with his own incantations—or even Fromentin, whose *Un été dans le Sahara* (1874) and *Une année dans le Sahel* (1859) conjure up before us burning sand and blinding light; but we must include Isabelle Eberhardt, the *bonne nomade*, whose whole work is a glorification of Islam; and a group of other writers of whom the most outstanding are Robert Randau, whose novels *Les Colons* (1907), *Les Algérianistes* (1912) and *Cassard le Berbère* are powerful and vivid; F. Duchene with *Au pas lent des caravanes* (1922), *Thamil'la* (1923) and *Le roman du Meddah* (1924); Maximilienne Heller with *La mer rouge* (1923) and many others. These works, however, have been inspired less by the influence of Africa than by that of the Mediterranean. In spite of such works as *Terres de soleil et de sommeil* (1916) and *Le voyage du centurion* (1916) by Lucien Psichari, *Visions congolaises* by Louis de Raulin and *Les explorateurs* (1909) and *Le commandant et les Foulbé* (1910) by Robert Randau the true African influence has only prevailed since 1919.

Since that time there has been a harvest of such literature, including the remarkable *Visage de la Brousse* by Pierre Bonardi (1920) and *l'isolement* by Dominique Combatte, which exude the stifling atmosphere of a tropical forest. *Des inconnus chez moi* (1920), by Lucie Cousturier, is a work profoundly true, profoundly human as well as infinitely pathetic. *Batouala* by René Maran (1921), *La randonnée de Samba Diouf* (1922) by the brothers Tharaud, *Koffi* (1922) by Gaston Joseph, *Diato*, a mine of Mandingo folk-lore, by André Demaison (1923), *Métempsycose* by Madeleine de Valcombe (1923), *Pellobellé, gentilhomme soudanais*, by Oswald Durand, *Ulyse, cafre* (1924) by the brothers Marius-Ary Lebland, *Les Chansons de Kou-Singa* by Jean Marville have also contributed to the researches of such men as Delafosse, Bruel and missionaries of all classes, lay, military, commercial and religious. These works may not perhaps have the lyric character which runs through *A travers l'Afrique* (1910) by Captain Baratier, nor the humour of that caustic adventurer to whom Pierre Mille, the French Kipling, has given the name Barnavaux. They are, however, a valuable contribution to the study of the negro mind, and as such increase our knowledge of humanity. (R. MA.*)

FRENCH LITERATURE (*see* 11.110)—The 15 years between 1911 and 1925 were overshadowed historically by the events which preceded the War of 1914, by the War itself and by post-War preoccupations and difficulties. If the course of literature was not entirely determined by this concurrence of great events, it at least responded to them, and bears deep traces of their influence. These marks can be found in the writings of practically all those who were at work during this period. Two literary generations occupied these 15 years; one, the older, that of the writers who belonged to the preceding period, already famous or recognised in 1911, who were only continuing their work; the other, a younger generation, that of the writers who made their first appearance in 1914 or after 1918.

I. THE PRE-WAR GENERATION

The most important writers of 1911 and succeeding years have already been accounted for in the preceding period. It will suffice here then merely to recall their names and the books which they published after 1911. It will be more interesting to note the general tendency of literature at this point.

[1] *Mercure de France* (Sept. 1921).

The peculiar characteristic of French literature in 1911 lay in the fact that the great movement of reaction against the excesses of naturalism which had started 20 years before had reached its culmination, and with entire success. About 1889 the doctrine of naturalism was still triumphant, and had imposed a general conception of things which was affirmed by the scientific spirit. It was material, subject to reason, in no way sentimental. It had invaded the novel with Zola, the theatre, and even made its way into philosophy. It claimed to make use of the discoveries of savants, of Berthelot in chemistry and Darwin in biology. It was fatalistic, pessimistic, setting itself against religious beliefs and even against the tradition of the things of the spirit. It claimed to reduce all life, even the life of the soul itself, to a mechanism of causes and effects, to a purely physiological basis.

It was about the year 1889 that new tendencies were manifested simultaneously in poetry, in philosophy, in criticism and in the novel. While keeping as a fundamental principle the recognition of the fact, that is to say the method of observation, the newcomers insisted upon their observation being complete, upon its taking into account the whole of reality, not merely facts, but also all the stuff of feeling, aspiration, of the impulses of the soul, of spiritual energy. As a result of all this, thought became re-invigorated, took a new lease of life. Such was the accomplishment of men very different in their inspiration and their convictions. Paul Bourget and Barrès among the novelists, Henri de Régnier among the poets, Rémy de Gourmont, Charles Maurras and André Gide among the critics, played a great part in this change. Groups like those of the *Mercure de France*, the *Nouvelle Revue Française*, the *Cahiers de la Quinzaine*, under the leadership of Charles Péguy, did their capable share.

It may be said that in 1911 the distinction had been clearly made between science, which establishes laws and fundamental causes and sets them forth in abstract terms, and art, which manifests these causes sympathetically by appealing at one and the same time to the reason, the heart and the senses. The works of a mathematician of genius, like Jules Henri Poincaré, had made for the development of a more exact conception of science and the scientific method. The books of Henri Bergson, especially the one which appeared in 1907 (*L'évolution créatrice*), had created a new spiritual awakening. Everything thus contributed towards liberating the spirit from the narrow boundaries of naturalism. A literary outburst was the result, the main characteristic of which is that each work reflects the temperament and the tastes of the author, without dependence on any school. Certain writers remain faithful to their conception of the novel (Gustave Geffroy, *Cécile Pommier*, 1922), and the Académie Goncourt continue the tradition of objectivity and naturalism. But the brilliant group of psychological writers that followed Paul Bourget and Maurice Barrès goes back to Benjamin Constant and Stendhal, indeed even invokes Balzac, and attempts to make of the novel a complete representation of life, of the spiritual life as well as the social and material.

During the 15 years (1910–25) there appeared a brilliant series of psychological studies. Writers already famous continued their work. Paul Bourget produced *Le Démon de Midi* (1914), *Némésis* (1918). Maurice Barrès wrote *Greco, ou Le secret de Tolède* (1912), *La colline inspirée* (1913), and just before his death published that *Enquête aux pays du Levant* (1923), which unites in itself all his peculiar qualities of thought and expression and which remains one of his finest books. René Bazin (*Les nouveaux Oberlé*, 1919); Henry Bordeaux (*La maison*, 1913, and *La résurrection de la chair*, 1920); René Boylesve (*Tu n'es plus rien*, 1914, *Elise*, 1921); Louis Bertrand (*Jean Serbal*, 1924); Edouard Estaunié (*Les choses voient*, 1913, *L'ascension de M. Baslèvre*, 1920), attest the vitality of a *genre* which was tried with success also by Emile Clermont (1878–1915), author of *Laure* (1913); Louis Codet (1877–1918), author of *La petite Chiquette* (1911), *César Capéran* (1918), *La fortune de Bécot* (1919); and Roger Martin du Gard, of a more philosophical turn (*Jean Barois*, 1914, and *Les Thibault*, 1922).

The analytic and descriptive novel of manners continued with

Henri Lavedan, *Irène Olette*, *Le chemin du salut*, 1920–3); Abel Hermant *Les Renards* (1912), *L'aube ardente* (1919), *La journée brève* (1920); with Gaston Chérau (*La prison de verre*, 1912, *Le monstre*, 1913). Jérôme and Jean Tharaud (*L'ombre de la croix*, 1917, and *Un royaume de Dieu*, 1920); Gilbert de Voisins (*L'enfant qui prit peur*, 1912); the tales of Henri Duvernois (*Le veau gras*, 1912, *Edgar*, 1912); Edmond Jaloux, Marcel Boulenger, Eugène Montfort, Claude Anet, Charles Géniaux. An offshoot of the symbolist movement, the poetic novel of fantasy has its most illustrious exponents in the poet Henri de Régnier (*La pêcheresse*, 1920, *Le divertissement provincial*, 1923); in the poet Francis Jammes (*M. le Curé d'Ozeron*, 1918, *Le poète rustique*, 1920); and in the young Alain Fournier (1886–1914), snatched away too soon from letters by the War, whose book *Le grand Meaulnes* (1914) remains a charming and impressive work. Finally, exotic literature, dominated by the great name of Pierre Loti, finds brilliant expression in Claude Farrère (*La Bataille*, 1911, *Dix-sept histoires de Marins*, 1914); Jérôme and Jean Tharaud (*La fête Arabe*, 1912); Pierre Mille, Marius-Ary Leblond, and in the posthumous book of Louis Hémon on Canada, *Maria Chapdelaine* (1916), which had a prodigious success.

Women have always excelled in the literature of imagination. Three writers occupy the first rank in this respect—Colette, who has added to her already famous list of works *La vagabonde* (1910), *L'entrave* (1914), *Chéri* (1920), *La maison de Claudine* (1922) and *La fin de Chéri* (1926); Gérard d'Houville, daughter of the great poet J. M. de Heredia, wife of Henri de Régnier, who has a rare poetic gift and who tells in the most fluid style prose stories of charming and often profound imagination, (*Le séducteur*, 1914, *Jeune fille*, 1916, *Tant pis pour toi*, 1920), and who has written in *L'enfant* (1926) a little masterpiece; and Comtesse de Noailles, a poet of passionate and inspired quality as well, who in 1923 under the title of *Les innocentes* published a series of novelettes and meditations in which lyricism is made the vehicle of a daring frankness. Mme. Marcelle Tinayre published in 1920 *Perséphone* and in 1922 *Priscille Séverac*. Mme. Lucie Delarue-Mardrus, a very gifted story-teller, observant and poetic, wrote *L'âme aux trois visages* in 1919 and *Graine au vent* in 1925. Mme. Andrée Corthés received in 1920 the novel prize of the Académie française for her book entitled *Pour moi seule*.

At the theatre that most personal of writers, François de Curel, produced *Terre inhumaine* (1923), *La viveuse* and *Le moribond* (1925). G. de Porto-Riche pursued his vigourous studies of passion with *Le vieil homme* (1911) and *Le marchand d'Estampes* (1918). Maurice Donnay, so charming, and, at the same time, so melancholy and whimsical, has continued his social studies in *Les éclaireuses* (1913) and *La chasse à l'homme* (1920). Alfred Capus, a lucid realist, ironical and with a gift for natural dialogue, produced *Hélène Ardouin* in 1913 and *L'institut de beauté* in 1914. Henry Bataille (1872–1922), hypersensitive, slightly involved and exotic, brought out *Le Phalène* in 1914 and *L'homme à la rose* in 1922. Henry Bernstein after a series of dramatic and violent plays (*L'assaut*, 1922), brought out *Le secret* (1917), in which his effects are drawn from psychology and character. Comedy has owed its greatest successes to Robert de Flers (*L'habit vert*, 1913, *M. Brotanneau*, 1914, *Les nouveaux messieurs*, 1925); to Tristan Bernard (*Les petites curieuses*, 1920); to Francis de Croisset (*Le coeur dispose*, 1912); and to Sacha Guitry, whose vivacity and wit find triumphant expression in *Le veilleur de nuit* (1911), *L'illusionniste* (1921) and *L'amour masqué* (1924). The most interesting attempts in the way of original work have been made by François Porché, who in *Les butors et la Finette* (1918) and *Le Chevalier de Colomb* (1922) combines in a curious way the relics of ancient traditions with an entirely modern feeling for symbolism; and by P. Claudel, author of *L'otage* (1911), *L'annonce faite à Marie* (1912), *Le père humilié* (1920) and *Le pain dur* (1918), works sometimes obscure, but freighted with purpose of an incontestable quality, and with austere emotion.

In the domain of poetry all the squabbles of the schools had already been silenced by 1911. Symbolism had done its work. Its most illustrious representative, Henri de Régnier, had returned to traditional forms. Master of rhythm and of rhyme, connoisseur of language, sumptuous and self-contained, he has amplitude and richness. Cultured, a great reader of history and old books, he knows the past. He has at his command all the images supplied by legend, history, nature and art. The outcome of this is a magnificent and lordly poetry which is the mirror of the passions, the adventures, the glories and all the multiple forms of human destiny (*Poésies*, 1907, *Vestigia Flammae*, 1921). Much nearer symbolism, Francis Vielé-Griffin has studied the ancient myths and has attempted to interpret their eternal significance (*Voix d'Ionie*, 1914). Francis Jammes is the poet of nature and divinity. He knows the country well, and he speaks of it with a charming simplicity and freshness (*Les Géorgiques chrétiennes*, 1911–2). He shows the same ingenuousness, the same healthy realism, the same humility in his poetry of religious inspirations; he has in him something at once bucolic and Christian (*La Vierge et les sonnets*, 1919). Comtesse de Noailles is on the contrary pantheistic and pagan. Impetuous and consciously unrestrained, heavy with doom like a priestess of old time, she has sung in eloquent and remarkably rhythmical verse of youth, love, the beauty of the universe, and also of human unhappiness, implacable destiny and death (*Les vivants et les morts*, 1913, *Les forces éternelles*, 1920). In her last verses (*Poème de l'amour*, 1924) she has adopted a deliberately simple and bare style, in which is traceable a growing melancholy, a strange lassitude in her ardent work, and, by way of substitute for resignation, a courage full of serenity. Paul Claudel, a vigorous personality, penetrated by a faith which, unlike the tenderness of Francis Jammes, is austere and sometimes sombre, and has written poems (*La cantate à trois voix*, 1914, *Trois poèmes de guerre*, 1915, *La messe là-bas*, 1919), which present a mixture of rather obscure metaphysics, rather self-conscious simplicity, and vivid and powerful imagery.

Charles Péguy, ardent, sophisticated and simple, Socialist and patriot, has shown in his poems *Le mystère de la Charité de Jeanne d'Arc* (1910), *Le mystère des Saints Innocents* (1912), *Eve* (1914) a fluency which is slightly wearing because of his repetition of the same themes, but at the same time a real power due to sincerity, tenderness and the human need for faith and piety. Finally, Paul Valéry, who had made his appearance between 1889 and 1898 in reviews of poetry and letters, *La Conque* and *Le Centaure*, after having kept silence for a long while, published in 1917 *Le jeune Parque*, and in 1922 *Charmes*. These two extremely slender collections contained much substance under an unpretentious form, and established his reputation. Mathematician and philosopher, a subtle and experienced artist, a disciple of Mallarmé, to whom he owes much, he gives expression to an abstract and intellectual life which though slightly arid is still passionate, and his work has a deep full note. The tendency to return to simple, pure and classical sources is found also with Paul Fort, whose *Ballades françaises* are full of colour and imagination; with J. P. Toulet, Fernand Gregh, Abel Bonnard, Franc-Nohain, whose *Fables* (1921) are delightfully humorous; with Alfred Droin and Pierre Camo; while symbolistic description is the more natural vehicle for Jean Royère.

If one were obliged, in spite of this diversity of temperaments, to characterise the period between 1911 and 1914, one might make two observations. One is that in matters of form pre-War writers went back almost without exception to classical traditions, to proportion, simplicity, clearness. The other is, that as far as guiding principles went they were for the most part occupied with furnishing a moral discipline to their contemporaries, and that in the wake of dilettantism and naturalistic pessimism they laboured to restore notions of order, of decorum, of hierarchy, which to them seemed useful to the national life. Whatever may have been the glory of Anatole France, it was not he who was then a leader, and who exercised an influence over men's souls; it was Paul Bourget and Maurice Barrès. There appeared at the approach of that danger constituted by

the War a phenomenon worthy of remark by historians of the future. The grandson of Renan, Ernest Psichari, wrote in 1913 *L'appel des armes*, and shortly afterwards *Le voyage du centurion* (1916). Political crises and intellectual visionings had brought about a state of uncertainty that might prove a cause of weakness. Under the pressure of national exigencies that were apparent to all thoughtful minds, French literature in 1911 was mainly inspired by the attempt, which has been justified by the facts, to assure the future of the threatened country, to make readers acquainted with the strenuous life and the fundamental principles of the social and moral worlds.

II. THE POST-WAR GENERATION

The War abruptly ended the literary careers of many young men, who were killed on the field of battle, men who in all branches of literary activity gave high promise—novelists like Alain Fournier and Emile Clermont, poets like Paul Drouot and J. M. Bernard, essayists like Dufresnoy and Pierre Gilbert. But with those who survived it and had passed through its fires it only stimulated the desire for expression. During the course of the War there appeared a series of brilliant books of diverse character, but sincere and passionate, retracing the heroic years. It is impossible to mention all, but we must at least set down here *Le songe* (1922), by Henry de Montherlant; *Les croix de bois* (1919), by Roland Dorgelès; *Le feu* (1916), by Henri Barbusse; *La flamme au poing* (1917), by H. Malherbe; *Gaspard* (1916), by René Benjamin; *Civilisation* (1918) and *La vie des martyrs* (1917), by Georges Duhamel; *Sous Verdun* (1916), by Maurice Genevoix; *La guerre à vingt ans* (1924), by Philippe Barrès; *Fond de Cantine* (1920), by Pierre Drieu la Rochelle, and *Les récits de guerre dits à une femme*, by Camille Mayran. None of these books pretends to give a summary or to describe the whole of the War. It will be a long time before these great events will find their poet to synthesise and express them; Bonaparte had to wait for Victor Hugo. But all these works powerfully represent direct impressions and strong emotions; they have a meaning, and our grandchildren will find in them one day a sincerely moving record of a period that was shaken by a terrible storm.

This interesting and noble outburst necessarily faded as the events moved further away. The current of life which had been interrupted for four years took up its course again. All countries had to repair the consequences of the conflict. New problems arose. Difficulties mounted. The combined effect of all these causes was that there was no longer a collective effort. Everyone returned to his own preoccupations, to the world of his own imagination and fancy. More or less indifferent to the heritage of their elders, the young writers appeared to be under the impression of existing in a new world where they had to recreate everything. But nevertheless they remained under the influence of the past, sometimes without suspecting it themselves. They discovered, by the very fact that they lived in a predetermined epoch, the result of the labours of their elders. Tendencies, varieties of talent and aspirations are very diverse. There is little unity in the literature of the younger generation. Everyone follows the inclinations of his own temperament. The situation viewed as a whole gives the impression of a melting pot in which everything is in a state of fusion but out of which one day something new and unforeseen will spring. Let us try, in so far as we can to-day, to discern what this may be.

The dominating form in modern literature is always the novel, and it will serve as a type. It is not distinctively, in spite of the definition, a narrative representing life, but often consists of recollections like a book of memoirs or of reflections like a book of essays. The strongest influence to appear has been that of Marcel Proust (1873–1923). According to the date of his birth he belongs to the pre-War generation; but one finds that his work appeared almost entirely during or since the War. Only the first volume of his great novel *A la recherche du temps perdu*, namely *Du côté de Chez Swann*, had appeared by the end of the year 1913. All the others appeared in sequence down to 1925. Marcel Proust is remarkable for the depth and daring of his analysis. Gifted with an acute, morbid sensitivity, he probed deeply into the motives of the heart and soul. With an extraordinary delicacy and detail, he succeeded in expressing new and original nuances of thought in sinuous and often interminable sentences. The bold analysis of the emotions in French literature had begun some years before Marcel Proust; by Anatole France but with discretion, and later with more freedom by the female writers; but Marcel Proust has gone much further. He has carried the taste and feeling for introspection to the extreme limits. By this one can say he has enlarged the scope of the novel, and that is the reason for his great prestige and influence among post-War writers.

This preoccupation with analysis is found in a series of works the most characteristic of which are: Jacques Rivière's *Aimée* (1921), Jacques de Lacretelle's *Silbermann* (1922) and *La Bonifas* (1925), and Drieu la Rochelle's *Etat civil* (1921). In reality a gift as personal and exceptional as that of Marcel Proust encourages tendencies more than it provokes imitation. Psychological introspection is part of our period. It appeared in the course of the War more acutely and frequently than ever. Carried to the extreme, it has resulted in the formation of the super-realist (*sur-réaliste*) school, which in essentials existed already before the War, but which has been revivified by younger enthusiasts. The object of literature in the opinion of this school is to seize upon the pure thought itself, in its barely conscious stage. The outcome of this is a series of jottings, often obscure, or at least unintelligible according to the ordinary processes of the understanding, and a series of images which has certain associations with the art of the cinema and which neglects traditional logic. At this extreme point the work of analysis is entirely occupied with the subjective, and hardly takes into account at all the exterior world. Although there have been young men of talent like Aragon among the followers of this school, it has as yet produced no work which has touched the world outside the literary cliques. Those who appear to have the most individual temperaments have detached themselves from the group, like J. Cocteau (*Thomas l'imposteur*, 1923) and Drieu la Rochelle (*Plainte contre inconnu*, 1924), and they are little by little returning to the classical forms. This attempt has had, however, up to the time of writing one result:—it has rid literature of all trace of rhetoric. In spite of a marked tendency towards simplicity and brevity for many years, there still remained traces of a declamation whose origin went very far back. The prestige of the sublimities of Hugo and of de Michelet was very great, and it nourished a love of the phrase. With all its excesses, the development in the direction of sketchy notations, suppression of logical associations and extravagant simplification has been made at the cost of a classic and sober art.

The writers who have been most successful in these last years escape any attempt at classification. Each follows his own temperament and inclination. Recourse to the past is necessary to distinguish influences, forerunners, schools. In contemporary literature the only thing that can be distinguished is the individual. The choir of young poets protest their personal freedom (Tristan Derême, Charles Derennes, Géraldy, Roger Allard, Chabaneix). The novelists do the same; M. Pierre Benoît is a master of the novel of adventure; he knows how to construct; he knows how to tell a story; and addressing himself to a public which, as after every period of upheaval, is in need of distraction, he has been able to captivate the attention in a series of well-made novels (*Koenigsmark*, 1918; *L'Atlantide*, 1919; *Mlle. de la Ferté*, 1923; *Le puits de Jacob*, 1924)—in which he shows a remarkable facility in employing imaginary or historical events and in keeping the reader breathless with suspense over the turns of his stories.

It is only necessary to recall *Le kilomètre 83*, by Henry Daguerches (1913), to show that since before the War the taste for the novel of adventure had been revived. The influence of Anglo-Saxon literature, and particularly that of Kipling, had been a powerful stimulant in this development. The War naturally only accentuated this tendency. A proof of this is

found in the books of Pierre MacOrlan (*La cavalière Elsa*, 1921), of Louis Chadourne (*Terre de Chanaan*, 1921) of Jean d'Esme (*Les Barbères*, 1925), of Roland Dorgelès (*Le reveil des morts*, 1923), of René Bizet (*La sirène hurle*, 1921) and of J. Kessil (*La Steppe rouge*, 1922, *L'Equipage*, 1924). All of these appeared between 1918 and 1925. Actually, however, it does not seem that this form of literature is capable of much further development, except in the case of the exotic, historical or colonial novel. French literature is traditionally psychological. It is characteristic that the best book of Pierre Benoît, the most popular writer of novels of adventure, is a novel of manners, *Mlle. de la Fertê* (1923).

Francis Carco is a painter of the lower depths of society, of the world of the apaches and of the outer boulevards. He deals, as did Francois Villon in his day, with the world of thieves. He has handled this difficult subject with a great deal of tact (*Les innocents*, 1916, *L'homme traqué*, 1922, *Perversitês*). Francis Carco is a true artist with a quick sensitivity. He has made a study of those who take no count of laws nor of social conventions; he has caught human beings with all their passions and all their energies. He has shown how they live beyond the law and current morality; how they have made their own laws, created their own code of honour and conventions. There are in his work many amusing, picturesque and curious scenes, but there is more. He has analysed, often with profound sympathy, these creatures of an outcast world and their imagination, dreams and miseries.

Jean Giraudoux is also a subtle analyst. He has a capricious imagination and a very individual, if somewhat complicated, poetic manner, which makes him difficult reading; but he is provocative. There is in him much humour, often of an unexpected kind, difficult to understand. The world of images has no secrets from him. Unusual comparisons and strange associations of ideas abound in his books. The most successful of these is *Suzanne et le Pacifique* (1921), the story of a shipwrecked young girl who lives alone on a desert island. She has to reorganise her life, and by a series of chances and deductions she discovers that the War, of which she knew nothing when she left, is going on. Psychology in this book takes precedence over adventure, for the author primarily wished to portray the reactions of an isolated human being in face of the vast world.

Henry de Montherlant is one of the most gifted among the young writers. He has a sense of style, and is capable of vigorous mental activity. After *Le Songe* (1922) he wrote about Verdun, and about sports (*Les onze devant la porte dorée*, 1924), books which disclose his national and moral preoccupations. He is interested in the disciplines which make a human being master of himself, permit him to live under the best conditions, and give the greatest possible value to his acts. He is very modern, and at the same time deeply attached to tradition; his works are filled with youthful ardour, strength of will, and an impetuosity which express themselves in vivid and poetic language.

François Mauriac is a harsh and powerful novelist. His books (*Le baiser au lêpreux*, 1922, *Genitrix*, 1923, *Le désert de l'amour*, 1925) have placed him among the most notable writers of his generation. Brought up in the Catholic tradition and attached to his faith, François Mauriac is aware both of the demands imposed by a Christian life and of the weaknesses of most human beings. All his work, which incidentally is open-minded, seems dominated by the idea of sin, by the necessary artifices in which egotism and passion entangle human beings, by the nothingness of their desires and the need for discipline. He combines realism, austerity and even daring. Just as in cathedrals, where bold sculpture representing vice and demoniac inspirations are adjacent to sacred arthitectural motives, so he has put into his work scenes that are sordid enough, side by side with aspirations towards purity.

André Maurois, who during the War was interpreter with the British Army, made his début with an impressionistic book, entitled *Les silences du Colonel Bramble* (1918), which had a great success. He published in 1923 *Ariel, ou la vie de Shelley*, which had great charm, and *Des dialogues sur le Commandement* (1924). He is less a novelist than an essayist. He has a penetrating, highly cultivated mind and loves the play of ideas; he excels in delicate analyses, in the nuances of the emotions and in psychological insight.

Valéry Larbaud is interested in the manifestations of the international mind, and has written fascinating novels. *Fermina Marquez* is an original study of the life of young people in South American schools. *Le journal d' A.O. Barnabooth*, which followed, is a novel in which satire is mingled with poetic fancy. In it he amuses himself with drawing the life of a millionaire who can see everything, buy everything, and almost do what he pleases, and yet is stifled with boredom and doubt, finding pleasure only in doing everything that runs counter to the conventions of his social position. This story of the weariness of one of the inheritors of the earth is written with a vivacity which is one of the most curious characteristics of modern art.

Paul Morand represents the impressionist school at its acme of success. His short stories *Ouvert la nuit* (1922), and his novel *Lewis et Irène* (1924) are certainly among the most entertaining studies of the present time. Paul Morand has a keen feeling for the feverishness and instability of contemporary life. He is also keenly aware of the international aspect of post-War cities—the mingling in all countries in the same places, restaurants and hotels of people belonging to every race and nation. He has caught finally the elementary flashes which these cosmopolitans have in common by way of certain instincts and manifestations. His pictures are alive and chaotic. The author contents himself with incisive characterisations and brief formulas. He is full of verbal coinages. He reduces the recital to the bare essential. There is something acrobatic and artificial in this art, but the feat is always successful and entertaining.

A great number of other writers and books should be added to this summary. There is much diversity of literary activity. Works like *Les métiers blessés* (1919), by Pierre Hamp, and *Les entretiens dans le tumulte* (1919) and *La confession de minuit* (1920), by G. Duhamel, are a combination of social study and meditation; others, like those of Jean Rostand (*De la Vanité*), revive the tradition of the writers of maxims and of the moralists; others, like those of Alexandre Arnoux (*La nuit de Saint Barnabé*), constitute in the form of a narrative an interesting attempt to represent material civilisation and to give a picture of the modern industrial and mechanical world.

The attempts at a revival of the theatre, undertaken by the "Théâtre du Vieux Colombier," are continued chiefly by the "Atelier." While plays with Deval and Natanson were rather psychological, with Zimmer rather sombre, with Marcel Achard rather fantastic, with Géraldy rather sentimental, the modern play is sketchy, containing little action, and above all else designed to portray character. So it at least appears among the last comers, J. J. Bernard, Obey, Amiel, Steve Passeur. The construction is loose, without complications. The young dramatic authors seem to desire chiefly directness; they have no ambition to uphold theses, and wish only to amuse and to provoke reflection.

This article does not pretend to give a complete survey of present-day literature. It is being made, and there is no history at present. All that is possible is to indicate general characteristics; the appearance of men of talent may change everything to-morrow; the appearance of a genius may accentuate current tendencies or transform them. If one wished to summarise the various comments which have been made, one might say that literature in 1926 is still dominated by pre-War writers After the activity which showed itself in the years 1918–20, it seems there should have been a sort of fruition. Many talents with a certain ingenuity have been revealed, many young writers with distinctive personal qualities have published their books. But no single work dominates recent years or seems capable of exercising a determining influence.

It is then towards the masters of yesterday, who are still living to-day (except Barrès and Marcel Proust) and who are still exercising their influence, that little by little the younger men are turning their attention. The names of Paul Bourget,

Maurice Barrès and Henri de Régnier, and those of Colette, Marcel Proust and Charles Maurras are dominating our period. Even when they know them only slightly or when they try to free themselves from them, the newcomers live in a society the ideas of which have in some way been fashioned by their elders. They breathe in air which is that of their time. One notices that the psychological analysis of Marcel Proust has strongly influenced some, that the impressionistic realism of Colette has attracted others, while the disciplines formulated by Bourget and Barrès form the mainstay of a great number. It is significant that a young writer like Drieu la Rochelle should leave his particular set and return to the Barrès tradition, and that after years of charming unconformity Jean Cocteau should entitle a book of essays, *Rappel à l'ordre*.

Thus after a detour of 10 years, violently disturbed by the War and its aftermaths, one can say that in 1925 French literature again took up the road which was foreshadowed in 1914. All the schools, after their trials and struggles, have achieved their work and have transmitted the best that was in them. The quarrels between romanticism and naturalism, between the Parnassians and the Symbolists have come to an end. The opposition between scientific rationalism and the world of the spirit has become less acute. It was a long struggle, bearing witness to the vitality of literature; of all the doctrines nothing is left but the trace of whatever in them was useful and true. Present-day French literature seems to be going in the direction of a classic revival in which certain other elements are mingled.

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FREUD, SIGMUND (1856–), Austrian physician and psychoanalyst, was born on May 6 1856, at Freiburg in Moravia, and studied medicine and psychology at Vienna, being strongly influenced by Brücke in the latter subject. After working in Paris under Charcot from 1885–6, he devoted himself, in co-operation with the Viennese physician, Josef Breuer, to the study of nerve cases. The results of their joint investigations were published in 1895 as *Studien über Hysterie*, expounding a new treatment, the so-called *catharsis*. This consisted in putting the patient in a hypnotic state, and the examination by the physician, while under this condition, of the forgotten original circumstances under which the symptoms first appeared. Subsequently Freud pursued a path of his own, and developed a special technique (*see* PSYCHO ANALYSIS). The technique and the results of this research work are explained in Freud's most important works: *Die Traumdeutung*, 6th ed. (1921); *Zur Psychopathologie des Alltagslebens*, 7th ed. (1920); *Drei Abhandlungen zur Sexualtheorie*, 4th ed. (1920). Freud's shorter works were collected in four volumes under the title, *Kleinere Beiträge zur Neurosenlehre*.

Freud also published two general sketches of his theory: a shorter one, *Fünf Vorlesungen über Psychoanalyse* (delivered at Worcester, Mass., in 1909) and a comprehensive one in *Vorlesungen zur Einführung in die Psychoanalyse* (1917). These medical-psychological studies yielded surprising results in relation to other subjects, and in the possibilities of their adaptation in other branches of knowledge, *e.g.*, mythology and the history of religion, civilisation and literature. The principal works in this connection are *Totem und Tabu*, 2nd ed. (1920); *Der Witz*, 3rd ed. (1921); *Eine Kindheitserinnerung: Leonardo da Vinci* (1916); *Jenseits des Lustprinzips* (1920); *Massenpsychologie und Ichanalyse* (1921). Freud's works have been translated into English.

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FREYCINET, CHARLES LOUIS DE SAULCES DE (1828–1923), French statesman (*see* 11.211) died in Paris May 14 1923.

FRICK, HENRY CLAY (1849–1919), American manufacturer and philanthropist, was born at West Overton, Pa., June 17 1849. As a boy he was clerk for his grandfather, who was a distiller and flour merchant; but he early became interested in the coke business. In 1871 he organised the firm of Frick & Co., which ultimately acquired large coal deposits and ran 12,000 coke ovens. He was chairman of the board of Carnegie Bros., from 1889 to 1892, and in the latter year, during the Homestead strike, was shot and stabbed by Alexander Berkman, an anarchist. He was a director of the Pennsylvania, the Santa Fé and other railways, and of the U.S. Steel Corporation. He died in New York Dec. 2 1919.

Besides large sums left to his family and friends, he left to the city of Pittsburgh land for a park, together with an endowment of $2,000,000. His New York mansion, with its collection of paintings, bronzes and enamels, he bequeathed to the city on the death of his wife, with an endowment of $15,000,000. He divided his residuary estate, estimated at $50,000,000, between various hospitals and educational and charitable institutions. The value of his New York mansion and its art collection was estimated in 1920, to be $50,000,000. Among the chief treasures are the Fragonard panels, Bellini's "St. Francis in the Desert," Velasquez' "Philip IV.," Van Dyck's "Paola Adorno," Rembrandt's "Portrait of Himself," Gainsborough's "The Mall," and "The Hon. Anna Duncan." It includes also fine examples of Titian, Vermeer, Frans Hals, Ruysdael, Cuyp, Rubens, El Greco, Goya, Sir Thomas Lawrence, Millet, Raeburn, Reynolds, Romney and Turner.

FRIEDJUNG, HEINRICH (1851–1920), Austrian historian, was born at Roštîn, Moravia, Jan. 18 1851 of Jewish parents. Friedjung spent much of his career in political journalism; he was a pronounced German nationalist, and the chief author of the nationalist *Unser Programme* of 1885. At the same time he devoted himself to historical research, especially over the period 1848–66, which he covered brilliantly and exhaustively in the three works *Oesterreich von 1849–60* (1908–12); *Der Krimkrieg und die oesterreichische Politik* (1907); and *Der Kampf um die Vorherrschaft in Deutschland*, 10th ed. (1917). His other chief works are the volume *Historische Aufsätze* (1919) and the monumental review of modern times *Das Zeitalter des Imperialismus* (1919–22), which was finished by Professor A. F. Přibram after Friedjung's death in 1920.

Friedjung was a conscientious and an attractive historian, whose works cover all aspects of life during the period with which they deal. The point of view expressed in them is, however, pronouncedly liberal, patriotic and anti-Catholic, and shows little sympathy for the Slav and Magyar nationalist movements in the Dual Monarchy. His last excursion into politics was most unlucky, and undeservedly clouded his name; on March 24 1909 when the conflict between Austria-Hungary and Serbia over the annexation of Bosnia-Herzegovina was at its height, he published an article in the *Neue Freie Presse*, accusing the Serbo-Croat politicians in the Monarchy of treasonable practices with the Government of Serbia, and violently attacking conditions in Serbia. Fifty-two deputies of the Croato-Serb coalition and their leader Supilo separately, sued Friedjung for libel. It was disclosed that Friedjung had received the documents on which his article was based from the Austro-Hungarian Foreign Office, that he had accepted them in good faith but after most insufficient scrutiny and that some at least were blatant forgeries. The affair ended at last in a compromise, but not until it had assumed the proportions of a European *cause célèbre*. Friedjung died in Vienna July 14 1920.

See Dr. R. W. Seton-Watson, *The Southern Slav Question and the Habsburg Monarchy* (London, 1911).

FRIEDRICH, JOHANN (1836–1917), German theologian (*see* 11.216), died in Munich, Aug. 19 1917.

FROHMAN, CHARLES (1860–1915), American theatrical manager, was born at Sandusky, O., June 17 1860. At the age of 12 he started to work at night in the office of *The New York*

Tribune, attending school by day. In 1874 he began work for *The Daily Graphic*. In 1877 he entered the theatrical business, being for a time associated with his brother Daniel in managing the Madison Square Theatre, New York. In 1890 he organised the Charles Frohman Stock Company. On Jan. 25 1893 he opened his Empire Theatre, New York. Other New York theatres with which he was at various times connected were the Criterion, Garrick, Knickerbocker, Lyceum and Savoy. He was an adept in developing talent. Among his successful players were Maude Adams, Ethel Barrymore, Blanche Bates, Billie Burke, William Gillette and Otis Skinner. During 1905–6 he presented E. H. Sothern and Julia Marlowe in Shakespearean plays. He was one of the organisers of the syndicate which for several years controlled the American theatres. Beginning in 1897 he presented many plays in London, leasing at different times such houses as the Duke of York's, Globe, Comedy, Vaudeville and Adelphi. He perished when the "Lusitania" was sunk by a German submarine May 7 1915.

FRONTIERS, BATTLES OF THE.—The generic name of "battles of the frontiers" covers the whole of the actions fought at the opening of the World War in Aug. 1914, on or near the French frontiers. For convenience these are here divided into six sections, each of which deals with a more or less distinct part of the series of operations. These are: I. Early operations in Upper Alsace; II. First battles in Lorraine; III. Battle of the Ardennes; IV. Charleroi and Mons; V. Le Cateau; and VI. Guise.

I. EARLY OPERATIONS IN UPPER ALSACE

At the beginning of the World War the French higher command was governed by two ideas. One was to avoid posing as the aggressors, and consequently the covering troops were withdrawn 10 km. behind the frontier. The other idea was to plant the flag in the lost provinces as quickly as possible. Not only, therefore, were strategy and politics not in harmony, but politics contained a double element, the one pacific, the other aggressive.

First French Advance.—Immediately on the order for mobilisation, an advance on Mulhouse was ordered. The offensive began on the morning of Aug. 7. Its start was promising. Mulhouse was reached and occupied in the evening of the 8th. The news of the approach of large German forces then became known. The French commander feared being caught in a trap, and after an eight-hour occupation the town was evacuated, a position in rear being occupied. During the evening of Aug. 9, the Germans attacked with superior force and drove back the French. The success was not followed up, since German supreme headquarters had prepared for a massed attack on Luxembourg and Belgium, which postulated a strict defensive in the south.

The retreat from Mulhouse was likely to have a prejudicial effect upon the French. To counteract it Joffre formed a special Army of Alsace. Early on Aug. 19 the Germans in front of Mulhouse were attacked and defeated, and at 4 P.M., for the second time in a fortnight, the victorious French entered the town. But though fortune seemed here for the moment to smile upon the French, reverses elsewhere extended their influence to Alsace. Orders were issued for the break-up of the Army of Alsace and the dispersion of its units. Mulhouse was again evacuated on Aug. 25. The fortress of Belfort was thus exposed and open to hostile attack.

Belfort and Dannemarie.—Belfort had two rôles to play, the one permanent and foreseen, the other thrust upon it very early in the War. In the first place, the fortress was designed to close the gap existing between the Vosges and the Jura. It was a vitally important rôle, for if the Germans secured the gap they might penetrate into the heart of France. The other rôle was to form a pivot for the bending back of the whole French line, from the Swiss frontier to Belgium. A vast amount of work had been done during the preceding 40 years to convert the small fortress of 1870 into the immense stronghold of 1914. Much, however, remained to be completed. The completion of the task was necessarily impeded by the fighting in which part of the garrison was engaged during August. Nevertheless, by the time that the Army of Alsace was broken up the enormous undertaking was achieved. The armament of the forts had been completed; numerous batteries had been constructed and armed; centres of resistance had been organised; and inundations in front had strengthened the zone of defence.

On the other hand, the German heavy artillery had introduced a new factor into war. The crushing of the resistance of Liége and Namur was disconcerting. By Aug. 25 there could be no possible doubt that if the Germans were allowed to plant their guns 8 km. from the forts the heart of the place would be bombarded and the forts themselves smashed before the artillery of the defence could fire a shot. Furthermore, by Aug. 25 the Allies were withdrawing all along the line. Clearly the Germans might make a special effort to seize the pivot on which this withdrawal hinged.

In these circumstances, and knowing that he had only his own resources to count upon, Gen. Thévenet, Governor of Belfort, decided not to await the enemy's attack, but at once to assume the offensive. The plan was quickly put into operation. The offensive reconnaissances in front of the fortress began on Aug. 28, and from that date were pursued without interruption. So successful was the operation that by Sept. 10 the advanced guards were over the frontier and 11 m. from the fortress. Eight days later the headquarters of the 57th Div., whose daily reconnaissances had been carried on uninterruptedly in advance of its front, was transferred from Foussemagne to Dannemarie. This transfer made a great impression in France, as also in Alsace, and had all the importance of a victory. It was indeed a considerable success, for the occupation of Dannemarie had been carried out with such precision and solidity that it had now to become definite. From Sept. 18 1914 onward, the French flag never ceased to fly over the little Alsatian town thus reconquered.

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II. FIRST BATTLES IN LORRAINE

The first French plan (General Instructions No. 1 of Aug. 8 1914) was purely offensive. It proposed to seek action with all forces united with the right on the Rhine. The two armies of Lorraine (I. and II.) were to lead, the I. in the direction of Saarburg, after having thrown back the German VII. Army towards Strasbourg and lower Alsace, while an isolated corps, the VII., would make a diversion to the east of the Vosges. The II. Army, covering itself from Metz, was to attack in the direction of Saarbrück, pivoting on the I. in the neighbourhood of Étangs. The two left corps were situated to the west of the Moselle, with a view to their eventual employment in the north.

Disposition of Forces.—In front of the I. and II. Armies the Germans had approximately equal strength (VI. and VII. Armies). They would at first keep to the defensive, acting as a pivot to the huge wheel being made by their centre and right. The rapidity of the invasion of Belgium determined the French to hasten the operations in the east in order to make a diversion. On Aug. 13, the I. Army had two corps on the Meurthe (VIII. and XIII.). Gen. Dubail, commanding the I. army, counted besides on the co-operation of the two right corps of the II. Army and on that of the XXI. Corps descending from the Vosges on his right. On Aug. 16 the II. Cavalry Corps was placed under his orders. The final concentration of the complete fighting force, however, could not be complete until the 18th. Nevertheless, the XIII. and VIII. Corps moved on the 14th, and on the 15th entered Cirey and Blamont, pushing back the I. Bavarian Corps, which retired toward Saarburg.

By the evening of the 17th the two French corps had reached the line Vasperveiller-Aspach-St. Georges, and the XXI. extended the line toward the Vosges. The II. Cavalry Corps had orders to go ahead on the 18th towards Saarburg, which was entered after a skirmish. The XXI. Corps pushed to the north-east as far as Walscheid; the XIII. held the heights north and east of Saarburg; the VIII., marching on Heming, seized the passage of the Marne-Rhine Canal and entered Saarburg. The II. Cavalry Corps bivouacked toward Diane-Capelle, in liaison with

the II. Army, which had reached the line Bisping-Château Salins. The Germans held entrenched positions on a front of 40 m., from the neighbourhood of Dobbenheim to Biberkirch.

French Offensives.—It was decided that the I. Army should attack with its left northwest of Saarburg, its centre and right standing fast to repulse an eventual counter-attack in the Vosges. The II. Cavalry Corps was to move on Saar-Union in order to operate south of the Saar. On Aug. 19 the VIII. Corps commenced the attack before dawn, gained the terrain northwest of Saarburg and repulsed a counter-attack. On the 20th it resumed the offensive, but during the morning it became evident that it was incapable of opening a passage for the Cavalry Corps; indeed it was necessary to bring back a division on the canal with heavy losses. In the centre and on the right the French were more fortunate. The XXI. Corps met no resistance on the 19th, and the XIII. had not yet been engaged.

On Aug. 20, the XXI. Corps, attacked by the German XIV. Corps, inflicted on it a serious check near Walscheid; the XIII. Corps, coming into line, attacked to the northeast of Saarburg, disengaging the right of the VIII. Corps, which held the town till nightfall. Dubail's intention was to entrench on the front Kerprich-Soldatenkopf, and to undertake afterwards a methodical advance; but the check to the II. Army led Joffre to direct a retreat in Lorraine. On the morning of Aug. 21 the I. Army retired slowly towards Blamont. Afterwards it was necessary to accelerate the movement on account of the rapidity of the retreat of the II. Army. On the evening of the 23rd, the I. Army extended from Dames-aux-Bois to the Col du Bonhomme. It had suffered heavy losses, the casualties in the VIII. Corps amounting to more than 50 per cent.

The offensive of the II. Army (de Castelnau) had been still less fortunate. On Aug. 14 the XVI. and XV. Corps moved in the direction of Avricourt, with the bulk of the XX., the remainder covering the front to the north. In the evening, it faced to the northeast on the high ground at Gondrexon, the XV. Corps alone having been stopped by the enemy at Moncourt. On the 15th the advance was still checked by the condition of the XV. Corps, which had suffered heavily; the XVI. Corps reached Igney-Avricourt, the XX. Bezauge-la-Petite and Xanrey. The IX. Corps remained on the Grande Couronne east of Nancy and sent out detachments toward the northeast.

On Aug. 16 the Germans continued their retreat and the French followed rapidly as far as Morhange, northwest of Donnelay. On the 17th the army was to swing round to the northwest toward Delme-Chateau Salins-Dieuze. The XVI. Corps progressed without difficulty; the XV. occupied Marsal, but could not bring its main body beyond the Seille; the XX. Corps, in possession of Château Salins, reconnoitred toward the north. Rearguard fights only were expected, but on the 18th the XVI. Corps from the early morning met the enemy in strength. The German artillery held the XV. Corps in the valley of the Seille and prevented it from occupying Dieuze. The XVI. Corps had to fall back on Angviller, and only the XX. advanced to the north of Morville-les-Vic and Château Salins. In spite of the loss of the IX. Corps, sent to the IV. Army on Aug. 18, de Castelnau ordered for the 19th the continuation of the offensive in the direction of Loudrefing, Bensdorf and Morhange.

French Retreat: Aug. 19–20.—From the morning of Aug. 19 the XVI. Corps was stopped on the Salines canal; the XV. could not pass Zommange and Vergaville; and only the XX. could make a real advance, pushing a brigade as far as Morhange. The 68th Res. Div., which had relieved the IX. Corps, insufficiently covered the left of the XX. Corps. De Castelnau ordered for Aug. 20 a combined attack by the two other corps on the line Cutting-Dommon-Bassing; the XX. was to consolidate its positions, ready to march to the north or northeast. On the 20th the corps on the right, instead of progressing, was attacked and even thrown back. The XX. having attacked and not having improved its positions was stopped by de Castelnau, but the Germans, taking the offensive, threw the left back on Château Salins. The right followed this movement on Lidrequin and the 68th Div. resumed its position of the previous day. At 4 P.M. the general ordered a retirement, which began during the night and continued through Aug. 21 under the protection of the XX. Corps and the 68th Division. In spite of the arrival of two new reserve divisions and the II. Cavalry Corps, the II. Army had to retire to the west of the Meurthe, the left to St. Nicholas. To the north, three divisions held the Grande Couronne.

French I. Army Action.—On Aug. 23, the I. Army commenced a three weeks' battle destined to stop the enemy and support the strongly attacked II. Army. To effect this, it took the offensive on the 24th and 25th, while the II. Army threw back the Germans to the northeast. From the 28th to the 31st the Germans stopped the advance of the I. Army, and their VI. and VII. Armies even aimed at forcing "the gap of Charmes," in such a manner as to carry out an enveloping movement to the west of the Vosges. This action was helped by ordering the XXI. Corps to take part in the battle of the Marne.

From these circumstances there resulted a series of very confused fights extending over a large front between the Grande Couronne and the Vosges. On Sept. 6, the German VII. Army, facing Dubail, was broken up, divided between the VI. Army and the German right then engaged on the Ourcq against Gen. Maunoury. But Dubail's army was also enfeebled by the removal of the XIII. Corps to the west of the Oise; and at the same time the II. Army lost to the west the 18th Div. and the XV. Corps. Evidently both sides had given up the idea of striking seriously in Lorraine. After having gloriously held its positions to the east of Nancy and on the Meurthe, the II. Army was itself to be broken up, to be reconstituted on the left of the French Armies in the "race to the sea."

Thus, after checks resulting from an inopportune offensive, the I. and II. Armies had been first able to stop the German progress; then to throw the enemy back to the frontier. Moreover, their merit was all the greater since they had been constantly weakened by the withdrawal of their best units. During the battle of the Marne they provided the unshakable pivot of the vast movement undertaken by the Allies. It was thanks to their efforts that that movement succeeded. But they had paid the price. A single reserve division between Aug. 24 and Sept. 12 lost 140 officers and more than 5,000 men.

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(B. E. P.)

III. BATTLE OF THE ARDENNES

On the outbreak of the World War, the III., IV. and V. French Armies concentrated towards the frontier, west of the Meuse, covered by the VI. Corps in front of Verdun, and the II. Corps in front of Stenay. On hearing of the German attack on Liége, Gen. Joffre decided to post the V. Army (Gen. Lanrezac) toward the Sambre and to direct the IV. Army, which he had grouped between Vitry-le-Français and Sainte-Menehould, in the region of Stenay. The concentration, which had scarcely begun on Aug. 8, was nearly finished on the 14th. Until the commander-in-chief had all his forces at hand, no one was allowed to be drawn into an important action.

The German high command had made a similar decision, hence the battle of the Ardennes was the "battle of the two blind men." However, on Aug. 10, a German mixed brigade arrived near Mangiennes and was launched into a mad frontal attack against the advanced posts of the IV. Corps (III. Army). While all its attention was taken up with the attack in front, a brigade of the II. Corps (under Gen. Cordonnier, IV. Army) took it in the rear, and the German brigade was destroyed. After this adventure, no German force made any further attempt against the French covering troops.

French Plan of Attack.—The German plan of operations placed the V. Army between Thionville and Tintigny, the IV. between Tintigny and the Meuse de Dinant,[1] the III. Army between Dinant and the Sambre, the II. on the Sambre and the I. in the neighbourhood of Mons. The III. Army was still in the

[1] Name given to the Meuse between Mezières and Namur.

Ardennes behind the IV. and the I. Army was hastening towards Brussels and Antwerp, when on Aug. 22 Joffre decided to attack.

It was certainly a strategic success to bring about a battle with all his forces in the Ardennes, while the German III. Army was unable to take part in it. Joffre had disposed his III. and IV. Armies in échelon, the left in front, so that he could face the north or east as he wished. On Aug. 16 he decided to attack towards the north with these two armies forming a rigid block, while the 7th Cavalry Div. reconnoitred towards Thionville, and the 4th and 9th Cavalry Divs. to the north towards the Meuse. The result was that in front, and almost everywhere, the Army Corps had only weak and insufficient cavalry for reconnoitring purposes. The liaison between the two armies was to be kept on the axis Marville-Virton-Étalle.

During the night of Aug. 20–1 the whole block moved forward. The only instructions given by G.H.Q. were "to attack the enemy wherever met." G.H.Q. estimated that the IV. Army would have almost nothing in front of it, and yet it was precisely there that the Germans had their IV. and III. Armies, the III. being behind the IV. The Lorraine Army, which consisted of the reserve divisions, groups under Gens. Pol Durand and de Lamaze, was placed under the command of Gen. Maunoury with orders to defend the Hauts de Meuse, or eventually, in the event of the advance of the III. Army, to besiege Metz and Thionville. These reserve divisions were mobilised after the active forces, the men were elderly, they had few officers, and their staffs were inexperienced, so that the III. Army could get little help from them.

On the evening of Aug. 21, after a long period, during which only patrols had been encountered, the block arrived on the line Conz-Lagranville (VI. Corps), Tellancourt (V. Corps), Virton (IV. Corps). At Virton the IV. Corps tried to get in touch with the II., which formed the right of the IV. Army. The line of battle continued by Villers-la-Loue (II. Corps), Geronville (Colonial Corps), Florenville (XII. Corps) and the Semoy (XVII. and XI. Corps). The IX Corps had just arrived from the neighbourhood of Nancy with the 17th Div. (Dumas); the Moroccan Div. (Humbert) was not yet in line. The IV. Army (de Langle de Cary) was to push on towards the north, while the III. Army was to cover the right of the IV. Army against any attack coming from the north or east. Everywhere the advance was made in divisions, except in the case of the II. Corps, which marched entire on a single road.

On Aug. 22, all the columns started in a fog at a very early hour for a long march with the idea of "attacking the enemy wherever met." To march quickly rather than to take precautions was the order of the day and almost everywhere the presence of the Germans was only discovered by receiving shell fire. In the III. Army, the V. Corps sent its infantry to the attack without the support of artillery, and it suffered such terrible losses that the leaders became completely unnerved, and Gen. Grossetti, chief of the staff, had to intervene to prevent a precipitate retreat. In the IV. Army the Colonial Corps exposed a division in column-of-route to the German guns. The XVII. Corps also suffered from a sanguinary surprise. But the most serious danger arose on the right wing of the IV. Army, uncovered by the premature check of the IV. Corps at Virton; and on the right wing of the III. Army, which was not covered either by the 7th Cavalry Div. or the Pol Durand group of divisions.

Fortunately the II. Corps was in a single column so that the rear division was able to make up for the absence of the IV. Corps. On the right of the III. Army there was a leader, Gen. Hache, who with his heroic division gained the necessary time for the other divisions to fall back. The Germans did not exploit their tactical success, but remained practically stationary in their positions. This battle of the Ardennes taught the French the necessity for co-operation of all arms in the field of battle.

Battle of the Meuse.—On Aug. 23, 24 and 25 the III. and IV. Armies retired slowly without being disturbed. On the evening of Aug. 23 the front of the IV. Army was the line Montherme (Meuse)-Montmédy; and that of the III. Army Montmédy-Spincourt. On Aug. 24 they were a little farther to the rear, but not pushed by the Germans. A German staff commander, killed in his motor in front of Avioth, was found to have on him the orders given to the German IV. Army for the forcing of the Chiers and Meuse crossings on Aug. 26 and 27. The III. Army had obtained in a similar way information to the effect that the German 33rd Div. was to leave Metz and attack at Étain. A trap was set, but the Lorraine Army (reserve troops) was not equal to the task and the Germans escaped.

Lorraine Army Dissolved.—On the morning of Aug. 25, the right of the IV. Army retired between the Chiers and the Meuse; the III. Army also approached the Meuse facing eastwards. Thus the two armies practically became one, and it is regrettable that from this time they were not placed under one leader. On the same day, the IV. Corps (III. Army) suffered a severe check at Marville and they feared they would lose their corps artillery, but the II. Corps came to their assistance and convoyed this artillery to Stenay, where they crossed the Meuse. This shows how intimate was the co-operation between the two armies. It was on Aug. 25 also that Joffre gave the first orders which contained the real beginnings of the battle of the Marne. He decided to reinforce the left of the Allied Armies and to lose ground in order to gain the necessary time for his strategic plans. The Lorraine Army was dissolved; the Pol Durand group was to defend the Hauts-de-Meuse; Verdun and Toul were to have their respective mobile forces returned to them; the 55th and 56th Divs. were entrained for Montdidier. Gen. Maunoury had in these two divisions the nucleus of that VI. Army which appeared on the Ourcq and determined the victory of the Marne.

On the morning of Aug. 26 the entire IV. Army was on the left bank of the Meuse, protected on its left flank by the IX. Corps and the 4th and 9th Cavalry Divs. between Mezières-Rocroi and Signy-l'Abbaye, and forming the connection between the IV. and V. Armies. On its right flank it was in immediate contact with the III. Army, which was concentrated on the left bank of the Meuse with the exception of the 42nd Division. So much feared was the envelopment of the III. Army's right, that the 7th Cavalry Div. was sent to the rear to Dombasle, between Verdun and Clermont, as if an extensive enemy movement was expected to take place south of Verdun. The III. Army took no part in the battle of the Meuse; its 7th Div. was summoned to Beauclair in order to help the II. Corps on Aug. 27, but it was not engaged. On the same day the 42nd Div. was taken from the III. Army, reached Varennes, and then served as part of Foch's Army.

Defence of the Meuse.—On Aug. 26, the orders for the IV. Army ran: "From to-morrow the IV. Army will fight a decisive battle on the Meuse. . . . The corps will make every effort to prevent any attempt of the enemy to cross the river."

Generally speaking, the IV. Army was some distance from the left bank. Its object was to carry out vigorous counter-attacks against German infantry who had passed the river before its artillery could come to its support. The Colonial Corps was somewhat driven back by the Germans, who had crossed the Meuse at Inor and Pouilly, but the arrival of reinforcements from the II. Corps soon checked this. The struggle was severe on the whole front. On the right wing the II. Corps had decided successes, three times throwing the Germans back into the river at Cesse and Luzy. On the left wing, the success was still more marked. There the XI. Corps, reinforced by the 52nd and 60th Res. Divs., gained the battle of la Marfée. The German 16th Div., making the same mistake as did the French at the battle of the Ardennes, advanced in massed formation without artillery support and were crushed, leaving in French hands the flag of the 68th Prussian Regiment.

On the evening of Aug. 27 Gen. de Langle de Cary gave the following order: "At all costs the Germans must be thrown back into the river Meuse. The successes gained by the offensive to-day make us hopeful that to-morrow will be equally successful." However, Aug. 28 was not so active as the previous day; the Germans scarcely attacked at all, and the orders given by Joffre for the coming retirement to the Aisne kept the IV. Army to its ground. On Aug. 28 Gen. de Langle de Cary, in a general order,

said: "The army inflicted heavy losses on the enemy, yesterday and to-day. It returns to the Aisne line, in accordance with orders received, to prepare for the offensive in a new direction." On the 29th the movements towards the Aisne commenced—the battle of the Meuse was ended. The French IV. Army had beaten the German IV. Army—a victory without a to-morrow, but certainly a victory.

Battle of Signy-l'Abbaye.—The French V. Army, having been beaten by the German II. Army on Aug. 22 and 23, had to retreat, leaving a gap 25 m. wide between the IV. and V. Armies. The Germans poured into this open space. The only known units were the advanced troops of the XII. Corps—it was really the III. Army commanded by Von Hausen. Gen. Dubois was ordered to fill up this gap and to cover the left of the IV. Army, and was given command of the IX. Corps, composed of the 17th Div. (Dumas), the Moroccan Div. (Humbert), and the 9th Cavalry Div. (de l'Espée). The 4th Cavalry Div. had been given up to the V. Army. Two roads led to the region occupied by the Germans at Rethel. The road Mezières-Rethel was barred by the 17th Div. and the 9th Cavalry Div. at Guignicourt, the road from Rocroi to Rethel by the Moroccan Div. at Signy l'Abbaye Launois.

On Aug. 28, the 17th Div., hearing the guns from la Marfée, had its attention drawn in that direction. On the same day, at 3 A.M., the advanced posts of the Moroccan Div. were attacked by the XII. (Saxon) Corps. At 11 A.M. the Moroccan Div. was turned in the west by the enemy, who seized Signy l'Abbaye and so opened up the way to Rethel. But the Germans did not exploit their success and allowed themselves to be checked at Novion-Porcien. The battle manoeuvres lasted through Aug. 29 and 30. Dubois, by clever movements, brought his forces to the north of Rethel, having thus accomplished his difficult mission. Again German strategy had not made the best use of its superior strength.

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IV. CHARLEROI AND MONS

Charleroi and Mons are the names given to the battles fought by the French V. Army and the British Army respectively in the latter part of Aug. 1914, against the right and right centre of the Germans.

The French Position.—Inasmuch as the British did not come up into line until Aug. 22, it will be necessary to deal with the purely French situation first. Germany had declared war on France on Aug. 2 and the right wing had crossed the Belgian frontier on the 5th. By Aug. 20 1914 the forward movement of the German right-wing armies into Belgium, and the failure of the offensive of the French I. and II. Armies, had caused a modification in Gen. Joffre's original plan of campaign. Broadly speaking the intention now was to attack through Luxembourg and Belgian Luxembourg with the object of threatening the communications of such German forces as had crossed the Meuse between Namur and the Dutch frontier. This duty devolved primarily on the III. and IV.—*i.e.*, the centre—Armies of the French. In the south the I. and II. Armies were to make a secondary offensive between Metz and the Vosges to hold the enemy, who might otherwise be able to take in flank the French advancing through Luxembourg; and the French V. Army and the British Army were to act upon the offensive, though this offensive would depend almost entirely on success by the III. and IV. Armies to their right.

On the evening of Aug. 20 the French V. Army was either actually within, or entering, the area bounded by the river Sambre on the north and the river Meuse on the east. The junction of these two rivers formed a very marked salient; but so far from being a point of weakness this locality was at the moment of great strength. It was sealed by the strong Belgian fortress of Namur which was to be the pivot of an Allied right wheel in the projected offensive. On the 20th there arrived from G.H.Q. the orders for Gen. Joffre's new offensive. The orders were to the effect that all information pointed to the intention of the Germans to carry out an outflanking movement in the north. The French III. and IV. Armies had been ordered to march against the line Neufchâteau-Arlon. As for the V. Army, its task was to pivot on Namur and the Meuse, and to seek out the main enemy mass in the north. On the left of the V. Army the British Army would advance towards Soignies in the direction of Nivelles.

British Expeditionary Force.—When England declared war on Germany during the night of Aug. 4–5 her forces available to take the field consisted of a cavalry division, six infantry divisions and some battalions of line-of-communication troops, the whole forming the Expeditionary Force for service overseas. The Govt. decided to retain two divisions temporarily in the United Kingdom and to transport the rest of the Expeditionary Force to France. The first ships sailed on Aug. 9 and, thanks to the perfection of the arrangements for mobilisation and transportation, the operation was completed without a hitch by Aug. 18. Sir John French, the British commander-in-chief, had reached his headquarters at Le Cateau on the previous day; and his army consisted of the I. Corps (1st and 2nd Divs.), Lt.-Gen. Sir Douglas Haig; II. Corps (3rd and 5th Divs.), Lt.-Gen. Sir Horace Smith-Dorrien; and the cavalry division under Maj.-Gen. Allenby, as well as line-of-communication troops. Concentration was completed by the 20th, south of Maubeuge; and the post assigned to the British was on the left of the French V. Army, preparatory to the advance north of the Sambre towards Soignies referred to above.

While his army was concentrating, Sir John French visited Gen. Joffre at Vitry-le-François on the 16th and discussed possible alternatives of action depending on information of the enemy's plans and dispositions. The main intention was, however, to attack. Next day, French visited Gen. Lanrezac at Rethel and there conferred with the commander of the V. Army. Lanrezac considered that it was not possible to carry out at once the order to attack, so far as it affected his V. Army. The whole of his troops had not yet come to hand. Then it had to be borne in mind that the British had not yet come up on the left, and that the action of the V. Army would also depend upon the success of the French IV. Army on the right. Lanrezac therefore confined himself for the moment to issuing orders for the occupation of a defensive position by the X. and III. Corps, south of the Sambre.

German Offensive Plan.—On this same day (Aug. 20), on the side of the Germans, a combined attack had been arranged in which the II. and III. Armies were simultaneously to attack the French V. Army, from the north and east respectively. The German I. and II. Armies were to close up to the line reached on that day, and an offensive against the enemy west of Namur was to be carried out in co-operation with an attack by the III. Army against the line of the Meuse between Meuse and Givet, details being left for decision by the Army headquarters concerned. As regards the British, the German Intelligence Dept. was woefully at fault, for it was stated that a "disembarkation of the British forces at Boulogne and the neighbourhood must be taken into account. It is the opinion here, however, that a landing on a large scale has not yet taken place." At the time, two-thirds of the British force was within 30 m. of Gen. von Bülow.

During the day the Germans attacked the French detachments on the Sambre. The events of the day had resulted in dislocating Lanrezac's preparations for the offensive, and at 12:30 P.M. he wrote to Joffre as follows: "I consider it dangerous to let the V. Army cross the Sambre during the 22nd, minus, on the one hand, the I. Corps, which must hold the Meuse until the IV. Army has made sufficient progress north of Semoy, and minus, on the other hand, the English who on the 22nd will not be able to get farther than Mons." During the evening a reply came from Joffre to say that Lanrezac could choose his own time for the offensive, and he accordingly decided that it would be launched on the twenty-third.

Early on the 22nd, fighting was resumed all along the French front on the Sambre. The X. Corps was forced back, and during the afternoon the road from Fosse to St. Gerard was crowded with artillery, infantry and transport moving southward. Fosse was occupied by the Germans about 8 P.M. Farther west the III. Corps had likewise to give ground. Severe fighting took place early in the afternoon round Chatelet, and both divisions had to retire, the 5th toward Tarcienne and the 6th to Nalinnes. By 1 P.M. the III. Corps had definitely to renounce its grip on the southern outskirts of Charleroi.

As for the XVIII. Corps, it came upon the field, but was south of the Sambre between Thuin and Malines instead of being, as Lanrezac had hoped, on the Mons–Charleroi road in touch with the British. The Cavalry Corps of Gen. Sordet had fallen back during the night to Solre, and in the afternoon was sent to guard the crossings from Jeumont to Thuin, and also to hold the cross-roads at Merbes Ste. Marie on the far side of the river. The night march following on long and arduous work in Belgium had been fatiguing to the horses, and the cavalry corps was in need of rest. Joffre had prescribed that it was to move to the British left, but Lanrezac considered that it was not in a fit state to move until the twenty-third. It was not, however, until the evening of Aug. 25 that it arrived behind the left flank of the British.

To Lanrezac on the evening of the 22nd, the situation of the V. Army seemed grave, but by no means desperate. Only two of his corps, the X. and III., had been engaged, and if these had suffered heavily they had also made the enemy pay the price. Withdrawn to more open terrain, where their artillery could render better support, they could re-form and, so he hoped, in their turn take the offensive. Further, the I. Corps was intact and now becoming available on the right, as was also the XVIII. Corps on the other flank; and the reserve divisions of Gen. Valabregue were coming up to support it. The British were now arriving in position on the left, round Mons. In one way Lanrezac was much more fortunate than he knew. Von Bülow had attacked prematurely by forcing the Sambre on the 22nd instead of waiting for the attack of the III. Army against the Namur-Givet section of the Meuse to take effect, and the retirement of the V. Army during the 22nd had seriously discounted the German chances of enveloping it.

The British Army in Position.—The British Army had practically completed its concentration on Aug. 21 and on the following day took up a position from Condé to Mons and thence southwest of that town, so as to be able to co-operate in the forward movement, pivoting on Namur, as ordered by Joffre. As a matter of fact Namur had been attacked by the Germans and during this day was *in extremis*. This fact was, however, unknown to French, who motored early in the morning from his headquarters at Le Cateau to visit Lanrezac at Philippeville. To his dismay French, on entering the area of the French V. Army, witnessed columns of infantry and artillery moving south. A British liaison officer reported that the Germans had forced the passage of the Sambre and were also making a wide turning movement through Belgium.

French at once decided to give up the attempt to find Lanrezac and returned to Le Cateau. From there he despatched a message to Lanrezac to say that he was waiting for the French Cavalry Corps to be posted on his left, as had been promised, and that he was prepared to fill the rôle allotted to him when the V. Army advanced to the attack. He also pointed out that his position was much in advance of the line now held by that army and hinted that although prepared to carry out his rôle he could not begin to do so until the French V. Army should recover some of the ground already lost. Late at night a French staff officer from Lanrezac's headquarters confirmed the news of the fighting which French had heard of during the day and asked if French, by striking at the right flank of the German columns, could thus relieve the pressure on the V. Army. The British commander-in-chief considered that this was quite impracticable but agreed to hold on to his position for 24 hours.

Situation on Aug. 23.—On the morning of Aug. 23—the day on which the battle of Mons was fought—the general situation of French and British was as follows: The French V. Army faced in two directions, east and north. The I. Corps was on or behind the Meuse, where all bridges had been destroyed except those at Dinant and Hastière. The X. Corps had its right on the high ground south of Fosse and Vitrivel, its left at Scry. The III. Corps (reinforced by a brigade from the XVIII. Corps) was deployed on the line Gerpinnes-Nalinnes-Claquedent. The XVIII. Corps was on the line Ham-Thuin, with detachments on the Sambre as far as Merbes-le-Château. The French Cavalry Corps was holding the passages of the Sambre from the left of the XVIII. Corps to Maubeuge. The 53rd and 69th Reserve Divs. (Gen. Valabregue) were about Solre le Château, and were to relieve the Cavalry Corps, which was to make for Maubeuge with the object of emerging eventually on the left flank of the British Army.

The British right flank was north of the Sambre between Erquelinne and Peissant. From here was the I. Corps—looking northeast—with its left near Mons. In front of the line, about Binche, was the 5th Cavalry Bde., which was subsequently withdrawn. The II. Corps carried on this line, from and including Mons, west of which there was a French division of territorials. The main body of the cavalry was in rear of the British left.

In this position of the theatre of war the I., II and III. German Armies were concerned. The German plan had been that the II. Army was to attack south across the Sambre, while the III. Army was to co-operate by attacking west across the Meuse, sending a strong force across the Meuse towards Rocroi to bar the French line of retreat. During Aug. 23, the I. Army (von Kluck) was to conform to this offensive movement. Gen. von Bülow had, however, made the mistake of attacking prematurely with his II. Army; the combined movement with the III. Army was unsuccessful, and consequently the trend of the fighting drifted westwards to where the advanced guards of the I. Army were coming into contact with the British on the Mons-Condé canal.

Battle of Charleroi.—In his published account of the battle of Charleroi, Lanrezac divides it into two distinct phases, the first from daybreak until 4 P.M., and the second from that hour until nightfall. In the first phase the course of the battle was as follows: The right wing of the X. Corps was driven back, and it reformed between Scry and St. Gerard; the I. Corps deployed on the high ground round St. Gerard with its right about Sart-St. Laurent. This operation was completed about midday, and the I. Corps was then well placed to act against the flank of the German Guard Corps, which was then attacking the X. Corps sharply. Gen. Franchet d'Espérey, commanding the I. Corps, instantly resolved to seize the opportunity and to attack *au fond*. His artillery prepared the way by an intense fire, and the Germans, apparently taken by surprise, suspended their attack to deal with this new danger.

It was now about 1 P.M. and Franchet d'Espérey was about to launch his infantry when disquieting news reached him from his right rear. The 51st Reserve Div., which had relieved the I. Corps on the Meuse, had failed in its task, and had allowed troops of the German III. Army to cross the river. The report went on to say that the reserve battalions had fallen back in disorder and that a detachment of the enemy had occupied Onhaye behind the V. Army. Franchet d'Espérey had no alternative but to suspend his attack and to send a division and a brigade to deal with the peril behind. Emboldened by the enforced inaction of the French, the Guard Corps again pressed on, its artillery maintaining a very severe fire. The French X. Corps and the fraction left of the I. Corps resisted energetically, with the result that in this portion of the field but little ground was lost, and connection was still maintained with the fortress of Namur.

While such was the state of affairs on the right wing, little was, in this first phase, taking place on the left wing. But after 4 P.M. a change for the worse set in, in that portion of the field. The left wing of the III. Corps was taken by surprise and driven back by a sharp attack, with the result that the whole III. Corps

fell back in confusion, while the XVIII. Corps, with its right now uncovered by the retirement of the III. Corps, was forced to withdraw to the stream which runs from Thuilles to Thuin. The reserve divisions of Gen. Valabregue, however, had come up to Bousignies and Thirlemont. On the right wing, in this second phase of the battle, the X. Corps had been forced to admit a loss of ground, but it was only slight. As for the I. Corps, the portion left at St. Gerard was holding its ground.

During Aug. 23 Gen. Franchet d'Espérey had been called upon to deal with the presence of a detachment of the German III. Army which had forced its way over the river. Some sharp fighting took place, and about 10 P.M. the French infantry carried Onhaye with the bayonet. This attack by the French came upon the Germans somewhat by surprise, and the units of the III. Army on the right bank of the Meuse were in consequence retained there for the moment.

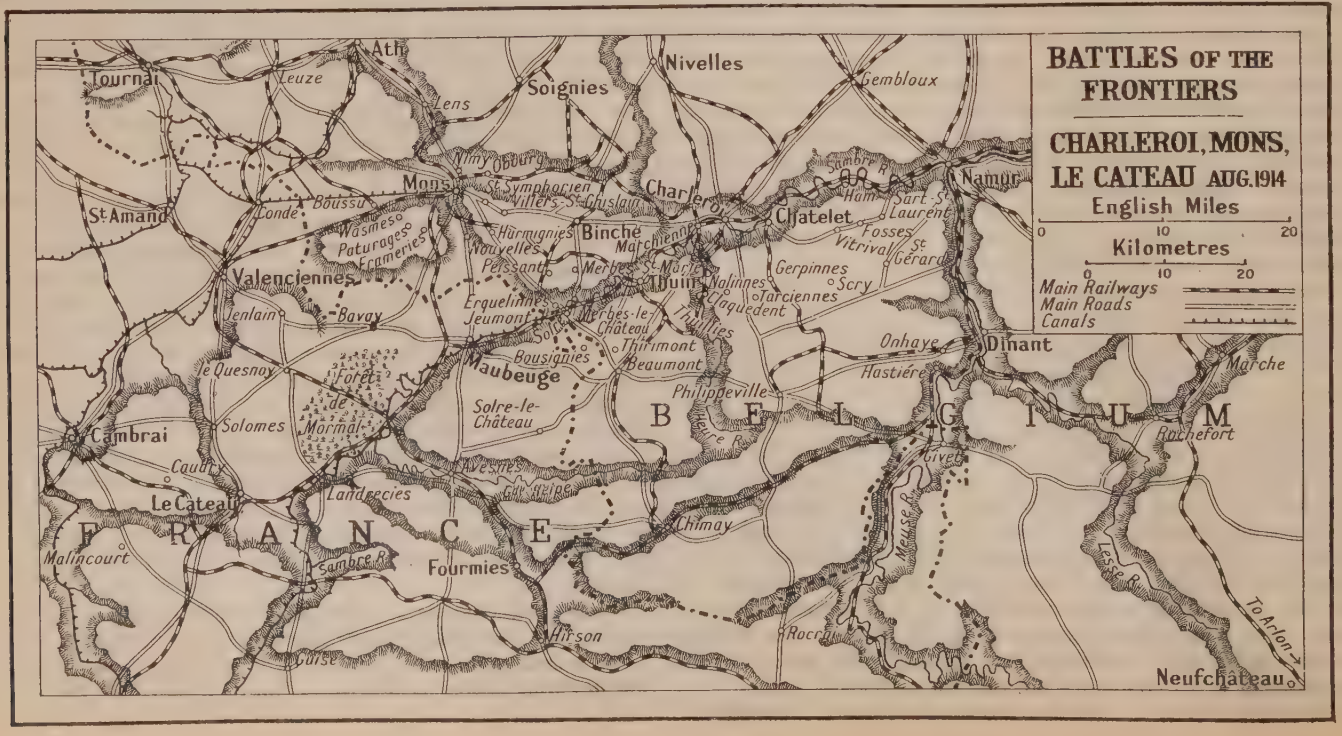
At the end of Aug. 23 Lanrezac came to the conclusion that immediate retreat was called for on the part of the V. Army. The chief causes of his decision are given by himself as follows: In the first place he had learnt definitely that the offensive of the IV. Army had failed and that the beaten troops were falling back to the Meuse with the left of the army on Mézières. The line of the river between that place and Givet was guarded by but a few battalions of reserve troops. The rear of the V. Army was thus threatened once again. In the second place Namur had fallen; in addition the roads on the right flank of the V. Army, already encumbered with thousands of civilian refugees, would be further blocked by the retreating Belgian troops from the fortress. Thirdly, the British Army was checked, and would in all probability be compelled to retire. Lanrezac, therefore, issued orders for the V. Army to retire on Aug. 24 to the line Givet-Philippeville-Beaumont-Maubeuge. Lanrezac's statement that his action was in part due to the conviction that the British would be forced to retire is a variant upon a previously held French opinion that such retirement actually preceded the retreat from Charleroi. How far both these statements are from the truth will now be seen.

The Battle of Mons.—The British position in detail was as follows: On the extreme left, about Condé, was the British 19th Bde., made up of battalions of line-of-communication troops in touch with a French division of territorials. Then came the 5th Div., while next on the right was the 3rd Div., holding a salient round Mons as far southeast as Villers St. Ghislain. The line was continued by the British I. Corps farther southeastwards to Peissant. The cavalry division was in rear of the British left, except the 5th Cavalry Bde., which was posted in advance of the right flank, but later withdrawn.

The British position was thus in shape somewhat like a broad arrow, with the two army corps practically at right angles to one another and facing, generally speaking, north and northeast respectively. As matters turned out, the German attack was directed almost entirely against the II. Corps, and here on the left the situation was not unfavourable to the British, for the canal made a valuable defensive line, while the terrain on the farther side held numerous difficulties for the attackers. Muddy ditches and barbed-wire fences impeded their movement, although, on the other hand, groups of trees and bushes gave cover from view and were of service for the enemy's machine-guns.

South of the canal the crests of the high ground afforded the British useful sites for artillery, but the slag heaps of the numerous mines limited observation to some extent. The line of the canal, however, had one very disadvantageous feature: after running from Condé to Mons in a mathematically straight line, it forms a loop round Mons, thus constituting a marked salient. Such a position might easily be found to be untenable, and Sir Horace Smith-Dorrien had prepared another and more defensible line in rear running through Frameries-Paturages-Wasmes-Boussu.

When day broke on Aug. 23 Von Kluck had three active corps and Von Bülow one, or about 150,000 men and 600 guns, within striking distance of the British force of some 75,000 men and 300 guns. The German I. Army was to march in a southeasterly direction. The British II. Corps on the Mons canal was facing north. Consequently the left of Von Kluck's army must collide with the II. Corps in the neighbourhood of Mons. As a matter of fact the German commander was in ignorance of the position of the British force. The march of the German I. Army, on the 23rd, was therefore shrouded in the fog of war, and, quite early in the day, delay was caused by a report that Tournai was held by British troops. These were actually two French territorial battalions, but, under the impression that they were British, orders were sent to the IV., III. and IX. Corps to halt on the Leuze-Mons-Binche road, in view of the possibility that it might be necessary to make a wheel to the right so as to envelop Tournai. Later reports showed that the British were in strength on the canal, and that the troops at Tournai, now known to be French, had retired toward Lille. The advance of the German I. Army was therefore resumed. But the orders for this resump-



tion of the march were late in reaching the III. and IV. Corps, with results that reacted on the German chances in the battle.

The left column of Von Kluck's army was the 17th Div. of the IX. Corps, and its march was directed towards St. Symphorien and Villers St. Ghislain. On the British side the I. Corps was on the line, generally, Harmignies-Peissant, and as it faced a gap between the German I. and II. Armies its share in the battle of Mons was destined to be very small. It was shelled by German artillery, covered in its advance by the 16th Dragoons, but the British casualties were slight. Of active fighting there was none save for some spirited minor actions between the British divisional cavalry and cyclists on the one hand and German patrols on the other. The bulk of the day's fighting fell upon the salient formed by the canal loop round Mons. So soon as Von Kluck had grasped the real state of affairs his plan appears to have been to envelop both the British flanks while bombarding the front heavily with his guns. The envelopment of the British left did not succeed, owing chiefly to the delay referred to above.

The battle opened in earnest about 10:30 A.M. with a bombardment by some batteries of the German IX. Corps which came into action on a ridge to the north of Orbourg, and from that time onward the guns were gradually extended westwards as battery after battery, first of the IX. and then of the III. Corps, came into action. At 1 P.M. the Germans had established a great superiority of artillery against the front of the British II. Corps. The actual loop of the canal was held by the 4th Royal Fusiliers and the 4th Middlesex Regt., the former being responsible for the bridge at Nimy while the right of the latter regiment held the crossing at Orbourg. At both these places the fighting was very severe, but the British musketry proved a terrible surprise to the Germans, who came on in masses which it was impossible to miss, and the British guns, though outnumbered by the German artillery, gave most effective support. Finally, however, the Germans were able through their superiority in numbers to make a converging attack against the salient from the north and east, and the British were gradually forced back east and south-east of Mons. But the Germans were cautious about pushing into the town, and it was not until after 7 P.M. that the 84th Regt. of the 18th Div. of the IX. Corps entered Mons, where it was thrown for a time into confusion by heavy fire. The British 3rd Div. fell back to a line running east and west through Nouvelles.

West of Mons the left division of the German III. Corps attacked the left of the British 3rd Div.; and still farther west along the canal the right division of the III. Corps, and later towards evening, the advanced guards of the IV. Corps, attacked the 5th Div. of the British. The retirement of the 3rd Div. from the salient round Mons inevitably led to a slight withdrawal of the 5th Div., and by nightfall the II. Corps was on a line which showed an average retirement of some three miles from the canal.

The Retreat Begins.—During the late afternoon and evening French had been receiving disquieting news as to the situation of the French V. Army on his right. At 11:30 P.M. a telegram arrived confirming the reports, to the following effect: Namur had fallen during the day; the French V. Army had been heavily attacked, and was falling back to the line Givet-Philippeville-Maubeuge; Hastière had been captured by the Germans; the Meuse was falling rapidly and had added to the difficulty of defence. In these circumstances not only was the original offensive out of the question, but the British line was now untenable. French, therefore, decided to retreat to a previously reconnoitred line from Jerlain eastwards to Maubeuge, and orders were issued accordingly in the early hours of Aug. 24. The withdrawal was effected without serious loss, and for a moment French thought of taking advantage of the fortifications of Maubeuge; but recollections of the fatal attraction of Metz for Bazaine induced him to pass the fortress, and orders were issued at 3 P.M. on the 24th for the retreat to be continued to the line Le Cateau-Cambrai.

BIBLIOGRAPHY.—A. Corbett-Smith, *The Retreat from Mons* (1916); G. Hanotaux, *L'Enigme de Charleroi* (1917); R. von Gleichen-Russwurm and E. Zurborn, *Schlacht bei Mons* (1919). (*See* also WORLD WAR: BIBLIOGRAPHY.)

V. BATTLE OF LE CATEAU

The battle of Le Cateau was fought by the left wing of the British Army on Aug. 26 1914, during the retreat from Mons. After Bavai the retreat was handicapped by the Forêt de Mormâl, which compelled the British Army during the 25th to march in two separated portions, the I. Corps east of the forest and the II. on the west. During the previous night the detrainment of the 4th Div. from England was almost completed, and it moved to its position towards Solesmes.

Meanwhile reports showed that the French were retiring all along the line, and Sir John French had now to decide whether to stand and fight on the line Le Cateau-Cambrai, or to continue the retreat at daybreak on the 26th. He decided that the retreat should be continued, and orders to that effect were accordingly issued. The order was complied with by the I. Corps, and after some delay caused by a violent attack by the Germans on Landrecies, the retirement was continued on the 25th in the direction of Guise. In the II. Corps, however, shortly after midnight Sir Horace Smith-Dorrien came to the conclusion that, in view of the fact that many of his troops had just completed over 20 hours of heavy and continuous work, and that the enemy were close along his front, it was out of the question to continue his retirement at dawn. He therefore issued orders to fight on the ridge just south of the Le Cateau-Cambrai road.

Disposition of the Forces.—The force at Smith-Dorrien's disposal was as follows, from right to left: The greater part of the cavalry was between Le Cateau and the Sambre; later it moved to the left flank to get in touch with the French I. Cavalry Corps, which was in the neighbourhood of Malincourt. Then came the 5th Division. The 3rd Div. held the centre as far as Caudry, and on the left lay the 4th Division. Thence to Cambrai was a gap filled by the 4th Cavalry Bde., and later by the French I. Cavalry Corps. The French 84th Territorial Div. was retiring slowly through Cambrai. Each British division had a front of approximately three miles. The 4th Div. was incomplete, lacking divisional cavalry, signal company, ambulances, ammunition columns and heavy artillery. The 19th Bde. was the general reserve.

The German force on the heels of the British was the I. Army whose commander, Gen. von Kluck, was the victim of faulty conclusions before, during and after the battle. He believed that the whole of the B.E.F. was opposite him; he thought that it was holding a position running north and south, whereas the line of the II. Corps was almost due east and west, and he was sure that it was either retreating or about to retreat in a westerly direction. His plan was similar to that which had been tried at Mons, a frontal attack mainly with artillery followed by enveloping movements against both flanks. The cavalry was to pin the British left until the German infantry should arrive.

The German Attack.—Soon after daybreak the British were engaged upon both flanks. On the right some German troops entered Le Cateau and confused fighting ensued, while on the left the 4th Div. became engaged with the enemy. Here the 4th Div., after defending an advanced position for some time, fell back slowly to a second line and brought the enemy advance to a standstill. These events were but preliminaries, and the battle of Le Cateau proper opened with a heavy bombardment, which grew in intensity as the artillery of four German corps came into action. The British artillery made a spirited reply, though heavily outmatched in numbers and weight of metal, and dealt severely with attempts of the German infantry to push forward. These attempts were, however, practically limited to the ground near Le Cateau on the British right, and to the village of Caudry, which now formed a salient in the centre of the line. Throughout the forenoon constant infantry attacks, varied by bouts of heavy shelling, were made against the latter village, from which about noon the defenders were forced out by artillery fire; but a counter-attack at once regained part of it and the German infantry advance was held up.

Until 1 P.M. the line of the II. Corps was everywhere intact in spite of the superior numbers arrayed against it. But on the right the situation was becoming grave, for the 5th Div., with its right

flank uncovered by the retirement of the I. Corps, was being threatened by more and more German columns converging upon the field. Smith-Dorrien realised that at all costs the fight must be broken off if his force was to be saved. Orders were sent to break off the fight and to continue the retirement of the previous days. Before the orders for retreat had reached all concerned the British right had given way before overwhelming numerical superiority. But the Germans failed to exploit this success, and the withdrawal of the II. Corps, thanks largely to the devotion of the British artillery and to the arrival of the French I. Cavalry Corps on the left, was effected with less difficulty than had been expected. Smith-Dorrien successfully withdrew his columns and marched them swiftly to the Somme at and near Ham. By Aug. 28 the II. Corps was safely across the river.

The losses of the British had been severe, 38 guns had been lost, and the casualties were over 7,800, the 4th Div. suffering particularly. The retreat was practically unmolested, for Von Kluck hurried southwest instead of south, and thus missed a chance not likely often to occur in war.

BIBLIOGRAPHY.—A. F. Becke, *The Royal Regiment of Artillery at Le Cateau* (1919). *See* also WORLD WAR: BIBLIOGRAPHY.

VI. BATTLE OF GUISE

By Aug. 25 the succession of victories achieved in Lorraine, the Ardennes and on the Sambre had produced an atmosphere of optimism at German general headquarters. It was thought that forces might be safely diverted to East Prussia to deal with the Russian invasion. Accordingly, on the 26th, two corps and a cavalry division received orders to proceed to the Eastern Front. On the side of the Allies, on the other hand, it was imperative to take immediate steps to check the onrush of the German right wing. During the night of Aug. 25–6 Joffre issued a new directive concerning a " new mass of manoeuvre " to be formed on the left flank to carry out an offensive and to consist of the French IV. and V. Armies, plus the British as well as a new French army—the VI.—to be made up of units moved by rail from other sections, chiefly from the right.

On Aug. 26 Joffre and French had a conference on this proposed offensive at St. Quentin, at which the commander of the French V. Army, Gen. Lanrezac, was also present. British co-operation was, however, impossible, for on this day half of French's army was engaged at Le Cateau, where it was very roughly handled. On the following day Joffre promised that the French V. Army would be immediately directed to take the pressure off the British. Accordingly at 1 P.M. on this day an officer arrived at Lanrezac's headquarters with verbal instructions to attack at once and with vigour toward St. Quentin. The French V. Army was at this time retiring over the Oise above Guise, and the attack it was called upon to carry out was with the object of following on the left flank of the German I. Army in order to delay the German onrush.

French Support for the British Army.—Nightfall on Aug. 27 found the French V. Army behind the Oise with its left below Guise and its right about Rumigny, the whole facing generally northeast. Lanrezac's task was a difficult one. He had to suspend a retirement toward the south and convert it into an attack toward the west. At noon on Aug. 28 Joffre came to see Lanrezac at the latter's headquarters at Marle. Lanrezac pointed out his difficulties and explained that his right flank would be considerably exposed in the operation enjoined upon him; but Joffre peremptorily ordered Lanrezac to proceed with the offensive and even threatened to relieve him of his command.

The German Advance Delayed.—At daybreak on Aug. 29 the main body of the V. Army began to cross the Oise above and below Origny, but the plan had to be modified owing to an attack made upon the right east of Guise by two corps of the German II. Army. Accordingly Lanrezac decided to postpone the attack toward St. Quentin and to deal with the threat against his right flank first. It was, however, impossible to carry out this new plan and it was now decided merely to mask St. Quentin and to devote every effort to dealing with the German attack east of Guise. The main body of the V. Army, assisted by a cavalry division, carried out its task with vigour and about 5 P.M. a general offensive took place along the 18 m. front from Origny-Vervins towards Guise. During the night the two German corps fell back across the Oise. This success was somewhat neutralised by events between the Oise and St. Quentin, where the situation took an unfavourable turn for the French.

Having carried out its task of delaying the Germans, the French V. army fell back during the evening of Aug. 30. The operation had been skilfully carried out, but Lanrezac was not in favour with French general headquarters and within a few days he was relieved of his command.

BIBLIOGRAPHY.—Viscount French, *1914* (1919), and *Despatches*, April 1914–July 1916 (1917); Marshal Joffre, *1914–15: preparation et conduite* (1920). *See* also WORLD WAR: BIBLIOGRAPHY.

(F. E. W.*)

FROST, ROBERT (1875–), American writer, was born in San Francisco, March 26 1875. His father was a New Englander and his mother was born in Edinburgh. In 1885 he moved with his parents to Lawrence, Mass., studied in the public schools, and entered Dartmouth College in 1892, remaining there one year. From 1897–9 he was a student at Harvard, and from 1905–11 taught English in the Pinkerton Academy, Derry, N. H., and then for a year taught psychology at the N. H. Normal School at Plymouth. In 1912 he went to England, where he remained three years and published his first two volumes of verse. On his return to America he retired to a farm at Derry and gave much time to active farming. During 1916–20 he was professor of English at Amherst College, Mass., a position which he resumed in 1923. His poems portray in realistic fashion everyday country life in New England. Some of the work of his first volume had been denied publication for 20 years, and some of the second for 10 years. He is the author of *A Boy's Will* (1915); *North of Boston* (1915); *Mountain Interval* (1916); *A Way Out*, a play (1917); *New Hampshire* (1923).

FRUNZE, MIKHAIL VASSILIEVICH (1885–1925), Russian soldier, was the son of a peasant who had settled in Turkistān and become a surgeon. While at school he came in contact with socialists, and on entering the Polytechnical Institute at St. Petersburg (Leningrad) he joined the Bolshevik group in the social democratic organisation. In 1905 he worked in the industrial district of Ivanovo-Voznesensk and helped to organise the big textile strike of that year. He was frequently arrested and in 1907 was sentenced to four years penal servitude, and to a subsequent six years on the grounds that he had offered armed resistance to the police.

At the end of 1914 his penal servitude was exchanged for banishment to Siberia, where he was arrested for revolutionary activities in the following year, but soon afterwards escaped from prison and the March revolution of 1917 found him in Minsk at the head of an illegal organisation in the army. He became president of a Front Committee, and later president of Soviet in the provinces, and at the time of the Nov. Revolution came to Moscow with a detachment of 2,000 men, with which he took part in the fighting in that city. After the revolt in Jaroslaw he became military commissar of that district, and in Dec. 1918, commander of an army on the Eastern Front. He later became commander in chief of four armies and directed the operations against Admiral Kolchak. When the Eastern Front was divided, Frunze became commander on the Turkistān section of it, where he surrounded and destroyed Kolchak's southern army. He afterwards took part in minor operations in Central Asia, returning to Russia in Sept. 1920 when he took command of the troops that eventually drove General Wrangel out of the Crimea. For this he was rewarded with a sword of honour and a portrait of Karl Marx. He then commanded the military forces in the Ukraine. In 1924 he became vice-president of the Revolutionary Military Council, and, in the absence of Trotsky, the actual head of the Red Army. He became president of this council and People's Commissar for Military and Naval Affairs in Jan. 1925, but died before the end of the year.

FRY, SIR EDWARD (1827–1918), English judge (*see* 11.270), died at Failand, near Bristol, Oct. 19 1918.

FRY, ROGER ELLIOT (1866–), British painter and art critic, son of Sir Edward Fry, was born in London, and educated at Clifton and King's College, Cambridge. He studied painting under Francis Bate and then in Paris, and exhibited at the Carfax Gallery, London, in 1903. His work, notably in his landscapes, is marked by deep feeling for form and a scholarly sense of design and technical means. An active member and exhibitor of the London Group, he gave an exhibition of his own paintings in 1920. As a critic, with his wide knowledge and acute sensibility, Fry became recognised in England and abroad as a leading expert. He published a study of *Bellini* (1899) and edited *Reynold's Discourses* (1905), but is best known by his championship through much opposition and prejudice, of Cézanne and the post-impressionists. Among other publications are *Vision and Design* (1920); *Architectural Heresies of a Painter* (1921), and a book of travel impressions, *A Sampler of Castile* (1923). He was also joint editor of *The Burlington Magazine.*

FRYATT, CHARLES (1872–1916), British seaman, was born at Parkeston, Essex, Dec. 2 1872. He entered the service of the Great Eastern Railway Co., and in 1904 became chief officer in their service of vessels plying between Harwich and Rotterdam. In 1913 he was promoted captain. At the end of July 1916, it was announced that his ship, "Brussels" had been captured and the captain himself arrested and tried by court martial, on a charge of having attempted, on March 28 1916, to ram a German submarine. The German authorities stated that Captain Fryatt had confessed that he had acted under orders from the British Admiralty; but the trial was hurried and secret, no intervention on the part of neutrals being allowed. The captain was condemned to death and shot at Bruges, July 27 1916. The body was, on July 7 1919, brought from Belgium to England and was buried at Dovercourt, near Harwich.

FUAD I. (1868–), King of Egypt, was born at the palace of Gizeh, March 26 1868, the youngest son of the Khedive Ismail Pasha. After his father's débâcle Prince Ahmed Fuad, as he then was, went to Italy where his youth was spent. He returned to Egypt in the 'nineties and was appointed aide-de-camp to the Khedive Abbas Hilmi. He found outlet for his energies by presiding over charitable and educational institutions and was largely responsible for the foundation of the Egyptian University, of which he became president. In 1917 his elder brother, the Sultan Hussein Kiamil died, and as the latter's son, Prince Kemal ed Din, renounced the rights of succession, Prince Fuad became Sultan. After the termination of the British protectorate on Feb. 28 1922, he was proclaimed King of Egypt (March 16). He had married on May 25 1919 the Princess Nazli, daughter of Abdel Rehim Sabri Pasha, a former governor of Cairo, and his heir, Prince Faruk, was born on Feb. 11 1920.

FUEL PROBLEMS (*see* 11.274).—The wood of our forests is our natural fuel. If we were restricted to that material, the enormous fuel demands of our industrial age would long since have razed our forests. As the dearth of wood made itself felt in industrial districts, recourse was had to the fossil fuels which Nature has stored up, coal and peat, and natural oil and natural gas. Bituminous coal was the most important of these fuels, and the iron industry required in particular those coals which gave a metallurgical coke suitable for replacing the wood charcoal in the blast furnace. In some countries, for instance in Germany, brown coal has of late almost broken the predominance of bituminous coal; brown coal is more easily mined and offers advantages as household fuel when briquetted.

Further, modern industry and transport, established on the coal-fuel basis, have recognised the advantages of liquid fuels and their necessity for certain purposes. Oceanic navigation makes an increasing use of crude oils; automobile and aerial motors are no longer to be thought of without gasoline fuel. Again, the cleanliness and precision attainable with gaseous fuels in furnaces and in the preparation of valuable products, have secured to these fuels a preferential position in the production of steel and in the manufacture of glass and of ceramic objects. Extensive systems of gas-pipes distribute gas through towns and industrial centres, even across states.

But the natural fuels, solid, liquid and gaseous, are by no means evenly distributed over our globe. Consequently we are forced to produce the required fuel from other sources, to meet local conditions, unless we are satisfied to depend upon imported fuel. The chemist and engineer are hence confronted with the problem of converting fuels of locally lesser value into fuels for which there is a greater demand. Thus arise many problems, the most important of which is the conversion of coal into oils.

I. GASEOUS FUELS AND THEIR PRODUCTION

From Solid Fuels.—The constitution of the gaseous fossil fuels is easily determined; for the molecules of gaseous substances are generally the smallest and the least complex. The combustible constituents of natural gases, exhaled as natural gas or fire-damp, are almost exclusively represented by methane, CH_4. The methane may have originated from residues of a fossil flora or fauna. The biological processes which resulted in the formation of petroleum took place under scission of methane, which was also produced during the formation of coal and during its natural ageing. Natural gas is therefore found in association with oil-fields and coal seams. As, however, natural gas is not replenished at the rate at which it is consumed in some industrial districts (*e.g.*, Pennsylvania), many works which originally relied upon natural gas have been obliged to adopt producer gas as their fuel. The chemical constitution of gaseous fuels is easily ascertained, and also the production of gaseous fuels from liquid and solid fuels offers no particular difficulties.

Dry Distillation.—For the preparation of gaseous from solid fuels two chief methods are now available. The so-called dry or destructive distillation of coal is historically the first. The gas formed by the thermal decomposition of the coal consists, when the temperature is kept as low as possible, essentially of methane and other hydrocarbons. When the coal is discharged into glowing retorts, as in gas and coke-oven works, the gas liberated will be the richer in hydrogen the higher the temperature. This method of coal distillation furnishes a gas of relatively high calorific value. With low temperature carbonisation, the calorific value may rise to 9,000 calories per cu. metre; at higher temperatures, the figure will lie between 4,000 and 5,000 calories. But the volumes of gas are comparatively limited; only a small portion of the coal substance is gasified, the bulk being transformed into coke. The yield is about 60 to 70 cu. metres of low temperature gas per ton of gas coal, and some 200 or 300 cu. metres of coke per ton. The complete gasification of coal cannot be effected by heat alone. The coke produced by the distillation must be gasified by chemical reactions. This can be done in three ways.

Chemical Reactions.—The reaction of air with white-hot coke yields a gas, theoretically consisting of two parts of carbon monoxide and four parts of nitrogen; this gas is of low calorific value. The reaction $2C+O_2=2CO$ proceeding under considerable liberation of heat, the manufacture of such a gas—air-gas—can be easily carried out continuously in shaft furnaces. The best material is coke; coal may be used provided it does not cake; brown coal briquettes are also suitable. From the standpoint of gas production, the ordinary pig-iron blast furnace may be regarded as a huge air-gas producer, with the difference that the oxygen required for the production of carbon monoxide is taken not only from the blast, but also from the iron ores. This process of coal gasification, the air-gas process, is associated with a pronounced liberation of heat.

Water-Gas Process.—In the water-gas process, however, the reaction $C+H_2O=H_2+CO$, heat is consumed and has to be replenished to sustain the process. The water-gas process can therefore not be carried out continuously in a shaft furnace unless external heat be supplied. The process is hence worked discontinuously. During the first hot run the coke charge is raised by the air blast to a temperature of about 1,000°C.; steam is then admitted, heat is absorbed and water-gas is produced, while the temperature of the layer of glowing coke sinks gradually. When the temperature has fallen a few hundred degrees, the hot-air blast is again turned on.

Mixed Gas Process.—Since the air-gas process liberates heat whilst the water-gas process absorbs heat, technical practice began to combine the two processes before the theory of the reactions was understood. Gas generators were worked with air and steam. Numerous advances have been made during the last decade in the domain of fuel gasification, particularly with regard to the difficulties caused by the use of coal instead of coke in the generation of both mixed gas and water-gas.

By the use of considerable additions of steam we have, in the mixed gas process, further learnt to recover the bulk of the nitrogen contained in the coal, in the form of ammonia (*see* AMMONIA). Success has also been achieved in the perfection of gas producers as economical apparatus for the manufacture of primary tar. The total gasification of the coal and coke has so far laboured under the disadvantage that, as the daily throughputs of gas producers were relatively small, a good many furnacemen and a good deal of stoking were required. Recently gas generators have been built for daily throughputs of 100 tons. This working in large units is one of the most important problems of coal gasification.

From Liquid Fuels.—Further substitutes for natural gaseous fuel can be obtained by the thermal decomposition of liquid fuels, such as crude oils or certain fractions of these oils, gas oil, tars or tar-fractions. The carburation of water-gas is a case in point. Water-gas does not burn with a luminous flame and its calorific power is low; it is therefore carburated by the injection of crude oil or tar oil into incandescent chambers. At temperatures above red glow the oils are decomposed, to a large extent, into gases, some tar and coke. The gases consist of very diverse hydrocarbons of higher calorific values than the water-gas. By mixing the two kinds of gases the water-gas is therefore enriched. In the early days the gas was carburated also for the purpose of rendering it luminous. With the invention of the Welsbach incandescent burners this application has lost its importance; but carburation for the sake of increasing the calorific value still remains important.

The thermal decomposition of oils is practised for the general purpose of obtaining gases of high calorific power. Thus tar or oil gas is manufactured by the decomposition of so-called gas oil. It served chiefly for lighting railway carriages, but is being replaced by electric illumination. The gasification of liquid, relatively inferior fuels, by the aid of steam might become valuable under certain conditions for the preparation of a water-gas rich in hydrogen, by a kind of water-gas process. Thus, petroleum vapours mixed with steam and heated to 1,000° in the presence of bauxite as catalyst can be converted into a mixture of carbon monoxide and hydrogen, which high-pressure catalysis further transforms into synthol and similar products.

From Other Gaseous Fuels.—It may happen that natural gas is available, but that hydrogen is needed. The conversion of methane into hydrogen may be effected catalytically by passing methane through tubes or kilns at the high temperature of 1,000°, when methane is decomposed into hydrogen and carbon. At lower temperatures the decomposition is incomplete. When shaft furnaces are used the carbon deposited can subsequently be burnt out again by blowing hot air into the furnace; the heat liberated is re-utilised to raise the furnace again to the high temperature and to decompose more methane. Like the vapours of liquid fuels (though less easily, owing to its high stability) methane can also be converted, by means of water vapour in the presence of bauxite as catalyst at about 1,000°, into a mixture of carbon monoxide and hydrogen.

The reversed process should finally be mentioned. If desired, the carbon monoxide contained in some available fuel gas mixture can be removed by transforming the carbon monoxide catalytically, at low temperature, into methane, with the aid of the hydrogen in the mixture. This was done experimentally about 1915. The process has not been adopted, however, although the elimination of the monoxide from illuminating gas seemed hygienically advantageous. The catalytic preparation of pure methane from water-gas, tried on an industrial scale some years ago, still remains in the preliminary stage, because the purification of the gas (of sulphur) and the partial removal of the carbon monoxide proved too expensive. Such a process, moreover, involves a loss of about 25% in calorific value, because the proportion of methane, represented by the theoretical mixture of carbon monoxide and hydrogen, possesses only three-quarters of the heat value of the four times larger volume of ($CO+3H_2$) which it replaces. The reason is that this methane formation is a strongly endothermic process.

Purification of Gaseous Fuels.—For many purposes the artificial gaseous fuels require careful purification. Thus, the gas escaping in large volumes from the mouth of a blast furnace has to be freed of all the dust it carries before it can be fed into internal combustion engines. The object is attained by mechanical cleaning and dust separation, by means of filters, centrifugal machinery or sprinkling with water. The electric dust precipitation by the Cottrell process should especially be mentioned (*see* FUME PRECIPITATION). The removal from the gases of the sulphur compounds is frequently a difficult problem. It is chiefly required in the case of illuminating gas, and the sulphur can be recovered in a utilisable condition. The old-established method purifies the gas by means of iron ore (bog ore). Activated carbon has recently been experimented with for the same purpose. The gas is mixed with a sufficient amount of air to oxidise the sulphuretted hydrogen in the gas into sulphur; the sulphur is retained by the carbon, and the process is accelerated if ammonia is present in the gas. The activated carbon impregnated with sulphur is then extracted with ammonium sulphide; the evaporated solution leaves the sulphur as a marketable residue. For most of the catalytic processes removal of hydrogen sulphide alone from the gas is, however, insufficient. The other sulphur compounds, notably carbon disulphide, must also be eliminated.

II. LIQUID FUELS AND THEIR PRODUCTION

The natural liquid fuels, natural oils or petroleums, occur in widely-diverging compositions, and are partly aliphatic, partly naphthenic in character; aromatic compounds are found in some kinds of petroleum. The natural oils are also classified according to the nature, asphaltic or paraffinic, of their high-boiling residues.

As regards the origin of petroleum, the biological hypothesis of Engler has found general support. According to this, petroleum was formed in the course of time by the decomposition of the fatty constituents of small and large organisms. The optical activity of certain petroleum fractions is regarded as affording a strong argument in favour of this view. That, however, liquid hydrocarbons, with which we are essentially concerned, may be prepared artificially in other ways and might naturally have been produced in such ways under certain conditions, has been established within this century, by chemical research in various cases. There are, *e.g.*, carbides, such as uranium carbide, which liberate liquid hydrocarbons when decomposed. It is further known that acetylene and hydrogen may catalytically be combined to form petroleum-like products; and within the last few years it has been shown that the high-pressure synthesis of water-gas leads to the formation first of synthol and further, when this synthol is heated under pressure, of an artificial petroleum. Whether or not petroleum has been formed in some localities by inorganic reactions of cognate nature, cannot be proved, but the possibility cannot be excluded.

From Solid Fuels.—Heating of geologically recent coals under exclusion of air seems to be the simplest method for the production of liquid fuels from solid fuels. Destructive distillation yields, in addition to the gases mentioned and to the residual coke, a tar which, when formed at low temperature, contains constituents of petroleum character. The proportions of such tar obtainable are considerable. Gas coals of more recent geological periods (ordinary coal) yield up to 12% of the tar, cannel coals still more. Certain lignites and oil shales are likewise suitable materials for the manufacture of the tar by distillation. The Scottish shale-oil industry and the brown coal carbonisation works of central Germany operate on these lines.

The large bulk of the tar which comes from our coal gas and

coke works is of a different composition. Owing to the high temperatures which are used in gas-works and especially in coke-ovens, in order to secure high yields of both gas and a firm coke, the tars are essentially aromatic in character and rich in benzene, naphthalene, anthracene, etc. By weight the chief product is in either case semi-coke or coke. The tar yield referred to the weight of coal, lies in general between 12 and 3% (*see* COAL TAR PRODUCTS).

Bergius Process.—Since coal contains only 5% of hydrogen on average, whilst petroleum contains more than twice as much, an increase in the oil yield from coal seems dependent upon a supply of hydrogen. In the Bergius process for the liquefaction of coal, hydrogen is made to react with coal at a pressure of more than 100 atmospheres and at temperatures of about 450°. The coal is ground and kneaded with 30% of tar into a paste; this paste is continuously pressed into the high-pressure autoclave. We may imagine that the coal is first carbonised, the temperature being sufficiently high for this purpose; the products are primary tar and semi-coke. The semi-coke is further hydrogenated and half of it, by weight, is converted into oil. That the reaction may proceed in this way has quite recently been established by experiments in which the carbonisation was effected at ordinary pressure, and only the hydrogenation of the semi-coke was carried out at high pressure. This "bergiannisation" is not equally applicable to all types of coal. Suitable materials are particularly coal of comparatively recent periods, rich in volatile constituents, but not inclined to cake. Such coals which are popular as fuel for gas generators, but in general unsuitable for coking, yield about 50% of oil by the Bergius treatment, whilst low-temperature carbonisation would at the best give 10 to 12% of oil. The oil of the Bergius process is not equal in value to natural oil. It contains, it is true, ample proportions of gasolene, but it also contains about 20% of phenolic constituents, and is hence more closely related in constitution to the primary tars than to petroleum. The Bergius process, which is expensive owing to the high-pressure apparatus required, offers advantages in localities in which there is no market for semi-coke, neither as domestic fuel nor for gasification or the manufacture of powdered fuel. Under other conditions, improved methods of low-temperature carbonisation will be serious competitors.

From Other Liquid Fuels.—Natural, as well as artificial liquid fuels contain in general fractions of almost all boiling points, ranging from ordinary temperature up to 400°. Not all these fractions are, however, in equal demand. In the 19th century lamp and illuminating oils, boiling between 150 and 250°, were the most valuable petroleum constituents. Since then electric and incandescent lighting on the one hand, and the development of automobiles, flying machines and industry generally on the other, have increased the values of the low-boiling benzenes and of the lubricating oils in petroleum, so that the evaluation of the various petroleum fractions has altogether changed. At present the supply of benzene from petroleum is not sufficient to satisfy the demand. Fortunately the high-boiling constituents of petroleum can be converted by cracking processes into low-boiling motor spirits. One-third of the gasolene wanted in America for automobiles is said to be now produced by cracking. Like the oil-gas production mentioned above, cracking involves heating of high-boiling oil fractions up to incipient decomposition. The cracking process is, however, conducted at lower temperatures, in the neighbourhood of 500°, and under pressure, because less gas and more vapours of gasolene type are formed when the pressure is raised. This heating up to partial thermal decomposition of oils of high boiling points is important in other respects. In the Diesel motor (*see* INTERNAL COMBUSTION ENGINE), it is believed, the air is first heated by the compression stroke to cracking temperatures; the oil injected into this hot air is then thermally decomposed and burns in the compressed air; separate ignition of the fuel can be dispensed with.

The dearth of low-boiling gasolene has induced designers of automobile internal combustion engines to use fuels containing high-boiling constituents. These constituents, however, are apt to ignite by the heat due to compression toward the end of the compression stroke and before the dead point is passed. The piston is then forced back and "knocking" occurs. This pre-ignition of gasolene-air mixtures seems to be favoured, if not caused, by the fact that the carbon deposited on the engine cylinder always carries some iron. The tendency to knocking is suppressed by adding to the motor spirit substances such as lead tetra-ethyl which, it is assumed, act by being adsorbed by the ferriferous carbon in the cylinder; the carbon is thus catalytically poisoned and cannot produce knocking. The anti-knocking reagents are, however, dangerous to the human system, and not likely to find favour. The best way of stopping the knocking trouble would be to return exclusively to motor fuels of low boiling points. The world's production of benzene is insufficient for the demand. Synthetic preparation of benzenes may bring the desired solution of this problem.

Some artificial liquid fuels can or should be improved or modified, wholly or partly, before utilisation. Half of the oil fraction of primary coal-tar consists of phenols for which there is little demand. By means of hydrogen at 700 to 800° they can be reduced to the more valuable benzene and toluene. Certain hydrocarbon fractions of primary tars are highly unsaturated; they can be hydrogenated and rendered more valuable in similar ways. The naphthalene of coke-oven tar can be converted into a liquid fuel, tetrahydronaphthalene, commercial tetralin. For this purpose the solid naphthalene is fused, purified by crystallisation and freed of the last traces of sulphur by treatment with metallic sodium. The naphthalene thus purified is then submitted to hydrogenation by means of hydrogen under pressure in the presence of nickel as catalyst, somewhat as in oil hardening; but the product, tetralin, is liquid.

Attempts have also been made to convert high-boiling liquid fuels and also tar and pitch into low-boiling motor spirit by the Bergius process, analogous to cracking but combined with hydrogenation. The process has not found industrial application, apparently because the American cracking processes attain the same object by less expensive means.

From Gaseous Fuels.—Gaseous fuels frequently contain vapours of liquid fuels of low boiling points. Natural gas, for example, very frequently, though not always, carries higher homologues of methane. There are benzene vapours in coke-oven gas, and the gases of low-temperature carbonisation retorts contain vapours of benzene character. These vapours can be removed and recovered by physical methods, scrubbing the gas with oil or treatment with adsorbents, such as activated carbon and recently also silicagel; the use of the latter reagent is so far largely experimental. These vapours are further condensed by cooling or by compression, or by a combination of the two methods. Both methods yield the liquid directly; in the former cases the oil or activated carbon used for the scrubbing or adsorption must afterwards be submitted to steam blowing in order to obtain the liquids.

The object of these processes is simply the recovery of fuels of low boiling point already present. Methods for the synthetic preparation of such fuels have been developed within the past few years. The process is a high-pressure catalysis, starting with carbon monoxide, utilised suitably in the form of a mixture of monoxide and hydrogen, a water-gas containing an excess of hydrogen. A mixture of one part of carbon monoxide and two parts of hydrogen is first carefully purified, especially of all sulphur compounds, and then compressed to about 150 atmospheres. At this pressure and a temperature of about 400°, the mixture is passed over the catalyst, for instance, zinc oxide or chromium oxide. The hydrogen is bound by the carbon monoxide and the reaction $CO+2H_2=CH_3OH$ yields almost pure methyl alcohol. Provided disturbing metals, particularly iron which would form iron carbonyl, be absent, no undesirable secondary reactions likely to diminish the alcohol yield seem to take place. Formation of methane, an undesirable reaction, would be aided by the presence of iron.

This synthesis of methyl alcohol hardly concerns the fuel problem. The alcohol contains almost 50% of oxygen, its

calorific value is about half that of benzene or gasolene, and it is not a motor fuel.

Higher Alcohols.—In the case of the higher alcohols, it is possible to prepare mixtures of those alcohols and ketones by high-pressure catalysis, starting with the same raw materials, carbon monoxide and hydrogen, but resorting to other catalysts. These alcohol mixtures of oily character (*i.e.*, little soluble in water) which may be designated by the general term " synthol," can, for instance, be produced with the aid of iron impregnated with potassium carbonate as catalyst. Ninety percent of this synthol boils below 200°, and it forms an excellent motor fuel, at least equal in value to benzene and gasolene. For the present the synthol process is too expensive. But in the future synthetic motor fuels must be prepared in this or similar ways. Water-gas can be produced from all types of coal and peat. It is therefore possible to manufacture synthetic motor fuels in all districts where some coal but not petroleum is available. This source of fuel would provide for the time when petroleum and petroleum products fail. We have more reliable knowledge as to the occurrence of coal than about oil-fields. The coal resources of the globe will probably hold out for many centuries.

III. SOLID FUELS AND THEIR PRODUCTION

So far man essentially relies on fossil, chiefly solid, fuels for obtaining heat and power. Chronologically these fuels may be classified as peat, brown coal and coal. A discussion of their genetic interrelations is unnecessary. The earlier view which traced the genesis of coal to cellulose is giving way. Microscopical examination of coal indicates that coal is the decay-product of wood. Decay of wood, biological researches teach us, is due to certain fungi; they work by destroying the cellulose, which is transformed into gaseous and water-soluble products, whilst they leave the lignin essentially intact. Chemists have proved that the lignin and the carbon constituents proper of brown coal and coal possess a similar chemical constitution, that is to say, a cyclic structure.

The assumption is, then, that the main constituents of our fossil fuels have been formed by a slow decay of lignin, during which the essential chemical character of the lignin was preserved. Cognate interesting conclusions have been arrived at concerning the bitumen in coal. It would appear that the bitumen of the highly diverse brown coals consists mainly of fatty acids of high molecular weights and of odd numbers of carbon atoms, whilst the biologically easily digested fatty acids, which predominate in the fats of plants and animals, contain an even number of carbon atoms. We may hence assume that the fatty acids of the mother substance of coal, which are easily destroyed in a living organism, have disappeared, whilst the more resistant fatty acids of odd carbon-atom numbers have survived and have been utilised in the formation of bitumen.

The solid fuels—coal, for example—cannot always be used in the form in which they are won. According to requirements solid blocks are broken up and sifted into the desired sizes, or ground up and atomised to yield convenient powdered fuels. Conversely, small coal is rendered more marketable by briquetting; this applies particularly to the lignites, whose moisture of 50% is first reduced to 15% .

Apart from these mechanical modifications, other methods of improving solid fuels have of late acquired importance. Metallurgical coke was first made in coke ovens merely as a substitute for charcoal. The enlargement and perfection of the blast furnace called for a firm, little breakable and friable coke. Then the quality of the coke had to meet higher claims. What is wanted is absence of sulphur compounds. To a slight extent the sulphur is removed with the pyrites when the coal is washed. A complete elimination of the sulphur has been attempted by treating glowing coal with hydrogen; the process has not yet been adopted, chiefly, perhaps, because the purification is not complete, in spite of its high cost. Meanwhile, however, ways have been discovered of controlling the combustibility of the coke. The blast furnace requires an easily combustible coke, the cupola a coke which burns slowly. The former coke can, in general, be obtained by accelerating the coking process and by avoiding subsequent heating, whilst high coking temperatures and long coking periods favour the formation of a sluggishly burning coke.

The semi-coke obtained when temperatures of 500 to 600° are not exceeded in its production is readily combustible. If in a handy, dense and little friable condition, this semi-coke, the so-called smokeless coal, would represent an ideal fuel. To produce such a semi-coke which will not require subsequent briquetting is one of the most important problems of the future; considerable progress has been made in the solution of this problem during the past few years.

The production of solid from liquid fuels is, as a fuel problem, a matter of secondary importance. Retort graphite is produced by decomposing the tar vapours and the hydrocarbons of gas in gas retorts. Petrol coke, so-called, is obtained by coking petroleum pitch. Both these cokes are products of considerable value for the manufacture, *e.g.*, of carbon electrodes; but they do not count as fuels. The soot prepared by the decomposition of vapours of liquid fuels, a high-priced form of carbon, is also utilised in the manufacture of electrodes.

Reference should finally be made to the preparation of solid from gaseous fuels. Here again a soot process should be mentioned in the first instance. Carbon black is obtained by the incomplete combustion of natural gas; the process is wasteful, however, and is only applied when the gas cannot be utilised in other ways. Better results can be secured by the catalytic decomposition of carbon monoxide. This method has not yet found any serious industrial application, but it deserves attention in cases where a carbon absolutely free of sulphur is wanted. The process might be developed in promising directions, since the decomposition of the monoxide $2CO = C + CO_2$ yields carbon dioxide which cyclically can be reduced to monoxide again. The essence of the process is therefore an intermediate gasification of impure coke for the preparation of pure carbon.

See " Fuel and Power Generation," in *Rogers' Manual of Industrial Chemistry* (4th ed., 1925). (F. Fl.)

FULLER, JOHN FREDERICK CHARLES (1878–), British soldier, was born Sept. 1 1878 and gained a commission in the Oxfordshire and Buckinghamshire Light Infantry 1898. After active service in the South African War, he relieved the tedium of peace-time soldiering by extensive scientific and philosophical studies, and gained a considerable reputation as an authority on Hindu mysticism and the Hebrew Kabbalah. These studies provided an unusual groundwork and mental equipment for his military researches later. In the World War, after holding a variety of staff appointments, he became chief general staff officer of the Tank Corps in April 1917. He had a responsible share in the project for the great tank surprise at Cambrai in Nov. 1917, and in the tank successes later, until in July 1918, he was brought back to the War Office to organise the vast tank expansion then contemplated for 1919, had the war continued.

Developing his ideas after the Armistice and preaching his new gospel of war, Colonel Fuller was for a time criticised as a tank extremist, an unpractical visionary. Abroad, however, his views were acclaimed, by the French general staff, who translated and circulated them throughout their army, as " an exact vision of the future." Gradually, however, his prophecies and his teaching permeated the army, gaining power from his appointment, in 1922, as chief instructor at the Staff College, and still more when, in 1926, he was appointed military assistant to the new chief of the Imperial General Staff. The result of his researches into the science of war is incorporated in his *Foundations of a Science of War* (1926), and among numerous other books, his *Tanks in the Great War* (1920), *The Reformation of War* (1923), and *Sir John Moore's System of Training* (1925) attracted wide attention (*see* STRATEGY).

FUME PRECIPITATION, ELECTRICAL.—The precipitation of smoke by electricity was described in 1824 by Hohlfeld, a teacher of mathematics in Leipzig, but only after it was independently rediscovered and critically studied by Sir Oliver Lodge about 1884 did it attract general attention and lead to attempts at industrial applications. At the time, however,

these proved unsuccessful due to the lack of modern equipment. It was not until 1906, following experiments at the University of California, that the process was commercially successful.

The first installation was at the Selby Smelting Works, near San Francisco, where it was used for the removal of sulphuric acid mist from about 5,000 cu. ft. of gases per min.; it was still in operation there in 1926. By 1910 a plant to remove dry dust and fume from 250,000 cu. ft. of gas per min. was built at another smelter, and in 1912 the process was successfully extended to the removal of cement dust at nearly a red heat from 250,000 cu. ft. of gas per min. at the Riverside Portland Cement Company. This mill, of 2,500 bbls. daily capacity, situated in the heart of the Californian orange groves, had been threatened with legal closure as a nuisance because of the dust emitted.

The electrical method as there installed removed 98% of the dust, the daily catch being about 100 tons, aggregating for these 13 years of operation over 350,000 tons, equivalent to a train of fully loaded freight cars 100 kilometres long. Although first applied to mitigate nuisances, the demand for the process to-day is

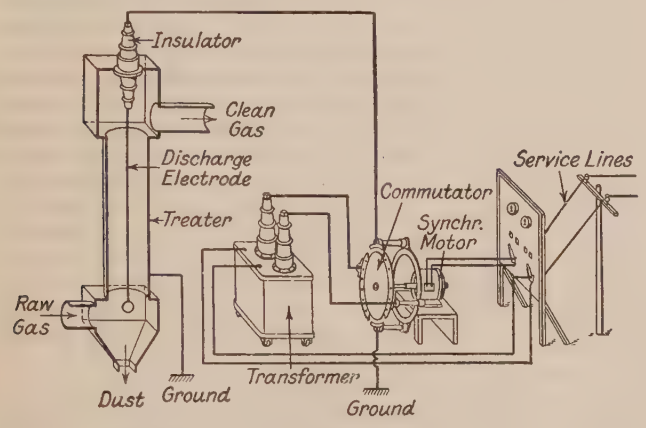


FIG. 1.—Apparatus for the electrical precipitation of dust or smoke from gases.

primarily based on a greater profit to be derived from the gases cleaned or the material removed. At one time during the World War, even the Riverside plant was making more profit from potash incidentally recovered in its dust than from its cement.

Research Corporation.—Another circumstance aiding the development through friendly public interest was the creation in 1912, under the auspices of the Smithsonian Institution, of the Research Corp. in New York City, to hold and administer as an endowment for research most of the United States patent rights to the process. The corporation besides supervising construction and development of this particular process, also serves in general as a clearing house for information and as an intermediary and trustee between inventors, the industries and the public.

The Process.—Technically the process consists in securing a uniform, copious but non-disruptive discharge of electricity from small electrode surfaces of one polarity into a stream of cloudy gas. The fine solid or liquid particles composing the dust, fume or smoke are immediately attracted to, and deposited on, large electrode surfaces of opposite polarity, the particles having become charged from the condensation on their surfaces of a portion of the electricity passing between the electrodes. The process is diagrammatically illustrated in fig. 1. Alternating current from service lines is stepped up in a transformer to a high voltage and then converted to a direct, or rather a pulsating unidirectional, current by a commutator or " rectifier " driven by a synchronous motor. One side of the line is grounded and connected to a pipe or " treater " carrying the fume-laden gases. This pipe serves as the collecting electrode. The other side of the line terminates in a wire serving as the discharge electrode, which is hung axially within the pipe. Voltage is regulated to secure as strong a glow as corona discharge from the wire electrode as possible without passing over into a disruptive discharge, *i.e.*, a spark or arc. This adjustment is easier when the discharge electrode is the negative, though either polarity may be used.

The gas treaters now in general use consist either of a multiplicity of pipes similar to that in the figure, or of plates hung vertically in a flue, the wires being stretched parallel between them. The materials of construction, including the collecting electrodes, vary from iron and lead to reinforced concrete and vitrified earthenware, depending on the composition and temperature of the gas stream to be treated.

Factors in Design.—Most plants are designed with electrodes of opposite sign 2 to 6 in. apart and operating at 30,000 to 80,000 volts. The size of installation is determined primarily by the volume of gas to be treated and the percentage of suspended matter to be removed, the amount, kind and size of particle of the latter being of minor importance. If P is the ratio of outgoing to incoming suspended matter, t the average time in seconds that the gas remains between the electrodes, and K, a constant depending upon the apparatus, voltage, temperature and kind of raw gas, then $P = K^t$. In most commercial practice t averages about 2 seconds and K varies from 0·2 to 0·7, the gases travelling from 10 to 40 ft. through the electric field of linear rates of 3 to 15 ft. per second. Removal of 90% to 99% of the suspended matter is usually aimed at, and the energy required is 1 to 3 kw. hours per 100,000 cu. ft. of gas treated.

Industrial Uses.—The earliest applications of the process were to the smelting and sulphuric acid industries. Installations in such plants in 1926 still outnumbered those in all other industries, and amounted to several hundred scattered throughout the world. Equipments at cement mills were fewer in number but handled a large volume of gas and a large tonnage of precipitate. Other important applications are to the detarring of coke-oven gases, the cleaning of producer and iron blast-furnace gas, the cleaning of ventilating air in crushing, grinding and polishing mills (especially where cost of heating in winter makes recirculation of air important), the recovery of sludge acid fumes in petroleum refineries, the recovery of dust from brown-coal dryers, and the removal of ash from the stack gases of large power-plants burning powdered coal. On a laboratory scale the process has also been applied successfully to sanitary atmospheric analysis and to gas masks, including the removal of bacteria from air, but suitable standard equipment for these small-scale uses is apparently not yet on the market.

The process in itself precipitates only suspended solid or liquid particles and makes no separation between gases. It has, however, an important indirect application to problems in this latter field, involving the recollecting of solid or liquid absorbents which have been dusted or sprayed into gas mixtures. The electrical demulsification or dehydration of crude petroleum and transformer oils, the separation of fine suspensions, such as clays in pure water and other poorly conducting liquids (electrical osmose or electrophoresis) and electrostatic concentration of ores, though dependent on some of the same natural phenomena, differ to such an extent, in principle and equipment required, from the process here described as to preclude their discussion under this heading.

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FUNDAMENTALISM AND MODERNISM.—Fundamentalism is the name given to a religious movement which, appearing independently in different denominations in the United States during the period after the World War, steadily gathered momentum until in 1925 it became a subject of national, as distinct from denominational, interest through the trial and conviction of John T. Scopes, teacher of science in Rhea High School, Dayton, Tenn., on a charge of violating the Tennessee law prohibiting the teaching of evolution in the state public schools.

The trial began on July 10 1925, and was concluded on July 21 1925, by the conviction of the defendant and his sentence to pay a fine of $100. The immediate issue was as to whether the defendant had or had not violated the provisions of the state law as to the subjects to be taught in public schools, but the wider issue was as to the extent to which the state, in its control of public education, may determine the nature of the religious instruction given to the students in its schools. The trial itself was the culmination of a movement which had been going on for some years. Alarmed by the steady growth of liberal tendencies, the conservatives of the different churches had banded themselves together to stay what seemed to them the rising tide of negation. The form of the movement differed in the different communions according to the particular issue which was in question at the time, but common to all the Fundamentalist groups was, first, the acceptance of a view of the supernatural which insists that God manifests His presence in nature and history through exceptional and extraordinary activities, transcending the laws of nature; and secondly, the determination to use this conception of religion as a test to limit the freedom of teaching hitherto enjoyed by the ministers of the denomination. In all this there is nothing new. In every age conservatives and liberals have carried on their conflict over some form of this issue. What is new is the wide-spread character of the movement, the missionary enthusiasm which has been brought to it by its advocates and the consciousness on their part of interests transcending denominational lines and calling for a new alignment, with the Fundamentalists of all denominations on one side and the liberals on the other.

The Presbyterian Church.—In the Presbyterian Church the controversy centred about the case of Dr. Harry Emerson Fosdick, a Baptist clergyman who had been invited to act as stated supply for the First Presbyterian Church in New York City. Dr. Fosdick, who is also a professor in Union Theological Seminary in that city and a man of moderate liberal tendencies, made it his condition of accepting the call that he should be allowed to retain his membership in the Baptist Church. A sermon preached in May 1922, entitled "Shall the Fundamentalists Win?" was the occasion of an attack upon his theology by conservative Presbyterians, which led the General Assembly of 1923 to direct the Presbytery of New York to take such action as would require the preaching in the First Presbyterian Church to conform with the Confession of Faith. The Presbytery, after full conference with Dr. Fosdick and the Church, reported that such was now the case, whereupon the Assembly of 1924, without passing any judgment on Dr. Fosdick's theological views, expressed the opinion that if he were to remain longer in the pulpit of the Church, he should accept the standards of doctrine required of other ministers. On this issue Dr. Fosdick withdrew, declaring that "Creedal subscription to ancient confessions of faith is a practice dangerous to the welfare of the Church and to the integrity of the individual conscience."

In connection with this controversy the General Assembly in 1923 reasserted the so-called "Five Points," a declaration originally made in 1910, setting forth as essential doctrines of the Christian faith, the Virgin Birth, the physical Resurrection, the inerrancy of Scripture, the substitutionary Atonement and belief in the Miracles. In reliance upon this statement the judicial commission of the Assembly, in May 1925, declared that the Presbytery of New York had erred in licensing a student who refused to affirm the Virgin Birth. The liberals attacked this procedure as an unconstitutional limitation of the liberty of interpretation accorded to every minister by the terms of subscription, and to the Presbyteries by the historic precedents of the Church. (*Cf.* Auburn Affirmation of May 1924, signed by 1,283 members.)

The Baptist Church.—In the Baptist Church the controversy has taken the form of an effort on the part of the conservatives to secure the adoption by the Annual Conference of a creed which should be used as a test of ministerial fellowship. This attempt failed at repeated conferences, but the conservatives, defeated at this point, have sought to secure their ends by instructions given to their Board of Home Missions as to the conditions to be observed in the administration of their funds. One large bequest was actually accepted by the board on conditions which seemed to some of its critics unduly to limit its freedom. A parallel effort to secure control over the teaching of the seminaries has thus far failed of success.

Not the least important feature in the Fundamentalist movement is its bearing upon foreign missions. In general the policy of the different missionary boards has been to put the responsibility for determining the doctrinal qualifications of candidates upon the home church; and in the work on the foreign field conservatives and liberals have co-operated successfully in various union enterprises. Fundamentalists have challenged this arrangement and attacked the theology of liberal missionaries. On the whole this attack has been unsuccessful, and the unity won on the field has thus far been maintained; but the battle is by no means over or the danger at an end. A case in point is the action of the General Convention of the Disciples at Oklahoma City, Okla., on Oct. 6 1925, in reaffirming the principle of close communion which has been departed from by some of their missionaries in the interest of wider co-operation.

The Episcopal Church.—In the Episcopal Church the controversy has centred about the literal observance of the creeds. On Oct. 5 1923 Bishop Lawrence of Massachusetts made an address (afterwards published in pamphlet form) entitled *Fifty Years*, in which he pleaded for a liberal interpretation of the creeds. On Nov. 14 1923 at Dallas, Tex., the Bishops of the Episcopal Church met this challenge by issuing a Pastoral insisting upon literal acceptance of the creeds and questioning the good faith of those ministers who gave their historic statements a symbolic interpretation. This Pastoral was attacked by the liberals of the Church who were organised in a body known as the Modern Churchman's Union. Sermons were preached by leading liberals, like Dr. Leighton Parks of St. Bartholomew's Church of New York, and Dr. William Russell Bowie of Grace Church of the same city, and manifestoes were issued by theologians like the volume of essays entitled *Creeds and Loyalty* by seven members of the faculty of the Episcopal Theological School of Cambridge, Mass. (1924). As a result of this agitation a trial for heresy begun against the Rev. Lee. W. Heaton for denying the Virgin Birth was abandoned, and for the moment a truce has been declared.

The Bible Institutes.—One of the main sources of popular conservative propaganda is the so-called Bible institutes, of which the most important are the Moody Bible Institute in Chicago and the Bible Institute of Los Angeles. These schools, interdenominational in character, recruiting their scholars from young people without college, and many of them without high school education, insist upon the inerrancy of the Scripture, which they interpret commonly in the pre-millennarian sense. They are carrying on an extensive propaganda partly through periodicals of interdenominational character and partly through conventions (the so-called prophetic conferences), which bring together large numbers of people. While not primarily designed as theological seminaries, many of their pupils are finding their way into the churches and are reinforcing the conservative elements which are already there.

It is against the background of these influences that one must interpret the Tennessee trial. Under the leadership of William

Jennings Bryan, the conservatives had been carrying on an active campaign throughout the country, attacking the views of liberal Christians as fundamentally irreligious and unchristian and insisting not only upon rigid measures on the part of the individual churches, but also upon such a stiffening of the laws of the states as to prevent what they regard as the insidious propaganda of modernism in the schools. The storm-centre of the debate was the doctrine of evolution which, as interpreted by Mr. Bryan, involves a denial of the Biblical doctrine of creation and the surrender on the part of the teacher to an all-devouring materialism. In view of the fact that similar legislation has either been passed or attempted in other states, it is not likely that a final decision will be reached upon this larger issue until the U.S. Supreme Court has passed judgment upon the matter. (W. A. B.)

FUNGUS: *see* MYCOLOGY.

FURNACE: *see* ELECTRO-METALLURGY.

FURNESS, HORACE HOWARD (1833–1912), American Shakespearian scholar (*see* 11.362c), died at Wallingford, Pa., Aug. 13 1912. His Variorum edition of *Cymbeline* was ready for the printer and appeared in 1913.

FUR TRADE (*see* 11.346).—The most important development in this field in the period 1910–26 has been the rise of fur farming, made possible through the domestication of the silver fox and other fur-bearing animals. This industry had its inception in Prince Edward Island, Canada, those chiefly responsible for its successful development there being R. J. Oulton, Charles Dalton, J. S. Gordon, Robert Tuplin and B. J. and Silas Rayner. As the silver fox pelt is the most valuable skin produced in North America, these men were able to accumulate great wealth for themselves as well as opening the door to similar opportunities for others. Domesticated silver foxes sold at first for as high as $35,000 a pair. Prices have since fallen, with the stabilisation of the industry, to less than $1,000.

Development of the Industry—The Governments of Canada and of the United States have taken cognisance of the new industry by the establishment of experimental ranches and information bureaux. Yearly exhibitions also have been instituted for the comparison and judging of the animals. The industry has since spread widely, ranches having been established in Great Britain, Norway, Sweden, Germany, France and other countries. The domestication of the silver fox has encouraged similar experiments with other animals and these have led to the successful rearing of minks, red foxes, blue foxes, raccoons, karakul sheep (persian lambs), martens and fishers. Muskrats and beavers have also been raised in confinement for the sake of their pelts and require a much larger territory in which natural conditions are maintained and enemies excluded. Under such conditions these animals multiply very rapidly.

Markets and Production.—Prior to the World War London and Leipzig were the two largest fur markets in the world, more than half the total supply being sold at these places. Most of the dressing and dyeing was done in Germany. It is estimated that in 1910 North America and Europe each produced furs valued at $24,000,000, Asia $26,000,000, Australia $6,000,000, South America $2,000,000, and Africa and Oceania $2,000,000. The annual production has, since that time, more than doubled in value, Canada producing the greatest amount and exporting in 1925 pelts valued at $17,119,981 (about $22,000,000 in 1919–20). This increase is to be accounted for in large part by the rise in value of furs, occasioned in the first instance by the scarcity of pelts following the War. Muskrat pelts, the staple fur of North America, which had formerly been sold for from 10 to 30 cents apiece, frequently brought a price of $5.00. The interruption in trade caused by the War resulted also in the rise of a number of new fur markets, notably in St. Louis, New York and Montreal. The combined offerings of muskrat pelts at these three cities in the years 1920–3 amounted on the average to 3,366,516 pelts. The combined offerings of all auctions for these skins held in North America for 1924–5 averaged 4,594,446 pelts per year.

Manufacture in America.—Before 1914 approximately 65% of the furs secured in North America were exported abroad for manufacture and sale. The difficulties of export during the War, however, resulted in a large increase in fur manufacturing in America and particularly in the United States, where it is largely concentrated in New York City. The total imports into the United States from Canada and other countries in 1924 were valued at $87,705,582. About 20,000 concerns in the United States were handling furs in 1924. Of these, New York City alone had 2,000 wholesale manufacturers, who disposed of 80% of the manufactured furs sold in the wholesale trade. The fur-manufacturing establishments in the United States increased from 1,300 in 1914, employing 9,000 people, to 1,700 in 1923, with 19,000 employees. The wages paid increased from $6,000,000 in 1914 to $28,000,000 in 1923. The estimated retail value of furs and fur trimmings sold annually in the United States is $500,000,000.

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(R. G. H.*)

FURTWÄNGLER, WILHELM (1886–), German conductor, was born in Berlin Jan. 25 1886, the son of the famous archaeologist and university professor, Adolf Furtwängler (1853–1907). He received his musical education in Munich from Beer-Walbrun, Rheinberger and Schillings, and then acted as conductor at Zürich. Later he occupied similar positions at Strasbourg, Lübeck, Mannheim, Vienna and Frankfort-on-Main. In 1922, on the death of Arthur Nikisch, he became director of the Berlin Philharmonic Orchestra and of the Gewandhaus concerts at Leipzig. Ranked among the finest conductors in Germany, Furtwängler also gained an international reputation, which was considerably enhanced by his annual concerts in New York.

FUSE: *see* AMMUNITION.

FUTURISM: *see* PAINTING.

GAELIC LITERATURE: *see* IRISH LITERATURE, GAELIC; SCOTTISH-GAELIC LITERATURE.

GAIRDNER, JAMES (1828–1912), British historian (*see* 11.390), died at Pinner, Middlesex, Nov. 4 1912. A third volume of his *Lollardy and the Reformation in England* appeared in 1911.

GALATZ or GALATI, Rumania (*see* 11.396), saw considerable industrial development before the World War. The population, 73,512 in 1914, was estimated in 1919 at 60,000. The export of grain and timber has revived, and there are grain- and flour-mills in the town. The port has been improved, and vessels of 5,000 tons can reach it since dredging on the Danube has been resumed; there is now from 20½ to 23 ft. at low water. The docks accommodate 10 steamers and 20 barges. The communications by road and rail, however, are unsatisfactory, and are liable to be interrupted altogether in winter. Galatz is the seat of the Rumanian naval school. The Rumanian naval base is at Sulina. (*See* DANUBE.)

GALE, ZONA (1874–), American author, was born at Portage, Wis., Aug. 26 1874. Having graduated from the University of Wisconsin, she engaged in newspaper work in Milwaukee, and in 1901 joined the staff of *The World* (New York). After 1904 she devoted herself to fiction, verse and plays, producing among other works, *The Loves of Pelleas and Ettarre* (1907); *Friendship Village Stories* (5 vol., 1908–19); *Birth* (1918); *Miss Lulu Bett* (1920); *The Secret Way*, verse (1921); and *Faint Perfume* (1923). She was awarded a Pulitzer Prize for her dramatisation of *Miss Lulu Bett*, produced in New York, 1920.

GALICIA, EAST (*see* GALICIA, 11.401), a district assigned to Poland in 1923. Its oil-fields are of great value. The province of Galicia, finally assigned to Austria in 1815, fell into two well-defined ethnographical parts. East of Przemysl, some 72% of the population was Ruthenian (Ukrainian), the minority being mainly composed of Poles and Jews, who are extraordinarily numerous in the towns. It was usually contended by the Poles of Galicia that Ruthenes do not exist; and the Austrian Govt. long accepted this theory in order to ensure the loyalty of the Poles. The Russian Govt. also supported this view in order to discourage the nationalist movement in the Ukraine; and the Ruthenes themselves were divided—one party feeling itself Russian, the other Ruthenian-Ukrainian. About 1910, when the Neo-Slav movement partly reconciled the Poles with the Russians, thus shaking their loyalty to Austria, Austria began to encourage the particularist Ruthenian movement as a counter-blast to Panslavonic ideas.

During the War East Galicia was the scene of heavy and continuous fighting. During 1916–7, in view of the importance of Poland for the Central Powers, it was proposed to unite all Galicia with Russian Poland in a Kingdom of Poland more or less closely attached to Austria-Hungary. But after the collapse of Russia, the Central Powers concluded a peace with the Ukraine at Brest-Litovsk (Feb. 9 1918) and Austria-Hungary promised to erect East Galicia, with the Bukovina, into a separate Austrian territory (Kronland).

The Ruthenes Claim Independence.—While the claims of the Poles to autonomy were universally recognised, those of the Ruthenes were forgotten. In Oct. 1918 the Austrian Govt. having promised to introduce a federal system, the Polish leaders claimed for themselves all Galicia. The Ruthenes replied that they would rather "fight and die than let themselves be annexed by Poland." They summoned a conference of representatives of all Ruthenes of Austria-Hungary to meet at Lemberg (Lvov, Lwow, Léopol) on Oct. 18. The Socialist party pressed for immediate union with the Ukraine; but the bourgeois parties formed a National Council which determined to form an independent state, inviting the Polish and Jewish minorities to co-operate. On Nov. 1 the Council occupied the government buildings in Lemberg with the help of Ruthenian regiments, and assumed the government of East Galicia within its ethnographical limits. The Poles refused their co-operation, and fighting began between Poles and Ruthenes. The Austrian Govt. recognised the Ruthenian Govt. which was now formed under Dr. Eugen Petrushiewicz, and handed him over a share of the old Imperial assets; but the Poles immediately invaded East Galicia, occupying Lemberg on Nov. 5. The Ruthenian Govt. retired to Vienna, and its activities now became very platonic, being chiefly concerned with propaganda, in which it developed prodigious activity.

Meanwhile on Jan. 3 1919 the Hetman Petlura, who at that time had established his authority in the Ukraine, proclaimed the union of Russian Ukraine and West Ukraine (East Galicia) in a republic. The Ruthenian troops joined the Ukrainian Army with the consent of the East Galician Govt., which recognised Petlura's authority on Jan. 20. Fighting continued throughout 1919, during which time Polish troops occupied East Galicia, in defiance of the efforts of the Supreme Council to arrange a truce and settle the problem. On May 8 the Supreme Council assigned West Galicia to Poland; but on June 24 it decided to give East Galicia the right of self-determination, although authorising Poland to proceed with her military occupation of the district. The East Galician Govt. revoked its recognition of Ukrainian authority on Aug. 28 1919, and continued to assert the legality of its own position and the right of East Galicia to self-determination.

In Dec. 1919 the Allied and Associated Powers announced that East Galicia would be granted autonomy for 25 years under a Polish protectorate, after which time the League of Nations would decide on its future. This remarkable arrangement evoked vehement protests from the Ruthenes. It also caused a crisis in Poland, which desired unconditional possession of the district, and resulted in the fall of Paderewski. Petrushiewicz's Govt. was, however, powerless, and the numerous Ukrainian governments which existed simultaneously or consecutively were fully occupied in war with each other, the Poles, the Bolsheviks or the White Russians. In April 1920 Petlura abandoned his claim to East Galicia in return for recognition by Poland; Petlura's and the Polish armies captured Kiev from the Bolsheviks on May 8; but by Nov. the Bolsheviks had driven Petlura out of the Ukraine and established themselves there firmly. In Galicia, however, the Poles held their own, and the Treaties of Riga, Oct. 12 1920 and March 18 1921, re-established the old frontier of Galicia with the Ukraine.

Petrushiewicz's Govt. was in a disastrous position. It was ignored by everyone; its funds were running out; its choice of allies lay between its hereditary racial enemies, the Poles, and Bolshevik Ukraine. The Poles meanwhile treated the district as their own; held elections to the Polish Diet in it in the autumn of 1922—although practically the whole Ukrainian population abstained from voting—and even pressed Ruthenes into the Polish Army. On March 14 1923 the Conference of Ambassadors recognised Poland's *de facto* eastern, northern and southeastern frontier.

The Polish Régime.—Political activity in East Galicia did not lose its customary complexity after this date. Many political leaders, including Petrushiewicz, came to terms with the Soviet authorities. The great bulk of these unfortunates were unable to return to their homes. A small minority accepted the situation, and attempted to combine with the other racial minorities in Poland. A general law passed by the Polish Diet on Sept. 26 1922, which established local government bodies to deal with purely local affairs, contained the proviso that in the East Galician provinces these bodies should consist of two chambers, of which one should be Ruthenian. This "autonomy," as it was described, was to be introduced within two years; the language rights of minorities in Poland were to be respected, and colonisation forbidden. But in fact, although a language law was passed on July 10 1924, providing that Ukrainian, White Russian or Lithuanian should be the language of administration,

law-courts and schools in districts where the majority of the population speaks one of these languages, and Count Skrzynski showed a not illiberal attitude towards the minorities generally, Polish policy in general was not hampered by an excess of scruples towards the Ruthenes. (C. A. M.)

GALLI-CURCI, AMELITA (1889–), Italo-American singer, was born at Milan, Italy, Nov. 18 1889. As a vocalist she was self-taught. Gifted with a singularly pure soprano voice, she made her début as Gilda in *Rigoletto* at the Constanzi Theatre, Rome, in 1909, and subsequently visited Spain and South America. She made her first appearance in the United States at the Auditorium, Chicago, Nov. 18 1916, where she remained four seasons. She was engaged by the Metropolitan Opera Company, New York, in 1921 and from that date constantly appeared in grand opera and concerts. Among her chief rôles were Butterfly, Juliette, Lucia, Mimi, Rosine, Violetta and Manon Lescaut. She made a concert tour through Great Britain in 1924–5.

GALLIÉNI, JOSEPH SIMON (1849–1916), French general and statesman (*see* 11.418), reached the age limit for retirement on April 24 1914, but was retained on the active list without duty, and on July 31 1914 was officially confirmed as the eventual successor of the commander-in-chief. On Aug. 26 he was appointed Governor of Paris and general commanding the armies of Paris. He took energetic steps for the defence of the capital, and on Sept. 3 issued the following order: " To the Army of Paris and the Population of Paris: The Members of the Government of the Republic have left Paris in order to give a new impulse to national defence. I have been ordered to defend Paris against the invader. This order I shall fulfil to the end."

After Sept. 2 the armed forces in Paris had been placed under the orders of Joffre, who could thus in case of need use the garrison for his operations; consequently, on Sept. 3 Galliéni wrote to Joffre asking for instructions. From information received during the day, however, Galliéni concluded that the German forces marching on Paris were inclined southeast, thus offering him an exposed flank. Joffre's answer to Galliéni's messages arrived on the 4th a little before 3 P.M. and contemplated an attack south of the Marne. Galliéni held that to gain the fullest possible advantage from the situation by enveloping Von Kluck and breaking his lines of communication the attack ought to be made on the line of the Ourcq north of the Marne, and made at once. Galliéni spoke to Joffre on the telephone on the 4th at 5 P.M. and obtained authority to move on the 5th north of the Marne for the attack on the 6th. The VI. Army under Maunoury was placed under Galliéni's command. Maunoury was given all the troops available and ordered to move on the 5th to the heights of the Ourcq, to attack on the 6th. But, while executing this movement, Maunoury was himself attacked on the 5th by the German IV. Reserve Corps, which covered Von Kluck. The two armies were almost equal; six divisions against six. But during the night of the 7th–8th Galliéni sent up the 7th division in taxis from Paris to Nanteuil-le-Haudouin. The Germans retreated and the French armies moved out of the zone over which Galliéni held command.

On Oct. 29 1915 Galliéni became Minister of War in Briand's Cabinet. His period of office was made notable by endeavours to create unity of command and by changes in the position of Gen. Joffre. He resigned for reasons of ill-health on March 16 1916 and died at Versailles, after undergoing two operations, on May 27. His body was given a state funeral, and lay for a time under the dome of the Invalides. He was buried at St. Raphael. On April 21 1921 the dignity of marshal of France was conferred on him posthumously.

GALLIPOLI: *see* DARDANELLES CAMPAIGN.

GALSWORTHY, JOHN (1867–), British playwright and novelist, was born at Coombe, Surrey, Aug. 14 1867. Educated at Harrow and New College, Oxford, he was called to the bar in 1890, but devoted himself to literature. His first novel, *Jocelyn*, appeared in 1898, but he attracted wider attention in 1904 with *The Island Pharisees*, and *The Man of Property* (1906). The latter was the first novel of the sequence to be known later as *The Forsyte Saga*, the others being *The Indian Summer of a Forsyte* (1918); *In Chancery* (1920); *Awakening* (1920); and *To Let* (1921). As a detailed picture of upper middle-class society during the later Victorian and Edwardian eras, the sequence is a remarkable achievement. That picture was supplemented by the greater number of Galsworthy's other novels, of which it is the characteristic social setting, among them *The Country House* (1907); *Fraternity* (1909); *The Patrician* (1911); *The Freelands* (1915); *The White Monkey* (1924). Galsworthy also wrote *The Dark Flower*, 1913, and many short stories, of varying merit, but often worthy of his best work, collected as *Caravan* (1925), essays on current social and moral questions, marked by liberal and humane feeling, and a commentary on the extravagances of war time, *The Burning Spear*.

As a dramatist also, Galsworthy enjoyed a deserved fame. His plays, for the most part, are based on ethical or social problems and are marked by a scrupulously judicial fairness in displaying the opposing points of view typified by his characters. Some have partaken too much of this scrupulousness to be counted as having an essentially dramatic quality, but at their best Galsworthy's plays reflect not only his finest powers as a literary craftsman—for their diction is natural and serious without becoming loose or facile—but also a keen sense of dramatic values. Among them should be noted *The Silver Box* (1906); *Joy* (1907); *Strife* (1909); *Justice* (1910); *The Pigeon* (1912); *The Eldest Son* (1912); *The Fugitive* (1913); *The Skin Game* (1920); *Loyalties* (1922); *The Forest* (1924).

See S. Kaye-Smith, *John Galsworthy* (1916); André Chevrillon, *Trois Études Anglaises* (1924).

GALTON, SIR FRANCIS (1822–1911), British anthropologist (*see* 11.427), died at Haslemere Jan. 17 1911.

GALVANAUSKAS, ERNEST (1882–), Lithuanian statesman, was born Nov. 7 1882 at Vabalninkai. He studied as a mining engineer at Leningrad (St. Petersburg) and Liége, and his activities in the Lithuanian national movement date from his student days. In 1906 he was imprisoned for his attempts to free the country from the Russian yoke. He escaped to Belgium in 1908, where he continued in touch with the Lithuanian liberation movement. The outbreak of the World War found him in Belgrade, and after the enemy occupation of that city, Galvanauskas left with the Serbian Army and shared all the privations of the retreat. He subsequently proceeded to France and volunteered for military service. On the recovery of Lithuanian independence in 1918, Galvanauskas served as a member of the Lithuanian Delegation to the Versailles Peace Conference. He was several times Prime Minister and Minister for Foreign Affairs, and also held the portfolios of Finance and Communications. He became president of the Lithuanian Delegation to the League of Nations and in Aug. 1924 was appointed Lithuania's first envoy extraordinary and minister plenipotentiary to London and simultaneously envoy extraordinary and minister plenipotentiary to The Hague. In Nov. 1925, for services to the Serbian cause in the World War, he received from the King of Yugoslavia, the high military order " Albarrakom Spozeincom."

GAMBIA (*see* 11.437a), a British colony and protectorate in West Africa. Its population was 210,530 in 1921, an increase of 60,000 in 10 years. Bathurst, the capital, had 9,227 inhabitants, of whom Europeans numbered 265 (130 British). Hemmed in landward by French territories, which make but little use of its magnificent waterway, Gambia depends upon its own resources.

The cultivation of the ground nut, entirely a native industry, is the chief occupation of the people. Up to 1915 the nuts (the oil from which is a main ingredient of margarine) went mostly to France, which in 1914 took 78% of the crop. Changes caused by the World War led to over 91% of the export going to England in 1919. France subsequently in part recovered the market. In 1924 England took 54% and France 33% of the crop, which represented some 95% of the total exports. The economic crisis caused by the War was safely weathered and 1920 was a year of trade activity. Imports are mostly cotton piece goods, rice and sugar and, from Sierra Leone, kola nuts. Great Britain's share of the imports averaged over 50% in the years 1914–24; France, Ger-

many (since 1920) and the United States supply most of the other imports. In 1922 it became necessary to demonetise the French five franc piece, the favourite coin of the natives, and this involved the administration in a loss of £187,000.

Taking 1914 and 1924 as normal years the revenue rose from £86,000 to £208,000, the expenditure from £120,000 to £203,000. The tonnage of shipping entered and cleared was 1,100,000 in 1924 compared with 571,000 in 1914. British shipping predominated, but from 1921 Germany became a keen competitor and in 1924 was second, with 158,000 tons as against 643,000 British, 93,000 American and 92,000 French. Since 1901 Gambia has enjoyed political tranquillity, and education and Christianity made progress, if slowly. Most of the natives are Moslems. The Gambia Co. of the West African Frontier Force served with credit in the campaigns in the Cameroons and German East Africa. Bathurst was the first place visited by the Prince of Wales in his 1925 tour.

BIBLIOGRAPHY.—H. F. Reeve, *The Gambia* (1912), an excellent monograph by a retired official; Sir G. Denton, "Twenty-three Years in Lagos and the Gambia," *Jour. African Society*, vol. 11 (1912); *The Gambia* (1920), a British Foreign Office handbook, and the annual reports issued by the Colonial Office, London.

(F. R. C.)

GAME PRESERVES: *see* NATIONAL PARKS.

GANDHI, MOHANDAS KARAMCHAND (1869–), Hindu nationalist leader, was born at Porbandar (Kathiawar, India) of a Bania family with official traditions. At the age of 19 he went to London, studied for a time at University College, and was called to the bar by the Inner Temple. Soon after starting practice in the Bombay High Court he was called, in 1893, on professional business, to South Africa, where he threw himself at once into a long and bitter struggle for the liberties of the Indian settlers in that country. He became leader of the opposition to a variety of measures taken by the local authorities to discourage Asiatic immigration and to limit the rights of citizenship available to Asiatics already resident.

It was in the course of this movement that his conception of resistance without violence developed; he relinquished his large income as an advocate, and founded a colony for his compatriots on Tolstoian lines near Durban. As the price he paid for his championship of the Indians' grievances, besides being more than once arrested and imprisoned he suffered frequent indignities at the hands of angry mobs. This neither checked his energies nor deterred him from rendering service of marked loyalty to the Government on three occasions; for he raised and commanded a Red Cross unit in the Boer War, he organised a plague hospital when the epidemic broke out in Johannesburg, and he led a stretcher-bearer party in the suppression of the Natal revolt of 1908. At last in 1914 a commission of inquiry into the Indian discontent recommended the removal of several of the worst injustices against which Gandhi had striven; and he felt justified in closing down his activities in South Africa and returning to India. There a wider field of political protest awaited him; and he was soon at work organising, in connection with the home-rule movement, resistance to the British Government by "soul force" and nonco-operation.

In Jan. 1919 there were published two bills (subsequently known as the Rowlatt Acts) giving the Government emergency powers for dealing with revolutionary crimes and conspiracies; these had followed the proposals of a responsible commission which had investigated the subject, and the powers they conferred were safeguarded by elaborate protections against abuse. But Gandhi declared them to be an insult, intended to discredit the Indian people on the eve of ostensible political reforms, and he denounced the bills as instruments of oppression. He instituted a campaign of Satyagraha (literally, insistance on truth) or nonviolent disobedience to unjust laws in the first instance, enlarging if necessary into disobedience to any law and complete nonco-operation with the Government. Spreading rapidly, the agitation burst into violence in the Punjab and elsewhere, with results which shocked Gandhi into a temporary suspension of his civil disobedience. Later in the year, he formed common cause with the Indian Moslems of the Khilafat party, aggrieved by the terms of peace which Great Britain was offering to Turkey; and in July 1920 he proclaimed a general campaign of "non-violent nonco-operation." Its points were the boycott of Government service, of the new legislatures and of the courts of law; the surrender of all public offices; and the withdrawal of children from Government schools; to which were subsequently added boycott of foreign goods and the adoption of the spinning-wheel as an emblem of economic independence.

The agitation spread rapidly. The unlettered people who saw his earnestness and asceticism, and heard his simple eloquence, regarded him as a saint, and invested him with the title of Mahatma, or Great Soul. By 1921 Gandhi was at the zenith of his power. The national congress, sitting at Christmas of that year, delegated its full authority to him, and empowered him to appoint his own successor. But signs of change were now appearing. The unrest into which the non-co-operation movement had plunged the country culminated in a series of grave outrages, some of a racial character, of which the Moplah outbreak was the worst, and others directed against the agencies of law and order. Gandhi met them by personal penances, and by repeated postponements of the date on which he had foretold that India would be liberated from British rule. But he had generated forces which he had no power to recall or control, and plain people were getting alarmed at the consequences. Moslem support was being deflected from him by the encouragement which Lord Reading's Government was giving to Islamic sentiment over Turkey; and his closest adherents were embarrassed by his frequent changes of policy. Consequently, when he was arrested in March 1922 and put on trial for conspiring to spread disaffection with a view to overthrowing the government of the country, the *coup* evoked little excitement. Gandhi pleaded guilty, accepted responsibility for all that had happened and invited "the highest penalty that can be inflicted upon me for what in law is a deliberate crime and what appears to me to be the highest duty of a citizen."

Condemned to six years' simple imprisonment, he was released in Jan 1924 after an operation in gaol for appendicitis, and the rest of his sentence was unconditionally remitted. He came back to a party which had chosen other leaders, and was soon to reverse his policy of boycotting the administration. Esteemed and consulted though he continued to be by his old followers, he was no longer a power to sway the masses, and at the end of 1925 he announced his intentions of retiring from the world for a year. The nationalist movement was switched on to lines more familiar to western constitutional usage. To the Oriental mind Gandhi symbolised self-sacrifice and high idealism; western enthusiasts were not wanting who, like M. Romain Rolland, compared him with the Founder of Christianity; and the transparency of his character commanded the personal liking of even strong opponents. But he expected too much of human nature, he played recklessly with inflammable material, his economic nostrums were unpractical and he gave way to unexpected bursts of intolerance, as when he described the British government of India as "satanic." His endeavour to unite Hindus and Moslems lacked sincerity; but his enduring legacy to Indian politics will be the part he has taken in consolidating Hindu nationalism.

See Romain Rolland, *Mahatma Gandhi* (Paris, 1924); Eng. trans. by C. D. Groth, 1924.

(ME.)

GARDEN, MARY (1877–), American operatic singer, was born at Aberdeen, Scotland, Feb. 20 1877. At the age of six she was brought to the United States. In 1888 her family settled in Chicago, where her early musical training was received. She went to Paris in 1896, and studied under Trabadello, Chevallier and Fougère. She made her début at the Opéra Comique, Paris, April 3 1900 in the title rôle of *Louise*, taking the place, at a few days' notice, of Mlle. Riotou, who had fallen ill. Her first appearance in the United States was at New York in the title rôle of *Thais* Nov. 25 1907. In 1910 she became a member of the Chicago Grand Opera Company, assuming, among others, the parts of Salome, Thais, Mélisande and Louise. She was appointed general director of the Chicago Opera Association Jan 13 1921.

GARDEN CITY: *see* CITY PLANNING.

GARIBALDI, GIUSEPPE (1879–), Italian general, eldest son of Gen. Ricciotti Garibaldi and grandson of the Liberator, was born at Melbourne July 29 1879. He fought under his father in the Greco-Turkish War in 1897, and served in the South African War, subsequently leading an adventurous life in South and Central America and in the Balkans. On the outbreak of the World War he raised an Italian Legion of 14,000 men, which fought on the side of France in the Argonne. In 1915 Garibaldi returned to Italy, and on Italy's entry into the War he enlisted as a volunteer. He was soon afterwards commissioned, being given command of a battalion, and served with distinction in the IV. Army. He returned to the French front in March 1918 in command of the famous Brigata Alpi, and in June was promoted brigadier-general. He resigned his command in June 1919 and gave up his commission in Feb. 1920. He became opposed to the Fascist Govt. and in the autumn of 1924 was involved in an anti-Fascist agitation organised by the *Italia libera* Association. Deciding, however, that the movement had no chance of success, he departed for New York to devote himself to business.

GARLAND, HAMLIN (1860–), American writer, was born at West Salem, Wis., Sept 16 1860. He graduated from the Cedar Valley Seminary, Osage, Ia., at the age of 21. After teaching in Illinois and taking up a claim in South Dakota (then Dakota territory), he went to Boston in 1884 and engaged in literary work. The drudgery of farm life in the Middle West and the adventurous life of the mountains furnished him with abundant material for his realistic tales. His works, all based on the life of the northwest states, include *Main Travelled Roads* (1890–8); *Ulysses S. Grant: His Life and Character* (1898); *Boy Life on the Prairie* (1907); *The Long Trail* (1907); *Money Magic* (1907); *Cavanagh* (1909); *Other Main Travelled Roads* (1913); *The Tyranny of the Dark* (1905); *A Son of the Middle Border* (1917); *A Daughter of the Middle Border* (1921); *The Book of the American Indian* (1923). He was made a member of the American Academy of Arts and Letters in 1918.

GARSTIN, SIR WILLIAM EDMUND (1849–1925), British engineer, was born in India Jan. 29 1849. He was educated at Cheltenham and King's College, London, and in 1872 entered the Indian Public Works Department. In 1885 he was transferred to Egypt and in 1892 became inspector-general of irrigation and Under-secretary of State for Public Works. He proved himself an indefatigable worker, and by his efforts extensive areas were reclaimed in Egypt and the Sudan. Among his greatest works were the Asyut barrage and the Aswan reservoir. In addition, it was due to him that the White Nile was cleared of sudd, thus rendering possible free navigation between Khartoum and Gondokoro. He was created K.C.M.G. in 1897 and G.C.M.G. in 1902. In 1907 he was appointed British Govt. director of the Suez Canal Company. During the World War he devoted himself to Red Cross Work in England, being created G.B.E. in 1918. He died in London Jan. 8 1925.

GARVIN, JAMES LOUIS (1868–), British publicist, and editor-in-chief of the present volumes of *The Encyclopædia Britannica*, was born at Birkenhead, Ches., April 12 1868. A political writer from the age of 17, he joined *The Newcastle Chronicle*, where from 1891 to 1899 he was leader-writer, literary critic and aide-de-camp to its proprietor, the celebrated orator, Joseph Cowen. From the age of 26 for many years he was a chief contributor to *The Fortnightly Review*, and later to *The National Review* and *The Quarterly*. In 1899 he went to London, joining the staff of *The Daily Telegraph*, which gave him unusual scope. When Mr. Joseph Chamberlain started his historic campaign for tariff reform and Imperial unity, Mr. Garvin became nationally known as that statesman's most powerful lieutenant in the Press. Editor in 1905–6 of the weekly review *The Outlook*, he passed in 1908 to the editorial chair of *The Observer*. He raised that oldest of great Sunday journals to the highest position it had ever reached, and made it quoted throughout the world. Simultaneously from 1912 to 1915 his editorship gave new life to the evening *Pall Mall Gazette*. Steeped in German studies, his articles on foreign affairs, anticipating the World War from as early as 1901, had a deep public influence. In the War his articles were famous; but, equally the advocate of "absolute victory" and a wise peace, he was a searching and damaging critic of the Treaty of Versailles. To promote international reconciliation and co-operation he wrote in six weeks during the Paris conference (1919) his elaborate book *The Economic Foundations of Peace*. His only son, Gerard, who had justified high hopes, was killed at the age of 20 in the battle of the Somme, gallantly leading two companies of the South Lancashire Regiment in a night action. Behind all Mr. Garvin's politics there is a deep background of history and literature. In 1926 he was chosen chairman of the Empire Press Union.

GARY, ELBERT HENRY (1846–), American jurist and business man, was born near Wheaton, Ill., Oct. 8 1846. He attended Wheaton College and then, after studying law for a time in an office, he continued his legal studies at the University of Chicago, and took the degree of LL.B. in 1867. In 1871 he began practice in Chicago, where he became a noted corporation lawyer. In 1874 he organised the Gary-Wheaton Bank, of which he was president. He was elected judge of Du Page Co. in 1882 and again in 1886; was three times elected president of the town of Wheaton, and on its becoming a city in 1892 served as mayor for two terms. He was president of the Chicago Bar Association 1893–4. He early saw the advantages of combination in business and in 1891 was one of the organisers of the Consolidated Steel & Wire Co. In 1898, upon the organisation of the Federal Steel Corporation, with a capital stock of $200,000,000, he became its head and retired from legal practice. This company was merged in the United States Steel Corporation in 1901 with a capital stock exceeding $1,000,000,000 and he was elected chairman of the board of directors and of the finance committee. He continues to fill these offices after twenty-five years of remarkable development of the steel industry, and growth of the corporation. The town of Gary, Ind., laid out in 1906 as a model home for steel workmen, was named in his honour. In 1914 he was made chairman of the committee appointed by Mr. Mitchel, mayor of New York, to study the question of unemployment and its relief.

When America entered the World War in 1917, Gary was appointed chairman of the committee on steel of the council of national defence. Through his own connection with a business essential for munitions of war he exerted great influence in bringing about co-operation between the Government and industry. He was interested in a strengthening the friendship between America and Japan. In 1919 he was invited by President Wilson to attend the Industrial Conference in Washington, and took a prominent part in it as a firm upholder of the "open shop," of which he was always a strong advocate. He also opposed the drastic restriction of immigration effected by the "Quota" law. Miss Ida M. Tarbell's *Life of Judge Gary* concludes with these words: "He has made a lasting contribution to our difficult and often baffling problem of substituting, in American business, balance for instability, mutual interest for militarism, co-operation for defiance, frankness for secrecy, goodwill for distrust. No man in contemporary affairs has more honestly earned the high title of industrial statesman."

GARY, Ind., U.S.A. (*see* 11.480), had become in 1920 a city with 55,378 inhabitants of whom 5,299 were negroes and 16,460 foreign-born. In 1925, the 20th year of its existence, its population was 81,888 (school census); it had an area of 40·83 sq. m., 155·35 m. of improved and 178·45 m. of unimproved streets, 15 m. of boulevards, 45 m. of street railway track, a fleet of motor-buses and 94 m. of water-mains. The assessed valuation of taxable property was $131,006,810. There were over 1,000 retail stores. During the nation-wide strike of the steel workers in 1919, Gary was occupied by Federal troops from Oct. 7 until the strike was called off on Jan. 7 1920. A city-planning commission was appointed in 1919 and a comprehensive zoning ordinance was adopted in 1925. The "Gary Gateway and Railway Developement," which was adopted in 1924, provided for improved freight and passenger facilities and for beautifying a large section.

The public schools of Gary offer academic instruction 48 weeks in the year and physical training for 52 weeks of 6½ days each week. The first superintendent of schools, William A. Wirt, worked out a system with the following features: (1) an enriched curriculum; (2) a school plant adapted to such curriculum, with playground, gymnasium, swimming-pool, shops, laboratories and auditorium; and (3) organisation of classes on a "platoon" system, by which each feature of the plant is in use all the time, thus providing for the most economical utilisation of both plant and teaching force. This administrative scheme (3) became known among educators as the "Gary Plan" and was adopted, with more or less modification, in many cities.

See F. P. Bachman and R. Bowman, *The Gary Public Schools*, a Study by the General Education Board in eight parts (New York, 1918).

GAS IN WARFARE: *see* CHEMICAL WARFARE.

GAS, MANUFACTURE OF (*see* 11.483)—In the period 1910–25 the work done on gas retorts, coke ovens, gas generators, the complete gasification of coal, low temperature carbonisation and other operations in the gas industry has been considerable. During the War, gas-retort and coke-oven plants were worked to their full capacity; repairs and renewals were often unavoidably deferred or effected under difficult conditions. Gas and coke manufacturers have studied nearly every branch of the industry, and therefore many important changes have taken place.

Therms.—In Great Britain the provisions of the Gas Regulation Act of 1920 impose an obligation on the suppliers to charge for gas at a price based on the calorific value of the gas and specified the use of a recording calorimeter for determining this value. The calorific unit selected, the therm, is equal to 100,000 B.T.U.'s or British Thermal Units. Each gas undertaking formally declares the calorific value of the gas it proposes to supply; this is called its "declared calorific value" and is usually from 450 to 500 B.T.U.'s per cubic foot of gas.

The method of reading the gas meter remains the same, but the gas account is made out in therms at so much per therm. The number of therms is easily computed, for, suppose that the meter readings show that 10,800 cu. ft. of gas have been supplied and that 500 is the declared calorific value, then $10{,}800 \times 500 \div 100{,}000 = 54$ therms. At tenpence per therm, the gas bill would be £2·5·0.

The Act allows a gas undertaking to declare any calorific value it chooses. Therefore, subject to the requirements of gas purification, the company is free to adopt gas-making processes which will yield the maximum number of therms for every ton of coal treated. Clearly, it may be most profitable to supply a mixed gas, or to leave in the gas constituents which, like benzol, have a high thermal value; with gas and benzol at their present prices, benzol is usually left in the gas.

Calorimeters.—Among the recording calorimeters used by gas undertakings are the Simmance Total Heat, the Fairweather, and the Boys, in all of which the heat of combustion of known quantities of gas to be tested is imparted to a flow of water; the Thomas, in which the heat is imparted to air; and the Beasley, in which a differential thermometer filled with oil is employed. At large gasworks, several calorimeters are used, one in connection with the town's gas supply and the others with the separate gas-making plants.

Refractory Materials.—In Great Britain, siliceous clays containing 80 to 92% of silica and silica clays with more than 92% of silica have been used to an increasing extent in the gas industry and carborundum has also been tried. For the hotter parts of vertical retorts, siliceous and silica clays are commonly used and silica clays have been employed largely in constructing the coke-oven plant of the Consett Iron Co., Ltd., and other companies. In America the use of silica clays is the standard practice, not only for the hotter parts of vertical retorts and for the chamber ovens of the Koppers and other types for supplying gas, but also for horizontal retorts.

Silica bricks are more fragile, and have a coefficient of expansion greater than that of firebricks. Their greater heat conductivity facilitates rapid carbonisation; they sustain high temperatures and keep their shape in a satisfactory way. It is probable that the life of silica is greater than that of fireclay retorts and ovens. At St. Helens, eight Glover-West retorts, in which Friden silica was used, had an average working life of 1,694 days. Some of the American chamber ovens, constructed by Messrs. Koppers, have worked continuously for 15 years and are said not to have needed repairs (*see* ELECTRO-METALLURGY).

Carborundum is very refractory, hard and strong; its coefficient of expansion is very small; its heat conductivity is about five times that of fireclay. The future of this valuable refractory material will depend largely on its initial cost, and on its behaviour in an oxidising atmosphere at high temperatures. Williamson, Cliff, Ltd., of Stamford, have constructed a horizontal retort with a tile of carborundum extending along the central part of the retort sole. In the United States, carborundum has been used in both retort and gas generator construction.

The Retort Controversy.—The question of the best type of gas retort has been decided to a large extent by the selections made by numerous gas engineers when erecting new installations of retorts. There are installations of inclined retorts working satisfactorily and numerous installations of horizontal retorts provided with efficient charging and discharging machines, but the tendency is clearly in the direction of using continuously operated vertical retorts.

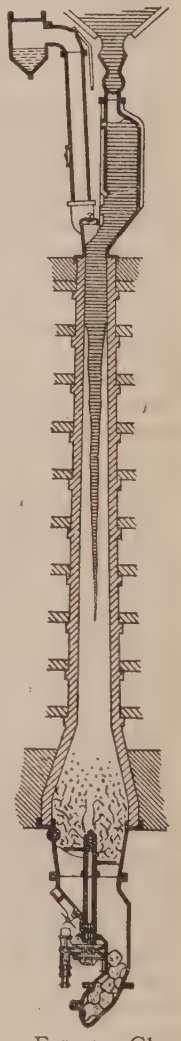


FIG. 1.—Glover-West Vertical Retort.

Horizontal Retorts.—The improvements made since 1910 in these retorts and their settings have been mainly in details. Some continuously operated horizontal retorts erected by West's Gas Improvement Co., Ltd., at Blackpool and Middleton, did not show any advantages over the Glover-West vertical retort, and were abandoned.

Vertical Retorts.—The chief improvements in vertical retorts have been in connection with those of the continuously operated type, in which coal is fed into the top of the retort and coke discharged from the bottom in a continuous and regular manner, the retort increasing in area downward to facilitate descent of the charge. The Glover-West and the Woodall-Duckham vertical retorts are the chief examples.

The Glover-West continuous vertical retort was originally developed on principles deduced from the practice with Scotch shale retorts. In its most approved form, the 40-in. new model, the cross-section is a flattened ellipse, the major axis of the mean section being 40 inches. Vertically, the retort enlarges regularly until the steaming chamber or "bell-bottom," clearly shown in fig. 1, is reached. This chamber opens up the core of coke and permits the exposure of a large surface of coke to the action of steam injected for making water gas. A powerful helix mounted on a vertical shaft, shown in fig. 1, supports the full weight of the coke; it is driven by worm gearing and, as it revolves, the coke is lowered continuously and regularly into the coke chamber, with a minimum of breakage. A step-grate producer generates gas which is led to combustion chambers arranged horizontally across the lines of retorts. The temperature distribution can be readily varied over the whole length, about 25 ft., of the retort, according to the carbonisation requirements of the coal treated. The Glover-West was successfully worked at the St. Helens gasworks in 1909. Since then, more than 135 gas undertakings in all parts of the world have adopted it; the new model has been installed recently at Oldbury, Nine Elms (Gas Light and Coke Co.), Dudley Leicester, Toronto and Malden, United States of America.

In the Woodall-Duckham continuous vertical retort the

continuous and regular discharge of the coke is effected by an extractor roller formed of a series of stars set on a horizontal shaft slightly in advance of each other, so as to form helical blades. The shaft is mounted in a gas-tight hopper, having one side curved so as not to prevent descent of the coke by gravitation while supporting the greater part of its weight.

Heating of the retort is effected by means of a regenerative gas producer. There are two very hot combustion chambers, one at the top of the retort and another lower down for ensuring that the charge is hot enough for obtaining good water gas by the action of steam admitted to the retort. The Woodall-Duckham retorts were installed at the Bournemouth gasworks, 1903–5; since then, numerous installations have been set up in all parts of the world. Among the most recent are those at Dunfermline, Glasgow, Edinburgh, Warrington and Bergen.

Coke Ovens.—The course of development in coke-oven practice has been chiefly in the utilisation of surplus gas for town supply, and in the installation of very large ovens of known types. In Great Britain parliamentary sanction was first given in 1910 for the supply of coke-oven gas. The Board of Trade returns for 1924 gave 16 towns taking gas from colliery and other coke-oven plants, Chesterfield, Sheffield, Leeds, Middlesborough and Pontypridd being included. Most coke ovens in Great Britain do not take a charge exceeding 8 tons, but ovens of the Piette type, of nearly 18 tons capacity, have been built at Stoke-on-Trent by the Semet-Solvay and Piette Co. of Sheffield. In the United States, it is common practice to use coke ovens of about 15 tons capacity.

Charging and Discharging.—The introduction during recent years of efficient charging and discharging apparatus has done much to enable horizontal retorts to compete with other types of retort. Many charging machines, *e.g.*, the Arrol-Foulis hydraulic charger and the de Brouwer, which projects the coal into the retort, are worked in association with a separate discharger. Drake's projector and pusher is a combination of a pusher made up of large, jointed sections, adapted to fold over a rotary, polygonal drum and a rapidly rotating wheel with vanes for projecting coal into the retort; the pusher discharges the retort and is withdrawn, and then the projector comes into operation. A further development is a type of apparatus called a discharging charger, of which Guest and Gibbons' discharging charger is an example; it is described in British Patent Specification No. 103143/1916. A sectional, jointed trough which, as it travels forward from its supporting wheel, discharges the coke, has mounted within it rollers supporting and guiding an endless drag-bar chain. During the withdrawal of the trough, this chain is driven independently and carries coal into the retort so as to fill it completely.

Steaming Practice.—Steam has been used, especially in the Dessau intermittent retorts, to increase the yield of ammonia. During recent years, however, the practice has been greatly extended, especially in working continuous vertical retorts, which are admirably adapted for steaming. The method admits of numerous easy variations; usually superheated steam under a pressure of 10 to 40 lb. per sq. in. through a $\frac{1}{8}$-in. nozzle. As long as the steaming is not excessive, it increases the yield of gas, ammonia (*q.v.*) and tar, and also the total thermal yield, although the calorific value per cu. ft. of gas is lowered.

Coal Blending.—The blending of different kinds of coal has long been practised, especially in America, to obtain suitable charges for use in coke ovens. Coal blending has recently attracted attention, especially in connection with smokeless fuel production. It has been proposed to mix several kinds of coal so as to obtain a blend having a predetermined resinic content or yielding a predetermined amount of volatile matter when heated. By this blending, it is sought to minimise the expansion of the coal when carbonised at low temperature, to facilitate discharge by preventing the coke from sticking to the retort, and to obtain a coke of good quality. Processes of this kind are described in British Patent Specifications Nos. 164104 and 186085 (Illingworth) and 187336 (Roberts).

Coal Cleaning.—The removal of clay, shale, pyrites and other impurities from coal by washing processes is important, especially in preparing charges for ovens used in making metallurgical coke, and in connection with smokeless fuel production to facilitate the making of a good quality fuel. The catalytic action of some of the inorganic constituents during carbonising processes, is also receiving attention.

Carburetted Water Gas.—During recent years, increasing quantities of water gas, especially carburetted water gas, have been made in Great Britain. In America, more than one-half of the gas manufactured is carburetted water gas; Philadelphia is supplied almost entirely with this gas.

In the self-clinkering, self-steaming generator of Humphreys and Glasgow, Ltd., an annular water jacket forms the lower part of the generator and supports an upper firebrick part; the jacket is high enough to prevent adhesion of clinkers to the generator wall. A steam reservoir communicates with the jacket by pipes, and serves as a source of steam supply for the generator. A mechanically operated grate, having an upper conical part, formed with air passages, and a lower cylindrical part, is mounted eccentrically on the base of a rotary water pan. A central conduit conducts the air blast or steam or carries away the down-run gas, when the run is downward, for the run may be upward or downward as desired. During its rotation, the grate crushes and expels the clinker and ash, the carbon content of which has been reduced as much as possible. The speed of the grate is regulated automatically; this regulation may be effected by electric means, the action of which is controlled by the temperature beneath the grate. When carburetted water gas is to be produced, the gas is led from the generator to a carburettor supplied with a spray of heavy oil and thence to a super-heater in which the cracked oil-vapour is fixed.

Many of these generators are working in association with batteries of horizontal or vertical retorts, the whole representing a very advanced development of gas-making plant. The coke

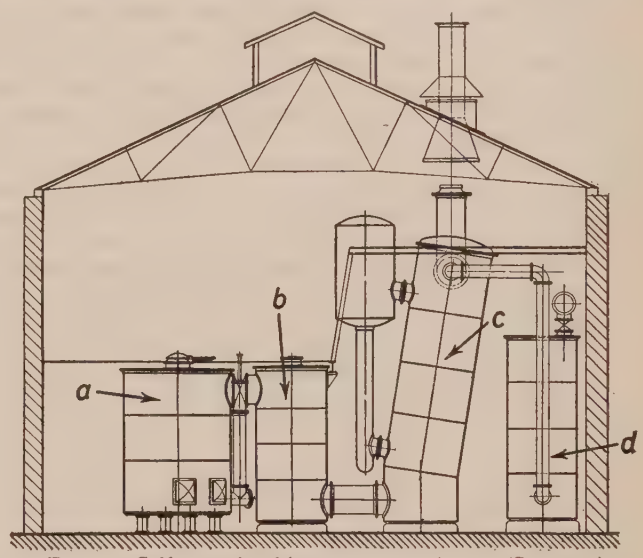


FIG. 2.—Self-steaming blue water-gas plant. (See text.)

from the retorts, in a cold, clean state, is charged into the producers and the operation of the whole installation effects a substantially complete gasification of the coal. The loss of heat of the incandescent coke is of comparatively small importance, for the clean, cold coke is rapidly brought to an incandescent state in the generator and there is no expensive handling of hot coke. A self-steaming, self-contained, blue water-gas plant, erected by Humphreys and Glasgow, Ltd., comprises (*a*) a generator, (*b*) a recuperator, (*c*) a waste-heat boiler and (*d*) a washer-scrubber (see fig. 2). This firm has brought into commercial use a means for automatically operating a generator plant, in which a series of valves governing the interdependent operations necessary in working, *e.g.*, coke feed, air supply, steam supply, duration of blow, etc., is operated by hydraulic power in an order correct in time and sequence. The order of operation, determined by the conditions of temperature, pressure, etc., in, or connected with, the generator, is set once for all by adjusting the indicators of a series of dials corresponding respectively with the various valves. If any valve fails to respond in its turn, the cycle of operations is stopped automatically by the action of electric circuits; this prevents explosions or other accidents.

Complete Gasification of Coal.—Complete gasification of coal in two steps is commercially successful. Numerous attempts have been made to effect complete gasification in one operation, but none appears to have been successful commercially. One of the earliest attempts was made many years ago by Fahnehjelm in the U.S.A.; his apparatus was a compact structure comprising a vertical conical retort, surrounded by heating flues and supported by a generator below. One of the many difficulties of this apparently simple process was that of obtaining in the

generator a regular supply from the retort of incandescent coke suitable for yielding gas. A great deal has been achieved in Germany by extensive trials of Strache's apparatus, which is generally similar to Fahnehjelm's. The problem is, in fact, receiving careful attention and complete success may be achieved.

Low Temperature Carbonisation (*see* FUEL PROBLEMS).—This is a process for the partial destructive distillation of coal at temperatures which are low compared with those of an ordinary gas retort or coke oven; an important aim of the process is to obtain a smokeless fuel suitable for burning in ordinary grates. About 1865, experiments on partial destructive distillation of coal were made by Mr. Scott-Moncrieff, but the process which has led to a more intensive study of the subject is that patented by Mr. Thomas Parker (British Specification No. 14,365 of 1906), for subjecting bituminous coal to destructive distillation at a temperature of about 800° F., until illuminating gases cease to be evolved, then stopping the distillation and quenching the charge. This process, usually carried out in tubular iron retorts, was tried repeatedly and many improvements were made, especially by Low Temperature Carbonising, Ltd., whose retort plant, set up near Barnsley, operates at a temperature between 600° C. and 800° C.

Other investigators have worked processes of this kind. The South Metropolitan Gas Co. (London) has made experiments on low temperature carbonisation with a view to obtain a good quality smokeless fuel. An installation of rotary, inclined retorts, developed by Mr. Nielsen, has also been worked near Barnsley, the temperature of working being about 675° C. By these processes, a smokeless fuel, burning freely with a clear flame, and almost odourless, has been obtained, together with a moderately large quantity of a rich gas, and good yields of tar and ammonia. No plant, however, has been working, on a commercial scale, long enough to justify an assertion that the process is a success. Any plant for which it is claimed that the problem of low temperature carbonisation has been solved may be tested, free of cost, by the Fuel Research Board, so that the possibilities of the process are still being considered.

Bergius Process.—A process which has attracted a great deal of attention, especially in Germany, is the Bergius process, elaborated by Prof. Bergius. Experiments have been made at Mannheim and recently efforts have been made to carry out the process commercially. The chief aim of the process is to obtain oil from coal and it is claimed that coal of poor quality can be used advantageously. The coal is pulverised, mixed with oil residues from a previous operation, and heated to a temperature of about 450° C. in an atmosphere of hydrogen under a pressure of about 150 atmospheres. The product is a viscous mass from which the oils can be separated.

Gas Purification.—During the 15 years under review numerous improvements in the details of construction of gas purifying apparatus have been made, especially in connection with the grids and valves of purifier boxes. In modern gasworks water-cooled tubular condensers, bubble washers of the Livesey type, the Pelouze and Audouin type of tar extractors, and rotary brush scrubbers of the Holmes type are largely in use.

Attempts to introduce new purifying processes have been made. In Birkheiser's process, two rather small oxide purifiers, working together, are used, the crude gas being passed through one for removal of SH_2 while a blast of air is passed through the other to revivify the oxide by converting its absorbed SH_2 into SO_2; this SO_2 is used to recover ammonia. This process and a later modification were tried at the Tegel gasworks, Berlin, and also at Bournemouth, but, apparently, not with complete success.

Processes have been introduced by W. Feld, all ingenious, but most of them too complicated for commercial use. In one, used with success in Germany, the reagents employed are a solution of $FeSO_4$ for washing the crude gas and, in later steps of the cycle of operations, a mixture of SO_2 and air. Both SH_2 and NH_3 are eliminated from the gas, the ultimate products being ammonium sulphate and sulphur, which is filtered off, and thus recovered in solid form.

Gasholders.—Some exceptionally large gasholders have been erected during recent years. The largest gasholders in the world appear to be those of the Astoria Gasworks, New York. Two gasholders in course of erection at Birmingham are intended to have five lifts and a total capacity of 20,000,000 cubic feet. A waterless, or tankless, gasholder recently erected in Michigan, is a chamber of polygonal cross section with a capacity of 1,000,000 cubic feet. The chamber is closed by a piston, which moves up and down within it. A tar seal forms a gas-tight joint between the chamber and its piston and is a very important part of the whole construction. In countries where the winters are severe, a waterless gasholder offers advantages. (T.E.L.)

GASES, ELECTRICAL PROPERTIES OF (*see* 6.864). These vary very greatly with the conditions to which the gas is exposed. A gas in its normal condition is practically a non-conductor of electricity even though it be the vapour of a good conductor like mercury. On the other hand, when it is exposed to such influences as cathode rays, Röntgen rays, intense electrical forces or the radiation from radioactive substances, it becomes a conductor of electricity. The very delicate methods now at our disposal reveal however a trace of conductivity in gases where precautions have been taken to shield off the effects just mentioned.

The most important electrical property of a gas in a normal state is its specific inductive capacity. The significance of this property is best illustrated from the relation $(K-1)/4\pi = NM$, between K, the specific inductive capacity; N, the number of molecules per unit volume, and M, the electrostatic moment which a molecule acquires under unit electric force. As we know N, we can if we know the value of K deduce the value of M, and this will tell us a good deal about the shape and size of the molecule. For example, if we regard the molecules as solid conducting spheres, $M = r^3$ where r is the radius of the sphere. Thus, on this hypothesis we can find the radius of the molecule if we know the value of K, and though the hypothesis itself does not throw much light on the structure of the atom, it is probable that the radius of a conducting sphere which would produce the same electrical moment would be of the same order of magnitude as the linear dimensions of the molecule: the radii of metallic spheres which would give the specific inductive capacities possessed by hydrogen, nitrogen, oxygen and chlorine, are respectively $1{\cdot}19\times10^{-8}$, $1{\cdot}60\times10^{-8}$, $1{\cdot}48\times10^{-8}$, $2{\cdot}04\times10^{-8}$ centimetres. On the more probable hypothesis that the atoms and molecules consist of electrons arranged round centres of positive electricity, the electric force will displace the electrons relatively to the positive centres and thus cause the molecule to have a finite electrical moment. The more rigidly the electrons are connected to the positive charge, the smaller will be this moment and the smaller the specific inductive capacity of the gas.

The values of $K-1$ for the elements belonging to the same family are connected by a remarkably simple and interesting relation, which was discovered by Cuthbertson (*Phil. Trans.* A.207, p.135). It is shown in Table I. where the numbers under the symbols denoting the elements are the values of $\frac{1}{2}(K-1)\times10^6$:—

TABLE I.

			He $144\times\frac{1}{2}$
N 297	O 270	F 192	Ne 137
P 1197 $=299\times4$	S 1101 $=275\times4$	Cl 768 $=192\times4$	Ar 568 $=142\times4$
As 1550 $=258\times6$	Se 1565 $=261\times6$	Br. 1123 $=187\times6$	Kr 850 $=142\times6$
	Te 2495 $=249\times10$	I 1920 $=192\times10$	X 1378 $=138\times10$

Thus the values of $K-1$ for successive elements of the same family—(N, P, As): (O, S, Se, Te): (F, Cl, Br I): (Ne, Ar, Kr, X)—are in all cases very nearly in the proportion 1, 4, 6, 10. In the simple theory, where the molecules are regarded as conductors, this would indicate that the volumes of the molecules of the

successive elements in the same family are in the proportion 1, 4, 6, 10, for each of these types of elements. On the theory which regards the atom as built up of electrons arranged round positive centres, the configuration of the outer layer of electrons for different members of the same family would be similar, and it is easy to show that for similar configurations of electrons the value of $K-1$ would be proportional to the cube of the linear dimensions, *i.e.*, to the volume enclosed by the outer layer of electrons; so that again on this theory Cuthbertson's result shows that volumes of successive elements in the same family are in the same ratio whether the family be that of the inert gases, the halogens, or the oxygen or nitrogen groups.

W. L. Bragg (*Phil. Mag.*, 40, p.169) using the method of Röntgen ray crystal analysis has measured directly the diameters of the atoms of many of the elements. He finds that the cubes of the diameters of F, Cl, Br, and I are proportional to 1, 3·72, 5·45 and 8 respectively; those of O, S, Se to 1, 3·9 and 6, and those of C and Si to 1, 3·6. Thus for these electronegative elements the ratio of the volumes of corresponding elements in two different periods is approximately constant. This, however, is not true for electropositive elements, where the sizes of the atoms in one period increase much more slowly from one element to the next than they do for the electronegative elements.

Another example of the information as to the nature of the molecule afforded by determinations of the specific inductive capacity is that, while the specific inductive capacity of many gases, *e.g.*, H_2, N_2, O_2, CO, CO_2, Cl_2, is equal (as Maxwell's Electromagnetic Theory of Light suggests) to the square of the refractive index, there are, as Bädeker (*Zeitschrift Physik. Chem.*, 36, p.305) has shown, others, such as NH_3, HCl, SO_2, and the vapours of water and the alcohols, whose specific inductive capacity is far in excess of the value given by this rule, and moreover the specific inductive capacity of these gases diminishes much more rapidly as the temperature increases than that of gases of the first type. The difference can be accounted for by supposing that the molecules of gases of the first type have no electrical moment when they are free from the action of an external electrical force, while those of the second type have an intrinsic electrical moment apart from that which may be produced by the external force. When there is no electrical field, the collisions between the molecules will cause the axes of electrical moments of the different molecules to be uniformly distributed, so that the average effect will be zero. An electric force will tend to drag the axes of the different molecules into alignment, and the assemblage of molecules will have a finite electrical moment which will be a measure of the specific inductive capacity. Inasmuch as the collisions between the molecules tend to knock their axes out of line and diminish the specific inductive capacity, the latter will diminish as the temperature and with it the vigour of the encounters increases. The substances which have an intrinsic electrical moment have exceptionally active chemical properties and are good solvents, dissociating the salts dissolved in them.

If the distribution of electrons in a molecule were not symmetrical about three axes at right angles to each other, the specific inductive capacity of a single molecule would vary with the direction of the electric force, but as the molecules in a gas are orientated in equal numbers in all directions we should not detect this by direct measurements of the specific inductive capacity. We can however detect this effect in another way; for if the molecules have different specific inductive capacities in different directions the light scattered by the molecules at right angles to the incident unpolarised light will not be plane polarised as it would be if the molecule were symmetrical (J. J. Thomson, *Phil. Mag.*, 40, p. 393), and if the incident light is plane polarised the scattered light will not vanish in any direction. Strutt (now Lord Rayleigh) (*Proc. Roy. Soc.*, 98A, 57) has measured the departure from plane polarisation for different gases with the results shown in Table II.

This shows that the molecule of argon is very symmetrical, while the nitrogen molecule is more symmetrical than that of oxygen, and this again more symmetrical than that of CO_2.

TABLE II.

Argon	0·46%
Hydrogen	3·83%
Nitrogen	4·06%
Air	5·00%
Oxygen	9·40%
Carbon dioxide	11·70%
Nitrous oxide	15·40%

Ionised Gases.—Gases may in various ways be put into a state in which they conduct electricity on an altogether different scale from the normal gas. They acquire this conductivity when Röntgen rays or the rays from radioactive substances pass through them, or when they are traversed by cathode or positive rays. Ultra-violet light of very short wave length can impart this property to a gas, while gases recently driven from flames or from near arcs or sparks or bubbled through certain liquids or passed slowly over phosphorus also possess this property.

The conductivity of gases possesses interesting characteristics. In the first place it persists for some time after the agent which made the gas a conductor has ceased to act; it always however diminishes after the agent is removed, in some cases very rapidly, and finally disappears. The conducting gas loses its conductivity if it is sucked through glass-wool, or made to bubble through water. The conductivity may also be removed by making the gas traverse a strong electric field so that a current of electricity passes through it. The removal of the conductivity by filtering the gas through glass-wool or water shows that the conductivity is due to something mixed with the gas which can be removed by filtration, while the removal of the conductivity by the electrical field shows that this something is charged with electricity and moves under the action of the electric force. Since the gas when in the conducting state shows as a whole no charge of electricity the charges mixed with the gas must be both positive and negative. We conclude that the conductivity of the gas is due to the presence of electrified particles; some of these particles are positively, others negatively, electrified. These electrified particles are called ions, and the process by which they are produced ionisation.

The passage of electricity through a conducting gas does not follow the same laws as the flow through metals and liquid

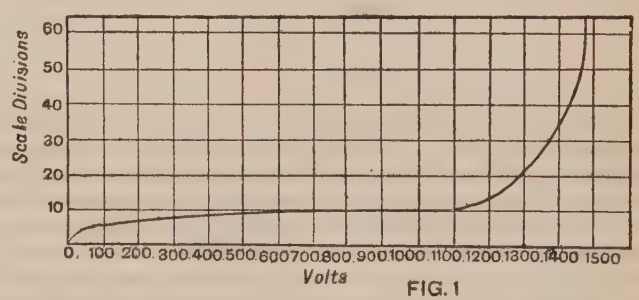


FIG. 1

electrolytes; in these the current is proportional to the electromotive force, while for gases the relation is represented by a graph like fig. 1, where the ordinates are proportional to the current and the abscissae to the electromotive forces. We see that when the electromotive force is small, the current is proportional to the electromotive force, as in the case of metallic conduction; as the electromotive force increases, the current after a time does not increase nearly so rapidly, and a stage is reached where the current remains constant in spite of the increase in the electromotive force. There is a further stage, which we shall consider later, where the current again increases with the electromotive force, and does so much more rapidly than at any previous stage. The current in the stage when it does not depend upon the electromotive force is said to be saturated. The reason for this saturation is that the passage of a current of electricity through the gas involves the removal of a number of ions proportional to the quantity of electricity passing through the gas. Thus the gas is losing ions at a rate proportional to the current; it cannot go on losing more ions than are produced, so that the current cannot increase beyond a critical value which is proportional to the rate of production of ions. This sometimes

produces a state of things which seems anomalous to those accustomed to look at conduction of electricity exclusively from the point of Ohm's law. For example, when gases are exposed to Röntgen rays, the number of ions produced per second is proportional to the volume of the gas, so that, if two parallel plates are immersed in such a gas and a current sent from one to the other, when the distance between the plates is increased the number of ions available for carrying the current and therefore the saturation current will be increased also. Thus the apparent "resistance" will diminish as the length of the gaseous conductor is increased.

The Nature of the Ions.—The question arises, what is the nature of the particles which carry the charges of electricity? Are they the atoms or molecules of the gas, or, for the negative charges, electrons? Information on these points is afforded by measuring the velocity with which the ions move through the gas under given electric forces.

The ion under the action of the electric force will soon attain a steady velocity which will be determined by the condition that the momentum communicated to the ion by the electric force in unit time is equal to the momentum lost by the ion in the same time by its collisions with the molecules of gas through which it is moving. Suppose that the average momentum lost by the ion per collision is qmu where m is the mass of the ion, u its velocity and q a quantity which will depend on the relative masses of the ion and the molecule and also on the force between the ion and the molecules, *e.g.*, if the ions and molecules behaved like elastice spheres q would not be the same as if they acted upon each other with forces varying inversely as the fifth power of the distance between them. The value of q will also depend on the electric charge on the ion. The number of collisions made by an ion with the molecules of the gas in time δt may be written as $\delta t/T$. Where T is the average interval between two collisions, T will vary inversely as the number of molecules in unit volume, *i.e.*, inversely as the density of the gas and will also depend upon the temperature and the masses of the ions and molecules. When the loss of momentum by collisions balances the gain from the electric force F

$$Fe\delta t = \frac{qmu\delta t}{T} \qquad (1)$$

$$\text{or } u = \frac{FeT}{mq}$$

we can determine by experiment the value of u/F and hence the value of T/mq. This will give us information as to the nature of the ions, *e.g.*, we can by the kinetic theory of gases calculate the values of T and q when the ion is a molecule of the gas and when the collision between an ion and a molecule is the same as that between two molecules; on these suppositions the calculated mobility is for most gases considerably greater than that found by experiment. The difference is to be explained by the effect of the electric charge on the collision and also the clustering of other molecules round the charged one to form a more complex ion. These two effects are not independent for it can be shown that if the effect of the charge is large enough seriously to affect the mobility, it follows by the Laws of Thermodynamics that the forces between the ions and the molecules must be great enough to lead to considerable aggregation at room temperatures. The effects to be expected from the formation of such aggregates may be illustrated from the expression for k, the mobility of the ion, *i.e.*, the velocity of the ion under unit force, deduced on the assumption that the force between the ion and the molecule varies inversely as the fifth power of the distance between them, this expression is

$$k = \frac{e}{2\pi N}\left\{\frac{M_1+M_2}{M_1\times M_2}\right\}^{\frac{1}{2}}\left\{1{\cdot}1e\sqrt{(\mu^2-1)/N\pi}+\frac{s^2}{2}\sqrt{2\beta\theta}\right\}^{-\frac{1}{2}} \qquad (2)$$

where M_1, M_2 are the masses of the molecule and ion respectively, N the number of molecules per unit volume, μ the refractive index of the gas, s the sum of the radii of an ion and a molecule and $\beta\theta$ the energy of a molecule due to thermal agitation when θ is the absolute temperature of the gas. For most gases the effect of the term $s^2\sqrt{2\beta\theta}$ is insignificant. When this is so the effect of the complexity of the ion is represented by the term

$$\left(\frac{M_1+M_2}{M_1M_2}\right)^{\frac{1}{2}}$$

This varies but slowly with the complexity, for when the ion consists of a single molecule $M_2=M_1$ and the expression is $\sqrt{2/M_1}$ while when the ion consists of an infinite number of molecules the value is $\sqrt{1/M_1}$ thus this great increase in mass only reduces the mobility in the proportion of 1 to $\sqrt{2}$. The formula given above for k may be used to find the value of M_2/M_1 and for positive ions in most cases this ratio is found to be greater than one. This indicates the formation of complex ions; these under the impact of the molecules break up and new aggregates are formed around the simple ions. This constant change of partners by the ions explains the very remarkable fact that in a mixture of different gases all the ions appear to move with the same velocity. Thus in a mixture of a light gas like hydrogen with a heavy one like methyl iodide we do not find ions of great mobility corresponding to the hydrogen and others of smaller mobility corresponding to the methyl iodide. Wellisch has shown that all the ions in the mixture move with the same velocity. If there had been stable ions with masses comparable with the hydrogen molecules and others comparable with the methyl iodide molecule they could easily have been differentiated. If however the ions form aggregates and the partners of the ions in these aggregates are constantly changing so that during the life of the ion it passes backwards and forwards through a great number of different phases, then though at any particular instant one ion might have a different mobility from another, yet the average mobility taken over a finite time would be the same for all the ions. To detect the different kinds of ions it would be necessary to observe not their average behaviour over a long time but to make the measurements so quickly that the ion had not time to pass from one state to another whilst it was under observation. The life of an ion in a particular phase is, at atmospheric pressure, probably considerably less than the millionth of a second; the length of life will vary inversely as the pressure so that the chance of detecting the different kinds of ions would be much greater at low pressures than at high ones.

Lately Erikson has detected a case when the velocity of the ion changes even though the gas through which it is moving remains the same; he has shown that the mobility of the positive ions in air at atmospheric pressure is, in the first second or so of their existence, about 1·89 but as the ions get older the mobility falls to 1·35, the ratio of these numbers is nearly equal to $\sqrt{2}$ which is the ratio of the mobility of an ion consisting of one molecule to that of one consisting of a very large number. It would thus seem that the old ions are much more complex than the young ones. The surprising thing about Erikson's result is that he found the ions to retain their youthful properties for the best part of a second at atmospheric pressure; during this time the ion will have collided with many million molecules of air, and so might have been expected to form partners in a very small fraction of a second. The results are consistent with the idea that the ion forms a stable connection with the molecules of some very heavy gas present in very small quantities as an impurity. The addition to the gas of small quantities of the vapours of water or alcohol whose molecules have a finite electrical moment produces a marked diminution in the mobility, indicating that they give rise to aggregates of exceptional permanence. Formula (2) is obtained on the assumption that the force between the ion and the molecule is due to electrostatic induction alone and so varies inversely as the fifth power of the distance; if the gas were one like water vapour or ammonia whose molecules are polar, the force between the ion and the molecule would vary inversely as the fourth instead of the fifth power of the distance and the mobility would not be given by formula (2).

We see from this formula that unless M_2/M_1 depends upon the pressure the mobility is inversely proportional to N, *i.e.*, to the pressure of the gas. This law has been verified for positive ions

down to pressures less than 1 mm. of mercury. As however the probability of forming complex aggregates is greater at high than at low pressures, we should expect M_2/M_1 to diminish as the pressure diminishes; this diminution in M_2/M_1 would produce a small increase in the mobility so that the formula would indicate that the mobility would increase just a little more quickly than the reciprocal of the pressure.

The behaviour of negative ions is in many respects quite different from that of the positive ones. In the first place the mobility of the negative ions is for the permanent gases greater than that of the positive; thus, for example, in dry hydrogen the velocities of the negative and positive ions, when the electric force is one volt per cm., are 7·95 and 6·7 respectively, and for air 1·87 and 1·36. The difference is less for moist gases than for dry, while for complex vapours which have comparatively small mobilities Wellisch found that there was very little difference between the mobilities of the positive and negative ions.

For the permanent gases the ratio of the mobilities of the negative and positive ions varies but little with the pressure, until the pressure is reduced below that represented by about 10 cm. of mercury. For lower pressures than this, the mobility of the negative ion increases, as Langevin showed, more rapidly than that of the positive; at the pressure of a millimetre or so the mobility of the negative ion in air may be three or four times that of the positive.

An even more interesting result was discovered by Franck and Hertz, who, when they experimented with very carefully purified nitrogen or argon, found that the mobility of the negative ion was more than 100 times that of the positive. The mobilities in these gases are extremely sensitive to traces of oxygen, and a fraction of 1% of oxygen added to the pure gas will reduce the mobility of the negative ion to less than one-tenth of its maximum value. The enormous mobility of the negative ion in nitrogen and argon as compared with that of the positive shows that in them the negative electricity must be carried by electrons and not by atoms or molecules, while the effect of introducing traces of oxygen shows that these electrons readily attach themselves to the molecules of oxygen though they are unable to adhere to molecules of nitrogen or argon. The same effect has also been observed in helium and hydrogen.

These properties of the negative ion are of great importance in connection with the mechanism of ionisation in gases and the structure of atoms and molecules. In the first place, they furnish strong evidence in support of the view that the first stage in the ionisation of a gas is the ejection of an electron from the molecule of the gas rather than the separation of the molecule into atoms of which some are charged with positive and others with negative electricity. On this view the negative ion begins its career as an electron and not as an atom, while the positive ion from the beginning is of molecular dimensions. As an electron has much greater mobility than a molecule the mobility of the negative ion will at first be much greater than that of the positive. In some gases, such as oxygen, the electron soon gets attached to a molecule, and its mass and mobility become comparable with those of the positive ion. The mobility we measure is the average mobility of the negative ion during its life; part of the time its mobility, being that of an electron, is very much larger than that of the positive ion, while in the other part the two mobilities will be much the same. The excess of mobility of the negative over the positive ion will depend upon the fraction of its life which the negative ion spends as a free electron—a fraction which would tend to increase as the pressure of the gas diminished.

The mobility of the electron may be estimated by formula (2); if the gas is nitrogen we must in that formula put $M_2/M_1 = 1/28 \times 1800$ which is the ratio of the mass of an electron to that of a nitrogen molecule. Using this value for M_2/M_1 we find that the mobility of the electron is about 220 times that of the positive ion, a result which is confirmed by experiment. Direct experiments on the mobility of negative ions do not give any indication of the existence of two kinds of these ions. This may be regarded as a confirmation of the explanation of the similar result for the positive ions, viz.: that our methods only give the average mobility of the ion through a comparatively long life; for there can be but little doubt that in all but a very few gases the negative ion can exist in two phases, one of them being the electron. The mobility in the electron phase is so exceptional that anything which prolongs the duration of this phase in comparison with that of the other phases must have a great effect upon the mobility. Some observations by Loeb (*Phys. Review*, 17, p.89) give us some information about the time an electron in oxygen requires to unite with the molecule and form a negative ion. He found that the electron made about 50,000 collisions with an oxygen molecule before combining with it and that this number is independent of the pressure. The time taken to make these collisions, taking the velocity of the electron at 0° C. as 10^7 and the free path as 10^{-5} at 760 mm., is 5×10^{-8} sec. and this will measure the life of the free electron. It is evident that, even allowing for the great mobility of the electron, it could not appreciably affect the mobility in experiments lasting for a time comparable with ·01 sec., and the mobility would be practically that of the negative ion, unless the electron were able to break away again from a molecule after it had united with it. The mobility of the carriers of negative electricity as compared with that of the positive one is evidence that the electron is continually changing partners. If k_1 be the mobility of the electron, k_2 that of the negative ion, T_1 the life of the electron, T_2 that of the negative ion, the average mobility will be

$$\frac{k_1T_1 + k_2T_2}{T_1 + T_2}$$

If p is the pressure of the gas, k_1 and k_2 vary inversely as the pressure, let them equal K_1/p, K_2/p, then the mobility is equal to

$$\frac{1}{p}\left\{\frac{K_1T_1 + K_2T_2}{T_1 + T_2}\right\} \quad . \quad . \quad . \quad (3)$$

Since Loeb's experiments show that the electron makes the same number of collisions before uniting with the molecule whatever be the pressure, and since the interval between each collision is inversely proportional to the pressure, T_1 varies as $1/p$, if the breaking up of the negative ions were due to collisions with the molecules T_2 would also vary as $1/p$ and the ratio of T_1 to T_2 would be independent of the pressure. This from equation (3) would make the mobility of the negative ion like that of the positive vary inversely as the pressure and would not explain the abnormal increase of the negative carriers at low pressures. Hence we conclude that the breaking up of the negative ions is not due to collisions. If T_2 is independent of p, while T_1 increases as p diminishes the product of the mobility and pressure will by (3), since k_1 is greater than k_2, increase as p diminishes, which is in accordance with the results observed by Langevin and others.

The difference between the behaviour of the electron in nitrogen or argon and in oxygen discovered by Franck and Hertz is of great importance in connection with the structure of the atom and molecule, for it indicates that, while a molecule of oxygen can accommodate another electron in addition to those already present, the molecules of nitrogen and argon are unable to do so. It is instructive therefore to consider the results obtained by the study of the positive rays as to the power of the atoms and molecules of the different elements to acquire a negative charge. These show that, while the atoms of hydrogen, carbon, oxygen, fluorine or chlorine readily acquire a negative charge, those of helium, nitrogen, neon and argon do not; and again that, while it is very exceptional for a molecule whether of a compound or an elementary gas to acquire a negative charge, the molecule of oxygen is able to do so. We see that this result is in accordance with the behaviour of the carrier of the negative charge in an ionised gas. Since the atoms in the positive rays show so much greater affinity for the electrons than the molecules, it follows that if the agent producing ionisation were to dissociate some of the molecules of the gas into neutral atoms (and to do this would require the expenditure of much less energy than to ionise the gas), these atoms would be much more effective traps for the electrons than the undissociated molecules. Loeb

has shown that even in oxygen an electron collides on the average with about 50,000 molecules of oxygen before it is captured; thus if the oxygen *atom* could capture an electron at the first encounter, if only one molecule in 50,000 were dissociated into atoms, the effect of the atoms would be as efficacious as that of the molecules in capturing the electrons. When this dissociation into atoms takes place the abnormal velocity of the negative ion will only occur in gases like nitrogen and the inert gases whose *atoms* cannot receive an electron.

Recombination of the Ions.—Even when the ions are not removed from a gas by sending a current of electricity through it, their number will not increase indefinitely with the time of exposure of the gas to the ionising agent. This is due to the recombination which takes place between the positive and negative ions; these ions as they move about in the gas sometimes come into collision with each other, and by forming electrically neutral systems cease to act as ions. The gas will reach a steady state with regard to ionisation when the number of ions which disappear in one second as the result of the collisions is equal to the number produced in the same time by the ionising agent.

If there are n ions of either kind per cu. cm., the number of collisions between the positive and negative ions in one second in a cu. cm. of the gas will be proportional to n^2; hence the number of ions of either sign which are lost by recombination in one second may be represented by αn^2 when α is called the coefficient of recombination. If the ionising agent produces q ions per cu. cm. per sec., then

$$\frac{dn}{dt} = q - \alpha n^2.$$

The solution of this equation, if we reckon t from the instant the ionising agent begins to act, so that $n=0$ when $t=0$, is $k^2=q/\alpha$

$$n = \frac{k(\epsilon^{2k\alpha t}-1)}{\epsilon^{2k\alpha t}+1}.$$

We see that, when the gas reaches a steady state, $n=k=\sqrt{q/\alpha}$, and that the gas will not approximate to this state until t is large compared with $1/2k\alpha$, *i.e.*, to $1/2\,n_0\alpha$ where n_0 is the value of n in the steady state. Thus when the ionisation is very weak it may take a considerable time for the gas to reach a steady state.

When the ionising agent is removed, the ions do not disappear at once, but decay at the rate given by the equation

$$\frac{dn}{dt} = -\alpha n^2.$$

The solution of this, when t is the time which has elapsed since the removal of the ionising agents, and n_0 the number of ions when $t=0$, is

$$n = n_0/(1+n_0\alpha t).$$

Thus the number of ions will be reduced to one-half their initial value after a time $1/\alpha n_0$. We may therefore take $1/\alpha n$ as the measure of the life of an ion when there are n ions per cubic centimetre. The values of α/e, where e is the charge on an ion, have been measured by various experimenters; the results are given in the following table: the agent used to ionise the gas is given in the second row.

TABLE III.

Values of α/e for Various Gases at Atmospheric Pressure and Ordinary Temperature

Gas	Townsend	McClung	Langevin	Thirkill	Hendren	Retschinsky	Rumelin	
	Röntgen rays	Röntgen rays	Röntgen rays	Röntgen rays	α rays	α rays	α rays	β rays
Air	3,420	3,380	3,200	3,580	3,300	4,200	4,240	5,820
CO_2	3,520	3,490	3,400	3,500	..	..	..	..
H_2	3,020	2,940	..	..	..	..	..	..
O_2	3,380	..	..	..	..	..	..	..
SO_2	..	..	..	3,000	..	..	..	..
N_2O	..	..	..	2,960	..	..	..	..
CO	..	..	..	1,780	..	..	..	..

The results ascribed to Thirkill were obtained by extrapolation from experiments made at lower pressures. Since e, in electrostatic measure, is $4{\cdot}8\times10^{-10}$, the value of α for air is about $1{\cdot}6\times10^{-6}$, so that, when there are n positive and n negative ions per cu. cm., the number of ions which recombine per second is

$$1{\cdot}6\times10^{-6}n^2.$$

This shows very markedly the influence of the electric charge in increasing the number of collisions between the particles, for the number of collisions in a second between $2n$, uncharged molecules in a cu. cm. of air is

$$4\times10^{-10}n^2.$$

which is only about 1/4,000 of the number of recombinations between the same number of ions.

The ions like the molecules of the gas will in consequence of thermal agitation be moving with high velocities, and unless the distance between them is less than a certain value will drift apart and not combine. The condition that they should not separate if they are a distance d apart is that the kinetic energy due to their relative motion should be less than e^2/d the work required to separate the ions to an infinite distance. The average kinetic energy due to their relative motion is equal to $\beta\theta$ where $\beta\theta$ is the average kinetic energy of a molecule at the absolute temperature θ; β is equal to $2{\cdot}02\times10^{-16}$. Hence the ions will separate unless

$$2{\cdot}02\times10^{-16}\theta < e^2/d.$$

At 0° C, $\theta=273$ and since $e=4{\cdot}8\times10^{-10}$ this condition shows that they will separate at this temperature unless d is less than $4{\cdot}18\times10^{-6}$ centimetres. This is on the supposition that they are not subject to any influence other than their mutual attraction. As they move through the gas they may, if one or other of them when they are close together comes into collision with a molecule of the gas, lose some of the kinetic energy which would enable them to separate. Assuming that collision with a molecule reduces the kinetic energy due to relative motion to $\beta\theta$, the value it has for thermal equilibrium, it follows that to ensure combination the collision with the molecules must occur when d, the distance between the ions, is less than $e^2/\beta\theta$ and that every such collision leads to recombination. To find the rate at which the ions recombine we have to find the number of collisions between ions and molecules which occur in one second, only those collisions to be counted when an ion is within a distance d of one of opposite sign at the time of collision. It can be shown (see J. J. Thomson, *Phil. Mag.*, 47, p.337) that this number is equal to

$$\pi d^2\rho\rho^1\sqrt{U^2+U_1^2}(1-\omega\omega^1)$$

where

$$\omega = \frac{\lambda^2}{2d^2}\left(1-\epsilon^{\frac{-2d}{\lambda}}\left[1+\frac{2d}{\lambda}\right]\right)$$

$$\omega^1 = \frac{\lambda_1^2}{2d^2}\left(1-\epsilon^{\frac{-2d}{\lambda_1}}\left[1+\frac{2d}{\lambda_1}\right]\right)$$

where λ and λ_1 are respectively the mean free paths of the positive and negative ion through the gas, U and U_1 the mean velocities of these ions due to their thermal agitation, ρ and ρ^1 the number of positive and negative ions per unit volume and $d=e^2/\beta\theta$.

It follows from the definition that α the coefficient of recombination is given by the equation

$$\alpha = \pi d^2\sqrt{U^2+U_1^2}\,(1-\omega\omega^1).$$

When the pressure is low enough to make $2d/\lambda$ and $2d/\lambda_1$ small, then $1-\omega\omega^1 = \frac{4}{3}d\left(\frac{1}{\lambda}+\frac{1}{\lambda_1}\right)$ approximately,

so that $\alpha = \frac{4}{8}\pi d^3\sqrt{U^2+U_1^2}\left(\frac{1}{\lambda}+\frac{1}{\lambda_1}\right)$.

Both $1/\lambda$ and $1/\lambda_1$ are proportional to the pressure, so that at low pressures α varies as the pressure, which agrees with the results of Thirkill's experiments. When the pressure is so high that λ/d and λ_1/d are small, ω and ω^1 are small and

$$\alpha = \pi d^2\sqrt{U^2+U_1^2}$$

approximately, so that α is independent of the pressure.

When the density is constant the value of α diminishes as the temperature increases. The connection between α and the absolute temperature T seems to be expressed with fair accuracy by the equation

$$\alpha = cT^{-n}$$

According to Erikson, n is equal to 2·3, 2·42, 2·35 for hydrogen, air and CO_2 respectively, while Phillips's experiments gave $n=2$.

Diffusion of Ions.—In addition to the loss of ions by recombination, there will be a loss due to the diffusion of the ions to the side of the vessel in which they are contained; when the ions strike against the walls they may lose their charges and thus cease to be ions. The loss of ions from this cause will be proportional to the surface of the vessel, while that due to recombination will be proportional to the volume, thus the ratio of the loss by diffusion to that by recombination will be greater in small vessels than in large. Again the rate of diffusion is inversely proportional to the pressure while that of recombination is directly proportional to it, thus the loss by diffusion will be relatively more important at low pressures than at high.

Large Ions.—The ions we have been considering are those produced in dust-free gases by Röntgen or cathode rays. In some cases, however, ions with very much lower mobilities are to be found in gases. Thus Langevin found in air from the top of the Eiffel Tower two types of ions, one consisting of ions of the kind we have been considering, with a mobility of about 1·5 cm./sec., the other of ions with a mobility of 1/3,000 cm./second. Ions with mobilities of the same order as this second type may be produced by bubbling air through water, by passing air over phosphorus or by drawing air from the neighbourhood of flames. They are probably charged particles of dust of various kinds, held in suspension in gas which is exposed to some kind of ionising agent which gives a supply of ions of the first type; these settle on the particles of dust and form the slow ions. The number of these slow ions, when the gas is in a steady state, will depend only on the number of dust particles in the gas and will not be affected by the strength of the ionising agent. This follows from the principle that in the steady state the number of dust particles which acquire a positive charge must equal the number which lose such a charge. A positively electrified dust particle might lose its charge by meeting and coalescing with a negative small ion or by coalescing with a negatively electrified dust particle. These dust particles are, however, so sluggish in their movements that, unless the dust particles are enormously more numerous than the small ions, we may neglect the second source of loss in comparison with the first.

Thus if U is the number of uncharged dust particles in a cu. cm. of the gas, P and N the number of those with positive and negative charges respectively and p, n, the number of positive and negative small ions, then the number of dust particles which acquire per second a positive charge will be $\alpha U p$ and the number losing such a charge by coalescing with a negative ion $\beta P n$, where α and β are constants; hence for equilibrium

$$\alpha U p = \beta P n$$

Similarly by considering the negatively charged particles we get

$$\alpha' U n = \beta' N p$$

Hence we see that the proportion between the charged and uncharged particles of dust depends only upon the ratio of p to n, and not upon the absolute magnitude of either of these quantities. Thus, though it would take much longer to reach the steady state with a feeble source of ionisation than with a strong one, when that state was reached there would be as much dust electrified in one case as in the other. De Broglie estimates that in this state about one-tenth of the particles would be electrified.

Relation Between the Potential Difference and the Current Through an Ionised Gas.—We shall take the case of two infinite parallel metal plates maintained at different potentials and immersed in an ionised gas; the line at right angles to these plates we shall take as the axis of x, it being evidently parallel to the direction of the electric force X. Let n_1, n_2 be respectively the number of positive and negative ions at the place fixed by the co-ordinate x; u_1 and u_2 the velocities of these ions. The volume density of the electrification in the gas, if it is entirely due to the ions, is $(n_1-n_2)e$ when e is the charge on an ion, hence

$$\frac{dX}{dx} = 4\pi(n_1-n_2)e \qquad (1)$$

If ι is the current through a unit area of the gas

$$\iota = e(n_1u_1+n_2u_2) \qquad (2)$$

Hence from (1) and (2) we have

$$n_1e = \frac{\iota}{u_1+u_2}+\frac{1}{4\pi}\frac{u_2}{u_1+u_2}\frac{dX}{dx} \qquad (3)$$

$$n_2e = \frac{\iota}{u_1+u_2}-\frac{1}{4\pi}\frac{u_1}{u_1+u_2}\frac{dX}{dx} \qquad (4)$$

When things are in a steady state, neglecting any loss of ions by diffusion we have

$$\frac{d}{dx}(n_1u_2) = q-\alpha n_1n_2 \qquad (5)$$

$$-\frac{d}{dx}(n_2u_2) = q-\alpha n_1n_2 \qquad (6)$$

where q is the number of ions produced per second in a cu. cm. of gas, and α is the coefficient of recombination; if k_1, k_2 are the mobilities of the positive and negative ions respectively, then

$$u_1=k_1X \qquad u_2=k_2X$$

From equations (1), (5) and (6) we get

$$\frac{d^2X^2}{dx^2} = 8\pi e(q-\alpha n_1n_2)\left(\frac{1}{k_1}+\frac{1}{k_2}\right)$$

and, substituting the values of n_1 and n_2, we get

$$\frac{d^2X^2}{dx^2} = 8\pi e\left(\frac{1}{k_1}+\frac{1}{k_2}\right)\left\{q-\frac{\alpha}{e^2X^2(k_1+k_2)^2}\left(\iota+\frac{k_2}{8\pi}\frac{dX^2}{dx}\right)\left(\iota-\frac{k_1}{8\pi}\frac{dX^2}{dx}\right)\right\} \qquad (7)$$

No general solution of this equation has been obtained, but when ι is small compared with the saturation current qle, l being the distance between the plates, an approximate solution is represented by the graph in fig. 2.

The force is practically constant, and equal to

$$\left(\frac{\alpha}{q}\right)^{\frac{1}{2}}\frac{\iota}{e(k_1+k_2)}$$

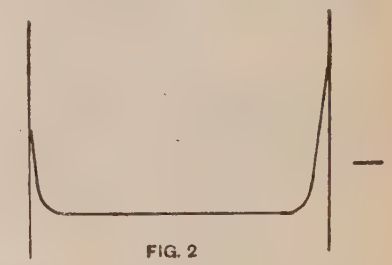


FIG. 2

except close to the electrode, where it increases; and as the mobility of the negative ion is greater than that of the positive the increase in the force will be greater at the cathode than at the anode. As the potential difference between the electrode increases, and the current approaches more nearly the saturation value, the flat part of the graph diminishes, and the graph for X takes the form given in fig. 3. When the potential difference is so large that the current is nearly saturated, X is very approximately constant from one electrode to another.

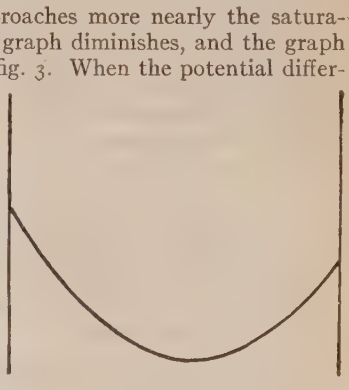


FIG. 3

In one extremely important case, that in which the negative ions are electrons and have a mobility which may be regarded as infinite in comparison with that of the positive ions, equation (7) admits of integration: for by putting $k_1/k_2=0$ in equation (8) it becomes

$$\frac{dX^2}{dx}+\frac{8\pi e^2k_2qX^2}{\alpha\iota} = \frac{8\pi\iota}{k_2} \qquad (8)$$

The solution of this is

$$X^2 = \frac{\alpha\iota^2}{qk_2^2e^2}\left(1+\frac{k_2}{k_1}\frac{\iota-\iota_0}{\iota}\epsilon^{\frac{-8\pi e^2k_2qX}{\alpha\iota}}\right) \qquad (9)$$

when x is the distance from the cathode and ι_0 the amount of negative electricity emitted by unit area of the cathode per unit time.

This distribution of force is represented by the graph in fig. 4; the force at some distance from the cathode is equal to

$$\frac{\iota}{k_2}\left(\frac{a}{q}\right)^{\frac{1}{2}}$$

and is thus proportional to the current; the force at the cathode itself is $\{1+k_2(\iota-\iota_0)/k_1\iota\}^{\frac{1}{2}}$ times greater than this. The fall of potential between the electrodes is made up of two parts, one arising from the constant force; as this force is proportional to ι this part of the potential fall will be proportional to ιl when

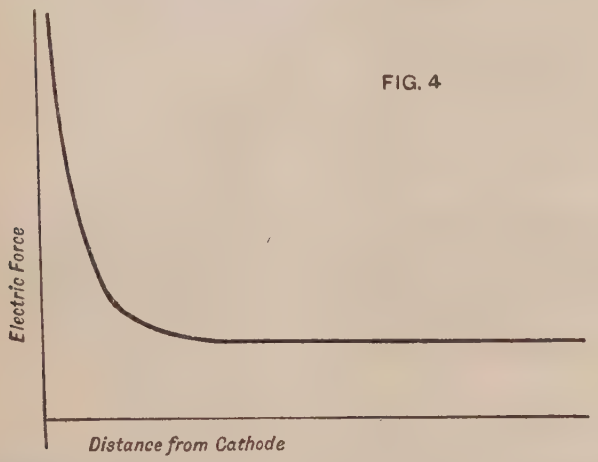


FIG. 4

l is the distance between the electrodes, and may be represented by Al when A is a constant; the other part of the potential fall is that which occurs close to the cathode. We find from equation (9) that this is proportional to ι^2 and does not depend upon l. Thus, if V is the potential difference between the electrodes when A and B are constants

$$V = Al+B\iota^2. \qquad (10)$$

H. A. Wilson has shown that an equation of this type represents the relation between the current and potential difference for conduction through flames. In many cases the drop of potential at the cathode is much greater than the fall in the rest of the circuit; when this is so we see that the current is proportional to the square root of the potential difference. The value of B increases with the pressure and decreases with the amount of the ionisation.

Current from Hot Wires.—A case of great importance from its industrial application in hot wire valves is one where all the ions are negative and are emitted from the cathode. Metal wires or plates raised to incandescence emit electrons, and if they are used as cathodes can transmit across a vacuum or gas at a low pressure very considerable currents.

Let the hot cathode be the plate x=o and let V be the potential at the point x, n the density of the negative ions at this point, and ι the current through unit area. If u is the velocity of the negative ion, we have

$$nue = \iota \quad \text{and} \quad \frac{d^2V}{dx^2} = 4\pi ne.$$

There are two cases to be considered; the first is when the hot plate is surrounded by gas of sufficient density to make the velocity of the ions proportional to the electric force; the second is when it is surrounded by a vacuum, and the motion of the ions is not affected by the gas.

In the first case $u=k_2\frac{dV}{dx}$, when k_2 is the mobility of the negative ion, and the equation $nue=\iota$ is equivalent to

$$\frac{k_2}{4\pi}\frac{dV}{dx}\frac{d^2V}{dx^2} = \iota. \qquad (11)$$

The solution of this is

$$\left(\frac{dV}{dx}\right)^2 = \frac{8\pi\iota}{k_2}x+C.$$

Therefore if V is the difference of potential between the anode and cathode, and l the distance between them

$$V = \frac{k}{12\pi\iota}\left[\left(\frac{8\pi\iota l}{k}+C\right)^{\frac{3}{2}}-C^{\frac{3}{2}}\right] \qquad (12)$$

where C is the constant of integration.

In consequence of thermal agitation some of the electrons near the plate will diffuse backwards and hit the plate; if n_0 is the density of the electrons near the plate it follows from the Kinetic Theory of Gases that the number hitting the plate in unit time is $n_0c/\sqrt{6\pi}$, where c is the velocity of mean square, *i.e.*, $\frac{1}{2}mc^2=\frac{3}{2}R\theta$; m is the mass of an electron, θ the absolute temperature of the electrons and R the gas constant $1\cdot35+10^{-16}$.

If I is the current per unit area emitted by the plate, then in consequence of the diffusion there is a backward current $en_0c/\sqrt{6\pi}$, so that ι, the current going through the gas is given by the equation

$$I-\frac{en_0c}{\sqrt{6\pi}} = \iota.$$

If u_0 is the velocity acquired by the electrons near the plate under the electric force, $\iota=en_0u$, hence

$$\frac{\iota}{I-\iota} = \frac{u_0}{c}\sqrt{6\pi}. \qquad (13)$$

So that, unless ι is small compared with I, u_0 will be comparable with c; in this case, however, the velocity of the ion is no longer proportional to the electric force so that equation (11) no longer holds. Again, when the current approaches saturation, $\iota/(I-\iota)$ is large and therefore by (13) u_0 will be large compared with c. For the negative ion to acquire a velocity of this magnitude the electric field would have to be so strong that sparks would pass through the gas unless the pressure were very low. Thus saturation currents from hot bodies are only obtainable at very low pressures.

Since the electric force when $x=o$ is $\sqrt{C}$, $u_0=k\sqrt{C}$, and therefore by (13)

$$C = \frac{c^2}{6\pi k^2}\frac{\iota^2}{(I-\iota)^2}.$$

Thus if the current is far from saturation, C will be negligible compared with $8\pi\iota l/k$. When C can be neglected, equation (12) gives

$$\iota = \frac{9k}{32\pi}\frac{V^2}{l^3}. \qquad (14)$$

Thus the current is proportional to the square of the potential difference. A remarkable thing about this expression is that for these very small currents the intensity of the current is independent of the temperature of the plate, although, of course, the range of currents over which this formula is applicable is wider the higher the temperature.

When the hot body is in a vacuum, we have, if the ions have no initial velocity,

$$\tfrac{1}{2}mu^2 = Ve$$

where m is the mass and e the charge on an ion; hence the equation $nue=\iota$ is equivalent to

$$\frac{d^2V}{dx^2}V^{\frac{1}{2}} = 4\pi\iota\sqrt{m/2e} \qquad (15)$$

a solution of which is

$$V = (9\pi\iota)^{\frac{2}{3}}(m/2e)^{\frac{1}{3}}x^{\frac{4}{3}}. \qquad (16)$$

Hence, if V is the potential difference and l the distance between the electrodes

$$\iota = \frac{l}{9\pi l^2}\left(\frac{2e}{m}\right)^{\frac{1}{2}}V^{\frac{3}{2}}. \qquad (17)$$

We see from equation (16) that the electric force vanishes at the cathode, and that the density of the negative electrification is as $x^{-\frac{2}{3}}$; thus it is infinite when close to the cathode and diminishes as the distance from the anode diminishes. The total quantity of electricity between the anode and cathode is proportional to $(l\iota^2)^{\frac{1}{3}}$. We see again that for a given potential

difference the current does not depend on the temperature of the hot wire; this law only holds when the currents are less than the maximum currents which can pass between the electrodes. When the current approaches this value, the current instead of increasing as $V^{\frac{3}{2}}$ becomes independent of V, and the negative electricity between the electrodes diminishes as V increases. Langmuir, who has made a very complete investigation of the currents from hot wires, finds that the expression (17) represents, with considerable accuracy, the relation between the current and

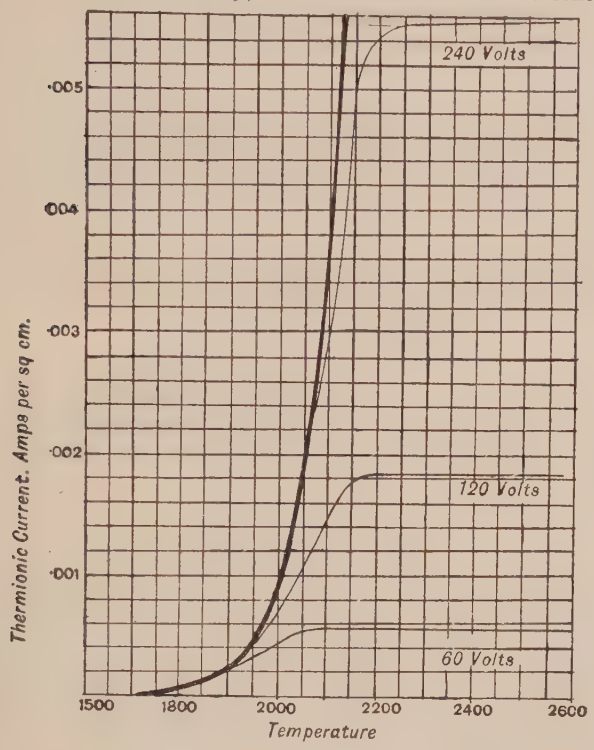


FIG. 5

potential over a wide range in the values of the currents. The curves in fig. 5, given by him, represent the relation between the current and potential for wires at different temperatures. They illustrate the point that a colder wire, until it is approaching the stage of saturation, gives as large a current as a hotter one, though the hotter one, of course, has a wider range of currents.

Ionisation by Collision.—The curve representing the relation between the currents through a gas ionised (say) by Röntgen rays and the difference of a potential between the electrodes is found to be of the form already shown in fig. 1, where the ordinates represent the currents and the abscissae the potential difference. The flat part represents the state of saturation when the potential difference is large enough to send all the ions produced by the rays to the electrodes before they can recombine. When the potential difference is still further increased we see that a stage is reached when the current begins to increase with great rapidity with the potential difference, and reaches values much greater than could be attained by the ions produced by the Röntgen rays. Thus in addition to the ions produced by the rays there must be other ions, and some other source of ionisation associated with the strong electric fields. Now the processes going on in a gas while it is conveying an electric current are:—(1) the ionisation of the gas by the external agent—in this an electron is liberated from the molecule and the residue forms a positive ion; (2) the electron and the positive ion acquire energy under the action of the electric forces; (3) in many gases the electron finally unites with an uncharged molecule to form a negative ion. As the most noticeable change in the conditions when the intensity of the electric field increases is in the energy of the electrons and ions, it is natural to look to these as the source of the additional ionisation. We have, moreover, direct experimental evidence that rapidly moving electrons and ions are able to ionise a gas through which they are passing. Hot wires and metals exposed to ultra-violet light yield a supply of electrons which when they leave the metal have very little energy; by applying suitable electric fields these electrons can be endowed with definite amounts of energy and can then be sent through a gas from which all extraneous ionising agencies are shielded off. When this is done it is found that, when the energy of the electrons exceeds a certain critical value, depending upon the nature of the gas, the gas is ionised by the electrons, but no ionisation occurs when the energy of the electron falls below this limit. It is convenient to measure the energy of the electron in terms of the difference of electrical potential through which the electron has to fall in order to acquire this energy. The potential difference which would give to the electron the energy at which it begins to ionise the gas is called the ionising potential. The values of the ionising potential have been found for several gases, as will be seen from Table IV. There is, however, considerable discrepancy between the results obtained by different observers.

TABLE IV. *Ionising Potentials in Volts.*

Gas	Stead & Gosling	Franck & Hertz	Davis & Goucher	Horton & Davies	Tate & Foote	Hughes & Dixon
H_2	15	11	11 & 15	..	..	10·2
He	20·8	20·5	..	25·6	..	..
O_2	..	9	..	..	..	9·2
N_2	17·2	7·5	17	..	..	7·7
CO	15	..	..	..	..	7·2
Arg.	12·5	12	..	15	..	..
Ne	..	..	..	16·7 & 20 & 22·8	..	..
Hg	10·8	..	..	..	..	10·2
Cd	..	..	..	..	8·9	..
Na	..	..	..	..	5·1	..
K	..	..	..	..	4·1	..
Zn	..	..	..	..	9·5	..

The most obvious view to take of this ionisation by moving electrons is that the moving electron comes so near to an electron in a molecule of the gas that the latter receives from the collision enough energy to enable it to escape from the molecule and start as a free electron. If the electrons repel each other with forces varying inversely as the square of the distance between them, and if T is the energy of the moving electron, and d the length of the perpendicular from the electron in the molecule on the initial direction of motion of the moving electron, then the energy communicated to the electron in the molecule by its collision with the moving electron is equal to

$$\frac{T}{1+\frac{d^2T^2}{e^4}}$$

where e is the charge of electricity on an electron. This is on the supposition that the electron is moving so rapidly that the time while it is in close proximity to the electron in the molecule is small compared with the time of vibration of that electron; if this time is comparable with the duration of the collision, the energy taken from the moving electron will be considerably less, and it will become vanishingly small when the duration of the collision is large compared with the time of vibration. The energy given to the electron in the molecule does not increase indefinitely with that of the moving electron, for it vanishes when T is infinite as well as when T is zero; it has the maximum value when $T=e^2/d$. In order that the electron in the molecule should receive an amount of energy Q

$$Q=\frac{T}{1+\frac{d^2}{e^4}T^2}, \quad \text{or} \quad d^2=\frac{e^4(T/Q-1)}{T^2}$$

If Q is the ionising potential, d^2 must be less than the value given by this expression. If n is the number of *electrons* in unit volume of the gas, and if the spheres with radius d described round the different electrons do not overlap, the probability that the moving electrons should come within this distance of one of them, when moving through a distance Δx, is $n\pi d^2\Delta x$, or

$$\frac{n\pi e^4(T/Q-1)}{T^2}\Delta x$$

The coefficient of Δx is the number of ions made per unit path by a moving electron with energy T. The maximum is when $T = 2Q$.

Experiments on ionisation by moving electrons have been made by Kössel (*Ann. der Phys.* 37, p. 406) and by Mayer (*ibid.* 45, p. 1), who found that the maximum ionisation per unit path occurred when the energy of the moving electron was in the neighbourhood of 200 volts. Mayer's results are 125 for hydrogen, 130 for air, and 140 for carbon dioxide. These numbers are much greater than twice the potential at which the ionisation begins, as this potential is of the order of 11 volts. It must be remembered, however, that though there may be some electrons in the atom which can be ejected by 11-volt electrons, there may be other electrons of different types which require more energy for their expulsion, so that, as the energy of the moving electrons increases beyond the energy required to liberate these electrons, fresh sources of detachable electrons will be trapped, and these may more than counterbalance the falling off in the ionisation of the more easily detached electrons. Again, some of the electrons ejected by the primary electrons may have enough energy to ionise on their own account; the total ionisation may thus be increased by ionisation due to the secondary electrons, and also by radiation excited by the impact of the primary electrons against the molecules of the gas.

When, as in the case of cathode rays in highly exhausted tubes or in that of the β rays from radioactive substances, T is very large compared with Q, the number of ions produced per unit path is $n\pi e^4/QT$, and so varies inversely as the energy of the moving electrons. The experiments of Glasson on ionisation by cathode rays, and of Durack on that by β-particles, seem to be in accordance with this result.

Scattering of Electrons.—The researches of Lenard and Ramsauer on the scattering of electrons in their passage through gases, have shown that the relation between the scattering produced by different gases depends to a great extent upon the velocity of the electrons which are scattered. If this velocity is small the scattering by most gases is approximately that which would be produced by impenetrable atoms of the size indicated by the Kinetic Theory of Gases and derived from the measurements of viscosity of gases and so on, there is no clear connection between the scattering produced by a gas and the number of electrons in its atoms. With high speed electrons the laws are much simpler and show proportionality between the scattering and the number of electrons in the atom. We should expect these results on the theory just given. For if 2θ is the angle through which the relative velocity of the electron and the atom is deflected by the collision

$$\sin^2\theta = \frac{1}{1+\frac{d^2}{e^4}T^2}$$

when T is the kinetic energy due to the relative motion of the electron and the atom.

Let us put $$T = \frac{e^2}{C}$$

then if T is expressed as V volts

$$C = 14{\cdot}4\times10^{-8}/V$$

and $$\sin^2\theta = \frac{1}{1+\frac{d^2}{C^2}}.$$

We see from this that θ will not be small unless d is considerably greater than C. Thus we may regard each electron in the atom as deflecting through considerable angles all electrons which pass within a distance C. They may, as far as collisions are concerned, be regarded as producing much the same effect as solid spheres of radius C. Now when the energy of the electrons is represented by 1 v., C is $14{\cdot}4\times10^{-8}$ centimetres. This is much greater than the distance between the electrons in the atom; thus the fields of influence of the different electrons in an atom will overlap, so that an increase in the number of electrons in the atom will not produce much effect on the scattering. On the other hand when T the energy of the electrons is so large that C, which is inversely proportional to T, becomes less than the distance between the electrons in the atom, the fields of influence of the different electrons will not overlap and each electron will provide an additional source of scattering, so that in this case the scattering will be proportional to the number of electrons in the atom.

With very slow electrons the scattering in most gases is independent of the speed but for argon and the heavier inert gases Ramsauer has made the very interesting discovery that very slow electrons are not scattered so much as those moving somewhat faster, it is as if the atoms of these elements were more permeable to slow electrons than to fast.

Ionisation by Moving Ions.—When the moving systems are ions instead of electrons, the collision between them and the electrons are collisions between masses of very different magnitudes, and in consequence a very much smaller fraction of the energy of the moving body becomes transferred to the electron than when the colliding bodies have equal masses.

The amount of energy transferred to the electron when the moving body has a mass M_1 is equal to:—

$$\frac{4M_1M_2}{(M_1+M_2)^2}\times\frac{T}{1+\frac{4d^2T^2}{e^2E^2}\left(\frac{M_2}{M_1+M_2}\right)^2},$$

when M_2 is the mass of the electron and E the charge on the moving body. When, as in the case of the collision between an ion and an electron, M_2 is very small compared with M_1, this becomes

$$\frac{4M_2}{M_1}\frac{T}{1+\frac{4d^2T^2}{e^2E^2}\frac{M_2^2}{M_1^2}}.$$

Thus, if Q is the ionising potential, the minimum value of T, which will communicate this energy to the electron, is $\frac{1}{4}\frac{M_1}{M_2}Q$.

For the smallest possible ion, an atom of hydrogen, $M_1/M_2 = 1{,}700$, so that the minimum energy that will enable an ion to ionise a gas by knocking out an electron from a molecule is equal to $425Q$. Q for many gases is about 10 v.; thus a positive ion must have at least energy represented by 4,250 v. to ionise the gas. With more massive ions the energy required for ionisation would be still greater.

An ion with a mass equal to that of a molecule of oxygen would not ionise unless its energy were greater than 136,000 volts. Thus any ionisation by ions taking place in discharge tubes where the potential difference is in general much less than this value must be due to ions of the lighter elements, hydrogen or helium.

If the ion came into collision with the atom instead of with one of its electrons, it could, since its mass is comparable with that of the atom, give up to this a large fraction of its energy, a very much larger fraction than it is able to give to an electron. Inasmuch as it requires less work to dissociate a molecule into neutral atoms than to dissociate it into positively and negatively electrified ions, the result of such a collision is more likely to be the production of neutral atoms than of electrified ions.

An ion is, however, a much more complex thing than the simple charge of electricity which has, in the preceding considerations, been taken to represent the forces it exerts; and it may be that some strongly electronegative ions have such a strong attraction for an electron that when they pass through the molecule of a more electropositive element they are able to capture one of its electrons and carry it away with them. This type of ionisation would differ from the ordinary type, inasmuch as in it the electron is never free; this type produces negative ions, the other type negative electrons.

It is evident from the preceding considerations that except in very intense fields it must be the electrons and not the ions which produce ionisation by collision. Let us consider what are the chances of an electron acquiring sufficient energy in a uniform electric field; if the electron moved freely under the electric force X for a distance l it would acquire Xel units of energy.

The electron in its course through the gas will come into collision with other bodies; its path will be deflected, possibly reversed, and in moving against the electric field it may lose all the energy it had previously acquired. Thus a collision of this type may destroy any ionising power given to the electron by the electric field before the collision.

Let λ be the average distance passed over by an electron between two collisions; then the chance of an electron moving through a distance l without a collision is $\epsilon^{-\frac{l}{\lambda}}$, but if it moves through a distance l it will acquire energy $=Xcl$, hence the chance of an electron acquiring energy equal to or greater than T is $\epsilon^{-\frac{T}{Xe\lambda}}$, and the chance that it should acquire energy between T and T+dT is $\frac{d}{dT}\left(\epsilon^{-\frac{T}{Xe\lambda}}\right)dT$. If it possess this amount of energy the chance that it makes one ion per centimetre of path is $n\pi\frac{e^4}{T^2}(T/Q-1)$; hence α, the chance that an electron should make one pair of ions per centimetre of path, is given by the equation

$$\alpha = n\pi e^4\int_Q^\infty \frac{d}{dT}\left(\epsilon^{-\frac{T}{Xe\lambda}}\right)(T/Q-1)\frac{dT}{T^2}$$

This may be written

$$\alpha = \frac{n\pi e^4}{Q^2}F(\theta)$$

where $\theta = Q/Xe\lambda$

and $$F(\theta) = \theta\int_\theta^\infty \epsilon^{-x}\left(\frac{I}{x}-\frac{\theta}{x^2}\right)dx$$

Since λ for the same gas is inversely proportioned to the pressure p, α will be of the form $nf(X/p)$ where $f(X/p)$ denotes a function of X/p; and since n is proportional to the number of molecules per unit volume, α may be written as $pf(X/p)$. When the spheres described round the electrons with radius d

where $d^2=\frac{l^4}{T^2}\left(\frac{T}{Q}-1\right)$

do not overlap, n will also be proportional to the number of electrons in the molecule. The greatest value of d is $e^2/2Q$; hence if D, the distance between two electrons, is greater than $e^2/2Q$ there can be no overlapping; if D is less than this quantity, there may be overlapping; since the value of d diminishes as the kinetic energy of the electron increases, n for very fast electrons will be proportional to the number of electrons in the molecule.

Some of the electrons will by adhesion to a neutral molecule become negative ions. Let the chance of an electron doing so while passing over 1 cm. be γp. If N be the number of electrons per c.c. at a place fixed by the co-ordinate x, then $\frac{dN}{dt}+\frac{d}{dx}(NU)=$ rate of increase of number of electrons per c.c., where U is the velocity of the electron parallel to x.

The number of electrons passing through the unit of area in unit time is NU. The new electrons produced by the passage of them through the unit volume is $NU\alpha$, while $NU\gamma p$ will disappear; hence:—

$$\frac{dN}{dt}+\frac{d}{dx}(NU)=NU(\alpha-\gamma p)+q \qquad (19)$$

where q is the ionisation due to external sources; when things are in a steady state $dN/dt=0$, and the solution of the equation, when the electric field may be taken as constant from one electrode to another, is:—

$$NU = C\epsilon^{(\alpha-\gamma p)x}-\frac{q}{\alpha-\gamma p}$$

Most of the experiments on this subject have been made without external ionisation; a supply of electrons has been obtained from the cathode, either by raising it to incandescence or by exposing it to ultra-violet light. In such cases $q=0$, and

$$NU = \iota_0\epsilon^{(\alpha-\gamma p)x} \qquad (20)$$

where ι_0 is the number of electrons emitted in unit time from the cathode. Townsend, and Townsend and Kirby have determined the value of $\alpha-\gamma p$ for various gases and over a considerable range of pressure. A series of these values for air are given in Table V.

TABLE V.

X = volts per cm.	Pressure (mm.)				
	·17	·38	1·10	2·1	4·1
20	·24	..	..	..	..
40	·65	·34	..	..	..
80	1·35	1·3	·45	·13	..
120	1·8	2·0	1·1	·42	·13
160	2·1	2·8	2·0	·9	·28
200	..	3·4	2·8	1·6	·5
240	2·45	3·8	4·0	2·35	·99
320	2·7	4·5	5·5	4·0	2·1
400	..	5·0	6·8	6·0	3·6
480	3·15	5·4	8·0	7·8	5·3
560	..	5·8	9·3	9·4	7·1
640	3·25	6·2	10·6	10·8	8·9

It will be seen that, when X is given, the increase in the number of electrons reaches a maximum for a particular pressure. From general reasoning this must be so, for if $p=0$ there will be no collisions to make fresh electrons, and if p is infinite the free path of the electrons will be so small that they cannot acquire sufficient energy to ionise the gas. Since α is of the form $pf\left(\frac{X}{p}\right)$, and γ does not depend upon p, $\alpha-\gamma p$ will be a maximum when

$$f\left(\frac{X}{p}\right)-\gamma-pf^1\left(\frac{X}{p}\right)\cdot\frac{X}{p^2} = 0$$

or when $f\left(\frac{X}{p}\right)-\gamma = f^1\left(\frac{X}{p}\right)\frac{X}{p}$ where $f^1(X/p)$ denotes the differential coefficient of $f(X/p)$ with respect to X/p. This equation determines X/p; hence the critical pressure will be proportional to the electric force. At this critical pressure $Xe\lambda$ bears to Q a ratio which depends upon the way in which the chance of an electron ionising by a collision depends upon the energy of the electron. If, for example, the chance were independent of this energy, provided the energy were greater than Q, the maximum current would be when $Xe\lambda=Q$; this relation would not hold for other and more probable laws connecting ionising power with the energy, but we should expect that for any such law the ratio of $Xe\lambda$ to Q would neither be very large nor very small.

Since the electrons cannot begin to ionise until their energy is equal to Q, and to attain this energy they must pass through a distance Q/Xe, it is clear that we ought in such an equation as (20) to write $x-Q/Xe$ in place of x. If V is the potential difference between the plates, $X=V/d$, so that $x-Q/Xe=x-dQ/V$ if Q is measured in volts. Thus in finding the current between two electrodes we must, if we use equation (20), write $d\left(1-\frac{Q}{V}\right)$ instead of d. Partsch (*Verh. d. Deutsch. Phys. Gesell.*, 14, p. 60) has shown that theory and experiment agree better by this change.

Ionisation Due to Radiation.—When rays of ultra-violet light of very small wave length or Röntgen rays which are vibrations with yet smaller wave length pass through a gas, the gas is ionised. The application of C. T. R. Wilson's expansion method (supra) to this case shows that the effect of the radiation is to expel from some of the gas an electron moving at a high speed. This electron ionises by collision the gas through which it passes and the majority of the ions are produced in this way. This is proved by the fact that on the Wilson photographs (*see* fig. 18) the drops of water which denote the presence of the ions are found to be arranged on lines starting from a molecule of the gas. For the ionisation to take place there must be some process going on by which the energy of the radiation can be concentrated on the minute volume occupied by an electron. The energy with which the electron is expelled from the molecule depends on the frequency of the radiation but not upon its intensity. Thus if the source of radiation be moved further away from the gas the number of high speed electrons ejected is diminished but the

speed of those which are ejected is not affected. This result has led to the quantum theory of radiation, which supposes that radiant energy is made up into units, or at any rate is only communicable by such units, the unit of energy is proportional to ν the frequency of the radiation and equal to $h\nu$ where h is a constant called Planck's constant. On the C.G.S. system of units it is equal to $6{\cdot}55\times10^{-27}$. Since to expel an electron from a molecule requires the expenditure of Ve units of work when V is the ionising potential, if the electron is expelled by the radiation the energy available must be greater than Ve, hence ν the frequency of the light must be greater than the value V given by the equation

$$h\nu = Ve.$$

For example if the ionising potential of helium is 22·7 volts, helium will not be ionised by radiation unless the wave length of the radiation is less than 540 Ångstrom units.

It has been shown by Barkla that when the radiation is wholly absorbed in a gas the number of high speed electrons ejected is independent of the nature of the gas. Thus we may regard the production of a high speed electron as involving the destruction of a unit of radiant energy.

The connection between the wave length of the radiation and the amount of ionisation produced in gases of definitely chemical constitution is a most vital and important one which unfortunately has not received the attention it deserves. One most important question is whether the ionisation is an additive property, or not. If the chemical composition of the gas is represented by $A_xB_yC_z$ where A, B, C, are symbols representing chemical elements, and x, y, z, are the number of atoms of A, B, C, in the molecule, can the ionisation per molecule, when radiation of known frequency passes through the gas, be represented by

$$x(A)+y(B)+z(C)$$

where (A), (B), (C), are constants appertaining to the elements A, B, C, respectively? The evidence on the whole seems to be in favour of such a connection but the tests have not been very severe. The amount of ionisation due to radiation varies enormously with the nature of the gas. Thus the ionisation in hydrogen is so small that some observers consider that such as is observed is due to a trace of impurity. It is not comparable with that which occurs in gases like chlorine, sulphur, bromine, iodine and mercury vapours. It has been found that μ the absorption of radiation of wave-length λ estimated per molecule of the absorbing substance can be represented by formulae of the type

$$\mu = CN^p\lambda^q$$

where N is the atomic number of the absorbing substance and C a constant. The values of p given by different observers range from 2·5 to 4 and of q from 2·5 to 3. Values such as these indicate that the absorption and presumably the ionisation increase rapidly with the molecular weight. Thus if we take $p=3$ the absorption of the rays by an atom of iodine would be about 1,000 times that by an atom of carbon. For the same substance and different kinds of radiation, the ionisation increases as the cube of the wave length. Formulae of the type $CN^p\lambda^q$ hold over only a limited range of frequencies; the values of p and q appear to change when the wave length of the radiation passes through a value corresponding to that of a characteristic radiation of the absorbing substance. The graph representing the relation between the wave length and the absorption is of the type shown in fig. 6.

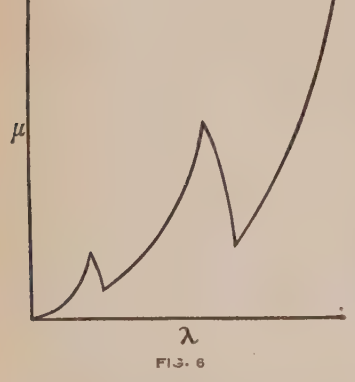


FIG. 6

It will be noticed that this curve differs very materially from the graph corresponding to the visible part of the spectrum. In this part of the spectrum we may have very intense absorption of light of a particular wave length, for example, the absorption by mercury vapour of the line 2536 is so strong that the light cannot pass through more than a few millimetres of the vapour at the pressure of one hundredth of a millimetre of mercury, and yet there is practically no absorption for lines whose wave length is either greater or less than 2536 by 1 Ångstrom unit. With radiation of the ionising type, on the other hand, though the absorption comes in abruptly when the wave length falls below a critical value, it does not fall away abruptly when the wave length is still further diminished but decays according to the λ^3 law. The application of this law leads us to expect that radiation between a certain range of wave lengths say from 20 to 250 Ångstrom units would be exceedingly powerful ionising agents. For the characteristic radiation given out by zinc whose wave length is 1·4 Å, μ has been found to have the values given in the second column of Table VI., the value of μ calculated by the λ^3 law for radiation of the wave length 248 Å, for which the quantum is 50 v., is given in the third column.

TABLE VI. *Values of μ by the λ^3 law.*

Substance	$\lambda=1{\cdot}4$ Å	$\lambda=248$ Å
Carbon	4·26	$1{\cdot}8\times10^{7}$
Air at 0° C. & 760 mm.	$9{\cdot}1\times10^{-3}$	$4{\cdot}0\times10^{4}$
Mg	59	$2{\cdot}6\times10^{8}$
Al	105	$4{\cdot}6\times10^{8}$
Fe	1723	$7{\cdot}6\times10^{9}$
Cu	490	$2{\cdot}2\times10^{9}$

Since the radiation falls to $1/\epsilon$ of its value after passing through a distance equal to $1/\mu$ we see that the radiation with the longer wave length would be practically completely absorbed by a layer of Al or Mg one molecule thick or by a layer of air one centimetre thick at a pressure considerably less than that due to a tenth of a millimetre of mercury. J. J. Thomson has shown by measuring the photo-electric effects produced inside the discharge tube by the radiation produced by the passage of the electric discharge through the tube that this radiation includes not only the visible part of the spectrum where the energy in the quantum is only some two or three volts, but soft Röntgen rays having quanta between 20 and 100 volts. These rays as we have just seen will be greedily absorbed by the gas and produce intense ionisation. A large part of the ionisation in the tube is probably due to these rays which are excited by the passage of cathode and positive rays through the gas and by their incidence on the electrodes and on the walls of the discharge tube.

Spark Discharge.—The production of ions by moving electrons will not by itself explain why a current of electricity can be maintained through a gas by an electric field when all other sources of ionisation are excluded. The electrons are continually being driven towards the anode, and unless there is some source of supply near the cathode the ionisation and therefore the current will rapidly come to an end. One way in which the electrons could be supplied by the action of the electric field would be by the positive ions which strike against the cathode communicating so much energy to the electrode that it is raised to incandescence. Since an incandescent metal gives out large quantities of electrons there will be a continuous supply of electrons from the cathode, which will ionise the gas and produce fresh positive ions to strike against the cathode and keep it hot. This is what happens in the arc discharge when the cathode is kept in a state of incandescence by the discharge. In this case there is a large amount of energy put into the arc. There are, however, other forms of continuous discharge where the cathode does not become incandescent, so that there must be other ways in which the supply of electrons is maintained. From what we know about ions there are several ways in which this might occur.

It has been found by experiment—[Füchtbauer, *Ann. der Phys.*, 23, p. 301 (1907); Saxen, *Ann. der Phys.*, 38, p. 319 (1912); Baerwald, *Ann. der Phys.*, 41, p. 643 (1913); 42, p. 1207 (1913)]—that electrons are emitted from metals when these are bombarded by high speed positive ions even though the metal is not raised to

incandescence. According to Baerwald the emission of electrons from metals bombarded by positive hydrogen atoms does not become appreciable until these have an amount of energy exceeding that represented by 900 volts. Again positive ions ionise a gas through which they pass. This was shown by McClelland, who found that the relation between the potential difference and the current from a hot wire anode surrounded by gas at low pressure was represented by a curve like that shown in fig. 7. The hot wire furnishes positive ions as well as negative ones, and

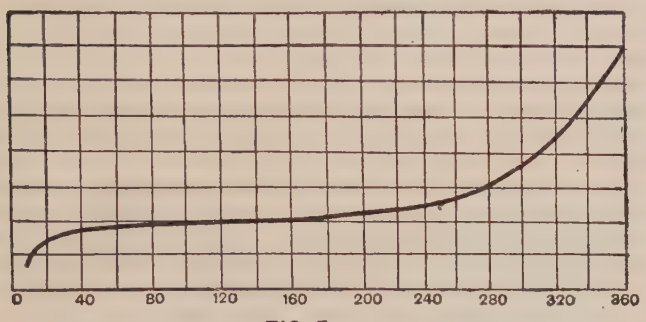
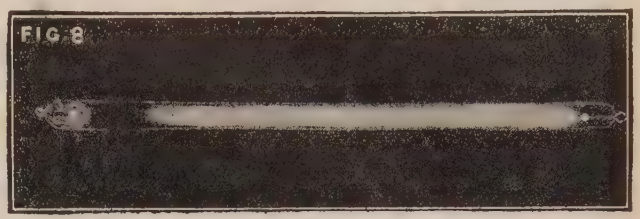


FIG. 7

the curve shows that fresh ions are formed when the potential difference is greater than about 200 volts. This is a much greater potential difference than that needed to produce ionisation by electrons, but it is smaller than would be expected by the considerations given above. As it requires less work to eject an electron from a metal than from a molecule, we should expect that if 200 v. ions could eject electrons from a gas through which they pass they would be able to do so from a metal against which they strike, but from Baerwald's experiments much more energy than 200 v. is required for this purpose. In McClelland's experiments the ionisation might have been into positive and negative ions rather than into positive ions and electrons; before the negative ions could be efficient for ionisation by collision they would have to undergo further dissociation into electrons and uncharged molecules. Curves similar to that in fig. 6 have also been obtained by O. W. Richardson. Pawlow (*Proc. Roy. Soc.*, A. 90, p. 398) and also Franck and E. v. Bahr (*Verh. d. Deutsch. Phys. Ges.*, 16, p. 57, 1914) came to the conclusion from their experiments, that ionisation was produced by positive ions even when their energy did not exceed a few volts; indeed they could not get any evidence of a minimum to the ionising voltage. Horton and Davies (*Proc. Roy. Soc.*, 95, p. 333) could not detect any ionisation in a gas by positive helium ions when the energy was due to 200 volts. They ascribe the ionisation observed by Pawlow, Bahr and Franck to photo-electric effects; they consider, however, that positive helium ions can liberate electrons from a metal against which they strike if their energy exceeds 20 volts. Baerwald considers that it requires an energy measured by 900 v. before positive ions can liberate electrons from metals.

There are thus at least four methods by which the supply of electrons near the cathode necessary to maintain the discharge can be obtained. The gas near the cathode may be ionised by positive ions or by radiation, or the cathode itself may emit electrons under the impact of positive ions or by the incidence of radiation.

When the gas is at a low pressure, the appearance of the discharge has well-marked characteristics which may throw light on the method by which the electrons are produced and the place from which they start. The discharge near the cathode is represented in fig. 8; in contact with the cathode there is a velvety glow, then a space comparatively dark called the cathode dark space; this joins on to a brightly luminous region called the negative glow; passing through this region, and making themselves evident by the luminosity they excite when they strike against the glass wall of the vessel in which the gas is contained, are the cathode rays. These have been shown to be electrons moving with high velocity. These electrons have been liberated by the action of the electric field and have acquired their velocity under the action of that field. The velocity of the cathode rays has been measured, and it has been found that the majority of them have the same velocity. This shows that they must have all fallen through the same potential. They would do this if they all started from the cathode itself, but if they had originated by the ionisation of the gas in the dark space in front of the cathode some would have started from one place and some from another, and they would have acquired different velocities. This is strong evidence in favour of the cathode itself being the primary source of the electrons which maintain the discharge. When a supply of electrons is produced by processes taking place at the cathode, ionisation by collisions of electrons with the molecules



of the gas is sufficient to maintain the discharge through the interval between the negative glow and the anode. This interval, as will be seen from fig. 8, is made up of a short part next the negative glow in which there is comparatively little light, called the Faraday dark space, and then a long uniform portion reaching right up to the anode. Unless the pressure is very low or the spark very short this portion, which is called the positive column, forms by far the larger part of the discharge. The discharge here will be maintained if the rate at which electrons are produced by collision is equal to the number lost by recombination. When this is the case, equation (19) gives $\alpha=\gamma p$, or, since α is of the form $pf\left(\frac{Q}{Xe\lambda}\right)$

$$f\left(\frac{Q}{Xe\lambda}\right) = \gamma$$

thus $Xe\lambda = cQ$ where c is a quantity which does not depend upon the pressure or strength of the field; as λ is inversely proportional to the pressure, this equation is equivalent to $X = c_1 p$, when c_1 is a quantity which will depend on the nature of the gas and possibly on the intensity of the current. If l is the length of the positive column the difference in potential between the anode and the end of the positive column next the cathode is lX, *i.e.*, $c_1 pl$.

Between the cathode itself and the negative glow there is a fall of potential, called the cathode potential fall, which, when the current carried by the discharge is not large, is independent of the current and the pressure of the gas; it depends upon the nature of the gas and the material of which the electrodes are made. If V_0 is the cathode fall, then (neglecting the change in potential in the negative glow and the Faraday dark space, which has been found by experiments to be very small) V, the potential difference between the anode and cathode, will be given by the equation

$$V = V_0 + c_1 lp \qquad (21)$$

It is assumed that the length of the spark is greater than that of the dark space D; at pressures comparable with that of the atmosphere, D is a very small fraction of a millimetre, but at the low pressures which can easily be obtained in highly exhausted vessels D may be several centimetres. It is to be noticed that V is a linear function of lp, and lp is proportional to the mass of gas between the electrodes; hence as long as the mass of gas between the electrodes remains unaltered the potential difference required to maintain the spark will be constant. This law, which was discovered by Paschen in 1889 as the result of a long series of experiments, is known as "Paschen's law." It has been found to be in agreement with the very numerous investigations which have been made on the potential difference required to produce a discharge in an approximately uniform electric field such as that which exists between two slightly curved electrodes.

The relation (21) does not give any indication of the relation between the potential difference and the spark length when the

latter is exceedingly small. When the spark length falls below a critical value which is inversely proportional to the pressure, and which in air at atmospheric pressure is about ·01 mm., the spark potential increases rapidly as the spark length diminishes; this was first observed by Peace. A simple way of demonstrating it is to use slightly curved electrodes and to observe the path of the spark as these are brought closer together. Until the electrodes get very close together the spark passes along the shortest line between them, but as they approach each other a stage is reached where the spark no longer passes along the shortest line

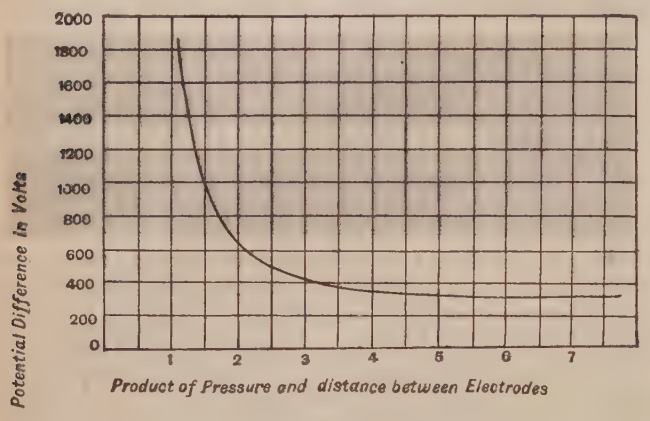


FIG. 9

but goes to one side, taking a longer path, showing that it is easier to produce a long spark than a short one. The relation between the potential difference and the spark length for several gases has been determined by Carr, who finds that Paschen's law that the potential difference depends only on pl is also true for very short sparks; Paschen's own experiments were made with sparks considerably longer than the critical value. Fig. 9 represents Carr's results for the relation between V and pl. The results of Carr's and Strutt's (Lord Rayleigh's) experiments for the minimum spark potential, and the value of pl, at which it occurs, are given in the following table:—

TABLE VII.

Gas	Minimum Spark Potential in volts	pl
Air	341 S[1]	5·7
Nitrogen	251 S	6·7
Oxygen	455 C	..
Hydrogen	{302–308 S {278 C	14·4
Carbonic acid	419 C	5·1
Sulphur dioxide	457 C	3·3
Nitrous oxide	418 C	5
Sulphuretted hydrogen	414 C	6
Acetylene	468 C	..
Helium	261 S	35

[1] S=by Strutt; C=by Carr.

The curves are very flat in the neighbourhood of the minima, so that the critical values of pl may be subject to considerable errors. Strutt found that even very small traces of impurity produced very large increases in the values of the minimum spark potential in nitrogen and helium; these are gases where, as we have seen, such traces produce large diminutions in the mobility of the negative ion. The existence of a minimum for the spark potential and a critical spark length follows from the view that the self-sustained discharge is maintained by radiation produced by electrons or positive particles. The condition for the self-sustained discharge is that an electron in its passage between the electrodes exerts some ionisation effect which produces another electron to succeed it. If V is the potential between the plates, the energy given to the electron is Ve. Let the amount of this converted into radiation be βVe; if μ is the coefficient of absorption, d the distance between the plates, then when d is small the number of ions produced by the electron will be $\beta\mu dVe$. If the electron is to provide a succession this must be equal to unity so that

$$V = \frac{1}{\beta\mu ed}$$

so that the potential difference varies inversely as $1/d$ and is infinite when d vanishes. Since μ is proportional to the pressure of the gas we see that V will depend upon pd so that Paschen's law is fulfilled.

The mechanism we have hitherto considered involves the ionisation of the gas between the electrodes, and no spark could pass across a vacuum. There are, however, other methods by which a discharge might do this. For suppose there was a stray electron between two parallel electrodes in a vacuum; then under the action of the electric field it would be driven against the anode; by the impact Röntgen radiation would be generated, which would fall on the cathode, and if it were intense enough to liberate one electron from the cathode the original electron would be replaced and the passage of negative electricity from the cathode to the anode would be repeated. From these considerations it is probable that even the highest vacuum would not act as a perfect insulator for very intense fields.

The linear relation $V = V_0 + c_1 l/p$ has been obtained on the assumption that the direction of the electric force was the same in all parts of the field; this is only true when the dimensions of the electrodes are large compared with the distance between them. The potential difference required to produce a spark of a particular length depends upon the size of the electrodes between which the spark passes, and is not a linear function of lp, where p is the pressure and l the spark length, unless l is small compared with the linear dimensions of the electrodes. If these are spheres, the spark potential will depend upon their radii, and for small spheres may be considerably less than for large ones. Thus, for example, the spark potential in air for a five centimetre spark is 26,000 v. for electrodes ·5 cm. in diameter, and 105,000 v. when the diameter of the electrodes is 5 centimetres.

In this connection it may be noted that, if the electric field is sufficiently intense at any place to produce there a local supply of ions, these may redistribute themselves between the electrodes, and by their electrostatic action produce a change in the distribution of the electric force more favourable to the passage of the spark than that prior to the production of the ions. To illustrate this, take the very simple case when the electrodes are two parallel plates: if there are any ions available these may distribute themselves so that the force between the plates is no longer uniform. Thus let us suppose that there are enough positive ions to congregate round the cathode in sufficient numbers to produce within the distance of the "critical spark length" or thickness of the cathode dark space, a difference of potential equal to the minimum spark potential. This would ensure a continual emission of electrons from a place in front of the cathode, and even though the electric field from this place to the anode were too feeble to give an electron enough energy to ionise the gas, the electrons coming from the cathode would be able to carry a small current, though this part of the discharge might not be luminous. The ions here would be all of one sign, so that the electric force will increase up to the anode. If the current is gradually increased, the place where the electric force will first rise to the value necessary to make the electrons ionise will be close to the anode. When this occurs a supply of positive ions will start from the anode and move towards the cathode, accompanied by luminosity close to the anode and very faint luminosity through the rest of the tube. The introduction of the positive ions into the region between the anode and cathode will diminish the retarding effect of the negative space charge which existed in this region, so that the current will increase. This increase in current will again increase the ionisation at the anode, and thus the supply of positive ions. In this way there might be a supply of electrons coming from the cathode, and of positive ions from close to the anode, which will maintain the current in spite of the fact that between these places there is a region where the electric

force is below that required to produce ionisation by collision, and the potential difference between the electrodes less than that calculated on the supposition that the electric force was uniform from one to the other. We should expect from these considerations that, if the electric force at any point were intense enough to produce ionisation by collision, some discharge would take place.

Russell (*Phil. Mag.*, 6, xi., p. 237) states that the results of the different experiments made on the potential difference required to produce sparks of various lengths between spherical electrodes of various radii are in good agreement with the rule that the discharge takes place in air at atmospheric pressure if the electric force at any point in the field before discharge begins is as great as 37,000 v. per centimetre. This value agrees well with that required to make electrons produce, in air at atmospheric pressure, other ions by collisions.

The curious lag observed by Warburg between the application of the potential difference and the passage of the spark, which when the applied potential is only a very little greater than that required to produce the spark may amount to several seconds, is naturally explained as the time needed by the ions to distribute themselves so as to produce the distribution of potential required for the discharge.

The discharge of electricity from points affords a good illustration of the preceding considerations. Suppose that the electrodes are a needle point and a plane. When the discharge first begins the only place where any light is to be seen is close to the

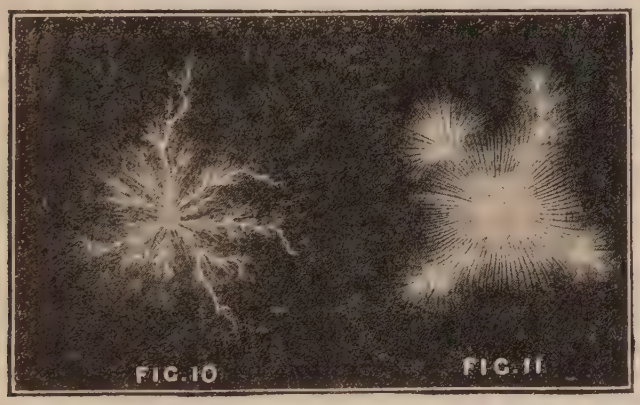


FIG. 10 FIG. 11

point; the current between the electrodes is very small; as the potential difference increases a stage is reached where light begins to appear close to the plate, the space between the point and plate being quite dark. This stage is marked by a large increase in the current. With further increase in current the luminosity extends into the gas and ultimately stretches from one electrode to another.

The potential required to start the discharge is less where the point is negative than when it is positive. This is what might be expected, for to maintain the discharge from the negative point there must be (1) ionisation of the gas by the outgoing electrons, and (2) liberation of electrons by the incoming positive ions, while when the point is positive there must be (1) ionisation of the gas by outgoing positive ions, and (2) liberation of positive ions by the impact of incoming electrons; as the process is not the same as for the negative point we should expect that there would be a difference between the potentials. It is not only the potential difference which is affected but the type of discharge. This can be shown by allowing the point discharge to pass in the neighbourhood of a photographic plate. Beautiful figures are found on developing the plate, and the character of these is different according as the point is positive or negative. Figures 10 and 11 represent discharges from positive and negative points respectively.

The discharge from a negative point is in some gases very much influenced by the purity of the gas; thus Warburg found that the discharge from a negative point in nitrogen increased about 50 times by removing the last trace of oxygen from the nitrogen, though this had little or no effect upon the discharge from a positive point. This can be accounted for by the discovery of Franck and Hertz that in very pure nitrogen the electron does not unite with the molecule and become a negative ion and has therefore a very high mobility. This is true for the inert gases as well as for nitrogen, and Przibram has shown that the difference between the discharges from positive and negative points is exceptionally large in these gases.

Electrical Wind.—The electrified ions' starting from the point in a point discharge sets the gas in the neighbourhood of the point in motion producing a current of air, called the "electrical wind." The momentum gained by the air is lost by the point, so that there is a backward force acting on the point, which has often been measured. This force, as well as the electrical wind, is smaller when the point is negative than when it is positive; this difference is especially marked at pressures low enough to make the negative ion have an abnormally large mobility.

Relation between Potential Difference and Current.—The potential difference required to maintain a discharge will depend upon the current passing in the discharge. The relation between the current and the potential difference for discharge through gases is often a very complicated one. We should expect that this would be so, for in the spark discharge, for example, the potential difference is made up of the cathode fall of potential (this increases with the current when the current is large) and a uniform force along the rest of the discharge, and this force in many cases diminishes as the current increases. Thus whether increases of current produce an increase or decrease in the potential difference will depend on the relative contributions of these two parts.

A curve whose ordinates are the potential difference between the electrodes and the abscissae the current through the gas, is called the "characteristic curve" for the discharge (see fig. 12). From such a curve it is possible to find the current sent through a gas by a given external electromotive force. Suppose that the current sent through a gas by a battery of cells of electromotive force E_0 is required. If R is the resistance of the curves connecting the battery with the electrodes in the gas, then $E_0 - R\iota$ is the potential difference between the electrodes in the gas, and one relation between this potential V and the current is represented by the straight line $V = E_0 - R\iota$. The other relation is that represented by the characteristic curve; the values of the current through the gas and the potential difference between the electrodes will be determined by the points of intersection of this straight line and the characteristic curve. Unless the straight line cuts the curve there can be no discharge through the gas;

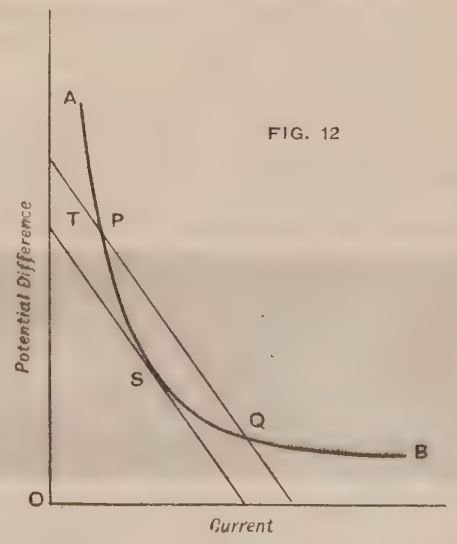


FIG. 12

on the other hand, the straight line may cut the characteristic curve in more than one point, indicating that there is more than one type of discharge. Some of these types may, however, be unstable and thus impossible to realise. Thus, for example, if the current is increased by $\delta\iota$ the difference of potential given by the battery between the electrodes is diminished by $R\delta\iota$;

if V is the potential difference between the electrodes required to send a current ι through the gas, then when the current is increased by $\delta\iota$, the increase in the potential required is $\frac{dV}{d\iota}\delta\iota$; thus unless $\frac{dV}{d\iota}\delta\iota$ is less than $-R\delta\iota$, or $-\left(\frac{dV}{d\iota}+R\right)\delta\iota$ be positive, the diminished potential supplied by the battery will not be sufficient to maintain the increase in the current; this increase will stop, the current will return to its original value, and the discharge will be stable; thus if $R+\frac{dV}{d\iota}$ is positive the discharge will be stable. If, however, $R+\frac{dV}{d\iota}$ is negative the fall in potential required to maintain the increased current is so great that, in spite of the diminution of the potential difference supplied by the battery, the residue is great enough to maintain the increased current, the increase in the current will continue, and the discharge will be unstable. Thus the condition for stability is that $R+\frac{dV}{d\iota}$ should be positive, a result first given by Kaufman. This result is equivalent to the condition that for stability the straight line must, at the point where it cuts the characteristic curve, fall more steeply than the tangent to the curve at that point. Thus if APQB, fig. 12, the characteristic curve and the right line cut at PQ, the type of discharge represented by P is unstable, and that by Q stable. Keeping the electromotive force at the battery constant and increasing the resistance will make the straight line steeper, and Q will move to the left and the current through the tube will decrease; when the line gets so steep that it touches the curve at S, the minimum value of the current consistent with the maintenance of this type of discharge by the electromotive force supplied by the battery will be reached, and any further diminution of the current will result in the extinction of this type of discharge. It is a well-known fact that the existence of most types of luminous discharges requires the current to be above a certain critical value which depends upon the external force. The electric arc is perhaps the most familiar example of this. As the characteristic curve for the arc discharge is a rectangular hyperbola represented by the equation $V=a+\frac{b}{\iota}$; we can easily show that if the external electric force is E, the maximum resistance which can be introduced into the circuit without extinguishing the arc is $(E-a)^2/4b$, and the smallest current compatible with the existence of the arc $2b/(E-a)$. For any stable type of discharge we see that an increase in the external electromotive force will result in an increase of current; at a point corresponding to an unstable condition it produces a diminution.

Structure of the Discharge.—The structure of the discharge at atmospheric pressure is on so fine a scale that its details can only be made out with difficulty; as the pressure is reduced the scale gets larger and larger, until, when the pressure is reduced to that due to a millimetre or so of mercury, the details of the structure become very conspicuous. The appearance of the

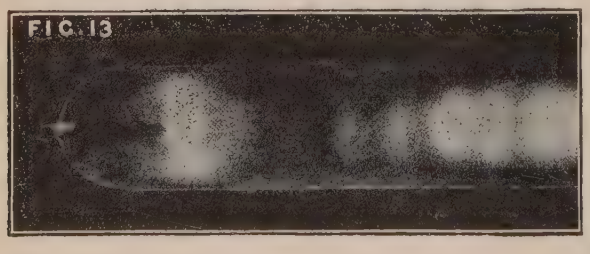


FIG. 13

discharge at such a pressure is shown in fig. 13, and we see that it is built up of several constituents of very different types. We have already, when considering the spark discharge, given a general description of some of them; there are, however, some features which require further discussion.

Starting from the cathode, we find a thin layer of luminous gas, the colour of which depends on the kind of gas through which the discharge is passing. In most gases the light appears to reach right up to the cathode, but in helium Aston has shown it is separated from it by an exceedingly thin dark space. This luminous layer is sometimes called "Goldstein's first layer"; next to this we have a region where there is comparatively little luminosity called "Crookes' dark space," the boundary of this space being approximately the surface traced out by normals to the surface of the cathode of constant length. The thickness of the dark space, which is of the order of the critical spark length, depends upon the pressure of the gas, varying approximately as the reciprocal of the pressure; for air at the pressure of 1 mm. of mercury the thickness of the dark space is about 2 mm. so that at atmospheric pressure the thickness would not be much more than about 1/400 of a millimetre. If the pressure remains constant and the current through the tube is increased, the thickness of the dark space remains unaltered until the current is large enough to cover the whole of the cathode with the luminous glow; after this stage is reached any further increase in the current

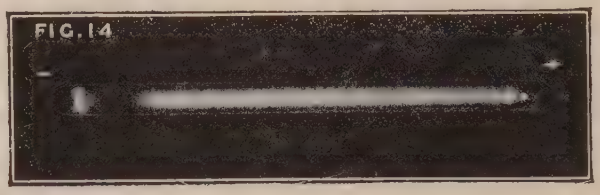


FIG. 14

causes a diminution in the thickness of the dark space. Starting from the boundary of the dark space there is a brightly luminous region called "the negative glow." The function of the parts of the discharge from the cathode to the negative glow is to produce the supply of electrons from the neighbourhood of the cathode necessary to keep the discharge going. The dimensions of this part of the discharge are independent of the distance between the cathode and anode; at very low pressures this part may occupy a length of several centimetres, but at atmospheric pressure they are crowded into a very small fraction of a millimetre and as far as length goes occupy a negligible portion of the sparks at such pressures. The Crookes' dark space, though it appears dark in contrast to the negative glow, is not devoid of luminosity; indeed Seeliger, who has made a spectroscopic examination of the dark space, finds that there are some lines, such as the Balmer series lines, which are almost as bright in the dark space as in the negative glow. But many lines are much stronger in the negative glow than in the dark space.

Beyond the negative glow there is another comparatively dark region called the "Faraday dark space"; the length of this is very variable even when the pressure is constant, as it is sensitive to any change in current. Beyond this and reaching right up to the anode is a luminous column called the positive column. The luminosity in some cases is fairly uniform in intensity, but when the pressure and current are between certain limits this column may exhibit remarkable alternations of dark and bright spaces called striations, such as are shown in fig. 14. Under some circumstances a dark space round the anode has been detected by several observers.

When the distance between the electrodes is considerable and the pressure not very low, the positive column forms by far the greater part of the discharge; thus at atmospheric pressures all but a fraction of a millimetre of the discharge next the cathode will consist of the positive column.

Distribution of the Electric Force Along the Discharge.—The electric force is very large indeed in the part of the dark space next the cathode, but diminishes rapidly towards the negative glow. In the negative glow itself it is smaller than in any other part of the discharge; passing the negative glow, the electric force increases in the Faraday dark space, until the positive column is reached. When the positive column is of uniform luminosity the electric force in the column is constant until quite close to the anode, when there is an abrupt change of potential of about 20 volts, called the anode fall of potential. When the positive column is striated, the alternations of luminosity in the positive column are accompanied by alternations in the intensity of the electric force, the maxima of the electric force occurring

at the bright parts of the striae, the minima at the dark. From the equation $\frac{dX}{dx} = 4\pi\rho$, where X is the electric force in the direction of x and ρ the density of the electrification, we see that there is an excess of positive electricity in the cathode dark space and of negative in the Faraday dark space; in a uniform positive column there is no appreciable excess of electricity of one sign over that of the opposite, while in the striated positive column there is an excess of negative electricity on the cathode side of a bright part of a striation and of positive on the anode side.

Cathode Fall of Potential.—Until the glow next the cathode covers the whole of the electrode the difference of potential between the cathode and the negative glow is constant, depending on the gas and the material of which the cathode is made, but being independent of the pressure of the gas and the strength of the current. This constant difference of potential is called the "cathode fall of potential," and there is evidence to show that it is equal to the minimum potential that can produce a spark through the gas. Its value, for different gases and different electrodes is given in the following table, due to Günther-Schulze:—

TABLE VIII.

	K	Na	Mg	Al	Zn	Fe	Pb	Cu	Ag	Aa	Pt
He .	68	80	125	153	143	161	177	177	162	165	163
Ne .	68	75	122	145	136	153	172	221	154	158	152
Arg .	71	78	158	150	155	166	166	155	156	157	162
N .	170	178	210	215	252	256	227	244	254	250	233
H .	172	185	171	192	233	250	316	299	301	330	300
Air .	181	198	240	242	292	281	306	282	305	297	324
ϵ_4	−2·92	−2·72	−1·55	−1·28	−0·76	−0·43	−·12	..	..	..	..

Further light is thrown on the origin of ionisation in gases by the study of the distribution of electric force in the neighbourhood of the cathode. Aston has shown that at low pressures the force in the neighbourhood of the cathode is a linear function of the distance from the cathode, so that if V be the electrostatic point at a point distant x from the cathode

$$\frac{dV}{dx} = C(d-x) \qquad (22)$$

when C and d are constants. If ρ is the density of the electrification at the point x: $4\pi\rho = d^2V/dx^2$, hence for this law of force ρ is constant. We have to consider what law of ionisation is compatible with this result. It can be shown that to make ρ constant the ionisation must be independent of the distance from the cathode, a result which seems much more probable if the ionisation is due to radiation than if it were mainly due to ionisation by collision. We see from equation (22) that dV/dx vanishes when $x=d$. This is the place where the negative glow begins. The potential difference between the cathode and the boundary of the negative glow is called the cathode fall of potential and is a quantity of great importance, of which many measurements have been made which are given in Table VIII. The cathode fall of potential depends on the nature of the gas and of the electrodes but is independent of the pressure.

The consequences of the hypothesis of ionisation by radiation are in fair agreement with the results of experiments; they are as follows:—

The normal cathode fall of potential is independent of the pressure of the gas.

The thickness, d, of the dark space is inversely proportional to the pressure.

The cathode fall of potential V is connected with I the density of the current carried by the positive ions by the relation:—

$$V^{\frac{3}{2}} = \left(\frac{M}{2e}\right)^{\frac{1}{2}} \pi^2 I d^2 \qquad (23)$$

where M is the mass of a molecule of the gas.

The cathode fall of potential is on this view equal to the smallest potential difference that can produce a spark through the gas and the thickness of the dark space at any pressure is the length of the spark which at that pressure passes with the minimum potential difference.

We see from equation (23) that in order to produce the discharge a definite current density as well as a definite potential difference is required. This density, for a flat electrode, is as we see from equation (23) inversely proportional to d^2 and therefore directly proportional to the square of the pressure.

The values of V and I at a pressure of 1 mm. of Hg for plane cathodes (1) of aluminium, (2) of iron, for different gases have been determined by Günther-Schulze (*Zeit. für Physik*, 20.1).

TABLE IX.

Gas	Aluminium		Iron	
	I(am/cm²)	V. volts	I(am/cm²)	V. volts
He .	1·07	153	1·187	161
Ne .	1·81	145	2·000	153
Ar .	14·07	150	15·5	166
N .	38·4	215	42·3	256
H .	9·0	192	9·96	250
O .	54·7	250	60·6	326

V depends on the nature of the electrode as well as upon the gas. Günther-Schulze's experiments indicate that V can be expressed approximately in the form:—

$$V = 35\cdot5\epsilon + a$$

where a is a quantity depending on the gas and ϵ, a quantity called the electrochemical normal equivalent, which is given in the last row of Table VIII.

The values of a in volts for different gases are He, 175; Ne, 169; Ar, 174; N, 265; H, 290; O, 350. The preceding values refer to what are called the normal values when the current flowing through the tube is not large enough to cover the whole cathode with glow, so that an increase in the current may occur through an increase in the area over which the current is spread and not from an increase in the mean density of the current.

Günther-Schulze gives the following empirical expression for the dark space, d

$$pd = (\text{constant})\ \lambda V_1$$

when p is the pressure, λ the free path of the molecule at atmospheric pressure, and V_1 the ionising potential of the gas. When the current is so great that the whole electrode is covered with glow V, I and d are no longer constant; the cathode potential fall increases and the dark space diminishes as the current I increases. According to Aston's experiments (*Proc. Roy. Soc.*, 86, p. 178), the following relations exist between these quantities:—

$$d = \frac{A}{p} + \frac{B}{\sqrt{I}}$$

$$V = E + \frac{F\sqrt{I}}{p}$$

Here p is the pressure and A, B, E, F constants.

As the current increases the values of V may increase to many thousand volts and thus be hundreds of times the normal value. According to Aston there is no sudden jump in potential at the cathode itself, some observers (*e.g.*, Westphal) have thought that such a drop occurred and that it amounted to a considerable fraction of the whole potential fall.

Though in many gases and especially in oxygen there is a very sharply defined boundary to the dark space, it must not be thought that no radiation comes from the dark space; it is only for certain types of radiation that the radiation from the dark space is absent. Thus for the type of radiation which is instrumental in producing ionisation, there is no discontinuity in the radiation as we pass across the boundary of the dark space, and Seeliger and his co-workers have shown that even for visible radiation the change in intensity on crossing the boundary depends to a great extent on the wave-length of the light. The electrical conditions inside the dark space differ very much from those outside; inside we have a great preponderance of positive ions over electrons, while outside the two are equal; again outside the density both of free electrons and of positive ions is much greater than inside, and there is recombination of electrons and positive ions outside and not inside. It is not surprising

therefore that radiation produced outside the dark space should differ substantially from that produced inside.

Anode Fall of Potential.—Unlike the cathode fall of potential which is spread out through a length equal to the thickness of the dark space, the anode fall as Skinner has shown occurs quite abruptly so far as it can be tested by experiment. If this fall took place in molecular distances the electric attraction might be sufficient to drag positive ions out of the electrode itself. By using a cathode heated to incandescence, and therefore emitting a plentiful supply of electrons, we can reduce the cathode fall of potential to a small fraction of its normal value; we cannot, however, with a luminous discharge get rid of the anode fall; thus in the arc discharge the anode fall of potential is greater than the cathode fall. Matthies has shown that, in chlorine, bromine and iodine, the anode fall of potential may rise to hundreds of volts, that in air or hydrogen being only about 18 volts. Reichenheim and Gehrke utilised this fact to get positive ions of sodium and potassium projected with great velocity. They made the anode of a mixture of the halogen salts of these metals and graphite, and worked at a very low pressure; under the action of the discharge the halogens were liberated from the anode, and the large anode fall they produced was sufficient to project sodium and potassium ions from the anode with great velocity; this stream of positive ions constitutes what is known as "anode rays."

The electric force in the positive column is a linear function of the pressure; it depends slightly on the diameter of the tube through which the discharge is passing; it also depends on the current through the tube; in most cases, though not invariably, an increase of current produces a decrease in the electric force. The condition determining the electric force in the positive column is that it should give to an electron during its free path the amount of energy that will enable the electrons to produce by collisions as many ions per second as are lost during the same time by recombination.

Striated Discharge.—The form of discharge when the positive column is striated is so beautiful and remarkable that it has attracted a great deal of attention. To get this type of discharge the current and pressure must be within certain limits. The striations are developed more readily in mixtures of gases than in a pure gas; in fact some physicists have advanced the view that they could not be obtained in an absolutely pure gas. There is no doubt, however, about their occurrence in gases in which great attention has been paid to purification. Nörbeck could not get them in pure nitrogen or pure helium, though they were conspicuous as soon as a trace of impurity was admitted. Nitrogen and helium are gases in which, when pure, the carrier of negative electricity is always an electron; in these gases the electron does not join on to a molecule and become a negative ion. Spottiswoode found that, in some cases when the positive column showed no signs of striation when observed in the usual way, striations moving rapidly down the tube could be seen when the discharge was observed after reflection in a rapidly rotating mirror. Aston and Kikuchi, who have studied this effect in neon and helium, are of opinion that the striations are moving in these gases with the velocity of sound; it must be remembered, however, that the velocity of sound in many gases is of the same order as the velocity of a positive ion under the electric forces in the positive column, so that this result does not necessarily prove that the moving striations are analogous to sound waves.

The distance between the striations increases as the pressure diminishes (in hydrogen the distance is inversely proportional to the square root of the pressure); it depends upon the size of the tube: the striations are nearer together in narrow tubes than they are in wide. The distance between the striations also depends upon the current. When several gases are in the tube, spectroscopic observation of the bright parts of the different striations shows that we may have one set of striations corresponding to one gas, another to another, and so on. Thus Crookes observed in a tube containing hydrogen three sets of striations, one set red, another blue and a third grey; the spectroscope showed that the first was due to hydrogen, the second to mercury vapour and the third to hydrocarbons. The striations are often curved with their concavities turned to the anode.

To get a general idea of the causes which might give rise to stratifications, let us consider a case where the current is carried entirely by electrons, the positive ions being regarded as immovable in comparison with the electrons. Let us consider a stream of electrons emerging from the negative glow; these electrons will have very little energy and will be unable to ionise the gas. The electrification beyond the negative glow on the anode side will be due to electrons and will be negative so that the electric force will increase towards the anode. As the electric force increases the energy of the electrons also increases, until it is sufficient to enable the electron to ionise the gas and produce positive ions and electrons; the increase in the number of ions will check the rate of increase in the electric force. The connection between the ionisation and this rate of increase is in the case we are considering represented by a very simple equation. For if n and m represent respectively the number of negative and positive ions per unit volume, X the electric force, and x the distance from the cathode

$$\frac{dX}{dx} = 4\pi(n-m)e \qquad (24)$$

If the current ι is carried, as we have supposed, by the electrons, $neu = \iota$, where u is the velocity of the electron. If we neglect the current carried by the positive ions, then when things have reached a steady state the number of positive ions produced in any region per second must equal the number which disappear owing to recombination. Hence, if q is the rate of ionisation, α the coefficient of recombination, $q = \alpha mn$ or $m = q/\alpha n$; and (24) is equivalent to

$$\frac{dX}{dx} = \frac{4\pi\iota}{eu} - \frac{4\pi q e u}{\alpha\iota} \qquad (25)$$

Thus as long as q vanishes, dX/dx is positive, but as soon as q becomes finite the rate of increase of X will be retarded; as X increases q increases, and when $e^2qu^2 = \alpha\iota^2$, dX/dx will vanish; but though X reaches its greatest value at this point, the values of u and q, which depend on the energy acquired by the electron, will continue to increase beyond it. For the energy acquired by an electron depends on $\int X dx$, taken over a distance measured by the free path of the electron; at low pressures this may be a centimetre or more, and the place where $\int X dx$ is a maximum will be beyond that where X is a maximum by a length of this order. Thus after X has reached its maximum u and q will increase and dX/dx will become negative, so that X will diminish; the diminution in X will ultimately produce a diminution in $\int X dx$ and also in u and q; the rate of decrease will slow down; X will attain a minimum, and begin to increase again when similar changes will be repeated. Thus the curve which represents the relation between X and x will resemble fig. 15, where the cathode is on the left, giving alternate maxima and minima for the value of X; and $\int X dx$, the energy acquired by an electron, will vary periodically along the path of the discharge. There are two values of this energy which are of special importance in connection with discharge through gases, one the ionising potential we have already referred to, the other, sometimes called the "radiation potential," is the energy which the electron must possess to make the gas luminous. The radiation potential is less than the ionising potential, and electrons with energy between these potentials will make the gas luminous but will not ionise it. Thus the molecules of the gas will give out light but will not be charged. When the energy of the gas exceeds the ionising potential the luminous molecules are or have been charged. If the

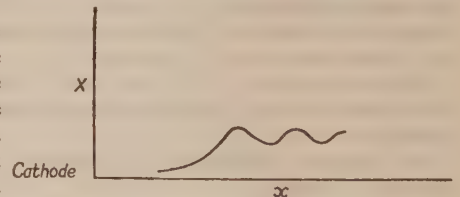


FIG. 15

variations in the energy along the line of discharge are large enough to make it sink below the radiation potential, then along the discharge we shall have: (1) places where the energy is below the radiation potential,—these will be dark; (2) places where the potential is between the radiation potential and the ionising potential,—the molecules here will be luminous and uncharged and will, therefore, not move under the electric field; (3) places where the molecules are luminous and charged,—these molecules will move down the tube towards the cathode with the velocity which the positive ion acquires under the electric field. This velocity, when the pressure is low and the field several volts a centimetre, as it is in the positive column, may be many thousand centimetres per second. Place (1) corresponds to the dark parts of the striations, (2) to the stationary luminous parts, while (3) is the origin of the striations moving down the tube observed by Wulner, Spottiswoode, Aston and Kikuchi.

Cathode Rays and the Discovery of the Electron.—In 1859 Plücker observed on the glass of a highly exhausted tube in the neighbourhood of the cathode a bright greenish yellow phosphorescence, which changed its position when a magnet was brought near to it. About 10 years afterwards Hittorf showed that a solid body placed between a pointed electrode and the walls of the tube cast a well-defined shadow of such a shape as to show that the agent producing the phosphorescence travels in straight lines at right angles to the surface of the cathode. The name "cathode rays" for the cause of the phosphorescence was introduced by Goldstein, who made many important investigations on their properties. The opinion held by Goldstein and generally in Germany was that cathode rays were waves in the ether. Varley and Crookes advanced the view that they were electrified molecules shot off at right angles to the cathode. The discovery by Hertz that the cathode rays could pass through thin layers of gold leaf was difficult to reconcile with this view.

The evidence in favour of the cathode rays being electrified particles was increased by Perrin's discovery that when a pencil of the rays entered the opening in a Faraday cylinder they gave to it a charge of negative electricity. One difficulty which had been urged against the rays being negatively electrified, viz., that, though they were deflected by a magnetic force, an electric force produced no effect upon their path—was removed by J. J. Thomson, who showed that the absence of deflection was due to the gas in the tube acting as a screen and protecting the particles from the electric force. As the gas in the vacuum tube is a conductor of electricity the rays move inside a conductor of electricity, and so will not be affected by an external electrified body. Thomson showed that when the vacuum was very high, so that there was but little gas in the tube, the cathode rays were deflected by an electric and magnetic field, and that the direction of the deflection indicated a negative charge on the particles. His measurement of the deflection by known electric and magnetic forces led to a determination of the mass of the particles which carried the charge, and showed that these particles were not atoms or molecules but something with a mass not one-thousandth part of the mass of the lightest atom known, that of hydrogen.

The deflection due to electric and magnetic forces can be calculated as follows. Suppose that the particles are travelling horizontally between two parallel horizontal metal plates A, B, maintained at a constant difference of potential, there will be a vertical electric force F acting between the plates, and if the axis of y is vertical the equation of motion of the electrified particle when it is between the plates is

$$m\frac{d^2y}{dt^2} = Fe$$

If y and $\frac{dy}{dt}$ are both zero when the particle enters the region between the plates, then, when it leaves this region, after a time

$$y = \tfrac{1}{2}\frac{Fe}{m}t^2 \quad \text{and} \quad \frac{dy}{dt} = \frac{Fe}{m}t$$

Since the electric force is at right angles to the direction of motion of the particles, v the velocity of the particles will not alter, and if the deflection is small, $t = l/v$ where l is the length of the plates. Thus

$$y = \tfrac{1}{2}\frac{Fe}{m}\frac{l^2}{v^2} \quad \text{and} \quad \frac{dy}{dt} = \frac{Fe}{m}\frac{l}{v}$$

Suppose the particles strike a photographic plate or a screen covered with a phosphorescent substance at a distance L from the end of the plates, the y displacement at this place produced by the electric force, is given by the expression

$$y = \tfrac{1}{2}\frac{Fel^2}{mv^2} + \frac{FelL}{mv^2} = \frac{Fel}{mv^2}\left(\frac{l}{2}+L\right)$$

Magnetic Deflection of the Rays.—If the rays go through a uniform magnetic field of length l and strength H, then if the magnetic force is vertical the force acting on the moving particles will be Hev, and will be at right angles to the magnetic force and also to the direction of motion of the rays; *i.e.*, it will be at right angles to the plane of the paper; if z is the displacement of the particle in this direction

$$m\frac{d^2z}{dt^2} = Hev.$$

From this we see that the value of z at the screen is given by

$$z = \frac{Hel}{mv}\left(\frac{l}{2}+L\right)$$

Hence

$$\frac{e}{m} = \frac{z^2}{y}\frac{F}{H^2l\left(\frac{l}{2}+L\right)} \qquad (26)$$

and

$$v = \frac{z}{y}\frac{F}{H} \qquad (27)$$

Thus the measurements of y and z, the electric and magnetic deflections, give the values of e/m and v.

The expressions for y and z have been obtained on the supposition that the electric and magnetic fields acted one at a time and not simultaneously. If, however, y and z are small, their values will not to a first approximation be altered if the electric and magnetic deflections occur simultaneously. Thus by making the cathode rays pass through superposed electric and magnetic fields, e/m and v can be got with one exposure by measuring y and z on the screen or photographic plate.

Since from equation (26) above z^2/y is constant as long as e/m is constant, we see that all the particles of the same kind, whatever their velocity, would strike the screen or plate on a parabola, and that if the rays were a mixture of particles of different kinds each kind of particles would trace out a different parabola. Since z/y only depends upon v, all the particles moving with the same velocity will strike the screen in a straight line.

The determination of e/m for the cathode rays led to results of fundamental and far-reaching importance, for it was found that all the cathode rays had the same value for e/m, and that moreover while for a charged atom of hydrogen in liquid electrolytes e/m was equal to 10^4, when e was measured in electromagnetic units, the value of e/m for the particles in the cathode rays was considerably more than one thousand times this value. Thus if e were the same for the particle as for the hydrogen atom (and we shall see later that this is the case) the mass of the cathode particle is only $\frac{1}{1800}$ of that of an atom of hydrogen, the smallest mass which hitherto had been recognised. Again it was found that whatever metal might be used for the cathode, or whatever might be the gas in the discharge tube, the value of e/m was unaltered. As those particles must have come either from the electrode or the gas, it follows that the particles of the cathode rays are a constituent of the atoms of all the chemical elements. These particles are called "electrons."

After the electrons had once been detected in the cathode rays they were very soon detected under many other conditions and found to be of very widespread occurrence. Thus, for example, it was found that streams of electrons are given out by incandescent metals, the rate of emission increasing very rapidly with the temperature. This has received a very important industrial application in what are known as "hot wire valves,"

at which a current from a hot cathode passes through a vessel in which the vacuum is so high that the gas takes no part in the discharge; the current, in some cases amounting to several amperes, is carried entirely by electrons. Lenard found that they were emitted by metals exposed to ultra-violet light. They are emitted when Röntgen rays strike against matter and by radio-active substances. The speed of the electrons ejected either by ultra-violet light or by Röntgen rays does not depend upon the intensity of the radiation but only upon the wave length. The energy acquired by the electrons is $=h\nu$, where ν is the frequency of the radiation and h Planck's constant.

Since the cathode rays are deflected by electric and magnetic forces proportionally to the magnitude of these forces, we can use the deflection of the rays as a measure for electric and magnetic forces. As these rays have practically no inertia they are especially adapted to measure very rapidly alternating forces which could not be detected by any index having an appreciable mass. The cathode ray oscillograph, an instrument by which electric and magnetic forces are measured by the deflection of cathode rays, has already been used in many investigations, and is a very important aid to research. Another property of cathode rays is that when they strike against matter they generate Röntgen rays, the hardness of the latter increasing with the speed of the former. The mass of an electron depends upon its velocity; this effect is not appreciable unless the velocity is comparable with that of light but the increase in mass becomes very marked when as in the case of the β rays from radio-active subjects the velocity exceeds 10^{10} cm./seconds. On the theory of Relativity the relation between m_v the mass of an electron moving with the velocity V and m_0 the mass of an electron at rest is

$$m_v = \frac{m_0}{\sqrt{1-v^2/c^2}}$$

where c is the velocity of light. This relation seems to be in agreement with the measurements which have been made on the masses of the β particles.

If the electron is regarded as a small sphere of radius a then it follows from the laws of electromagnetic action that $m_0 = \frac{2}{3}\frac{e^2}{c^2 a}$ where e is the charge on an electron in electrostatic measure. The value of e/m_0 found by experiment is $1{\cdot}78\times10^7\times c$, the value of e is $4{\cdot}8\times10^{-10}$, and $c=3\times10^{10}$, hence the value of a from the preceding equation is equal to $1{\cdot}9\times10^{-13}$ cm.

Positive Rays.—Goldstein discovered in 1886 that, if the cathode in a highly exhausted tube was perforated, bundles of a luminous discharge streamed through the aperture into the space behind the cathode. The colour of this discharge depends upon the gas in the tube; thus in hydrogen it is rose colour; in air, yellowish. The colour of the light due to these rays is not the same as that produced when cathode rays pass through the gas. In some gases the difference is very striking; thus in neon the light due to the cathode rays is pale blue, while the discharge which streams through the cathode is a gorgeous red. Goldstein called the rays which stream through the hole in the cathode *Kanalstrahlen;* but as they have been proved to consist of positively charged particles it seems more natural to call them "positive rays." These rays produce phosphorescence when they strike against glass and many other substances, though the phosphorescence is generally of a different colour from that produced by cathode rays. They also affect a photographic plate. It was at first thought that the positive rays were not deflected by a magnet, as magnetic forces which produced large deflections of cathode rays had no appreciable effect upon positive ones. Wien showed, however, by using very strong magnetic fields, that they could be deflected and that the direction of the deflection indicated that they carried a charge of positive electricity; they can also be deflected by electric forces.

By measuring the deflection provided by electric and magnetic fields we can determine by using equations (26) and (27) the value of e/m for the particles which constitute the rays. The result is of great interest. Instead of, as in the cathode rays, e/m having the same value for all the carriers, we find that e/m has many different values separated by finite intervals; and instead of e/m being equal to $1{\cdot}78\times10^7$, as in the cathode rays, we find the greatest value of e/m is 10^4, which is the same as its value for a charged hydrogen atom. The values found for e/m depend on the gases in the discharge tube; the outstanding result is that all these values of m correspond to masses of atoms or molecules of the chemical elements or compounds. Thus while the determination of e/m for the cathode rays shows that in a gas at a very low pressure the carriers of the negative electricity are all of the one type, being electrons whose mass is exceedingly small compared with that of any atom, the determination of e/m for the positive rays shows that the carriers of the positive electricity are of many different types; and that all these types correspond to atoms or molecules of the chemical elements or compounds. It has already been shown that if charged particles, after passing through electric and magnetic fields, are received on a screen or photographic plate, all particles, for which e/m is the same, strike the

FIG. 16

plate on a parabola, and that for each different value of e/m there is a separate parabola.

These parabolas are shown in fig. 16, which is a reproduction of a photograph made by allowing the positive rays in a tube containing gases liberated by heating a certain mineral to strike against a photographic plate; taken from the top downwards they correspond respectively to the atom of hydrogen, the molecule of hydrogen, the atom of helium, the atom of carbon with two charges, the atom of nitrogen with two charges, the atom of oxygen with two charges, the atom of carbon with one charge, the atom of nitrogen, the atom of oxygen, the molecule of water, the molecule of CO and that of N_2 (these form one parabola), the molecule of oxygen, the molecule of CO_2 and the atom of mercury. We find that many of the atoms can carry more than one charge, for when we find a parabola corresponding to one value of e/m we frequently find another corresponding to twice this value; thus carbon, nitrogen and oxygen occur very frequently with two charges, other atoms such as argon with two and three charges, while mercury atoms have been detected with 1, 2, 3, 4, 5, 6, 7 charges. It is significant that the atom of hydrogen never occurs with more than one charge. Multiple charges generally occur on atoms but not on molecules; there are, however, some molecules such as CO on which double charges have been found. Some of the positive particles, after passing through the hole in the cathode, lose their positive charge and become uncharged, and some of these neutral particles acquire a negative charge; thus mixed with the positively electrified particles there are some negatively electrified ones. This power of acquiring a negative charge is confined to certain atoms; thus while the atoms of hydrogen, carbon, oxygen, fluorine occur with a negative charge, the atoms of nitrogen, helium, argon and neon do not. It is exceptional for a molecule to acquire a negative charge—the molecules of oxygen and carbon, however, can do so.

The equation of a parabola formed by a particle on the photographic plate has already been given

$$z^2 = \frac{e}{m} yC$$

where z is measured parallel to the displacement due to the magnetic field and y to that due to the electrostatic. C is a quantity which depends on the strength of the electric and magnetic fields and on the position of the photographic plate. If, as in fig. 17, we draw a line parallel to the axis of z, the intercept made by a parabola on this line will be proportional to $(e/m)^{\frac{1}{2}}$; thus, if the top parabola is due to the atom of hydrogen, the next to the molecule of hydrogen, the third to the atom of helium and the fourth to that of oxygen, the intercepts AH, AH_2, AH_0, AO are in the proportion of 1, $1/\sqrt{2}$, 1/4. Thus by comparing the intercept made by any parabola X with that made by

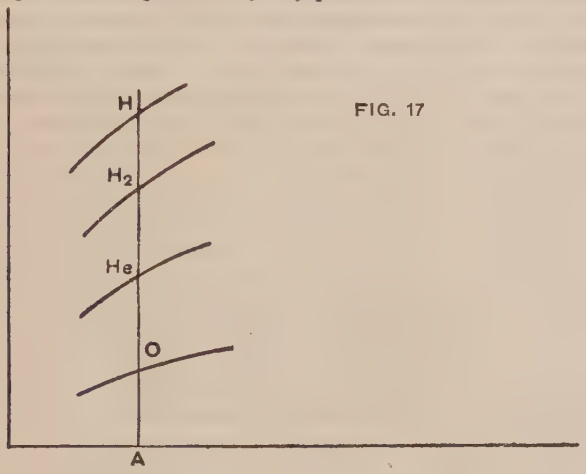


FIG. 17

the parabola due to the hydrogen atom we can find the molecular weight of the substance producing the parabola X.

Positive Rays as a Method of Chemical Analysis.—Since from the measurement of the positive ray photographs we can determine the molecular weight of the gases in the discharge tube, we can analyse a gas by putting a small quantity of it in a discharge tube and taking a photograph of the positive rays. It is thus a method of chemical analysis, and its application has already led to the detection of several new substances. In fact, though it has only recently been introduced, more substances have been discovered by this method than have ever been discovered by spectrum analysis. The method has many advantages. In the first place only a very minute quantity of the gas is required; a small fraction of a cubic centimetre of gas at atmospheric pressure is all that is required to fill the discharge tube at the pressure at which the positive rays are produced. Again, the method is very sensitive, as it will detect the presence of a gas which only forms a small percentage of the gas in the tube. The method not only detects the presence of the gas, but at the same time determines its molecular weight. It indicates, if the gas is an element, whether it is monatomic or diatomic; for if it is diatomic it will give rise to two parabolas, one due to the atom, the other to the molecule. The absence of double or negative charges will suggest that it is a compound and not an elementary gas. The only ambiguity is that it does not distinguish between two substances of the same molecular weight; thus CO_2, and N_2O give the same parabolas, as also do CO and N_2: we can often, however, remove this ambiguity by putting substances in the tube which would absorb one gas and not the other, and testing whether or not this has removed the parabola.

Use of Positive Rays to Determine Atomic Weight.—The measurement of the parabolas give, as we have seen, the atomic weight of the elements producing them; they can therefore be used to determine the atomic weight of elements which can be introduced in a gaseous state into the discharge tube. This method has the great advantage that the presence of impurities does not affect the result. Mr. Aston has lately, by the use of a positive-ray method for determining atomic weights (*see* ATOMIC WEIGHTS), found the very important fact that, if oxygen is taken as 16, the atomic weights of the elements with the exception of hydrogen are represented by whole numbers. Thus in working with chlorine he found no substance with an atomic weight of 35·4, but two substances with atomic weight of 35 and 37 respectively; he regards these substances as identical in chemical properties and inseparable by chemical reactions, and ordinary chlorine as a mixture of about 3 parts of (35^2) and one part of (37^1). Mr. Aston, by the method of positive-ray analysis, has discovered and measured the masses of the isotopes (*see* ISOTOPES) of most of the chemical elements.

The Charges of Electricity Carried by Gaseous Ions and Electrons.—The deflection of cathode and positive rays by electric and magnetic forces supplies a method for finding the value of e/m; for the determination of e, the charge of an ion, other methods have to be employed. One such method used by J. J. Thomson is based on the important investigation of C. T. R. Wilson on the effect of ions on the deposition of clouds and fogs from supersaturated air. If dust-free air saturated with water vapour is suddenly cooled by expansion, no cloud or fog is deposited unless the supersaturation due to the cooling is very large. C. T. R. Wilson found that if ions are present in the gas they act as nuclei round which drops of water are deposited with a supersaturation much below that required for gas free from ions. A beautiful application of this is the detection of the path of an α particle from a radioactive substance. The α particle produces by collision ions all along its path; if the damp gas through which the particle is passing is suddenly cooled by expansion, drops of water will deposit on the ions and thus mark out the path of the particle. One of Mr. Wilson's photographs of such a path is shown in fig. 18. Mr. Wilson found that less supersaturation is required to deposit water on negative than on positive ions.

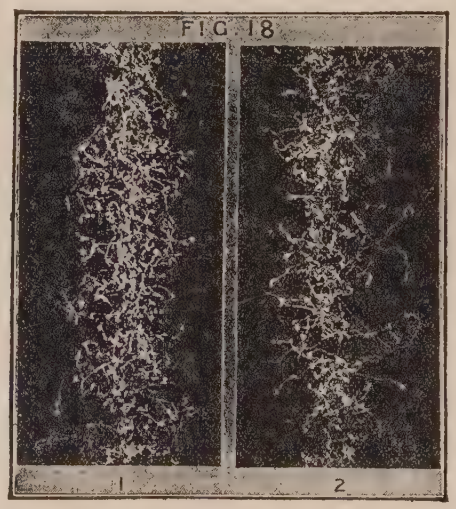


FIG. 18

This result can be applied to find the number of ions in a moist gas, for if the gas is suddenly expanded by an amount sufficient to deposit drops on ions, but not sufficient to produce condensation in their absence, then each ion may be made the centre of a drop, and the problem of counting the ions is reduced to that of counting the drops.

We can calculate the amount of water that will be deposited by any given expansion of the air: hence since we know the volume of the water we can determine the number of drops if we know the volume of a single drop. Observation of the rate at which a drop falls under gravity will give the size of the drop, for Stokes long ago showed that the velocity of a rain drop falling under gravity is given by the equation $v = \frac{2}{9} g \frac{a^2 \rho}{\mu}$; when v is the velocity of the drop, a its radius, μ the viscosity of the gas, g the acceleration due to gravity, and ρ the density of the gas. It has been found that, with the exceedingly fine drops formed round ions where the radius of the drop is comparable with the free path of the molecules of the gas, the velocity is $\left(1 + \frac{C}{pa}\right)$ times

that given by the above equation when C is a constant, and p the pressure. But though this correction makes the relation between a and v a little more complicated, it still enables us to determine a when v is known. Thus the radius, and therefore the volume, of the drop can be determined, and from this, as we have seen, we can deduce the number of ions.

Let n be this number per unit volume; then if a current of electricity is sent through the gas by an electric force X, the current passing through unit area will be neU when U is the mean velocity of the positive and negative ions under the force X. We know that it is proportional to the force and for a force of one volt per cm. is 1·5 cm./second; and hence when X is known U is known, the current neU can be measured, and hence ne deduced; as n has been found by the drops, the value of e can be determined immediately. This was the method used by J. J. Thomson; a simpler method used afterwards by H. A. Wilson was to get drops round the negative ions alone by using an expansion that would deposit moisture on negative but not on positive ions. He then showed the rate of fall of these drops, first under gravity alone, and then under a vertical electrical force X, acting on the drop in the same direction as gravity. Thus, when the electric field is acting, the force on the drop is

$$Xe+\tfrac{4}{3}\pi\rho a^3 g,$$

and when it is off the force is only $\frac{4}{3}\pi\rho a^3 g$. Thus, if v_1, v are respectively the velocities of the drop when the field is on and off,

$$\frac{Xe+\frac{4}{3}\pi\rho a^3 g}{\frac{4}{3}\pi\rho a^3 g}=\frac{v_1}{v}$$

or

$$Xe=\tfrac{4}{3}\pi\rho a^3 g\frac{(v_1-v)}{v}$$

From v, the rate of fall when the field is off, we can calculate as before the radius of the drop, and from the preceding equation we can determine e. Millikan (*Phil. Mag.*, 34, p.1), who has made most extensive and accurate investigations on the value of e, used a modification of the preceding method. Instead of producing water drops by expansion on the ions, he obtained, by means of a sprayer, minute drops of oil; he observed the motion of one of these under an electric field in a gas which was subject to some ionising agent, and from time to time an ion would strike against the drop and alter the charge; this would alter the velocity, and from the alteration of the velocity he could by a formula similar to that just given calculate the charge communicated to the drop by the ion. The value obtained for e by this method is, in electrostatic units,

$$e=4{\cdot}77\times10^{-10}$$

If M is the mass of an atom of hydrogen the value of E/M can be determined by the positive-ray method, so that as E is known M can be determined. When M is known Avogadro's constant and the number of molecules of hydrogen in a cubic centimetre of gas at standard temperature and pressure are at once determined.

Thus the study of the electrical property of gases gives the most accurate values available of two of the most important constants connected with the constitution of matter. By studying electrified atoms and molecules, we are able to determine their masses and their properties with an accuracy far beyond that attainable by any method which can be used when they are in the normal state. See Sir J. J. Thomson, *Conduction of Electricity Through Gases* (1926) (J. J. T.)

GASOLENE, commonly known in Great Britain as PETROL, is a motor fuel particularly suitable for use in motor vehicles. It has been officially defined by the American Society for Testing Materials as a refined petroleum naphtha which, by its composition, is suitable for use as a carburant in internal-combustion engines. Petroleum naphtha, as understood in the above definition, is any product of petroleum of which not less than 10% distils below 347° F. (175° C.) and not less than 95% below 464° F. (240° C.) when subjected to distillation according to the current tests of the American Society for Testing Materials. The term gasolene (natural gasolene) is applied also to a liquid product of natural gas, which, however, in order to be marketable, must be blended with light grades of petroleum gasolene. On the other hand, among other motor fuels derived from petroleum, which, even in its crude form, is sometimes used for this purpose, are kerosene, which is suitable for tractors, and the distillate fuel oil employed in the semi-Diesel type of engine. Besides serving as fuel in motor-vehicle engines, gasolene is used for aeroplanes, motor-boats, motor rail cars and many kinds of stationary engines.

The increase in the use of motor vehicles, particularly in the United States, has made the question of gasolene supply a matter of vital concern. The consumption in the United States during 1924 was approximately 7,750,000,000 gal., nearly 500 gal. for each of the 16,000,000 cars then in service. The largest consuming countries outside of the United States are, in order: Great Britain, France, Canada, Argentina, Belgium, Australia and Italy. The European consumption for 1924 is estimated at 1,300,000,000 U.S. gal. ($\frac{6}{5}$ of the imperial gallon). The following tabulation, based on figures supplied by the U.S. Dept. of Commerce, shows the production and consumption in the important countries in typical years.

Production and Consumption of Gasolene

Country and Year	Production	Consumption (in U.S. gal.)	
United States	U.S. Gal.	Gross	Per Capita
1914	1,460,038,200	1,255,218,538	..
1923	7,555,945,143	6,685,035,280	..
1924	8,959,690,220	7,780,625,085	69·3
Great Britain	Imperial Gal.		
1914	5,140,364	141,029,305	..
1923	71,000,000	417,027,593	..
1924	95,000,000	549,600,000	11·6
France	Metric Tons		
1913	..	63,113,000	
1923	3,848	261,011,000	..
1924	4,000	297,234,000	..
Canada	Imperial Gal.		..
1924	170,000,000	260,252,000	29·0
Argentina	Liters		
1924	59,900,000	68,200,000	8·0
Belgium			
1923	..	35,155,185	..
1924	..	57,272,142	7·6
Australia			
1922–3	Metric Tons	46,800,000	8·6
Italy			
1913	2,800	12,046,900	..
1923	898	48,226,700	1·3
Germany			
1913	..	88,483,000	..
1922	..	70,214,000	..
1923	..	43,704,000	0·7
Rumania			
1913	422,019	10,889,000	..
1922	285,097	27,089,000	..
1923	300,847	31,655,000	1·9
Russia	Poods		
1923–4	12,748,800	14,750,000	0·2

Gasolene Supply.—The supply of gasolene depends on the available petroleum reserve (*see* PETROLEUM 21.316), efficiency in refining methods, and economic utilisation. The increase in the yield of gasolene from a given amount of petroleum is to be expected chiefly from more careful fractionation, improved cracking methods, and raising the upper distillation limits in the production of straight run gasolene by straight distillation. According to an estimate made by the United States Bureau of Mines, the gasolene produced from crude oil amounts to

about 33% of the oil entering the refineries. This percentage might be increased to 55, in the opinion of the Committee of Eleven on Conservation, American Petroleum Institute. Of greater promise are possible improvements in engine design, as a result of which the energy available from a given amount of gasolene may be greatly increased (*see* INTERNAL COMBUSTION ENGINE). It is estimated by C. F. Kettering, president of the General Motors Research Corporation, that the percentage of energy in gasolene transformed into work is, on the average, only 5, but that this might be increased to 10 through structural mechanical changes, thereby almost doubling the transportation efficiency of a gallon of gasolene.

Marketing Methods.—Highly specialised methods for the marketing of gasolene have been developed, particularly in the United States. The gasolene is shipped from refineries in tank cars or ships (tankers) to large storage terminals and thence to smaller storage tanks along railways. From these it is taken by motor tank truck to " service stations," garages and curb pumps, where it is pumped into motor vehicles. It is estimated that there are about 100,000 " service stations " in the United States, while innumerable curb pumps are to be found on the city streets and along country highways. Similar marketing methods are employed in Canada. In Great Britain and France the distribution of petrol was largely effected by tins but the gasolene pump has come into wide use. Public service stations for automobiles are now to be seen also in the principal cities of Germany, Belgium, northern Italy and other European countries.

Anti-knock Fuels.—A significant recent development has been the production of a gasolene designed to eliminate or reduce the " knock " of an engine. There are also substances on the market advertised to effect the same result if added to ordinary gasolenes. One such compound, known as ethyl gasolene, consists of commercial gasolene to which has been added a small fraction of 1% of a synthetic oil containing tetraethyl lead. Anti-knock fuels are said to increase the mileage per gallon, to reduce carbon deposits in the motor, to facilitate starting and to improve engine efficiency in cold weather. Of greater importance, however, is the fact that the elimination of " knock " removes the barrier to the introduction of an automobile engine which would greatly increase the mileage per gallon and otherwise compare favourably with the performance of engines now in use.

Gasolene Substitutes.—Benzol, derived as a by-product from coking coal, is used to a limited extent as a blend with gasolene in the United States, the limitation being due to the relatively small production of benzol. The substitutes for gasolene which promise the greatest usefulness are oil derived from shale and especially liquid fuel derived from coal. The use of alcohol (*q.v.*) as a fuel for internal combustion engines is growing in Great Britain, where extraordinary measures have been taken to encourage research and production of this fuel. The French Govt. also has undertaken research to this end and has encouraged the development of a local alcohol industry, the product of which can be used as fuel. The use of alcohol as a motor fuel in Germany was tried some years ago; more recently benzol, prepared by the carbonisation of coal and lignite, has been used as a motor fuel. Methanol, also, produced on a commercial scale from carbon monoxide and hydrogen by the so-called Bergius method for the liquefaction of coal, has attained importance as a substitute for gasolene. (*See* COAL; FUEL PROBLEMS.)

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GASQUET, FRANCIS AIDAN (1846–), English Roman Catholic divine and historian, was born in London Oct. 5 1846. He was educated at Downside College, Bath, afterward becoming Superior of the Downside Benedictine monastery (1878–84). Created cardinal in 1914, in 1918 he was appointed prefect of the Vatican archives. He has produced various works on mediaeval church history and liturgies, among them being *Henry VIII. and the English Monasteries* (1888–9); *A Short History of the Catholic Church in England* (1903); *Parish Life in Mediaeval England* (1906); *The Bosworth Psalter* (1908); *Monastic Life in the Middle Ages* (1922); *His Holiness Pope Pius XI.* (1922).

GAUL, GILBERT WILLIAM (1855–1919), American painter (*see* 11.532), died in New York Dec. 21 1919. He was awarded a gold medal at the Appalachian Exposition, Knoxville, in 1910.

GAUVAIN, AUGUSTE (1861–), French journalist and diplomat, was born at Vesoul Oct. 6 1861. From 1889 to 1892 he was on the staff of *Le Journal des Débats* and in 1893 became general secretary to the European Commission of the Danube. In 1904 he was appointed French secretary to the Central Office of International Transport at Berne. In 1908 he returned to the staff of *Le Journal des Débats* and from that time directed its foreign policy. By the continuity and clearness of his views, his freedom from bias and, above all, by his exceptional talent as a writer, M. Gauvain came to exercise considerable influence. He gave early warning of the menace of German imperialism, and more especially of the danger threatened to Europe by the condition and policy of Austria-Hungary. He was an unceasing advocate of energetic action and moderation in aim on the part of the Allies in the World War. Gauvain, who became a member of the Academy of Moral and Political Sciences, published verbatim in 14 volumes all his articles in *Le Journal des Débats* from 1908 to 1920. (*See* FRANCE: HISTORY)

Among his other works are: *Les origines de la guerre européenne* (1915); *L'Europe avant la guerre* (1917); *L'affaire grecque* (1917); *La question Yougoslave* (1918); *L'encerclement de l'Allemagne* (1919).

GDYNIA or GDINGEN.—This Polish seaport and naval base is situated on the small bay of Gdynia, opening out into Danzig Bay, on the Baltic. It is 12 m. northwest of Danzig, with which it is connected by the railway running westerly from that city to Stolp and Stettin. The Polish Govt., in building a railway to the port which will pass over territory entirely Polish, has also a scheme for a canal to the port from a convenient point on the Vistula, thus tapping the whole waterway system of Poland.

During the struggle with Soviet Russia in 1920, the Poles were unable to utilise Danzig for naval or military purposes, and this led them to build a port of their own. A suitable site was found at Gdynia, where a fishing village of about 200 souls already existed. The depth of water near the shore varies from 10 to 20 metres; the bed of the bay gives firm anchorage; and the entrance is sheltered by the peninsula of Hela. The Polish Govt. began the construction of the port in 1921, and by the summer of 1924 had built the southern mole, 550 metres in length, and a breakwater 175 metres long, forming part of the northern mole, together with a landing stage 150 metres long, a narrow gauge railway along the southern mole, an electric power station, water supply and other equipment. A contract for further construction was signed on July 4 1924 by a Franco-Polish syndicate, the date for the completion of the contract being Dec. 31 1930.

Its main provisions are (1) the making of an entrance canal, 11 metres deep, to the harbour, (2) the construction of the harbour with a water area of about 400 ac. and 1,060 metres of quays, together with a basin eight metres deep and a pier for passenger vessels, the depth of water at the quays being from eight to 10 metres and (3) the digging of an inner basin or dock on the foreshore, with a water area of about 100 ac. and a depth of water at the quays of 10 metres. In 1924–5 the northern mole was extended to a length of 700 metres, and considerable dredging and excavation work was done. In addition the Polish Govt. proposes to spend a large sum on the equipment of the port, comprising large warehouses, a grain elevator, powerful cranes, railway sidings and paved roads. In 1930 the port will have quayage for 30 large steamers and a handling capacity annually of 2,500,000 tons, but it will be constructed so as to permit of a great increase in its size and capacity. In 1925, 85 vessels, of 73,351 net tonnage, entered, and 79 vessels, of 69,981 net tonnage, cleared the port, exclusive of coastal shipping.

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GEDDES, SIR AUCKLAND CAMPBELL (1879–), British politician, was born June 21 1879, the son of Auckland Campbell Geddes of Edinburgh and the younger brother of Sir Eric Geddes, and was educated at George Watson's College, Edinburgh, and Edinburgh University. He studied medicine, qualified as a practitioner, was at the London hospital for a time and later studied at Freiburg. He was a demonstrator and professor of anatomy first at Edinburgh, then at the Royal College of Surgeons, Dublin, and afterwards at McGill University, Montreal. He also had some military experience in the South African War and afterwards in the World War 1914–6.

In 1916 Geddes became director of recruiting, and in Aug. 1917 Minister of National Service. A seat in Parliament was found for him at Basingstoke and he had little difficulty in accommodating himself to parliamentary life. After the Armistice, Sir Auckland, who had been made a K.C.B. in 1917, became President of the Local Govt. Board and Minister of Reconstruction, and in May 1919 President of the Board of Trade. In this latter capacity he began the removal of the barriers to British Trade which the War had necessarily set up, and he had to deal with the difficulties which immediately arose in the coal industry. In this delicate task he was at least temporarily successful, and managed materially to reduce the price of domestic coal. In the same year an opportunity was afforded him to return to academic life by his election as principal of McGill University. He accepted the appointment, subject to its not being operative till the abatement of the coal crisis allowed of his leaving the Board of Trade. But during the delay the Government prevailed on him to accept instead the post of British Ambassador in Washington. His tenure of the Embassy only lasted three and a half years (1920–3), but the time was crowded with important negotiations in which he showed himself a successful diplomatist. On quitting Washington, Sir Auckland, who had been made G.C.M.G. in 1922, left the public service and became chairman of the Rio Tinto Company. He married in 1906 Isabella Gamble, daughter of W. A. Ross of New York.

GEDDES, SIR ERIC CAMPBELL (1875–), British man of business and administrator, born in India Sept. 26 1875, was the son of Auckland Campbell Geddes of Edinburgh, and the elder brother of Sir Auckland Geddes. He was educated at the Oxford Military College and Merchiston Castle School, Edinburgh. He gained some business experience at lumbering in the United States, and was afterwards connected with railways—first, the Baltimore and Ohio system, and then the Rohilkhand and Kumaton in India. Returning to England he joined the North Eastern Railway Co. under Sir George Gibb, and, having succeeded him in 1906, was himself the general manager of this line when the World War broke out.

Geddes was one of the business men whom Mr. Lloyd George, on becoming Minister of Munitions, enlisted in Government employ. He became deputy director general of munitions supply, 1915–6, and was then appointed, though a civilian, director general of transportation, and succeeded in bringing the British lines of communication in France into a high state of efficiency. He was knighted in 1916, and in 1917 he was created K.C.B. and G.B.E., being transferred to the Admiralty in May of that year as controller, in order to develop and utilise the whole of the shipbuilding resources of the country and concentrate them under one authority. A month or two later, in spite of having no parliamentary experience, he was appointed First Lord of the Admiralty, and was returned to the House of Commons as M.P. for the borough of Cambridge.

After the Armistice Mr. Lloyd George made use of Sir Eric's powers as an organiser by commissioning him to co-ordinate Government departments in regard to demobilisation. His success in these varied tasks was rewarded in Jan. 1919 by the G.C.B. When the Government was reconstructed in that month, he left the Admiralty in order to organise and preside over a new Ministry of Transport. But in the autumn of 1920 there came the sudden break in trade, and it became evident that the country could not afford a department on the proposed scale. In 1921 a bill introduced by Sir Eric for the re-grouping of the railways was passed; he then resigned office in Oct., and the ministry was reduced in personnel and importance. Sir Eric himself was appointed in Aug. 1921 chairman of a small committee, later known as the "Geddes Axe," to recommend public economies to the Government. In various reports in the winter of 1921–2 the committee recommended savings amounting to £86,000,000; but Sir Eric complained that only £52,000,000 of this amount was actually saved. In 1922 he left Parliament and returned to a business career, becoming chairman of the Dunlop Rubber Co. and of Imperial Airways, Ltd. He married in 1900 Gwendolen, daughter of the Rev. A. Stokes, and had three sons.

GEDDES, PATRICK (1854–), British biologist and sociologist, was born at Perth Oct. 20 1854. He was educated at Perth Academy, and in London and France, and became demonstrator in physiology at University College, London, in zoology at Aberdeen and in botany at Edinburgh. In 1883 he was appointed professor of botany at University College, Dundee (St. Andrew's University) and in 1919 he became professor of sociology and civics in Bombay University. As a biologist, in collaboration with James Arthur Thomson, he wrote *The Evolution of Sex* (1889; revised ed. 1901); *Evolution* (1911); *Problems of Sex* (1912); and *Biology* (1925), tending towards a new Lamarckian position. Interested in the synthetisation of science with art and history and its application to the conditions of modern life, especially in the direction of town-planning and housing, he travelled extensively, established a publishing house and promoted civic museums and industrial exhibitions. He was one of the leading members of the Sociological Society founded in 1904. His views are embodied in the papers of this society and in *City Development*, a report to the Carnegie Dunfermline Trust (1904), and *Cities in Evolution* (1915). He also wrote *Chapters in Modern Botany* (1893) and *Life and Work of Sir Jagadis C. Bose* (1920). In collaboration with Victor Branford he edited the series, *The Making of the Future*, himself contributing volumes, *The Coming Polity* and, with G. Slater, *Ideas at War*.

GEIGER, WILHELM (1856–), German scholar, was born in Nuremberg July 21 1856. He qualified as an academic lecturer in 1886 in Munich and became professor at Erlangen in 1891. In 1920 he was appointed professor of Indian and Iranian philology at Munich. He became the publisher of the *Zeitschrift für Indologie und Iranistik*, the *Zeitschrift für Buddhismus* and the *Grundriss der Iranischen Philologie*. His chief works are: *Handbuch der Avestasprache* (1879); *Ostiranische Kultur im Altertum* (1882); *Ceylon, Tagebuchblätter und Reiseerinnerungen* (1898); *Litteratur und Sprache der Singhalesen* (1900); *Dipavamsa und Mahavamsa und die Entwicklung der geschichtlichen Ueberlieferung in Ceylon* (edited 1905); *Pāli, Litteratur und Sprache* (1916); *Pāli Dhamma* (1921); *Elementarbuch des Sanskrit* (3rd ed., 1923); *Samyutta Nikāya* (Eng. trans., 1924).

GEIKIE, SIR ARCHIBALD (1835–1924), Scottish geologist (*see* 11.552), received the O.M. in 1914. He died at his residence near Haslemere, Surrey, on Nov. 10 1924.

GEIKIE, JAMES (1839–1915), British geologist (*see* 11.553), died in Edinburgh March 1 1915.

GENERATOR: *see* DYNAMO.

GENETICS (*Greek* γένεσις, origin or creation).—This term was proposed at the third International conference on hybridisation, London, 1906, to denote the study of heredity and variation. In that sense it has been generally adopted, and by extension is understood to include the physiology of reproduction and the art of breeding. Though such inquiries have been pursued from the earliest times, the development of a special branch of science relating to them is recent. The primary incentive was the hope that by applying accurate methods of observation and experiment to the course of heredity and variation a more precise knowledge of evolutionary processes might be acquired.

Modern theories of evolution are based on the assumption that species have arisen by descent with modification, and that the constancy and diversity which living things manifest in their reproduction provide a sufficient basis for that conception. It is significant that as a result of the preliminary work done under the new inspiration, attention has been largely diverted from

these more philosophical aims. Beliefs current among naturalists, especially as to the nature and incidence of variability, were at once found to be widely incorrect. The scope and character of these discoveries are referred to below. Their immediate consequence has been that the development of evolutionary theory is tacitly suspended or postponed, and activity is concentrated on the exploration of genetical physiology, the theoretical evaluation of the knowledge thus gained being relegated to the future.

In these researches several methods of investigation are available. Modern genetics began with an attempt to observe empirically the course of contemporary variation from type; but though observations of this class have proved valuable in a preliminary survey, and have often been of use as indicating material for more prolonged investigation, the main advances have been accomplished by either (1) experimental breeding or (2) cytology. Important sidelights on genetical problems have also been obtained through the study of developmental mechanics (*Entwicklungsmechanik*) by experimental methods.

Experimental Breeding

The great stimulus to this method of research was given by the rediscovery in 1900 of Mendel's paper (*see* 18.115). Heredity, long regarded as a fortuitous and seemingly lawless phenomenon, was proved to follow regular principles which could in great measure be ascertained by experiments properly planned. A vast field was at once thrown open for investigation. Mendel's success was made possible by his genius for simplification. Working with peas, he made crosses between distinct varieties and watched the descent of their numerous characteristics, fixing his attention on each separately, and disregarding other differences. He then found that numerous distinctive features behaved in descent as if they were transmitted as units.

These determining elements or units are referred to as *factors* or " genes " (a term especially used by American writers, the equivalent of Johannsen's *Genen*). The differences determined by these factors can commonly be shown to be treated in heredity as pairs of alternatives or opposites, such as tall and short, coloured and colourless, hairy and smooth, each germ-cell being usually pure in respect of one or other of the contrasted characteristics. This is the principle of *allelomorphism*, and the members of such pairs are called *allelomorphs*. The zygote, formed by two germ-cells united in fertilisation, may be made up of two germ-cells alike in respect of any given pair, in which case it is said to be *homozygous* in that respect, or it may be a *heterozygote* if the uniting pair of cells are unlike. Before the germ-cells of the heterozygote are formed a process of *segregation* occurs, and there is a dissociation between the opposing elements introduced at fertilisation, such that the resulting germ-cells are again in normal cases pure in regard to each allelomorph.

In respect of any such pair of differences the character of the heterozygote is sometimes intermediate, but it most often approaches more nearly to one of the parental types. Not infrequently the approach is so close that the pure homozygote cannot be distinguished with certainty from the heterozygote. In Mendel's terminology the character thus prevailing is a *dominant*, the other being *recessive*. The distinction is of importance and is the basis of certain suggestions as to the possible nature of allelomorphism.

After the rediscovery of Mendel's work progress was rapid, and it was soon found that similar principles of descent apply to a great range of characteristics by which living things are distinguished. The number of forms of life studied is now very large, and includes most of the kinds of plants and animals which are readily amenable to experiment or observation. Man is evidently no exception, and we already know that certain features of human colouration, especially of hair and eyes, and several congenital abnormalities are transmitted according to the Mendelian scheme, some being dominant and others recessive.

Scarcely any satisfactory opportunities for studying the genetics of the lower plants (ferns, mosses, algae, etc.) have yet occurred, but one example has been described in a unicellular alga (Pascher). Of the features by which animals and plants are distinguished most have now been shown to be dependent on segregable elements. Reservation must be made in regard to differences which are simply quantitative, for there is a good deal of evidence suggesting that the elements by which size and weight are determined do not often form themselves into simple allelomorphic pairs. A similar doubt exists in regard to numerical or meristic distinctions.

Abnormalities.—Differences in instinct and other characters dependent on nervous mechanism are not, as such, distinct in their genetical behaviour, and some have been proved to depend on segregable factors or elements. In several breeds of fowls the hens are devoid of maternal instincts, and do not sit on eggs. This characteristic is recessive to the normal instinct, and segregation takes place in regard to it. The same is true of the pacing habit in horses as opposed to the trotting habit. The " waltzing " habit of certain Japanese mice is recessive to the normal, segregates from it and breeds true when it reappears. This example is interesting, since the abnormality is almost certainly a consequence of deformity in the semicircular canals of the ear.

Descent in Man.—As to the descent of the normal mental attributes of man little is known with accuracy, but several abnormalities of the nervous system are known to follow modes of descent which prove them to be subject to segregation. Feeblemindedness is a recessive condition which breeds true. Paralysis agitans is also a recessive. Hereditary chorea descends as a dominant; colour-blindness and a form of night-blindness may also be termed recessive (*see* Sex). In heterozygous combination with the normal there is segregation, but the descent of these conditions is complicated by sex.

It will readily be understood that though the determining factors may be transmitted as units, the distinguishing characters of animals and plants often must be due to the association of many independent units. Of these, some produce their effects separately, but not rarely, though, independently transmitted, two or more unit-factors may be complementary to each other and combine to produce a joint effect or " compound character," as it is sometimes called. Such complementary factors, if separately present in the organism without their complement, need not manifest their presence at all, and it is then only by breeding tests that their existence can be demonstrated.

Organisms may now be represented as aggregates of units which confer upon them their various attributes. The degree to which an organism may be thus resolved is as yet undetermined, but there is presumably a limit to the process, and it is natural to suppose that the detachable elements are implanted on a *basis*, which for a given type is irreducible.

Reversion.—Conceptions, formerly vague, now acquire an exact meaning. For example, reversion or " throwing back " to an ancestral form, previously regarded as a mere caprice of nature, can at once be perceived to be due to one of two definite causes which operate with regularity. The reversion is either (*a*) the reappearance of a recessive characteristic, or (*b*) it is the consequence of the reunion of complementary factors which, though both present together in the ancestor, had been separated by variation and transmitted in distinct strains. For example, when a red-haired child is born to dark-haired parents the fact proves that the two parents are heterozygous in respect of the recessive red, which reappears when two germ-cells carrying it unite in fertilisation. Moreover, if the statistics of a considerable number of such families of children were collected and added together it would be found that the proportion of red-haired was approximately a quarter of the whole. The mere fact that one or both of the parents traces descent from a red-haired ancestor is not the cause of the reversion—for if either of the parents were homozygous in dark hair the red would not have reappeared.

The reversion to an actual or supposed ancestral form consequent on the meeting of complementary factors is less common in the ordinary practice of breeders, but is frequently seen in experimental crossing. When two white orchids crossed together give a coloured flower in F_1, or when a rose-combed fowl bred with a pea-combed bird gives chickens with the walnut comb of the Malay fowl, the production of the unexpected colour or

structure is due to complementary action of two independent factors. But the old interpretation of the phenomenon as a consequence of such an ancestor having occurred in the pedigree is illogical and misleading. In the case of the walnut comb, for instance, it is quite possible that either or both of the parent breeds never had a Malay ancestor. The production of a new form by the meeting of complements should be regarded, like the properties of a chemical compound, simply as the empirical consequence of a certain combination of units, without reference to the previous history of those units.

Purity of Type.—Of greater importance, both theoretical and practical, is the fact that it is now possible to assign a precise meaning to this expression. To the pre-Mendelian evolutionist purity was always a matter of degree, which might be gradually and, as it were, asymptotically approached in successive generations of selection, but never actually attained. The practical breeder also has always regarded purity as a property necessarily dependent on a long course of selection. Purity is now seen to be the condition of the animal or plant which is formed by the union of gametes bearing identical units. In respect of any allelomorphic pair purity may thus be conferred, though in respect of other pairs of units the same organism may be impure, *i.e.*, heterozygous, or, in ordinary parlance, cross-bred. This is the central fact of Mendelism, and on it Genetics is based.

The question of purity must therefore be considered separately for each pair of units. A thoroughbred horse, for example, may be pure in a number of characteristics which go to the making of the breed, but it may be impure in, say, colour. A chestnut horse, however, of whatever parentage, is pure-bred in colour, since that colour is the lowest of the series of horse colours, and chestnuts bred together give chestnuts only. By selection, the likelihood of producing purity is increased, but, as will subsequently appear, no amount of selection can ensure purity. On the other hand, purity in respect of any character may be attained at once in any mating by which gametes of similar factorial composition happen to be brought together in fertilisation. From this proposition the corollary follows that the combination of two strains pure in any given respect will give a family uniform as regards the character considered, and the uniformity of such cross-bred families, especially when one of the parents contains few dominant factors, is in practice one of the simplest and most convincing tests of purity.

Genetic Analysis.—By the institution of a series of crosses with varieties and study of the composition of the succeeding generations an *analysis* of the factorial constitution of a given type can be made. The numerical proportions or ratios in which the several combinations of characters are represented, the number of these terms in the series, and their respective genetical powers of transmission furnish the data from which the nature and number of the factors comprising the parental type may be determined. In the earlier article on Mendelism (*see* 18.115) some of the simpler ratios and their significance are explained, but examples of a much higher order of complexity are often encountered. The unravelling of these complications has led to some important discoveries. The many ways in which it may come to pass that two or more terms in a series of factorial combinations may be indistinguishable from each other cannot be enumerated here, but a knowledge of some of the more significant causes of disturbance of what may be called the normal ratios (9:3; 3:1; 9:3:4; 27:9:9:9:3:3:3:1, etc.) is essential to a proper comprehension of Genetics.

Cumulative Factors.—From certain crosses (especially of cereals) into which only one pair of differences had apparently been introduced it was observed (Nilsson-Ehle; East) that the recessives reappearing in F_2 were only 1:1:5 instead of the usual 1:3. Investigation proved that from the dominant side *two* factors with identical functions, though belonging to distinct pairs, had been introduced. Consequently, among the dominants in F_2 were some containing both these factors and others having one only. Various results suggest that this multiplication, or better, *accumulation*, of similar factors is a common occurrence, and that the process may be extended in special cases.

Inhibiting and Lethal Factors.—Many factors act by producing a negative result, inhibiting the development of some character, the determining elements of which are present though their action is not perceptible or largely diminished. Of these the most easily demonstrable operate by inhibiting the formation of colour. The white pigment of the coats of animals and the feathers of birds, or of flowers, for example, is commonly due to the absence of the elements necessary for the formation of colour, but both in animals and in plants varieties have been found which are white, or nearly so, not through absence of pigment, but through the presence of factors which, in some way not yet defined, inhibit the production of the coloured pigments. From some matings a mixture of white individuals may be obtained, which to the eye look alike or nearly so, though they represent various factorial terms and are genetically dissimilar. The process of inhibition may be carried much further, and there are well-established instances in which the animal or the plant cannot live if it is homozygous (containing two "doses," in popular terms) for a given factor.

The classical instance of such *lethal* factors, as Morgan has called them, was met with in the breeding of yellow mice (Cuénot; F. M. Durham). Mice with yellow coats, bred together, give a majority of yellow, but always throw a proportion of some other colour—for example, chocolate or black. Since in mice yellow is a dominant, it is clearly caused by a factor which the gametes can carry. But the union of two gametes, both carrying this factor, does not give rise to a viable animal. It was suggested that two such gametes could not unite in fertilisation, but later work has practically proved that these fertilisations occur and that the resulting embryo perishes at an early stage (Ibsen). The physiological action of the yellow factor in causing death is not known. In plants the "golden"-leaved varieties are comparable. They cannot breed true, but throw 2 yellow: 1 green. The purely yellow term is missing, and is clearly not viable (Baur). The suggestion has been made that the yellow factor acts not merely negatively by diluting the amount of chlorophyll, but by inhibiting its formation, probably producing a body with this specific power. This is the more likely since golden varieties in dull weather turn almost a full green, whereas in sunlight they bleach to a full yellow, a fact indicating that the production of the inhibiting body is promoted by sunlight. Two doses of this factor kill the plant altogether, probably during embryonic life.

Linkage.—At an early stage in these inquiries it was observed that factorial units belonging to separate allelomorphic pairs are not always distributed independently among the gametes of a heterozygote, but that some combinations occur regularly with a greater frequency than others. The next step was the discovery that this *linkage* depends on the association of the linked factors in the parent from which the heterozygote was formed. For example, if a form AB is crossed with ab the normal expectation is that the double heterozygote $AaBb$ will form gametes AB, Ab, aB, ab in equal numbers; but if there is linkage between A and B, then the parental combinations AB and ab will be more frequently represented in the gametic series than the other, or "cross-over" combinations, Ab and aB. But if the original cross were in the form $Ab \times aB$, then the most frequent gametes will be Ab and aB, the cross-overs, AB and ab being the rarer. This observation forms the starting-point from which modern genetical theory has been very largely developed.

The terminology followed above is that introduced by T. H. Morgan, to whom progress has been especially due. It is sometimes convenient to distinguish the case in which the two dominants ($AB \times ab$) are introduced together by the parent as *coupling*, and the converse ($Ab \times aB$) as *repulsion*, but the physiological process is now recognised as being clearly the same in both cases, and there is no difference in the numerical proportions in which the parental combinations respectively reappear. It should be observed that the factors thus linked have plainly no connection with each other as regards the effects which they produce in the zygote, but may concern the most dissimilar characters. For instance, in the example first observed the linkage was that between the factor which makes the flower of the sweet pea

blue or purple (as distinguished from red) and that which makes the pollen grains long (as distinguished from round). According as the proportion of cross-overs is small or large the linkage is more or less complete. If both parental and cross-over terms are equally common there is no linkage. The most satisfactory test of the linkage-ratio is obviously provided by breeding the double heterozygote (*Aa–Bb*) with the double recessive (*aabb*), and this mating should be carried out reciprocally since it is known that in plants (*e.g.*, *Primula sinensis*) male and female sides of the same plant may show different degrees of linkage (R. P. Gregory), and that in animals (*e.g.*, *Drosophila* and the silkworm) crossing-over may be absent in one sex though occurring in the other.

Allelomorphism: Multiple Allelomorphs.—Apart from linkage, segregation is always a separation of units affecting the same character, and from a very large range of observations it is possible to represent the distinction between the allelomorphic pair as one in which a *positive* element separates from a *negative*. In other words, allelomorphism may commonly be conceived as a difference which consists in the *presence* of something on the one side and its *absence* on the other. This conception is applicable whenever there is definitely pronounced dominance. It is natural that the characteristic which possesses dominance should be looked upon as due to the positive or present element, the recessive being the consequence of its absence. Nevertheless, there is as yet no strict proof that this representation is physiologically correct. For since we know that many factors may operate by inhibition it is always possible to *invert* the conventional representation and by putting negative for positive, to make a factorial scheme which equally agrees with the observed results. Conventionally, for instance, the tall pea is represented as either *TT* (homozygous) or *Tt* (heterozygous), the dwarf being *tt*, from which the positive element *T* tallness is absent.

But we cannot positively declare that the dwarfs may not be *II* homozygous in the presence of an inhibitor *I*, whereas the tall plants might be either *Ii* heterozygous, or *ii* homozygous in respect of the absence of this inhibitor. The significance of this alternative mode of representation will be apparent when the application of factorial systems to evolutionary theory is attempted (*see* MENDELISM). But when the heterozygote is intermediate between the two homozygous forms the " presence-and-absence " method of representation cannot be applied with any confidence. From the existence of such cases and from certain other considerations it has been urged, especially by American geneticists, that the method of representation by presence-and-absence is incorrect, and that a negative allelomorph should be treated as a real entity. There is no valid means of deciding this question as yet. The probability is perhaps that the absence should always be regarded as relative only. As a mode of symbolic expression the representation of the two allelomorphs as differing quantitatively is often convenient, though perhaps not universally applicable.

Types of Allelomorphs.—Allelomorphism is, as the term implies, a relation between two alternatives, and in any one zygote there can be no more than two. Nevertheless, there are instances in which the same unit-factor enters into heterozygous combination with various alternatives in different zygotes, and each of these may thus be in allelomorphic relation with it. Alternatives composing such a group of possibilities have been termed by Morgan *multiple allelomorphs*, and this expression is commonly adopted. Its use, however, makes the application of the term " multiple " to " factors " in a totally different sense a probable source of confusion, and for this reason the word *cumulative* or some equivalent is there to be preferred as suggested above. The distinctions which together make up a set of multiple allelomorphs may commonly be recognised as a series of *quantitative* differences, the character affected being throughout the series the same.

Albinism in Rabbits.—One of the most familiar illustrations is provided by the degree of albinism in rabbits. The fully albino form is white with pink eyes, but there is a variety called Himalayan, which, though born white with pink eyes, acquires some pigment in certain parts. Himalayan is dominant to albino but recessive to the ordinary coloured types. If a coloured type is bred with Himalayan the heterozygotes so raised cannot, when interbred, throw albinos, nor can heterozygotes raised from coloured x albinos throw Himalayans, even though the albino used as their parent had itself been extracted from Himalayans. The degree of albinism put in by the parents comes out in F_2 and in the same degree. Hence it is not possible from similar parents to breed all three kinds, but on the other hand, each family can contain at most two of them.

This phenomenon can be interpreted in either of two ways. The Himalayan pattern may be regarded simply as a quantitative diminution or fraction of the sum total of colour needed to make the self-coloured type. The real albino is thus produced by the absence of the whole unit needed for colour, and the Himalayan by the absence of part of this total. It is then obvious that the heterozygote, coloured x albino, could never produce a Himalayan unless the colour-complex broke up again *de novo*. But on the analogy of the behaviour of other colour patterns the self and the Himalayan might be conceived as each consisting of two units: one for colour and one a factor determining its pattern, intensity or distribution. If there were a very close linkage between each " pattern," factor and colour the observed facts could then be represented; but by continued breeding the supporters of this view would expect the missing cross-over to appear eventually as either a Himalayan associated with recessive albinos or an albino associated with recessive Himalayan. On the ground of simplicity the former view seems preferable. The significance of these two alternatives will presently appear.

Study of Grasshoppers.—More complex illustrations of these possibilities have been described by Nabours in certain grasshoppers (*Paratettix*). The species studied presents a long series of colour forms, and experimental breeding showed that with certain exceptions all the pure forms behaved as if allelomorphic to each other. In other words, whichever two pure forms *A* and *B* were crossed together, the F_1 generation was *A B*, giving in F_2 a family approximating to $1AA:2AB:1BB$. The whole series of colours is thus often described as a vast set of multiple allelomorphs. Nevertheless, there are curious features in this case which raise a doubt whether this account is really correct. Many of the distinctions are plainly *quantitative* degrees in development of some one type of coloration whch are, as might be expected, allelomorphic to each other (*cf.* the Himalayan rabbit): but among the elements comprising the total colouration of these grasshoppers there are several in which both the pigments and the positions they occupy are so distinct that the characters cannot easily be represented as determined by factors allelomorphic to each other. Only by a very loose application of the term ' colour ' can the distinctions be said to apply to the same character. Hence, in this hitherto generally accepted illustration it seems probable that, in so far as the distinctions are actually quantitative differences in one respect, true allelomorphism may be recognised, but that the appearance of an allelomorphism between factors of differing scope is more probably spurious and referable to close linkage (*cf.* Haldane). No decision on this question can yet be made with any confidence.

Allelomorphic Complexes.—Among modern extensions of genetical theory none is more remarkable than the discovery that large and apparently miscellaneous groups of characters are sometimes governed by elements capable of segregating collectively as a single complex. Nevertheless, in the case of sex, we have long been familiar with one example. Since the distinction between the two sexes in many animals is known to behave in segregation as if it depended on a single Mendelian factor, we have to recognise that a number of distinctions of all kinds, structural and functional, may be treated in segregation as factorially single. In the special case of sex we know further that particular genetic elements may be detached from the complex (*e.g.*, the elements governing spur and broodiness in fowls, the beard in man, etc.), though the possible limits of such disintegration are unknown.

Oenotheras.—Renner's experiments have shown that the inheritance of the protean variations of several Oenotheras is largely

effected by the transmission of similar complexes. Each of these large composite factors or groups of factors (in so far as they prove to be divisible) may govern many characters of form, colour, habit, etc., and the whole group is transmitted as a single heritable entity. Similar discoveries will probably be made in regard to other forms. The details are beyond the scope of this article, but it may be remarked that these complexes in Oenothera supply one of the most striking illustrations of the phenomenon which may be called *anisogeny* (see " Somatic Segregation," *inf.*) or the relegation of a factor or factors exclusively to one sex-side of a plant. For instance, whereas *Oenothera Lamarckiana*, the species which provided de Vries with his most celebrated but unsound evidence of mutation, can be proved to be a permanently heterozygous form having two complexes equally distributed in segregation to both the male and the female gametes, the species *biennis* and many more, though similarly heterozygotes of two complexes, in segregation pass the whole of the one complex into the male gametes and the whole of the other into the female gametes.

The question whether the apparently simple factors which commonly behave as Mendelian units are capable of further resolution is of much theoretical importance in its bearing on the problem of the nature of variation. Such a complex factor as that which determines sex may evidently break up into simpler components, but for various reasons some geneticists incline to the belief that factors in general are permanent and irresoluble. Whenever a series in F_2 derived from two clearly distinct and true-breeding types, consists of a number of intergrading forms, it is possible to interpret this result as due to the operation of a multitude of *originally* distinct factors, or to the fractionation of some one or more of them. Not very rarely in such series an extreme parental type fails to reappear at all [*e.g.*, the many-feathered tail of the fan-tail pigeon (Morgan), or the long glumes of Polish wheat from crosses with ordinary types. It is difficult to interpret the absence of the extremes simply as an indication of their statistical infrequency. The production of an innumerable series of colour-forms, as in the sweet pea, is almost certainly due to the fractionation of the colour-complex. Until systematic crossing was undertaken, the extremes existed, but the intergrades did not. So also in *Drosophila*, of which the normal eye is red, a profusion of intergrades ranging to the white eye, which was discovered first, has now appeared. Though " mutation " is involved, the essential change is probably the disintegration or fractionation of the originally integral complex.

Cytological Interpretations of Genetic Phenomena

Soon after the rediscovery of Mendelian analysis the plausible suggestion was made that the behaviour of the chromosomes in the course of the maturation divisions was consistent with what might be expected if they were actually the bearers of segregable factors. Since, however, the number of segregating factors in many forms far exceeds the number of chromosomes possessed by those forms, it is clear that if the chromosomes are the carriers of factors they must be capable of carrying many. The discovery of linkage, and especially of the fact that linkage was determined by the parental associations of the factors, pointed in the same direction, for, as hinted (by Punnett) in the earlier article on Mendelism (*see* 18.115), linkage or " gametic coupling " as it was then called might not unreasonably be supposed to be based on chromosomal association. The first development of this conception was made by T. H. Morgan, whose investigations relating mainly to the fruit-fly *Drosophila*, have inaugurated a new phase in the development of genetical theory. This insect is a subject unusually favourable for experiment inasmuch as it offers a profusion of variations or " mutations," and reproduces itself with great rapidity under laboratory conditions.

The work began with the observation that the eyes, normally red, may be white, and that this variation is sex-linked, behaving genetically precisely as colour-blindness does in man. The white-eyed male mated with normal females produces offspring all normal. Of these the sons cannot transmit the abnormality at all, whereas the daughters mated with normal males transmit the white eye to half their sons. White-eyed females can only be produced as daughters of white-eyed fathers and all the sons of such females are white-eyed. Supposing the male to possess an X-chromosome, this system of descent would be represented if it were assumed that in the normal the X-chromosome carried the dominant factor for red eye (*see* Sex). The linkage with sex is thus found to be an expression of the association of the two determining factors for sex and red eye in the same chromosome.

Numerous other sex-linked characters were soon after discovered, to which the same considerations apply, all collectively composing one linkage-group. The other factors identified in *Drosophila*, amounting to more than a hundred, can all be represented as grouped in three separate linkage-systems which, with the sex-linked group, make four; and since from cytological observations the haploid number of chromosomes in this animal is also 4 the inference is drawn that the factors composing each linkage-group are borne in one chromosome. Developing this conception, Morgan suggests that the factors are arranged in the chromosomes as beads on a string, each having a position normally fixed in relation to the rest. Crossing-over is thus represented as the consequence of an exchange of material between homologous pairs of chromosomes in synapsis. (*See* Cytology.)

The pairs of chromosomes which then conjugate are with much probability regarded as respectively of maternal and paternal origin. The conjugating pairs seem to twist round each other, and occasionally there is (especially in Amphibia) an appearance of anastomosis between them which is regarded as providing for an exchange of material between the homologous pairs, and thus for the formation of cross-overs. According as the linkage between two factors is more or less complete it is supposed that the distance between the position of the two factors in the chromosome is smaller or greater, and in proportion as factors are placed close together the probability of their being separated in the process of twisting and anastomosis is regarded as diminished.

The proportion of cross-overs is thus taken as a measure of the position of two factors in the chromosome. If A, B and C are three factors in the linkage group, and the closeness of the linkages between A and B and between B and C respectively be determined experimentally, then from these two the linkage between A and C can be calculated, and the result of the calculation is commonly found to agree with the value found experimentally for that linkage. In this way the relative " loci " of numerous factors have been determined with fair consistency, and the fact that this can be done forms a strong argument for the belief that in some way at least the factors must be disposed in linear systems. That these systems are actually arranged along the lines of the chromosomes is as yet a matter of inference.

Attention must be called to the curious fact that in *Drosophila* crossing-over never occurs in the males in any of the four linkage-systems. As in most examples of sex-linkage studies, the linkage with the sex-factor is always complete; but all the other factors are liable to crossing-over in the female, though among the male gametes the original parental combinations reappear unchanged. Conversely Tanaka, examining linkages in the silkworm, observed that a pair of linked factors show crossing-over in the male, but not in the female, and the two facts together suggest some limitation of crossing-over to the sex which is homozygous in sex, the female in Diptera, the male in Lepidoptera. The development of the idea here outlined has become the subject of very active research and is described in a copious but somewhat esoteric literature, which can be followed only with difficulty by those not personally engaged in the work. That the outcome of these researches has led to a valuable codification of genetic principles is not in dispute; but until the main thesis, that the number of independent factors or of linkage-systems is never greater than the haploid number of chromosomes, has been shown to hold generally for animals and plants, this account of the nature of linkage, though probable, cannot be regarded as proved. The defect of the theory at the present time is that it rests on many subordinate hypotheses which are not all capable of independent verification.

The position of the factors, for example, is believed to be liable to changes due to the action of other factors, the effects of age and miscellaneous influences difficult to distinguish. Errors of cell-division long regarded as the most probable source of variation, may also cause disturbance. In two very remarkable instances it has been found possible to connect a disturbance in the normal course of heredity with a visible cytological irregularity—called by Bridges " non-disjunction." In a certain family he observed that a sex-linked character failed to follow its normal distribution to the sexes, and he was able to find that in this family the sex-chromosomes showed corresponding irregularities. In 1921 he obtained similar evidence in regard to the fourth chromosome and the group of genes attributed to it. Thus a definite association between particular chromosomes and the transferable factors must certainly exist.

Giant Forms.—The interrelation of genetical and cytological phenomena is further illustrated by the behaviour of " Giant forms." This name is applied to certain varieties (chiefly of plants) in which the haploid and diploid numbers of chromosomes are double those of normal forms. R. P. Gregory bred such varieties of *Primula sinensis* and found that in respect of various allelomorphs they might be quadripartite and not merely bipartite as the normals are. A plant, for example, might be *DRRR* in colour or leaf-shape, and in consequence of the extra recessive elements, not distinguishable from the ordinary recessive, though in fact capable of throwing a small proportion of dominants. Since recent cytological studies have shown that series of allied forms may contain various multiples of the lowest haploid number (Chrysanthemum, for instance, having 9, 18, 27, 36 or 45) various extensions on these lines may be expected.

Somatic Segregation.—In the genetics of plants a number of phenomena have been encountered which are difficult to reconcile with the view, otherwise not unacceptable, that the distribution of the factors occurs exclusively in the maturation processes of the germ-cells. Apart from certain special conditions best known in variegated plants (which are sometimes irregular mosaics and sometimes consist of an outer " skin " and an inner " core," dissimilar in their genetical potentialities) there are many plants in which the distribution of factors must have been laid down before the formation of germ-cells. E. R. Saunders's results proved that in certain stocks (*Matthiola*) the pollen all carried doubleness though the ovules were mixed in character, single and double. C. Pellew showed that in the hermaphrodite *Campanula carpatica* " pelviformis " the pollen bore exclusively femaleness and preponderantly white flower-colour (the plant being heterozygous for blue). The pollen of *Begonia Davisii* (a wild species with single flowers) carries doubleness exclusively, and several similar examples are known, in all of which the segregation of characters must precede the maturation of the germ-cells. Thus, while it is not a question that segregation depends on some cell-division, and very possibly on a differentiation of the chromosomes, there is evidence that the cell-division in which this differentiation occurs must at least sometimes precede germ-formation. As mentioned, in *Oenothera* this " anisogenous " distribution is exceptionally frequent.

Bearing on Evolutionary Theory.—This aspect of genetics can only be briefly treated here (*see* also MENDELISM). Genetic analysis has shown that the appearance of variability as a contemporary and widespread phenomenon is largely illusory. On studying a variable species critically it is found that the various forms cannot all produce each other as was formerly assumed, but that they stand in a regular descending order, being terms in a series of combinations of definite factors. Such series are no evidence of contemporary variability. Many of the terms can be separated in the homozygous condition, and thereafter may breed perfectly true. Even such an appearance of variability as that seen in polymorphic species is frequently not above suspicion of being the consequences of a cross, more or less remote. Contemporary variation certainly may occur; but of the contemporary origination of new species, or of the occurrence of genetic changes which can be colourably interpreted as likely to lead to the production of incipient species in a strict sense, no indication has been found. That the forms of life have been evolved from dissimilar precedent forms we know from the geological record, but as to the process by which this evolution has come to pass we are still in ignorance. All that can be said at present is that variation most commonly arises as an error of cell-division, and that it is quite conceivable that new species have so arisen.

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GENEVA, Switzerland (*see* 11.587), had in 1920 a population of 135,059, including suburban districts. In the city proper it was 56,292. Geneva has been much changed in recent years, a large number of public and private buildings having been erected. The manufacture of motor-cars is a new industry, but it is as much an educational and intellectual centre as in the past. An historical and art museum was opened in the Boulevard Helvetique in 1919, and various collections of arms, pottery, coins, pictures, etc., including those from the Arsenal and the Musée Rath, have been brought together there. The Musée Rath, which was the International Prisoners of War Bureau during the World War, is now used for exhibitions. The imposing Electoral Palace was rebuilt with a large hall in 1913–6. A bridge to carry a loop line between the two railway stations has been thrown across the Rhone below the junction with the Arve. A Reformation monument, begun in 1909 on the 400th anniversary of Calvin's birth, was unveiled in 1917; it represents a stretch of rampart, the wall of Geneva with a narrow moat in front. In the centre are colossal figures of Calvin and others, with statues on each side of eminent champions of the Reformation, and bas-reliefs and monumental inscriptions between.

Geneva was chosen in 1919 as the seat of the League of Nations. The Assembly met first in 1920 in the Hall of the Reformation, built by public subscription in memory of Calvin, near the Grand Quay. The league secretariat is housed in the Palace of the Nations, formerly a hotel, beyond the Jetée des Pâques. In Dec. 1925 this building was put up for sale, but as there were no buyers it was decided to retain it for the use of the league. A tablet in memory of President Wilson was placed on the terrace wall in 1924. The International Labour Organisation was housed at first near the Ariana Museum, but for it a new building has been erected near Parc Mon Répos. The office of the International Red Cross is in the Rue de la Promenade du Pin, in the southeast part of Geneva.

GENOA (*see* 11.597), the chief port of Italy and capital of the province of Genoa, had a population of 316,217 in the municipal area of about 12 sq. m. in 1921. The industrial quarter of San Pier d'Arena on the west is now joined to Genoa, and there is a growing residential quarter beyond the Torente Bisagno to the southeast, to which the Via Venti Settembre gives direct access. Large buildings include the imposing Banca d'Italia in the Via Dante, and a building containing the bourse, the post office and a theatre in Piazza de Ferrari. The improvement of this piazza, the central square, was begun in 1913; blocks of houses have been demolished, and the area opened up. The historic Palazzo San Giorgio has undergone complete restoration, and is now the headquarters of the harbour board. A fine new sea front, the Corso d'Italia, adds considerably to the attractiveness of the new residential quarter. During the present century suburbs have arisen on the higher ground, and the Via di Circomvallazione a Monte has been laid out over the hills behind the city.

The tonnage of the port is growing, and is considerably higher than that of any other in Italy, representing almost one-fifth of the total tonnage of the country. Exports are on an average hardly an eighth of the imports, which are chiefly coal and cereals, and the marked drop which began in 1917 was due mainly to the decrease in coal. The doubling of the railway track to Pisa and the development of the stations at San Pier d'Arena and at Genoa Brignole, about two m. east of the principal station, with the extension of electric power to the main line towards Turin and along the coastal line, have improved the port's facilities. A scheme for the extension of the harbour, taken in hand in 1922, included the new Vittorio Emanuele and San Pier d'Arena basins. Shipbuilding is increasing in importance, and there is a considerable motor car industry; the manufacture of hats is also a growing trade.

GENOA, CONFERENCE OF, (April 10–May 19 1922,) a meeting of representatives of the British self-governing Dominions and of 29 European states, including not only the Allies and ex-neutrals, but all the ex-enemy Powers except Turkey (who was excluded on the ground that she was an Asiatic country). Above all, the conference was attended by representatives of Soviet Russia, and the dominant issue was the renewal of relations between Russia and the countries of Europe. The principal result achieved, however, was one which the organisers of the conference had not intended, namely, the signature at Rapallo, on April 16 1922, of a separate treaty between Soviet Russia and Germany.

The prospects of the Genoa conference had been somewhat clouded, before it assembled, by the wave of anti-Liberal feeling in France, which declared itself politically in the superseding of M. Briand by M. Poincaré as Prime Minister. Since the project of the Genoa conference had already been accepted by the Supreme Council, including the representative of France, before M. Poincaré came into power, he could not reject it altogether, but he took every possible step to interpret the agreed programme in the narrowest sense, and to hedge the participation of Russia with the fullest possible restrictions. He refrained from attending the conference but enforced his policy by giving detailed and stringent instructions to his representative, M. Barthou.

The general conference was preceded by a meeting between M. Poincaré and Mr. Lloyd George at Boulogne on Feb. 25, a meeting of Allied economic experts in London from March 20 to 28 which drew up detailed agenda for Genoa, and two other preliminary meetings of a regional character, one between the members of the Little Entente at Belgrade, and another at Warsaw between Poland, Latvia, Estonia and Finland. The parties represented at Warsaw subsequently conferred at Riga with representatives of Soviet Russia. The invitation to Genoa was accepted by the Soviet Govt. with alacrity, but was declined by the United States.

Adverse Influence of the Rapallo Treaty.—At its first plenary session the conference set up four commissions, the first to examine methods of putting into practice the principles of the Cannes resolution of Jan. 6 1922 (*see* CANNES, CONFERENCE OF), while the other three were to deal respectively with financial subjects, economic and commercial subjects and transport. These three latter commissions, which were concerned with technical questions, all reported before the conference came to an end; but their reports were bound to remain academic unless the first commission achieved positive results. The task of the first commission was more difficult, because it was general and political in character, and its work was soon suspended in favour of informal discussions between the three principal Allied Powers and Belgium on the one side, and the Russians on the other. The Germans, who felt themselves left out in the cold, retorted by negotiating their separate treaty with the Russians at Rapallo, in which, at least on paper, the objects of the Genoa conference were achieved as between these two parties by a mutual renunciation of reparation claims and a resumption of normal consular and diplomatic relations.

However, this separate Russo-German treaty damaged the general prospects of the conference by the shock which it gave to the Allies, and especially to Belgium and France, who, ever since the Armistice, had been oppressed by the nightmare of a military alliance between Germany and Russia. The Rapallo treaty seemed like a first step in this direction, even though the published text contained no military clauses, and the Allies addressed a series of acrimonious though ineffective notes on the subject to the German delegation. In these circumstances there was little prospect of success for a general pact of non-aggression, which Mr. Lloyd George suggested on April 25. Meanwhile at the very first session, M. Barthou had had a hostile encounter with the principal Russian delegate, M. Chicherin; but the conference actually broke down through the intransigence of Belgium. When an attempt was made to secure a common draft of proposals to be presented by the European delegates to the Russians, the Belgians insisted upon the integral restitution of foreign-owned private property in Russia. M. Barthou supported the Belgian contention, and was himself supported in this attitude by M. Poincaré. Eventually a formula on the British lines was carried over M. Barthou's head, even Belgium finally giving way, but it was so evident that, with Great Britain and France divided, no positive result could be achieved, that the Genoa conference was quietly wound up by remitting its agenda to a mixed commission of experts. This conference of experts duly met at the Hague from June 26 to July 20 1922, but it foundered, like the Genoa conference, on the rock of foreign-owned private property in Russia, in regard to which the Russian and the Franco-Belgian views again proved incompatible.

The Reconstruction Standpoint.—Although the Genoa conference led to no positive results, it was interesting as the first general European conference after the War of 1914–8, and because economic and financial problems were approached from the point of view of reconstruction, and not of reparation. It was also interesting as the first attempt at a settlement between the European governments and Soviet Russia. At Genoa the difficulties which proved crucial on later occasions were already encountered. (A. J. T.)

GENTILE, GIOVANNI (1875–), Italian philosopher and politician, was born at Castelvetrano (Trapani) May 29 1875. He studied literature and philosophy at the University of Palermo, and after a series of university appointments became in 1918 professor of the history of philosophy in the University of Rome where he founded and became director of the school of philosophy. Two years later he founded the *Giornale critico della filosofia italiana.* Created a Senator in 1918, he supported the Fascist movement from its beginnings, and when Mussolini's Govt. came into power, Gentile was appointed Minister of Education. He was then a Liberal, but subsequently joined the Fascist party, of which he became a prominent member. As Minister of Education he carried out an organic reform of the Italian educational system, abolished the traditional shibboleths of positivist and materialist teaching, and suppressed many inveterate abuses. He introduced the system of state examinations and also the teaching of religion into the elementary schools. The universities wholly maintained by the State were limited to 10, while others, maintained privately or by local administra-

tions, received state subsidies if they complied with certain standards. Among Gentile's numerous works are: *Il modernismo e i rapporti tra religione e filosofia* (1909), *I problemi della scolastica e il pensiero italiano* (1913), *I fondamenti della filosofia del diritto* (1917), *Le origini della filosofia contemporanea in Italia* (4 vol., 1917–23), *Il Problema scolastico del dopo guerra* (1920), *La Riforma dell' educazione* (1920), *Il Fascismo al governo della scuola* (1924), *Che cosa e il fascismo* (1925), etc.

GEODESY (*see* 11.607 and 8.801).—The geoid is the surface which coincides with the ocean surfaces and their hypothetical continuations inland in imaginary channels; all tidal movement being considered suppressed. The study of the form of the geoid, frequently referred to as the " Figure of the Earth," is a main object of geodesy. It has been prosecuted by various agencies in separated portions of the land areas. Even in 1926 only a small fraction of the total area of the globe has been examined.

Such results as have been obtained may be co-ordinated by the assumption that the geoid does not differ greatly from a spheroid (ellipsoid of revolution); and the assumption of an ellipsoid of three unequal axes is not at present considered useful. " Determination of the Figure of the Earth " may be used conveniently in the restricted sense of determination of the elements of the most suitable spheroid; while the science of geodesy embraces further the study of the actual geoidal form in detail, and even the explanation of this form.

Figures of the Earth.—During the progress of the science and the growth of observation results, various figures of the earth have been obtained. Each Survey department has made use of that figure which at the time seemed best. A variety of spheroids are now in use as reference figures, on which the calculations of the corresponding surveys are based. There is growing inconvenience in this, and it would be ideal if all the separate geodetic surveys could express their results in terms of a single spheroid. Although there are technical difficulties in the relation of the origins of separate surveys to any unique spheroid, it was none the less decided at the meeting of the International Union of Geodesy and Geophysics at Madrid in 1924 that one spheroid should be internationalised and that, so far as practicable, results should be expressed in terms of it. The International Spheroid is that determined by J. F. Hayford in 1909.[1]

Equatorial radius	6,378,388 ± 18 metres
Reciprocal of flattening	297·0 ± 0·5
Polar semi-diameter	6,356,909 metres

The above figures were derived from observations made in the U.S.A. only; and the introduction of the principle of isostasy (*q.v.*) was the novel feature of the work. Remembering that the entire U.S.A. area of 3,026,789 sq. m. is but 1/66th of the entire earth's area, 197,000,000 sq. m., some doubt might be felt as to their universal applicability and their stated probable errors. An independent consideration by Helmert[2] of Hayford's figures yielded probable errors ± 35 metres and ± 0·8. Further, Helmert [3] in 1915, from a discussion of numerous gravity results from places scattered over the globe found 1/296·7 ± 0·6 for the flattening, which is a very strong corroboration of Hayford's value.

The Reference Spheroid.—That the geoid should be a spheroid was a very plausible conjecture; for a spheroid is a possible boundary for a rotating gravitating fluid mass—the flattening depending on the internal density distribution. When a solid mass is considered in place of a fluid mass some modification in the resultant form may be expected; at the same time the development of isostasy supports the view that the earth behaves in many respects as though it were viscous, tending to the form it would assume if fluid. However, long before such evidence became available, it was tacitly assumed that the geoid was actually a spheroid. Nineteenth century observations were reduced by Clarke and others, treating any discrepancies from spheroidal form as due to observation error. This was justifiable when data were scant, and the instruments, with which they had been obtained, were of poor precision.

More recent data from greatly improved instruments, however, leave no room for doubt that there are measurable differences between the geoid and any adopted spheroid. Geodesists study the actual form of the geoid, expressing it with reference to a spheroid, which is accordingly named the " reference spheroid." When the reference spheroid is in close correspondence with the geoid, the mutual separation is small at all points. This facilitates many computations: for some purposes observed horizontal angles, which are geoidal angles, may be treated as spheroidal angles: as has practically always been done, though in a few cases small correction was really necessary.

The General Origin.—Suppose that the geoidal form were known throughout, and apply to this the international (or any other) spheroid. How is the latter to be orientated? The minor axis of the spheroid may be set parallel to the actual axis of rotation of the earth, whose direction is known unequivocally to the precision of astronomical telescopes. This answers the question of orientation. The location of the spheroid remains at choice. Any point on the spheroid may be brought into coincidence with corresponding point on the geoid; but *only one point can be so treated*, which may be called the "general origin." When this has been done, some portions of the geoid will lie without the spheroid, and other portions will lie within. The two surfaces will intersect in a number of closed curves, on one of which will lie the general origin. The normals to the geoid—verticals—will not coincide with the corresponding normals to the spheroid except at points along certain closed curves, quite distinct from the curves of intersection of the two surfaces. The form of these curves will change if the general origin is changed. The inclination of geoidal and spheroidal normals at corresponding points is what has generally been called the " deflection of the plumb-line." It will be clear now that the deflection of the plumb-line at a point depends on the choice of spheroid of reference and of general origin. It is not an absolute quantity, but dependent on the reference system. When this latter has been selected, there is a unique value of the deflection at any point which has been geodetically connected with the origin. In practice, however, it is necessary to assume separate origins for each detached survey, and accordingly the deflections of surveys on separate origins cannot be regarded as absolute quantities. In this respect the international spheroid cannot be considered as unique as yet.

The Selected Figure.—Meanwhile the study of the geoid in each detached survey may be continued. At any point of the earth's surface, astronomical observations combined with W.T. signals enable both latitude and longitude to be uniquely determined, independently of any assumed reference figure. A number of such points are connected by linear measure and triangulation, and values, called geodetic, of latitude and longitude are computed *on the selected figure*. The differences of astronomic and geodetic values are the deflection components. If these are sufficiently numerous—which may be judged by the smoothness of deflection variation—the separation of the geoid and spheroid can be integrated.

An alternative method of finding this separation is based on the measurement of vertical angles between the triangulation stations combined with spirit levelling and deflection results.

The observed vertical angles are reduced to the spheroidal vertical by application of the appropriate deflections. If the terrestrial refraction[4, 9b], of each ray is computed, it becomes merely a geometrical problem to calculate the differential *spheroidal* heights. Spirit levelling, which with its short rays intimately follows the geoidal surface, yields the *geoidal* heights. Both spheroidal and geoidal heights are thus known, and hence the separation of geoid from spheroid.

Ordinary triangulated heights, uncorrected for the deflection, are not the same as spirit levelled heights, apart from the question of precision; and they certainly are not geoidal heights. Geoidal heights are what enter into practical problems; but from the geodesist's point of view they do not mean much until the form of the geoid, to which they refer, has been determined.

Base Line Measurements.—Modern bases are measured with wires hanging in catenary under constant tension, a system introduced by E. Jäderin of Stockholm. His original plan was to use two wires having different expansion coefficients, whence the temperature could be determined and the necessary corrections applied. With Guillaume's invention of " Invar " this became unnecessary.

A bright wire of small gauge (1·65 mm. is the usual diameter) is not much affected by the sun's radiant heat, and so its temperature does not differ much from that of the air. With the low expansion coefficient of invar, 4×10^{-7} per degree Centigrade, an error of 2°·5 causes an error in length of only 1 in 10^6. The method of using invar

[1] Figures throughout the text refer to notes at the end of the article.

wires has been closely studied by Benoit and Guillaume[5] and their procedure may be confidently followed. It is vastly simpler than the old methods with compensated bars and is also much more accurate; further, much rougher country can be negotiated and so, longer bases become possible.

For the standardisation of wires at the observatory, before and after the measurement of the base, different methods of laying out a length of 24 metres, which is the usual length of the wires, have been employed. An apparatus designed by Sir David Gill for India was fully described in *Engineering* 1915. The ultimate standard of length in this is a nickel bar of H section, one metre long. Standards for ordinary use are H bars of invar, one metre and four metres in length. Invar has been observed to undergo a secular change in length which continues for many years. Investigating this, Guillaume found that the instability is due to the presence of carbon which gradually forms cementite, Fe_3C, with the iron. The addition of chromium, which has a greater affinity for carbon than iron has, prevents this and an invar with ten-fold increased stability has been produced.

Triangulation.—Theodolites with circles of 12 or 10 in. are usually employed for the highest class geodetic triangulation. Mr. Connolly of the India Stores Department considers even that the fullest instrumental accuracy can be incorporated in an 8-in. theodolite fitted with a large objective telescope. Luminous signals, heliotropes by day and lamps by night, are essential. Vertical angles should be taken between 1 and 3:30 P.M., when the refraction is usually a minimum and most regular. None the less there is frequently at this time poor definition, and horizontal angles should be observed at night or by day within three hours of sunrise or sunset.

Control.—Triangulation emanating from a fixed point with observed base and azimuth yields positions of all stations and lengths and azimuths of all sides. Errors are unavoidably generated. Their probable amounts are given by the formulae of de Graaff Hunter[6] now indicated.

These involve the quantity $M=(1+f)m\sqrt{18/l}$, in which l is the average length of side; m (Ferrero's error of mean square of an angle) $=\sqrt{\Sigma(\Delta^2/3n)}$, where Δ is the triangular error and n is the number of triangles; and f, which lies between 0 and 1/6, depends on the type of figures in the series. Further, if O is the starting point and A the station at which errors are sought: R = OA and S = curved distance, OA measured medially through the series, both expressed in units of 100 miles, then P.E. in seconds of azimuth at $A=1''{\cdot}575\sqrt{\Sigma M^2 S}$, P. E. in 7th figure of log. side at $A=33{\cdot}2\sqrt{\Sigma M^2 S}$, P. E. in feet in northing or easting at $A=4{\cdot}03\sqrt{\Sigma(M^2 f R^2 dS)}$.
The summation Σ is in each case for a set of series for which values of M differ.

The first two of these formulae give the means of determining at what intervals control of triangulation is desirable. Clearly an extra base will control the error developed in side length: to control the azimuth it is necessary to form a Laplace point, at which azimuth and longitude are determined astronomically. A numerical example will illustrate the method. It is desirable to introduce a control when the P.E. attains 3 times the error of the control. Two bases are involved, one at each end. If the P.E. of a base is 1 in 10^6 then the P.E. of the control is $\sqrt{2}$ in 10^6. The P.E. of side reaches thrice this amount when $33{\cdot}2M\sqrt{S}=3\sqrt{2}\cdot 10^7$ log. $(1_{+}10^{-6})$. Taking $M=0{\cdot}2$, corresponding to very high class triangulation, we find S is 772 miles.

Next, if ΔA, ΔA_o are differences astronomic minus geodetic azimuths; L, L_o, λ, λ_o triangulated values of longitude and latitude of A and O, and T the difference between the local times at A and O, then Laplace's equation is

$$\Delta A_o \operatorname{cosec}\lambda_o - \Delta A \operatorname{cosec}\lambda = (L-L_o) - 15T$$

which serves to determine ΔA, a quantity to be subtracted from the astronomic azimuth to give the correct geodetic azimuth. The P.E. of an astronomic azimuth is taken as $0''{\cdot}2$ for high class work; that of T as $0^s{\cdot}03$. Hence the P.E. in azimuth determined from Laplace's equation is

$$\sqrt{[(0{\cdot}2\sin\lambda\operatorname{cosec}\lambda_o)^2+(0{\cdot}2)^2+(0{\cdot}45\sin\lambda)^2]}$$

If we take $\lambda=\lambda_o=45°$ this become $0''{\cdot}42$ and $1{\cdot}575\times 0{\cdot}2\sqrt{S}=3\times 0{\cdot}42$, whence S is 1600 miles. If the time error could be reduced to $0^s{\cdot}01$ the value of S would be almost halved and the precision of azimuth would be about the same as that of side control. It is to be pointed out that there is little gain in controlling the side length with great accuracy while the equally important azimuth control is much less precise. Hitherto the ruling criterion has been that of azimuth. The conclusion is that until time observations are more precise, the highest class triangulation is not likely to be much improved by the controls available unless its extent is considerably greater than 1,000 miles.

Determinations of Height.—The precision of spirit levelling is so great as to justify the recognition of the lack of parallelism of the various level surfaces, each of which is approximately spheroidal. It is nowadays customary in levelling of high precision to apply to the observed differences of height the correction [7,8] for the convergence of these surfaces, that is to say, the orthometric correction; and to publish the orthometric heights. As regards differences of height found by triangulation much improvement is called for. Observed vertical angles are referred to the local geoidal vertical; they require correction to the reference spheroid vertical, as well as for refraction, after which the height differences can easily be calculated.

Refraction.—When reciprocal observations have been made at two points A_1, A_2, if E_1, ω_1, δ_1 are respectively the angle of elevation, the refraction and the deflection at A_1 towards A_2, and similarly with changed suffixes for A_2, then

$$E_1+\delta_1-\omega_1+E_2+\delta_2-\omega_2+C=0,$$

C being the angle between spheroidal verticals at A_1, A_2, computed from the triangulation. The ordinary practice is to ignore δ_1 and δ_2 and to assume that $\omega_1=\omega_2=\Omega$; whence $2\Omega=E_1+E_2+C$. The ratio $\Omega/C=k$ has been called the coefficient of refraction, and as $k=\frac{1}{2}\left(1+\frac{E_1+E_2}{C}\right)$ it can be computed when a ray has been observed at both ends.

There are cases when $\delta_1+\delta_2$ is by no means negligible in comparison with $\omega_1+\omega_2$; moreover there is little justification for the assumption $\omega_1=\omega_2$, unless the two stations are at the same height.

Refraction has a diurnal change, falling to a minimum about the time of maximum temperature, moreover the value of the minimum is pretty constant from day to day. It is in this constancy that lies the value of observing vertical angles between the hours of 1 and 3:30 P.M. Consideration [4,9b] of the physical laws leads to a formula which represents the refraction usually met with at these hours. At other hours the refraction is ordinarily larger by an amount which varies as the defect of temperature from maximum and as the cosecant of the angle of elevation of the ray. The physical cause [10] is that the temperature lapse-rate is nearly constant within the height limits of the ray, and does not vary much during the day except comparatively close to the ground. The refractive effect of a plane stratum of air close to the ground can be expressed in terms of the air densities of its upper and lower surfaces. Some confirmation of this view is obtained by considering barometric height readings. Further research is required, and more observations, with full particulars of local deflection, are needed for investigation. In cases where the data are complete, the refraction does not appear so intractable as has generally been supposed.

Astronomical Latitudes.—For the observation for latitude the zenith telescope and the Talcott-Horrebow method seemed to have superseded all others (*see* 11.610); but the method of equal altitudes is worthy of attention. Several special instruments have been designed for this observation, all of which determine latitude and time simultaneously; whereby in association with wireless time signals, deflection in both meridian and prime vertical can be found.

The prismatic astrolabe of MM. Claude and Driencourt, [11, 12, 13] which is made in two sizes, has a horizontal telescope with an equilateral prism mounted in front of the objective. The edges of the prism are horizontal, and one face, that nearest to the objective, is vertical. A mercury bath is suitably placed below and slightly in front of the prism. Light from a star of approximately 60° altitude falls normally on the upper face of the prism, and is reflected internally at the lower face towards the lower half of the objective. At the same time light from the same star falls on the mercury, is reflected into the prism through the lower face, then internally at the upper face, and so to the upper half of the objective. In both cases after reaching the objective, the light is brought to a focus and two images of the star are formed. These approach one another, and the instant at which they pass is timed—this instant corresponding to a fixed altitude depending on the angle of the prism, imperfection in the focus of the telescope and the refraction. The actual altitude is usually regarded as an unknown; corrected for refraction it should be a constant for one instrument.

Provisional values for this, for the latitude and for the time being assumed, the result of one observation can be plotted as a straight line on a chart with time and $\lambda\sec\lambda$ as co-ordinates. Four stars, one in each quadrant, form a set of observations and yield four such lines which should touch a circle of radius equal to the discrepancy of the altitude from that provisionally assumed, both multiplied by $\cos\lambda$. The co-ordinates of the centre of this circle represent the time and latitude sought, and the constancy of its radius is a measure of pre-

cision of the observation. If there is too much wind the partially shielded mercury surface is disturbed, and observation becomes impossible. The adjustments are very simple, as is also the observation when the observer is practised; and there is practically no recording. Computations and preparation of star programme are not excessive. Excellent results have been obtained with this instrument. In the discussion of a paper[14] Jackson stated that the images are elongated, being in reality short spectra; so that stars of different colour would give different results. Other users of the astrolabe have not found this to be appreciable. Practical drawbacks are that each star yields only one observation and that the time estimate is burdened by personality. To overcome the latter L. Favé[15] described equipment to measure the personal equation, but up to 1925 this has not proved completely successful.

An alternative instrument, free from two of the above noted objections is the Circumzenithal Apparatus of MM. Nusl and Fric.[16] In this the light from the star enters the instrument through a parallel plate of glass and falls on a half silvered mirror, being split into two portions. One portion proceeds to a mercury bath, and after reflection there and at a second mirror passes again through the half silvered mirror. Thence both portions enter the observing telescope. The mercury is completely screened from the wind. By means of an achromatic reversible prism placed in front of the plate at which light enters the instrument, a star can be observed at three slightly different altitudes. An additional interior prism in front of the objective, which causes the formation of four images, allows 7 observations to be made on the same star at each altitude.

A simple bent telescope, in which reflection occurs at a mercury bath, has been designed and used by de la Baume Pluvinal. Observing 10 stars on the same evening at the Paris Observatory, he obtained values of latitude and longitude differing by 0″·2 and 0ˢ·03 from the well established observatory values.

In Egypt, Wade has employed a simple method[17] of finding differential latitudes at places a few hundred metres apart.

Longitudes.—Several of the large wireless stations send out special time signals, which can be picked up at very great distances by suitable apparatus. These provide a basis for longitude determination when the local time has been observed.

The very powerful station at Bordeaux is an example; and the precise times of the signals are determined by the "Service Horaire de l'Observatoire de Paris." The signals are of the "rhythmic" type, in which 300 dots are sent out uniformly spaced over 293 seconds. At the end of the set the precise times of those of the previous day are signalled. Very precise comparison can be made by noting at what exact seconds the incoming signals coincide with the beats of the observer's clock: alternatively, when a recording receiver is used, all the 300 dots are recorded and subsequently measured. Owing to the time of duration of the signals and of the clock beats not being precisely equal, there is some personality in the estimate of instant of coincidence. To obviate this Thrum[18] devised a method in which the incoming signals and those of the clock extinguish one another in the telephone when they overlap. Difference of opinion exists as to whether the registration or the audition method is the more precise.

Time signals have been picked up at several of the larger observatories day by day for years. Sampson[19] pointed out and discussed serious discrepancies of the order of 0ˢ·1 in the relative times. The complete explanation is still to be found. On the other hand longitude circuits recently formed by the U.S.C. and G.S. are stated to have closing errors of the order of 0ˢ·01, suggesting that field instruments and conditions are superior to the large instruments and conditions at the fixed observatories.

A world project of longitude was put forward by General Ferrié in 1921. A mixed commission of the International Unions of Astronomy and of Geodesy and Geophysics was formed, and the project has been discussed at Rome, 1922, Madrid, 1924, and Cambridge, 1925. Details have been advanced sufficiently for a decision to execute the scheme in 1926 to be arrived at. It is hoped to fix very accurately the longitude of numerous points over the earth, thus helping to co-ordinate geodetic surveys. At the same time much experience in the highest precision work of this nature will be obtained. A comprehensive account of clock and wireless installations for this purpose is given by the Bureau des Longitudes.[20]

Gravity.—The absence of means of measuring the "sway" or flexure of the stand of pendulum apparatus was perhaps the principal cause of uncertainty in the older pendulum observations. Two methods have been devised and used for a number of years; and a further advance in eliminating the effect of sway has been made by Vening Meinesz.

Of the two methods referred to, one is in vogue in the U.S. and consists in actually measuring the movement of the stand by aid of an interferometer.[20a] It is claimed that the error in "g" from this determination rarely exceeds 2 in 10^7. The other method, due to Schumann, [21] provides a means of mounting a second pendulum on the same stand. The first pendulum is set swinging, and from time to time the amplitude of the second pendulum, originally at rest, is noted. Formulae expressing the effect of sway in terms of oscillations are given. The precision appears to be much the same as that of the first method. Both of these methods regard the sway as a constant during the course of the observations at a station, lasting perhaps three days.

Vening Meinesz [22, 23, 24], solves the problem more completely, and also overcomes the effects of earth movements by always employing simultaneously two isochronous pendulums. These are mounted on one stand so that the distance between their points of support is invariable, and are set swinging in different phases. Denoting the angles of elongation by θ_1, θ_2 then the angle $\theta_1-\theta_2$ may be regarded as the angle of elongation of a hypothetical pendulum which is free from the effects of sway; as also of various irregular perturbations. So far is this the case that apparatus so arranged has been used for determining gravity at sea in a submarine; and determinations have been made in Holland in places where the ground is very unstable. Observation is much as usual in pendulum work, the ray of light passing from the mirror of the first pendulum to that of the second and thereby recording the differential angular movement of the two.

In consideration of its success at sea, Vening Meinesz's method supersedes the earlier work of Hecker and Duffield [25] with hypsometers and barometers. The possibilities opened up are very extensive. Helmert's formula of 1901 has been used widely in pendulum work. It is

$$g_0 = 978{\cdot}030\ (1+0{\cdot}005302\ \sin^2\lambda - 0{\cdot}000007\ \sin^2 2\lambda),$$

λ being the latitude. Bowie, [26] p. 196, taking isostasy into account, found 978·039 as the equatorial value, and ·005294 as the coefficient of $\sin^2\lambda$, while Couchman [27] found Helmert's value too small by ·011 in the case of Indian stations.

In 1915 Helmert[3] gave a formula involving the longitude L,

$$= 978{\cdot}052\ (1 \mp {\cdot}005285 \pm 7\ \sin^2\lambda - {\cdot}000007\ \sin^2 2\lambda + {\cdot}000018 \pm 4\ \cos^2\lambda\ \cos 2(L+17^\circ \pm 6)$$

This is based on 3,000 stations reduced by Borass. It implies an elliptic equator with major axis in 17° W. longitude, whose half length is 230 metres greater than the semi-minor axis—compare Clarke's 3-axial figure results, with 8° 15′ W. as the longitude and 465 metres excess length of the semi-major axis.

The Eötvos Gravity Torsion Balance [28] measures the rate of change of gravity. The change per cm. along meridian given by the formula is $8{\cdot}1\times10^9$ C.G.S. units in latitude 45°; and as the instrument is incredibly sensitive, it is capable of measuring 1×10^9 and less, and easily detects irregularities. Nowadays it is used in prospecting for oil. (*See* GEOLOGY; ISOSTASY.)

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GEOGRAPHY (*see* 11.619).—The advance of geography as a subject of scientific study and research in fields other than that of exploration of untrodden ways is largely due to a change in the spirit of the times, which, from a vivid realisation of man's power over nature through his invention of mechanical power-schemes, has swung across to a deep sense of the play of dimly apprehended physical and social influences, which need study for men's sakes.

Within the scientific geographical field special credit must be given to the pioneering work of Réclus in France, to Ratzel and von Richthofen among others in Germany, to Vidal de la Blache and E. de Margerie and their schools in France, to W. M. Davis and others in the United States of America and to A. J. Herbertson in England. The geographer explores the earth and hands over to many specialists the tasks of analyses of geological, meteorological and other data, but he keeps the duty of building up more and more synthetic pictures of the various regions of the world, and he does this especially by studies of the conclusions of structural, physiographical, climatological and biological specialists, and by institution of comparisons of the interrelations of these conclusions as they affect every part of the world. Alongside of this he seeks "exact and organised knowledge of the distribution of phenomena on the earth's surface."

Natural Regions.—He is thus concerned to gain on the one hand general distributional knowledge, and on the other hand synthetic regional vision, the view of interrelations of specialist conclusions with reference to a region. The latter task involves the former, for it is through an appreciation of coincidences of distribution that we are able, scientifically, to recognise a region in geography. Herbertson gave notable service in this direction, for he saw the world as composed of a number of major natural regions within each of which there reigned, for him, partial uniformities of structure, drainage, climate and ecology. Though the progress of knowledge may well alter the relative weights given to different groups of facts, and may thus lead to schemes of natural regions that diverge from Herbertson's, the basic idea, for which he was largely responsible, maintains and develops itself. His major natural regions are, inevitably, almost entirely climatic, and here the problem is relatively simple if we allow enough for transition zones. When the subdivision of major regions is discussed, divergence of view is usually developed, as so much depends on the subjects of election of the disputants.

Physical Geography.—The older form of study of physical features of the earth's surface reviewed matters such as denudation by rain and rivers, coast erosion and deposition of materials, and endeavoured to find types of various natural processes. This type of work has continued, and Dr. Vaughan Cornish has contributed especially to the study of waves. Another physical study has received a great impetus from the publication of E. Suess' masterpiece *Das Antlitz der Erde* (1883–1909). This work, made possible by the researches on mountain structure pioneered for Britain by C. Lapworth, Peach and Horne, gave a glimpse of order, of pattern, in the physique of a country, and turned studies of physical geography in a regional direction, for it was now possible in a far more real sense than previously to see how physical features had come to be as they are. The trend in this direction was encouraged by the prevalence of evolutionary thought at the time. Few fields of research have yielded such harvests in the last generation as have been reaped by the geomorphologists, students of the regional history of the earth's physical features, and advance continues rapid for Wegener's views; and Argand's ideas on the evolution of the mountain systems of the northern hemisphere through northward drift of Africa, Arabia and the Deccan are valuable as aids to thought, whether they themselves stand or fall (*see* GEOLOGY).

Geomorphology.—To geographers, whose business is the synthetic picture of a region, the conclusions of geomorphology are of the first importance, for in no other way, save by the study of geomorphology, is it practicable to gain a vivid and understanding view of the physical features of a region studied. With the help of geomorphology the physical map becomes a palimpsest in which we decipher numerous superposed patterns of hill and valley lines, of basins and domes, of scarps and plains, and the superposition of patterns indicates the course of their evolution.

Mention should be made, incidentally, of the progress of knowledge as to the general factors of the surface history of the earth since Fisher's *Physics of the Earth's Crust* appeared in 1882. The recent outstanding contributions have been Hayford's theory of isostasy (*q.v.*) and Joly's boldly interesting speculations. These researches are bringing with them a vision of law and order in the formation and evolution of characters of the major regions of the earth's surface of both land and water.

To the work of Suess are naturally related the studies of coral reefs and their origins initiated by Darwin, and continued by many workers. Deperet has studied the ordering of coastal terraces around the Mediterranean, and a body of knowledge of coastal plateaus and of their relation to fluvial and fluvioglacial terraces is growing up, especially for Europe and North America. It still needs more detailed comparisons to be made, but already promises to spread the idea of orderly changes as a key to the interpretation, on evolutionary lines, of a large range of surface features most important in the landscape.

We note also the continuation of the work of Penck and his followers on glaciers and moraines in the Alpine regions, of that of de Geer and his students in Scandinavia, and of the extension of this work by Dainelli to the Himalaya and by Renngarten to the Caucasus. The effects of the phases of the last great ice-age on the landscapes of the northern hemisphere are thus becoming known, especially as American workers have brought out parallel studies for their continent. This work may be said to have arisen from the pioneer studies of James Geikie.

Oceanography (*q.v.*).—Studies of physical conditions in oceans and seas have progressed largely owing to the efforts of commissions investigating fisheries. Schmidt's description of the life history and migrations of the eel was an outstanding advance. (*See* DISTRIBUTION OF ANIMALS.) As an example of some bearings of this work on geographical synthesis may be mentioned the work of O. Pettersson on the hydrography of fiords and partially enclosed seas around Scandinavia, in which he suggests secular variations of tidal power as factors of changes of climate from time to time.

Meteorology (*q.v.*).—In climatic study we note J. G. Bartholomew and A. J. Herbertson's *Atlas of Meteorology* (1899), the work of Lyons and others in Egypt, and that of the British Meteorological Office in preparing tables of normal figures for climatic facts, and Dr. G. C. Simpson's theory of the Indian summer monsoon published in 1921 are notable. The study of the general distribution of barometric pressure and of its changes in cyclonic systems is associated in England with the name of Napier Shaw, and there has been a great increase of knowledge of the layering of the atmosphere and of its more detailed conditions at different levels connected with the development of flying-machines and the mapping of air-routes. The many new facts and views attained are modifying very seriously our expositions of factors of the climates of the earth's regions, and here again a stable position has by no means been reached.

Climatology.—Climatological researches in polar regions have been of great value for better understanding of climate elsewhere. C. E. P. Brooks, Berg, Murgoci and others have tried to argue from the present to the climatic conditions of the past, and have thus contributed factors of interpretation of various soil and other features of the present day; von Richthofen pioneered in this direction with his classic work on Loess. (*See* CLIMATE.)

Ecology.—Ecological study of plants (*see* ECOLOGY), animals and man is both geographical and biological, the former in so far as it works out features of the place inhabited, and it is indeed sometimes argued that geography is essentially human ecology. In this field there has been increasing recognition of the fact that the flora and fauna of a region represent no more response to present conditions, but result from accumulation and interference of effect of a long series of past changes. In many cases, such as that of the virgin equatorial forest, a complex and delicate balance of life has been established through the course of ages, and these forests will probably not regrow in anything like their present form if cut down. The work of de la Bathie on Madagascar brought this out specially. Several opinions concerning plant and animal distributions need adjustment if newer views on continental drifts and on climates of the past are established.

Regional Studies.—Another generation saw the appearance of a large number of studies of regions based upon scientific data. Von Richthofen's *China* is rather old in parts, but its influence has been widely extended. Vidal de la Blache's *Tableau de la Géographie de la France* (1903), like F. von Richthofen's *China* (1887–1912), emphasises the facts of structure most of all. J. Dantin Cereceda's work on Spain, in turn, emphasises rather the facts of climate and ecology. The volumes of the Filippi expedition to the Himalaya are conceived in an encyclopaedic spirit, but as yet it is too early to say whether much effort will be made towards synthesis. The American Geographic Society began a series of scientific studies chiefly on Latin America. Sir M. A. Stein's *Serindia* (1921) is another encyclopaedic work with the emphasis largely on cultural distributions. A. Philippson's *Mittelmeergebiet* (1914) may be used as an example of a less encyclopaedic type of work which nevertheless effects with some success a synthesis of a large number of scientific facts. The Atlas de Finlande is another type of the collection, and to some extent the synthesis of scientific data, this time concerning a state. Throughout these works it will be seen that the geographer's special part is to correlate specialist data and to synthesise the facts into a picture of the region.

Great services have been rendered to the science of geography by writers on various regions whose main object is a somewhat different one. H. W. Bates' "Naturalist on the Amazon" (1892), Hudson's works on La Plata (1892) and C. M. Doughty's "Arabia Deserta" (1888) are typical examples in this connection.

Maps.—The map (*q.v.*) is the geographer's special instrument and he must work at its improvement, both as a representation of larger or smaller parts of the earth's surface and as a record of special types of data. The War provided enormous opportunities for surveying and cartography, and remarkable results were also attained by mapping from aerial photographs (*see* SURVEYING). Different tints in turf brought out unsuspected lines on development of the negative and led to interesting discoveries. (*See* ARCHAEOLOGY: AIR SURVEY.) The mathematical theory of map projections has been advanced especially by A. E. Young in England and Adams and Deetz in America. The "One in a Million" map, on the other hand, met some difficulties on its way towards the goal of world-wide unity; political reasons led to the crowding of some sheets with names while others were left nearly blank. Sheets including frontiers led to troubles between states in some cases, and the wave of nationalism after the War thus harmfully affected for the time what promised to be a great step forward in scientific geography. The Italian geographers issued an interesting collection of map sheets showing typical examples both of physical features and of human occupation of the surface.

Demography.—The mapping of various types of data has engaged much attention. General poverty after the War largely stopped improvement of the topographical map. The demographic map, fundamentally giving distribution of population is still in a state of flux. It is generally felt that density of population cannot be adequately marked by contours, and, both in this matter and in that of mapping commercial production, the method of stippling with fine dots has been tried, while Sten de Geer conducted experiments utilising large circles, etc., for the purpose of indicating agglomerates. The mapping of data has spread remarkably as an auxiliary in many fields of study, such as ethnography (*see* FOLKLORE), archaeology, anthropology, history and commerce. In most of these cases the stipple and contour methods of representation are rivals, while new methods tend as much towards insuring graphical power as towards accuracy of detail. The growing tendency to display on any one map only appropriately related facts is a testimony to the acceptance of the map as an instrument of research. The maps in C. Fox's *Archaeology of the Cambridge Region* (1923) illustrate the development of this point of view. (*See* MAP.)

Place Names.—On the border line of geography is to be noted especially the development of the study of place names under Longnon in France, the English Place Name Society in Britain, and the effort of the British Permanent Committee on Geographical Names towards standardisation. (*See* PHILOLOGY.)

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GEOLOGY (*see* 11.638).—The progress of geology suffered from a four years' break, which provided, however, a stimulus to economic geology by the compilations on mineral resources required during the peace negotiations, and to monographs on little-known areas such as the war fields (*Die Kriegsschauplätze 1914–1918 geologisch dargestellt*, Berlin, 1923–5).

The accumulation of geological evidence has increased apace owing to the foundation of new universities, the fuller educational employment of research work and the wider recognition of the economic value of geology. Its literature has become overwhelming, while its bibliographies and indexes are less efficient owing to the increasing bulk of material and cost of publication. One of the urgent needs in geological development is co-operation between the agencies which publish synopses of literature to secure prompter and fuller references and less serious omissions.

In the progress of geological philosophy since 1910 three features have been especially remarkable. First, the lessened over-emphasis on the geological conditions of northwestern Europe and the eastern states of North America, with the consequent abandonment (*cf. e.g.*, G. A. J. Cole, *Rep. Brit. Assoc.*, 1915) of that ultra-uniformitarianism which had developed in

those countries. Second, release from the restricted range of geological time that had been declared necessary from physical and mathematical data. Instead of a possible maximum of ten million years, as maintained by Tait, geologists are at liberty to assume 8 to 10 thousand million years, and need not discard hypotheses which demand prolonged time for minor geological phenomena. Third, recognition of the plasticity of the earth's crust, and of the world-wide effect of earth movements on the relations of land and water. The physical evidence has been found to afford a more precise correlation at some dates than that based on fossils. The belief in the plasticity of the crust and the lateral movement of the land masses has led to the study of mountain ranges and crustal movements with renewed zeal, and to a flood of speculative hypotheses which are perhaps a reaction from the mental strain of the War.

Origin and Constitution of the Earth

The discussions on the origin of the earth have marked the steady wane of the nebular hypothesis of Laplace. The hypotheses which are replacing it agree in accepting the solar system as derived from one aggregation of matter; but they attribute its start to the tidal disruption of the parent mass by a passing star. This theory has been put forward in various forms. Its modern development is based upon the planetesimal hypothesis, which has been restated by T. C. Chamberlin in his *Origin of the Earth*, 1916 (and in *Jour. Geol.*,[1] Chicago, 21–29); it has been adopted by J. H. Jeans, *Problems of Cosmogony and Stellar Dynamics*, 1919, and Harold Jeffreys, *The Earth*, 1924.

According to Jeans the parent mass extended throughout the range of the solar system, while according to Jeffreys it was restricted to the inner part. The material of the earth on each of the theories was once loose and was welded by heat due to collisions or pressure. That the original material was gaseous is urged by Eddington, since so many stars have the size appropriate to a gaseous body; but that the earth was constituted by the aggregation of solid meteoritic material agrees with the well-established facts of the earth's high internal heat, zonal structure, and composition. The planetesimal theory has undergone important developments and modifications in recent memoirs by its founder, T. C. Chamberlin. He calls attention (*J. G.*, 28, 1920, pp. 144–6) to the possibility of the planets still receiving matter from the sun, in consequence of such solar explosions as those which in May and July 1919 hurled material to the height of at least 475,000 m. above the sun's surface, and probably outward to the orbits of some planets.

The planetesimals, according to Chamberlin's estimates of 1920 (*J. G.*, 28, pp. 672, 681; 29, pp. 407–8) were originally very minute, and weighed about one-fiftieth of a pound apiece; amongst other phenomena he attributes to them the zodiacal light and Saturn's rings. He compares them (*J. G.*, 29, 1921, pp.407–9) with the chrondrules, the rounded grains found in meteorites, rather than with the meteorites themselves. They therefore approximate to the meteoritic dust, which, according to T. J. J. See, was once spread throughout space. In spite of the small size of the planetesimals Chamberlin regards them as having contributed two-thirds of the mass of the earth by their fall from space as rain upon the original core (*J. G.*, 28, p. 681). Jeffreys, however, denies the possibility of any great accretion of such material, and dismisses the planetesimal hypothesis as no solution of any of the main problems of geophysics, and as quite unacceptable on cosmogonic grounds. He has brought it forward in a modified form, which, according to Chamberlin (*J. G.*, 32, 1924, p.713), accepts all the essential doctrines of the planetesimal hypothesis.

Meteoritic Theory.—Lockyer, the founder of the meteoritic theory, recognised that many of the meteorites which formed the earth had planetary orbits, and that they came from a single source or zone is supported by the work of Sir William Crookes (*Phil. Trans.*, 1918, vol. 217A, pp. 427–30). According to Crookes the stony meteorites consist of the elements which form the bulk of the earth's crust, and he suggests, from the striking similarity in the proportions of their four chief constituents, that they were all derived from the disruption of a planet that once existed between Mars and Jupiter; the nickel-iron meteorites may have been derived from the core of the same planet, or may have come from a different source. The chemical similarity of the core of the earth to the iron meteorites is asserted by L. H. Barnett (*J. G.*, 32, 1924, pp. 615–35) as according to him the core consists of 90% iron, 7% nickel, cobalt and copper, and 3% of the other elements. The elementary constitution of the earth has been recalculated and its agreement with a meteoritic composition follows from Tamman's (1924) estimate that 98% is composed of 7 elements in the following order of abundance—iron, oxygen, silicon, magnesium, nickel, calcium and aluminium; four others—sulphur, sodium, chromium and potassium, constitute another 1.6%; all the other elements together amount to only four parts per 1,000 of the substance of the earth.

The stony meteorites, so far as is known, correspond only to the basic igneous rocks. The occurrence of acid meteorites has been claimed from the obsidianites of Australia, but their microscopic structure indicates their formation as aerial fulgurites by the fusion of dust by lightning during dust storms.

Zonal Structure of the Earth.—The earth consists of a series of layers, and much light has been thrown on their constitution and thickness. The bulk of the earth consists of a nickel-iron mass, the barysphere, which is enclosed by a rocky crust, the lithosphere. Within the barysphere is a core, 1,600 m. in diameter, which, according to the late C. G. Knott, is fluid, as it does not transmit distortional waves. In spite, therefore, of the oft-repeated conclusion that the whole earth is solid, seismology proves this large central core to be fluid. Between the barysphere and the lithosphere, moreover, according to various authorities, is a weak plastic layer, the asthenosphere of Barrell (*J. G.*, 22, 1914), or the fluid layer of basalt glass which, according to Daly (*Amer. Jour. Sci.*, 1923, pp. 347–71), lies below a holocrystalline rigid shell 25 m. in thickness.

The lithosphere has been subdivided into various zones. Suess adopted two: the basic Sima, composed predominantly of silica and magnesia, and the lighter, more acid Sial, composed predominantly of silica and alumina. V. M. Goldschmidt (*Geochemische Verteilungsgesetz der Elemente, Vid. Selsk. Skr., Math.-Nat. Kl., Kristiania, 1923–24*) considers that the nickel-iron core is surrounded by a sulphide and oxide zone which is comparable in metallurgical operations to a matte; above that ore zone is a stony zone which is comparable to a slag, and is subdivided into a lower layer of dense silicates, and an upper layer of light silicates and silica. E. D. Williamson and L. H. Adams (*Jour. Washington Acad. Sci.*, vol. 13, 1923, pp. 413–28) divide the lithosphere into three zones; the lowest consists of heavy silicates mixed with nickel-iron and is comparable to the meteorites of the Pallasite type; this layer passes down into the barysphere and upward into heavy silicates, which are covered by a shell of light silicates and silica.

That the barysphere is composed of nickel-iron was affirmed by Milne from the acceleration of earthquake waves, toward which it behaves as a rigid material; but under the influence of the intense heat and pressure, the material must at that depth be capable of flow into any cavities like a fluid, so that it has been described as elastico-rigid, or 'fluidible.' The work of F. D. Adams (*J. G.*, 20, 1912, pp. 97–118) has shown that the estimates of Van Hise as to the depth at which all rock material would be fluidible must be extended; for Adams, by an experiment suggested by Sir Charles Parsons, found that small cavities remained open for months in a granite cylinder which was laterally supported at conditions comparable to those in the earth, at a depth of 11 miles. These experiments, however, deal only with a short period and small cores in a rigid case; they do not represent the conditions of large masses acted upon by immense pressure at a high temperature for long periods. The high rigidity of the surface of the earth against tidal deformation was supported (*J. G.*, 27, 1919, pp. 585–601) by the observations of Michaelson and Gale on a horizontal waterpipe 502 ft. long.

[1] This journal is referred to in subsequent parts of the article as J. G.

The limited depth of the lithosphere and the constitution of the barysphere of nickel-iron have been supported by the evidence of radioactivity, for the earth's activity is of a strength which can be explained by the restriction of radioactive materials to a depth of about 40 miles. The material of the nickel-iron meteorites is the only non-radioactive substance that is likely to form a considerable part of the earth. The inner earth is assigned a more moderate temperature than formerly; that of the primitive sun, according to Jeffreys, cannot have been less than 3,000° C., but within the earth the maximum may be much lower, for the temperature may be nearly uniform in such a good conductor of heat as the nickel-iron core.

The Depth of Earthquake Origins

Knowledge of the physical nature of the earth's interior has made most progress from investigation of earthquakes, most of which have been attributed to a depth of 5 or 6 m.; Dr. Oldham (*Quar. Jour. Geol. Soc.*, 78, 1922, p. 57) concludes that the great majority arise less than 10 m. from the surface. Lately, however, physicists have assigned their origin to much greater depths. The late G. W. Walker (*Rep. Brit. Assn.*, 1917, pp. 13–4 and *Phil. Trans.* A.222, 1922, pp. 45–56), from the angle of emergence of earthquakes recorded by the Galitzin seismographs at Pulkova, inferred that some originate at least 800 m. deep. This deep-seated source has been supported by Prof. Turner (*Rep. Brit. Assn.*, 1923, pp. 283–6) who assigns the majority to a zone bounded below at a depth of 145 m., and some to a depth of 300 m., such as the Formosa earthquake of April 14 1906, at 280 miles.

Earthquakes.—The word earthquake originally meant a shaking or quaking of the earth which could be felt, might cause damage and was occasionally accompanied by changes in the aspect of the surface of the earth. Seismology was the department of science which dealt with these disturbances, and was naturally regarded as a minor section of geology; with improved methods of observation and the invention of special instruments the scope of this subject has been enlarged, and it has come to include much that does not belong to earthquakes in the original sense of the word, or to geology, yet cannot be entirely separated. Recent developments in the study of the earthquake, which might be dealt with here, are, therefore, transferred to the article Earthquake.

The shallow origin of some earthquakes was concluded by Milne from the twisting and breaking of telegraph cables by slips of material down submarine slopes. It has been found that such breaks are not recorded on seismographs, so that they cause no widespread vibration in the underlying rocks. The main claim for the superficial origin of a world-shaking shock, other than those due to volcanic explosions, is that by the late Prince Galitzin, who referred an earthquake, on Feb. 18 1911, to a landslip in the Pamir. A mass of earth weighing 7,500,000,000 tons fell into the valley, buried a village and all its inhabitants, and formed a bank over 3 m. long and 2 m. wide, and a lake 15 m. long and 900 ft. deep. Dr. Oldham in a rediscussion of the evidence (*Quar. Jour. Geol. Soc.*, 79, 1923, pp. 237–45) has shown that the landslip was a result of the earthquake and not its cause, for it was not above the centre of the disturbance, which he assigns to a depth of 30 miles.

Volcanic Action

Volcanic studies have been greatly advanced by work at the Observatory on Kilauea in the Hawaiian Islands under the direction of T. A. Jaggar. His weekly letter enables geologists in all parts of the world to follow the changes in that instructive volcano. Its cauldron was enlarged by huge subsidences in 1919, 1922 and 1924, the last being associated with powerful explosions.

The destructive eruption of Vesuvius of 1906 has been described by Perrett (*Publ. Carnegie Institute*, No. 339, 1924), who shows that the weight of the lava in the throat of the volcano broke through the wall, and the relief of pressure on the molten rock enabled its superheated water to explode; the explosion threw up a column of vapour 7 m. high and produced avalanches of hot volcanic sand like that from Mt. Pelée, which overwhelmed St. Pierre, the capital of Martinique, in 1902. The Pelean eruption has been further brought into line with ordinary volcanic phenomena by the eruption of Katmai, at the base of the Alaska Peninsula, in June 1912—the most notable volcanic event of recent years. Katmai is an old volcano of basic andesite resting upon Jurassic sandstones. The eruption was of the paroxysmal explosive type. It scattered 5 cu. m. of pumice and scoria over the district, depositing a layer a foot thick even 100 m. away. The eruption left a great hollow with numerous steam vents on its floor; the summit of the mountain was replaced by a pit 2½ m. wide, and from 2,000 to 3,700 ft. deep. This crater was at first attributed to the explosion, but C. Fenner (*J.G.*, 28, pp. 569–606, 1920) shows that it was due to subsidence, aided by the solution of the older andesites by the 1912 lava.

The eruption is explained as due to the intrusion of a sheet of rhyolite under the volcano. The intrusion shattered the overlying rocks and the rhyolite rose through the fractures. The Katmai obsidian, when heated, froths up to pumice, and when it reached the surface it was blown into fragments by its superheated steam. This eruption has explained two phenomena of the West Indian eruptions of 1902 that had appeared unique. Part of the Katmai area was covered with beds of sand, composed of pumice that had been pulverized by the explosive escape of the steam. This sand is of the same nature as the incandescent dust which fell in an avalanche upon St. Pierre. A new secondary peak named Nova Rupta was formed at Katmai by the forcing of a dome of rhyolite into the overlying rocks; it is similar to the lava spine which was pushed up through the vent of Mt. Pélée.

Volcanic Cauldrons.—The first report that the great cauldron at Katmai was due to an explosion, threw doubt on the origin of some volcanic basins that had been attributed to subsidence. J. S. Diller (*J. G.*, 31, pp. 226–7, 1923) has restated the evidence proving that "Crater Lake" in Oregon lies in a basin due to subsidence. It is therefore a cauldron. This origin has been attributed to some huge volcanic basins in East Africa, such as Menengai in Kenya Colony, and Ngorongoro which has been further described by Barns in his *Across the Great Crater Land* (1923). Mount Aso in Japan remains by a little the largest known cauldron, being 14 m. long by 10 m. wide (Anderson, *J. G.*, 16, p. 499, 1908). Still larger subsidences form sunklands in some of which, such as the Riessenkessel in southern Bavaria, the sunken rock, there a shattered granite, is surrounded by a ring of lava. The ring-shaped intrusion of syenite, 16 m. in diameter, at Pilansberg in the Transvaal, described by W. A. Humphrey (1914), represents the deeper part of such a formation. The importance of such ring-dikes in volcanoes has been shown in the island of Mull in western Scotland. Its central mountains are the deeply dissected foundation of a volcano of the first order; and the tendency of lavas to rise along circular fractures is there well displayed and has been described in *Geological Survey Memoir* (by E. B. Bailey and others), which confirms the view of Judd that the ancient volcanoes of the Western Isles were separate volcanic vents.

Plateau Eruptions.—That some of the Mull lavas were ejected by fissure eruptions is still advocated, but this origin is not shown for any lava left on the island.

Knowledge of the vast lava fields that have been attributed to fissure eruptions has been extended for those in South Africa and South America. Those in South Africa have been described by Du Toit, "Karroo Dolerites of South Africa" (*Trans. Geol. Soc. South Africa*, 22, pp. 1–42), who shows that the Stormberg lavas (of which the age is Rhaetic or Liassic) cover an area around Basutoland 350 m. long by 150 m. wide. A surrounding area of some 320,000 sq. m. is seamed by dolerite dikes, so that the volcanic area was doubtless more extensive than it is now. C. L. Baker, "The Lava Field of the Barana Basin, South America" (*J.G.*, 31, 1923 pp. 66–79), points out that the basalt flows there cover an area of 300,000 sq. m. with an average thickness of 1,000 ft.; and the surrounding country, to the extent of 75,000 sq. m., is penetrated by innumerable sills and dikes of dolerite. These South American eruptions are of the same or of approximately the same age as those of South Africa—namely, at the very beginning of the Jurassic.

Meteoritic Impact Crater.—The view that Coon Butte or Meteor Crater in Arizona was due to the impact of a great meteorite has failed of further support by the explorations of D. M. Barringer. It was suggested that the crater was made by the nucleus of a comet instead of by a single meteorite. Recognition that this body struck the earth obliquely led to a fresh search for the meteorite under the southern rim of the crater and not, where previous borings were made, under the centre. Recent boring found only country rock.

Isostasy

The most significant discussion of the period has been upon the extent of isostasy, *e.g.*, *Bull. Geol. Soc. Amer.*, 33, 1922, pp. 275–410 (*see* Isostasy). The evidence for the greater density of the rocks below the oceans has been strengthened by pendulum observations in a submarine. This high density, according to F. P. Shephard (*J. G.*, 31, 1923) may be due to compression. The view generally adopted is, however, that the rocks below the oceans consist of denser material—the sima. Since the ocean floor must consist in places of sunken continental rocks, the existence of sima so near the sea bed appears uncertain.

Isostasy explains how large areas of the earth's crust may be uniformly uplifted, though the possibility of such a movement was denied by Suess. Burrard (*Prof. Pap. Survey of India*, No. 12, 1912, p. 6) has, however, supplied an instance in which 5,000 sq. m. of country between Saharanpore and Mussurie in northern India were upraised 5 inches during an earthquake. This fact was proved by re-levelling a line that had been surveyed shortly before the earthquake.

Areas of Tension

Areas that are being slowly upraised are torn by tension clefts and broken by normal faults. Faults so weaken the rocks they traverse that the side left upstanding is usually reduced to a gentle slope; nevertheless some recent faults in areas of hard rock are marked by fault-scarps which bound sunklands and rift valleys. Of the latter the greatest extends from Palestine across East Africa, and as shown by Teale and Wilson (1915) south of the Zambezi. Its geology has been described by Gregory (*Geology and Rift Valleys of East Africa*, 1921) and Krenkel (*Bruchzonen Ost-Afrikas*, 1922). That this valley had a longer history than was originally recognised by Suess is now admitted. E. Lehmann (*Zeit. Vulkan.*, Erg. 4, 1924) has described the volcanic area in the Rift Valley north of lake Nyasa and shown that its rocks are alkalic in composition. The tectonic origin of the Gulf of Suez, a branch of the Great Rift Valley, has been proved by the Petroleum Bulletins of the Geological Survey of Egypt, and Prof. Brock has confirmed that view for the Dead Sea (*Quar. Jour. Geol. Soc.*, 75, 1919).

Abendanon, as a corollary to his view of the radial contraction of the earth, considers that some parts are forced upward by the subsidence of others, and that tension in the rising parts gives rise to rift valleys. W. H. Bucher, (*J. G.*, 32, 1924) has illustrated the importance of tensional structures by model shells in which the plan of the crumpled bands of the earth are produced by tension and not by compression.

The deformation of the earth leads to wide areas of subsidence and uplift. Thus the subsidence of an ocean floor, by forcing the material below it to flow outward, may uplift its borders. Where the uplifted area consists of hard rocks, the surface will be torn by a network of tension clefts forming fiords and fiord-valleys (J. W. Gregory, *The Origin and Nature of Fiords*, 1913). The upheaval of these areas accompanied great subsidences that followed the crumpling of the earth's surface during the mountain formation which culminated in the Miocene. Where the surface consists of soft rocks the rupture may control the topography, as in the rectangular valley system of north-eastern France, and S. W. Wooldridge (*Proc. Geol. Assoc.*, 34, 1923, pp. 175–92) suggests that many topographic features of the London Basin were determined by intersecting fractures in the underlying platform of old rocks. The tectonic origin of the Greenland fiords has been supported by L. Koch (*J. G.*, 31, 1923, pp. 42–65) who points out that some of the fiord valleys are pre-glacial, while others are of very late origin and have been but slightly influenced by denudation. These fiords he calls fracture-fiords, as they were formed by the cleavage of gneiss along planes of fracture.

Areas of Compression and Fold Mountain Chains

Alpine Structure.—Intense compression of the crust produces fold mountains, the study of which has been especially active in the Alps. It has long been known that some of the northern Alps consist of blocks of old rock resting on younger beds. These "Klippe," or "mountains without roots" have been pushed sideways on to their present foundations, a process demonstrated in the north-western Highlands of Scotland. There, in some cases, the rocks were broken into short slabs which were forced one over another, giving rise to the "imbricate" structure, such as would be produced if a row of slates on a roof were pressed into a shorter space. In Switzerland the process has taken place on a great scale, and successive slabs of rocks have been thrust one over another as *Decken* or overthrust-sheets.

In some parts of the Alps this structure is indisputable, but in others the evidence depends on an uncertain identification of the rocks. Thus Monte Rosa and the Matterhorn have been interpreted as pinnacles of old rock thrust northward over the Trias. The Triassic age of the underlying rocks is uncertain, and is a tradition dating from the time when many of the Alpine schists were regarded as Jurassic. Bonney's work in the Lepontine Alps showed that the so-called Jurassic schists, like the Carboniferous "fossiliferous gneiss," were beds composed of schist debris, and were infolded amongst the ancient rocks. The pre-Palaeozoic age of the crystalline schists of the Alps is now generally adopted, and the Triassic age of the base of Monte Rosa and the Matterhorn is uncertain. The supposed overthrust parts of those mountains have no similar rocks to the south, so that they must have been transported from afar; and some advocates of the extreme Decken theory regard parts of the overthrust sheets or "nappes" as African in origin. This view is dismissed as fantastic "Ultra-nappismus" by some Alpine geologists, and has led Heritsch to describe the Decken theory as a fantasy.

The distance to which sheets of rock can be thrust is limited by their crushing strength. According to A. C. Lawson the mechanical limit of overthrusting must be between 20 and 30 m., and Oldham has adopted a limit of about 5 miles. An overthrust of 150 m. has been claimed in Scandinavia but appears impossible and is unnecessary on a more probable correlation of the rocks. The Decken theory in its extreme form may prove untenable. Amongst the voluminous literature on the theory reference may be made to Albert Heim's work, *Geologie der Schweiz* (1918–22); to the case for it by R. Staub, *Der Bau der Alpen* (1924); for a critical view to F. Heritsch, *Die Grundlagen der alpinen Tektonik* (1923).

The investigation of Alpine movements has shown that they began earlier than was realised. The movements culminated in the Oligocene and Miocene; but the preliminary buckling began early in the Mesozoic. Increasing importance is attached to the younger granites of the Alps, to which fresh attention has been directed by Steinmann. Movements of the Decken type in the southern and eastern Highlands of Scotland have been advocated by E. B. Bailey (1910–25); but his interpretation has not been generally accepted.

The Decken theory of the Alps agrees in one respect with Suess's interpretation, by attributing the main folding to pressure from the south. That direction of movement has been rejected by L. Kober, *Bau und Entstehung der Alpen* (Berlin, 1923), who denies the asymmetry essential to Suess's view that the Alpine belt has been pushed northward and buckled against the resisting masses of Central France, the Black Forest, Bohemia and the Russian Platform. Kober regards the Alps as symmetrical; he explains Alpine mountains as due to a belt of the crust being crushed between the continental coigns, as they are forced together by the earth's contraction. He regards the Mediterranean basin as one mountain block or "orogen," which has been

crumpled between northern Europe and North Africa, the movements being outward from the compressed belt and therefore northward in the Alps and southward in the Atlas. In the Atlas the pre-Alpine folds are southward; but those of the Alpine period, according to Gentil, are northward. That direction is inconsistent with Kober's requirements. Longwall has pointed out that the structure of the Sierra Nevada of California is also inconsistent with Kober's explanation of the Rocky Mountains; and Hobbs has rejected the theory for the Asiatic Arcs, which he attributes to deep-seated pressure from the rear or concave side.

The Contraction of the Earth.—The view that mountain folding is due to the compression of a contracting earth has been further discussed; arguments against it have been stated by Sandberg (1924) and Keith (*Bull. Geol. Soc. Amer.*, 34, 1923); but it has been more widely adopted owing to the recognition of the fallacy of some objections. It was claimed that the utmost possible shrinkage of the earth was inadequate for the observed compression; that view was based on the limited age of the earth, but with the multiplication of its age 10 or 20 times that argument has become invalid. Jeffreys has pointed out that shrinkage by cooling would be sufficient, and there are other even more potent factors of contraction. T. C. Chamberlin has supported the shrinkage of the earth's crust from the greater density of the earth as compared with the moon. If both originally consisted of similar material, the higher specific gravity of the earth is due to condensation, and to the shrinkage of its circumference by 4,555 miles.

The number of mountain chains in which overthrusting is recognised has been increased, as by the work of Deprat in Tonkin and southwestern China (*Mem. Geol. Serv. Indo-China*); his conclusions in this respect have been confirmed by Jakob. Overthrusting has been recognised in the areas between Indo-China and the eastern end of the Himalayas in northwestern Yunnan (*Phil. Trans.*, vol. 213B, pp. 171–298, 1925). Other mountains, however, though folded, show but slight overthrusting. Thus the Andes, though gently folded in the Upper Cretaceous and Eocene, have subsequently undergone block faulting without thrust planes, as shown by Steinmann (*Geol. Rundsch.*, 1922) Bosworth (*Geol. North-West Peru*, 1922), Douglas (*Quar. Jour. Geol. Soc.*, 1914, 1920, 1921) and H. Backlund (1923). Different parts of one mountain system may have been affected by both types of movement; thus the northern Rocky Mountains are shown by Mansfield (1923) to have undergone intense lateral compression, while Lee (1923) and R. T. Chamberlin (1919) showed that the movements in the southern Rockies were vertical.

Narrow U-shaped Fold-lines.—Suess explained some important topographic features by the fold-lines having been diverted in a hairpin-bend, in Assam, the Caribbean Islands, the South Georgia arc in the South Atlantic, and the Moluccas to the west of New Guinea. This view has been adopted by Hobbs (1925) and extended for the Moluccan Arcuate fold by G. A. F. Molengraaff and H. A. Brouwer (1921); but the evidence for these narrow U-shaped bends is inadequate, as the main Himalayan line of Assam continues eastward into South China; the rocks of South Georgia are fundamentally different from those of the Andes; in the West Indies the contorted foundation of Barbados strikes west to east almost at right angles to the supposed arcuate fold; and in the Moluccan islands the essential strike is across the direction of the chain, and the depression to the west may be due to a foundered block.

Igneous Rocks and Earth Movements.—That distinctive series of igneous rocks are associated with different types of earth movement has been reaffirmed by Harker (*Address, Geol. Soc.*, 1917), but has not been generally confirmed (see for example Loewinsson-Lessing, *Bull. Geol. Soc. France* (4), 23) from the Russian evidence, and for the Australasian area (*cf.*, *Scientia*, 11, 1912, pp. 56–63).

The nature of the intrusions of the great plutonic masses has been discussed by Daly in his *Igneous Rocks and their Origin* (1914), with many luminous suggestions. Hans Cloos of Breslau, from work in southwest Africa and Silesia (*Der Mechanismus tiefvulkanischer Vorgänge*, 1–21, and *Abh. Preuss. Geol. Landesanstalt*, n.f. 89, 1923), rejects Daly's theory that the granite masses eat their way into the crust by assimilating the material they replace. Cloos, agreeing thereby with Suess, concludes that intrusive granite either forces the rocks apart or occupies spaces made during the subsidence of blocks of the crust. Some assimilation naturally occurs on the margin, but Cloos regards it as only a minor incident. According to him the direction of pressure during the intrusion and consolidation of the granite may be inferred from the rifts, joints and dikes in the granite, which are parallel to the general grain of the country. The foliation in the granite he regards as less important, as it expresses only the local pressure.

Stratigraphical Geology

In stratigraphical geology the national Geological Surveys and private workers in all countries have been collecting an immense accumulation of new data. The most notable addition to the Geological Surveys is that of China, which, with the new Geological Society of China, have together made a great contribution to knowledge of that country. Among the principles of stratigraphy the problem whether geological evolution has been even and continuous, or periodic by alternate rapid developments and long intervals of repose, has been further discussed. Shepard (1923) insists that the rate of progress has been on the whole regular; but advance by periodic spurts has received wide support, as from T. C. Chamberlin (1921, etc.), R. T. Chamberlin (1914, 1921), G. Stille, *Die Schrumpfung der Erde* (1923) and Prof. J. Joly (*Phil. Mag.*, 1923, pp. 1167–88) and *Surface History of the Earth* (1925) from his theory of the periodic re-melting of the foundations of the crust by radioactive heat; and also from the distribution of land and water by tetrahedral deformation of the crust and its spheroidal recovery.

The classification of the pre-Cambrian rocks has made much progress, especially in Canada, though there is no general agreement in the nomenclature. The tendency is to subdivide the pre-Palaeozoic rocks into a lower division of gneisses and coarse schists, an intermediate division of strongly metamorphosed sediments, and an upper division of sandstones, which are but little altered and may contain traces of organic remains. Some of the pre-Cambrian limestones, which are especially abundant in the middle division, are often attributed to an organic origin; but the extensive chemical precipitation of carbonate of lime has become more apparent, and some oölitic structure is inorganic as shown by its artificial formation (*e.g.*, Johnston and Williamson, *J. G.*, 24, 1916) and the crystalline structure of some recently formed oölite; Van Tuyl (*ibid.*, pp. 792–7) on the other hand shows how oölites with an organic structure may lose all traces of it.

In stratigraphical geology the process has been especially important in regard to the pre-Palaeozoic and the Palaeozoic. Much work has been done by many British geologists on the Lower Palaeozoic rocks of Wales and the Welsh border country, and on the zonal study of the Carboniferous Limestone, in papers published mainly by the Geological Society of London.

Important proposals for the reclassification of the Lower Palaeozoic have been made by E. O. Ulrich of the U. S. Geological Survey, in a paper which, owing to the extreme changes proposed, has been issued in the Bulletin of the Geological Society of America (23, 1912, pp. 261–680) with a note by the Director of the Survey disclaiming responsibility for its views. Ulrich classifies the Lower Palaeozoic into five systems instead of three, adding the Ozarkian and the Canadian systems between the Cambrian and Ordovician. Neither system is likely to be welcomed by British geologists, for there is little evidence for them in the British Isles. The Ozarkian system is either absent or is represented only by the Upper Lingula Flags; the Canadian system includes the British Tremadoc and Arenig Series. The proposed systems have not been widely accepted in America. The better American representation of this part of the geological record has enabled Dr. Grabau to settle an old problem in the northwest of Scotland; he confirms Salter's view that the Durness Limestone is Ordovician, and not Lower Cambrian, to which it was transferred

from its superposition on the Lower Cambrian quartzites with *Olenellus*.

Much light has been thrown on some stratigraphical problems by the separation and identification of the heavy constituents of rocks—a method especially advanced by the work of Boswell. The Kainozoic classification of many areas has been put on a firmer basis by detailed palaeontological work, which has permitted the correlation of different sequences of beds in independent basins, as in California (for example, by B. L. Clark, 1921), and in Australia and New Zealand, largely by F. C. Chapman. Man has been traced back into the Pliocene by the rostrocarinate implements found in the Red Crag by Moir (*see* ARCHAEOLOGY), which, however, like the early Palaeolithic implements from the Forest Bed of Cromer, are not universally accepted. A great stimulus to the study of the geological history of man followed the description of the Piltdown skull (Eoanthropus) by Sir A. S. Woodward (*Quar. Jour. Geol. Soc.*, 69, 1913), and important skulls have been found in Queensland, South Africa and Palestine (*see* MAN, EVOLUTION OF). Claims have again been made for the occurrence of early man in America, but without carrying conviction. The reports published by various Antarctic expeditions have thrown much light on glacial processes, strengthening doubt as to the extent to which ice erodes hard rocks, attaching increased importance to the shattering action of frost, and supporting the subaqueous origin of boulder clay from its absence on the Antarctic lands and its formation on the floor of the Ross Sea. (*See* PALAEONTOLOGY.)

PALAEOGEOGRAPHY

The steady advance of stratigraphical geology enables palaeogeography to be placed on a firmer footing and its data have been summarised in a series of works by Theodor Arldt, *Handbuch der Palaeogeographie* (1919). Eduard Suess's great work, *Das Antlitz der Erde* was completed in 1909, but the comprehension of his views has been much aided by the French translation edited by Prof. E. de Margerie (completed 1918), with its invaluable collection of maps and supplementary material. Suess's teaching has led to increased recognition of the fundamentally different arrangement of ocean and continent in former times, combined with the stability of some areas and the weakness of others. E. Haug in his *Traité* (completed 1911) has laid stress on the importance of the geosynclinals as mobile bands. C. Schuchert (1923) in several luminous contributions to the palaeogeography of North America has also shown the continuous influence of the geosynclinals and has organised symposia which have collected on various problems expert opinion which might otherwise not have been expressed.

Ruedemann (1923) believes that in spite of the many changes in the earth's geography three archi-continents have persisted throughout geological time. This view has, however, been criticised by W. J. Miller, who considers that it is impossible to distinguish between the pre- and post-Cambrian folding.

L. Kober has extended his theory of the Alpine structure to the world in general; he explains the distribution of land and water as due to the massive resistant coigns having been surrounded by weak belts, which sink in geosynclinals, are then crumpled into fold mountains, and on refoundering may carry down with them adjacent parts of the continental blocks.

Climatic Changes.—In connection with stratigraphy a good deal of attention has been devoted to former variations in climate (*see* CLIMATE), which many authorities refer to changes in the heat emitted from the sun, leading at times to universal refrigeration. This view has been strongly advocated by Huntington and Visher (*Climatic Changes*, 1922) and some change of this nature is regarded as probable by Jeffreys. Prof. Coleman (*Amer. Jour. Sci.*, 1924, pp. 298–404) has called attention to the world-wide nature of the refrigeration during the Pleistocene glaciation. The leading alternative explanation rests on geographical changes in the arrangement of ocean and continent or in the relief of the land. Prof. William Ramsay of Helsingfors (*Geol. Mag.*, 1924) points out that a period of high relief produces a cold climate and that the wearing down of the land into extensive peneplains produces a milder climate. C. E. P. Brooks, *Evolution of Climate* (1922), gives important help to this line of explanation by calculating the quantitative effects of changes in the position of land and water. Of the former glacial periods, the known range of that in the Upper Carboniferous and Permian has been greatly extended, especially in America, in Brazil, Paraguay and the Argentine, and in the eastern United States, where Quayle has shown that the till at Squantum near Boston is a boulder clay of this period. There has been a tendency to attribute all coarse boulder beds to glacial action, though some have now received other explanations. The glaciation in South Australia and Central China is generally regarded as belonging to the upper part of the pre-Palaeozoic instead of Cambrian.

Darwin's theory of coral reefs has gained general acceptance, and the main interest in connection with them has been from Daly's view that their up-growth was due to the rise of sea-level owing to the release of water by the melting of the glacial ice sheets. This argument is largely based on many of the coral reefs rising from banks at the depth of 100 fathoms; but those banks and platforms are probably cut down to that level, as it is the lower limit of wave action. The numerous variations in level of raised coral reefs and beaches do not support a uniform world-wide rise of the oceans. The irregularity in the rise and fall of coral reefs has been explained by Molengraaff as due to the isostatic subsidence of volcanic areas by the weight of the volcanic materials being favourable to the growth of coral reefs.

ECONOMIC GEOLOGY

Perhaps the most marked change since 1910 has been the improved status of economic geology, due to recognition of its increasing practical service, and to the value of its contributions to academic science. The further study of coals has strengthened the view that anthracite is formed from the same vegetation as bituminous coal, the difference being due to subsequent changes. The enormous increase of output of oil, which has been magnified more than threefold in the past 14 years, has roused anxiety as to the duration of the supplies. Oil geology attaches less value than formerly to anticlinal structure as indispensable to a profitable oil field. Oil prospecting has revealed the form and structure of the salt domes, and the oil fields in Persia have become the most important under British control.

The extensive boring stimulated by the high prices of 1916–9 led to energetic well drilling from 1917–22, and to a sensational increase in oil production in California. It is doubtful whether the oil output can be extended to meet the growing demands or even be maintained, although improved methods of extraction of oil from beds will lengthen the life of many fields. The indications of a decline in some of the leading sources of supply have led to increased attention being paid to oil shale, in the expectation that before the end of the century it will be the main source of mineral oil. Discussion on ores of magmatic origin indicates that they are relatively unimportant, unless the term be so defined that practically all primary ore deposits are regarded as magmatic. There has also been increasing recognition of the importance of magmatic water—as in the series of papers by 13 American authors (*J. G.*, 32, 1921, pp. 177–225, 292–310, 373–99, 449–71), who agree that part of the water from the hot springs of the United States is of deep-seated origin.

The deep flowing wells of east-central Australia have continued to decrease in volume, supporting the view that their flow is due partly to the plutonic water which rises from below and mixes with the water stored in the stratified beds. No single chemical distinction has been found by which the proportion of the plutonic to the meteoric waters in a deep-seated supply can be determined; but, with the prolonged age now accepted for the world, a small annual supply of plutonic water would, in the course of geological time, make an important addition to the volume of the oceans.

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(J. W. G.)

GEOLOGY: NEW THEORIES (*see* 11.638).—In considering the origin of continents and oceans it is important to have a clear idea of the magnitudes concerned. If we imagine a globe a foot in diameter to represent the earth, with all its features in their true proportions, by far the greater part of the ocean will be less than $\frac{1}{200}$ in. deep and only its extreme depths will reach $\frac{1}{100}$ inch. Almost the whole of the land will rise less than $\frac{1}{1000}$ in. above the sea and even Mt. Everest will have an altitude of less than $\frac{1}{100}$ inch.

Leaving out of consideration exceptional heights and depths the difference in level between the surface of the land and the floor of the deep oceans will be less than $\frac{1}{200}$ inch. These are the features for which we are trying to account. Of the 12-in. globe all that lies more than an inch beneath the surface is under conditions of temperature and pressure which cannot be approached in our laboratories, and we have no experimental knowledge of the behaviour of materials under such conditions. Moreover, time is an important factor, and our experiments give but little indication of what may happen under stresses acting for thousands or millions of years. It is not surprising that there is no general agreement as to the causes that have produced the present distribution of land and sea.

Earlier Ideas.—Throughout the greater part of the last century geologists in general believed that our present continents and oceans were only temporary features of the globe. It was easy to prove that much of the land had once been beneath the sea, it was not possible to show that any part had always been land. It was reasonable to suppose that much of the ocean had once been land, it was not unreasonable to imagine that no part had always been sea. In the last quarter of the 19th century, however, the idea of the permanence of the ocean basins began to gain ground. It cannot be said that there is any universal agreement upon the question even yet. Many geologists are now inclined to ascribe a high antiquity to the Pacific Ocean but to look upon the Atlantic and Indian oceans as comparatively modern. Haug and others still suspect the former existence of a Pacific continent.

If continents and oceans are not permanent the present distribution of land and sea is only an episode in the history of the globe and has no more significance than the distributions in the past. It was not geologists therefore who first endeavoured to formulate general theories to account for the present shapes of continents and oceans. Those who made such attempts ignored the changes in the past and their speculations were received with little favour by geologists.

The Tetrahedral Theory.—By far the most suggestive of these speculations was the tetrahedral theory of Lowthian Green. It was to some extent foreshadowed by him in *The Edinburgh New Philosophical Journal* in 1857 and was fully elaborated in his *Vestiges of the Molten Globe* in 1875. Following the widely accepted notions of the time, he assumed that the earth is cooling, the interior contracting more rapidly than the exterior, and under the force of gravity the outer crust collapses. Fairbairn's experiments on the crushing of wrought-iron tubes led him to believe that the collapsing sphere will tend to approach a tetrahedral form. The corners of the tetrahedron will rise above the water, forming triangular masses of land; the faces of the tetrahedron will remain covered and will form the oceans. He places one of the corners at the South Pole and the other three in the Northern Hemisphere. The corner at the South Pole is the Antarctic Continent and the opposite face of the tetrahedron is covered by the Arctic Ocean. The triangular masses of land formed by the other three corners are represented respectively by North and South America, Europe and Africa, Asia and Australia, all of them wide toward the north and tapering toward the south. The two last are united in the north, but the Caspian depression is below sea-level and the plain of the Obi but little above it. Between these three land-masses lie the Atlantic, Indian and Pacific oceans, all narrowing toward the north and, in the south, where the tetrahedral edges are lowest, uniting into a continuous belt around the globe.

The actual form which Lowthian Green believes the earth to have reached is the hexakis-tetrahedron (*see* 7.575, fig. 29), and he supposes that all the faces are much rounded so that the departure from the spheroidal form is only slight. Lowthian Green's theory was entirely neglected in England for many years, but was more favourably received in France. De Lapparent seems to have been the first to recognise it as a probable hypothesis and at a later date both Michel Lévy and Marcel Bertrand adopted it in a modified form. Since the closing years of the last century a tetrahedral theory in some shape or other has been accepted by many writers in England, Germany and America.

Modifications of the Tetrahedral Theory.—That the lithosphere shows some approximation to the tetrahedral form is matter of observation and not of theory. But that the approximation is only rough is indicated by the fact that the writers who support the theory do not all place the tetrahedron in the same position. Michel Lévy's tetrahedron, for example, is not the same as Lowthian Green's. The question naturally arises whether so ill-defined an approach to the form is due to some general cause such as Lowthian Green imagined, or to the accidental concourse of a number of minor causes. If the form is due to a general cause, then, since three of the corners of the tetrahedron are placed symmetrically with respect to the axis of the earth, the three land-masses which represent them should have a similar geological history. In particular it might be expected that their coasts should show some uniformity of type. But, as has been pointed out by Suess, the Pacific and Atlantic coasts differ fundamentally in character. The former runs parallel to the folds that have affected the surrounding land, and it is clear that the cause that produced the folds also determined the coast. The Atlantic coast, on the other hand, in general cuts right across the folds that have affected the neighbouring land and must owe its origin to another cause. The difference is too great to be accounted for by later modifications of coasts which were originally of similar origin. Further, if the differences are due to later modifications, the approximation to the tetrahedron should have been closer in the past than it is now. All the available evidence goes to show that the tetrahedron which fits best to the present distribution of land and sea will not fit at all to the distributions in past times.

On physical grounds objection has been raised that the tetrahedron is not a figure of equilibrium for a rotating earth, and even a slight approximation to it cannot be retained. Gregory has suggested that there may have been periods of collapse with an approach to the tetrahedral form, and in the intervening periods the spheroidal form was resumed. Moreover, in these periods of collapse the tetrahedron may not always have been in the same position, and thus we get the different distributions of land and sea in the past. Other writers also place the tetrahedron differently for different periods, but the geological evidence in favour of these views is not convincing.

Suess's Theories.—A great advance in our knowledge of the history of the globe was made by Suess in his *Das Antlitz der Erde*. He showed that there are large areas where even the oldest fossiliferous beds still lie horizontal. Here the crust of the earth has been rigid, in the ordinary sense of the term, since Cambrian times. It has broken, but it has never crumpled. Between these areas lie broad belts in which the strata are often folded. Here the crust has been weaker and has yielded to tangential pressures by crumpling and overthrusting. The crumpling was not a continuous process. There were well-defined periods of folding separated by intervals during which the whole earth was free, or almost free, from such disturbances. During these intervals, however, fracturing of the resistant areas took place and large blocks sank; and there were also wide extensions or "transgressions" of the sea over the land. Some of these transgressions seem to have been nearly simultaneous throughout the world and the whole land-surface must have been greatly reduced. The most extensive of them, so far as positive evidence can be adduced, occurred in the middle and later parts of the Cretaceous period.

In the Northern Hemisphere there are three areas in which the Cambrian beds remain unfolded. These are: (1) "Laurentia,"

which includes most of Canada east of the Rockies and probably stretched to the Western Is. of Scotland, (2) the " Baltic Shield " and " Russian Platform," (3) " Angaraland," which includes a great part, but not the whole, of Eastern Siberia. In all these areas, except upon the Russian Platform, no marine beds of Mesozoic age have been found, and during the Mesozoic era they were land. Probably by that time Laurentia and the Baltic Shield had been united by the folding of the intervening belt that took place at an earlier date.

In the Southern Hemisphere Cambrian fossils have only been found at one or two localities, but there are areas in which the oldest fossiliferous beds known show no folding. The most extensive of these is " Gondwana-land," which includes the greater part of South America east of the Andes, most of Africa between the Atlas and the mountains of the Cape, Arabia, Syria and the Peninsula of India. Strictly speaking, perhaps, the whole of this region should not be called Gondwana-land, for the Cretaceous sea extended far over it and even marine Jurassic beds are found in places. But much the larger part was land throughout the Mesozoic era. A similar remark applies to a great part of Australia. Between the Mesozoic land-areas of the north and those of the south lies a belt in which the Mesozoic beds are for the most part marine. This is the " Tethys " of Suess.

Between the rigid masses of the north and those of the south the more yielding crust beneath the sea of Tethys was crushed, and the great series of mountain ranges which run from west to east across the Old World was elevated. Tethys was much reduced in size and is now represented chiefly by the Mediterranean Sea. About the same time Laurentia and Gondwana-land broke up, large portions sinking beneath the sea, and thus the present Atlantic came into existence.

Such are some of the more important events in the history of the globe according to the researches of Suess, and it is impossible here to enter into further detail or examine the evidence more closely. The Pacific appears to have been sea throughout the Mesozoic era at least, but nevertheless it has functioned as a rigid area.

Suess imagines that the interior of the earth is contracting and the crust settling down upon it. The settling is accomplished partly by the fracturing of the more rigid portions, partly by the crumpling of the more yielding parts between them. Sometimes one portion of the crust is pushed over another and thus there must have been changes in the relative positions of different points upon the surface, but in comparison with the size of the globe these changes are small.

The Wegener Hypothesis.—Wegener introduces an entirely different conception, according to which the relative positions even of whole continents have altered greatly in quite recent times. The idea is not altogether new, for Schwarz had already suggested that Africa and South America were once nearer to each other; and other writers, on less solid ground, have made somewhat similar suggestions. But Wegener goes further than his predecessors and brings forward a much greater body of evidence.

Sial, Sima and Nife.—It has long been known to geologists that the visible part of the earth's crust consists chiefly of the lighter and more acid rocks, and beneath this it has been commonly supposed that there lies a layer of the denser and more basic rocks. The interior core must be denser still. In formulating these ideas Suess proposed the names Sal, Sima and Nife for the three concentric regions respectively. The term Sal is now usually replaced by Sial, and with this modification Suess's nomenclature is widely adopted. It has generally been supposed that the sial covers the whole globe. It may be thinner under the oceans and thicker on the continents, but it is present everywhere. Wegener believes that the sial is discontinuous. The floor of the ocean is formed of sima and the continents are sheets of sial floating in the sima. Because the sial is of smaller density its surface rises above the surface of the sima. The sima is not liquid in the ordinary sense of the word; but there is no perfect solid, and the sheets of sial, supposed to be about 100 km. thick, could not lie upon the sima without the force of gravity pressing them in until they floated like a cork in water. This is quite in accordance with the observations of geodesists, which indicate that the earth is very nearly in a state of isostatic equilibrium.

It was long ago shown by Pratt that there must be an excess of density beneath the oceans and a deficiency beneath the elevated regions; and Airy suggested that all elevated masses must be supported by a downward protuberance of the lighter rock of which they are formed, into a denser layer below—in fact by flotation. It should be noted, however, that all the observations are equally consistent with the notion of a continuous sial thinner in oceanic areas and thicker in elevated regions, the downward extension into the sima bearing such a relation to the protruding portion that the whole is in hydrostatic equilibrium.

Wegener's view is that the sheets of sial are not only separate and floating in the sima but also moving laterally, and that their positions relatively to one another have altered in the past and are altering still. There are certain forces arising from the rotation of the earth and the attraction of the moon which would *tend* to cause lateral movements. Whether they are sufficient to produce such movement through so resistant a medium as the sima is open to question; but it is conceivable that they may be.

Wegener says that if we take the edge of the continental shelf as the edge of the sial sheets and allow for the effects of Tertiary folding, the pieces of sial can be fitted together into one continuous sheet covering about a third of the globe. This, he thinks, was the condition at the close of the Palaeozoic era. He brings Africa and South America together and both into contact with the Antarctic continent. Australia also is placed against Antarctica, and Madagascar and the end of an elongated India are wedged between Africa and Australia. In the north, Greenland, Canada and north-western Europe come together but a wide gap is left between the rest of North America and the continents of Europe and Africa.

Criticisms of the Theory.—There is far too much scope for the imagination in this process. Wegener does not follow the edge of the continental shelf with any precision, and the allowance that he makes for the Tertiary folding is purely fanciful. Moreover, in his fitting he has introduced great distortion. If we keep the masses rigid and fit South America into the Gulf of Guinea, Canada will not come within 1,000 m. of the position it occupies in his scheme. Indeed, if his theory rested solely on the evidence of fitting, it might be dismissed at once. But there is much stronger evidence than this. He says that with his fitting the geological structures on the eastern side of the Atlantic become the direct continuation of the structures on the western side. The argument is weakened by the great amount of distortion that he has introduced to make them fit, it is almost entirely destroyed by the real facts. Several of his statements are quite at variance with those of the actual observers, and others rest on a very imperfect basis.

It is in the Southern Hemisphere that the geological evidence for a former union of the continental masses is strongest, and it is perhaps significant that the nearest approach to a fit is that between Africa and South America. The close similarity between the rocks and fossils of these two areas has led most geologists to assume a former land connection. Both regions are characterised by the occurrence of the fossil *Glossopteris* flora, which differs considerably from the contemporaneous flora of Europe. The same flora has also been found in India and Australia. All these are brought together in Wegener's scheme and the similarity in rocks and fossils is at once explained. But the argument is considerably weakened by the fact that the *Glossopteris* flora is also found in Siberia and northern Russia, which in his reconstruction become farther away from the presumed home of *Glossopteris* than they are at present. In view of our very imperfect knowledge of the geology of Asia, and the discovery of the *Glossopteris* flora in a few other Asiatic localities, it seems probable that it had a wide distribution and was far from confined to the regions that Wegener brings together.

Associated with the *Glossopteris* beds in South America, Africa,

India and Australia there is a boulder bed containing glaciated boulders, which has long been a puzzle to geologists. On the most favourable supposition with regard to the position of the South Pole the ice that carried the boulders must have extended nearly to the tropics, and it seems improbable that any glacial period could have reached the required intensity. In Wegener's reconstruction of the period all these areas come together and would lie within a reasonable distance of a suitably placed pole. But here again there are difficulties. A similar boulder bed, also associated with beds containing a *Glossopteris* flora, has been found in Afghanistan, which, with Wegener's fitting, must have been within thirty degrees of the equator when the other areas were centred about the pole. The Afghanistan boulder bed was laid down near sea-level, for it is associated with an alternation of marine and terrestrial deposits.

In general it may be said that Wegener's theory removes certain difficulties, but in removing them it introduces others of equal magnitude. By far the most suggestive point in his favour is the resemblance between the African and South American rocks and fossils. Even here Coleman, who has examined the South American boulder bed, states that the ice which deposited it reached the sea on the eastern side of South America.

Joly and Radio-activity.—Joly's theory is based on the effects of radio-activity. Like Wegener he thinks that the continents are sheets of sial floating in the sima, which forms the floor of the ocean. Relative displacements of the continents may have taken place, but only at certain periods.

The sial and the sima are both radio-active and the radio-active elements in them are continually generating heat. Unless this heat can escape the temperature must rise. The melting point of the sial rocks is known to be much higher than that of the sima, which is basaltic in composition.

Suppose that at a certain period the whole of the sial is solid and the sima also is solid down to a considerable depth. Heat can only escape by the slow process of conduction. Beneath the sial there will be no escape from the sima, because the base of the sial itself, owing to its own radio-activity, must be nearly at the melting point of sima.

Since the escape of heat is so slow the temperature rises and the sima melts to within some 20 m. of the surface. Tidal movements in the molten sima acting upon the downward projections of the sial move the whole crust so that the local accumulations of heat originally formed beneath the sial come to lie under the thin layer of solid sima beneath the ocean. This is quickly thinned still further, and molten sima escapes through fractures. The loss of heat now becomes more rapid and an era of cooling and consolidation begins.

We must suppose, then, that there are periods during which the sima layer melts more or less completely and periods during which it solidifies down to a considerable depth. It has been shown experimentally that basalt, and most other rocks that have been tried, expand on melting and decrease in density. As the sima melts it expands, and therefore the general level of the earth's surface is raised. But because the density of the sima is decreased the masses of sial which are floating in it sink more deeply into the layer. Their surfaces, owing to the general rise, become farther from the earth's centre, but, relatively to the surface of the sima they are depressed. In this way the widespread transgressions characteristic of certain geological periods are explained. As the sima cools again and becomes denser the surface falls, but the sial masses rise relatively to the sima.

When the sima begins to cool, the crust upon it, if not already complete, is soon completed by the consolidation of molten material in its fissures. Together with the sial masses it now covers the whole globe. But the sima continues to contract further, and the covering becomes too large. And now begins a period of folding and other earth movements to enable the crust to descend with the sima.

It is not possible here to enter further into the consequences of the theory. Its great merit, from the geological point of view is that it seems to offer a clear explanation of the most remarkable features in the history of the globe, the periodicity of earth-folding and sea-transgressions and their widespread character.

Conclusion.—In view of our ignorance of what goes on in by far the greater part of the interior of the globe it remains improbable that any theory founded on examination of a thin external skin can be wholly true. The old hypothesis of a contracting core fits the observed facts of geology as well as any other. It has been urged that the possible amount of contraction is insufficient, but on this point it is unsafe to dogmatise. Recent astronomical observations show that the companion star of Sirius consists of gas and yet is denser than any material upon the earth's surface. A discovery so unexpected leads us to revise our ideas and, though the conditions are very different, renews interest in the suggestion of Arrhenius that the interior of the earth is gaseous.

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(P. LA.)

GEOMETRY (*see* 11.675).—The usual history of the development of the ideas of a student of geometry in England to-day is somewhat as follows: After a more or less prolonged (and highly desirable) course of experimental geometry, very largely (and undesirably) limited to a plane, in which a line is a mark made on paper, and a straight line is a mark which agrees with a physical object (a ruler), the student passes through a course in which he is shown that there is a logical connection between the geometrical conceptions his experience may have led him to form.

I. FOUNDATIONS

At first, and for a long time, often permanently, lines and circles are regarded as objects of perception and, for instance, there is no hesitation in accepting the idea of two lines being in the same direction, and it appears intuitive that two points must have a certain distance, a result of familiarity with the rigid bodies which the student has had put before him. This teaching, after a certain knowledge has been obtained of the detailed relations of circles and lines, often painfully acquired and difficult to remember, is continued on the same plan, for the so-called geometrical properties of conic sections, though these are apt to appear at first as much less concrete than circles.

After this, as soon as some facility with algebraical computation is acquired, the student learns that a straight line has an *equation*, and that, *e.g.*, the common points of two circles depend on the solution of a quadratic equation, while the common points of two conics depend on a quartic equation. If his instruction is pursued far enough, he learns, with the expenditure of much time and energy, a vast number of algebraical devices, and is now, if apt in using them, capable of proving algebraically almost any question that his usual examinations are likely to require of him.

For his further efficiency to this end he is probably taught towards the close of his career something about harmonic relations, about homography, and about projections. In particular, for example, he may be taught that the equations which give the foci of a conic are obtainable by applying the analytical conditions for a circle to the equation of the pair of tangents to the conic from any point. If he is fortunate it may be pointed out to him, near the end of his laborious drilling in detail, that a circle behaves as if it were a conic with two definite (albeit imaginary) points; and if he must in any case know the properties of conics he may, for economy of memory, seize hold of this remark, and come also to a geometrical description of the property of foci just referred to—and pursuing this course, if circumstances allow, he may finally reach a framework of hypothetical constructions including the so-called circular points and the circle at

infinity, from which, looking back, as from a hill-top, he sees the whole country of geometrical fact, with which he has so laboriously become acquainted, shrink into a landscape dominated by very few main routes.

He may now be at the stage of the third year university student. With continued consideration he may be led finally, even if only with the purpose of summarising his geometrical outlook in the fewest possible ideas, to regard as working hypotheses such as the following: (*a*) there is no fundamental difference between points at infinity and those not at infinity; (*b*) there is no difference in reality between real and imaginary points; (*c*) there is no gain but great loss in refusing to consider space of more than three dimensions; (*d*) distance, as a fundamental conception is unnecessary. And with these will come a recognition that the so-called non-Euclidean geometries are logically prior to the Euclidean geometry.

Leaving aside now the tempting pedagogic question of whether he has been justly treated in being so long denied the synthesis which, if he could have appreciated it, would so much have lightened his task of becoming familiar with the details, we remark that he finally works with a conceptual scheme which includes the perceptual experiences by which it has been suggested —but discards many ideas which at earlier stages his perceptions seemed to suggest as necessary. For instance, the points of a line are not now in (linear) order, and lines have lost their straightness, the lines of threefold space being for many purposes better regarded as points of a quadric in five dimensions.

Questions then arise such as: is geometry unique in thus replacing the first crude ideas of physical experience by a conceptual scheme of entities, whose properties are determined logically, not from a set of *definitions* which tell us what these entities are, but from a set of fundamental propositions or statements of relations between them? And connected therewith: are the ideal entities of such a conceptual scheme less *real* than those, for example, which the physicist employs, say the aether or electrons, to explain his conceptions? May the statement that distance is not necessary as a fundamental conception be fairly replaced by the statement that distance in the abstract is an illusion? It would seem that the difference is one only of the degree of abstractness of the conceptual scheme employed. We may in geometry itself have different levels of abstractness; for example, we may in the first instance regard the points of a line as conforming to our idea of an abstract order of such a kind that the so-called Dedekind's axiom is applicable, although finally when we allow the so-called imaginary points we discard this notion of order and use the word line in a still more abstract sense. It would seem that every science as it advances in comprehensiveness must similarly evolve for itself a conceptual scheme of ideal entities; and that in strict logic, no proposition can be asserted to be true or false except in reference to entities whose fundamental relations have been made explicit.

Such questions as these arise when it is assumed that it ought to be possible to ascertain by observation whether the world is finite, or still more whether space (in the abstract) is Euclidean or non-Euclidean. If the attitude which has been suggested is sound, the most that can be done is to inquire what would be the modifications in our statements of perceptual regularity which would follow if we adopted a particular scheme of conceptions in regard to the extent of the world, or the character of space.

Of such conceptions, those which have reference to a method of measurement are of fundamental importance. And if measurement is possible at all, it must presumably be based upon a scheme for assigning identification numbers to the points of bodies which are to be measured. This is not the same as assigning numbers to points of space, nor, even if this could be done, would the method of measurement be determined uniquely thereby. A way of assigning identification numbers to the points of a figure must be conditioned (*a*) by the fundamental theorems of incidence of the elements of the figure (as that a line is determined by two points, or that two planes meet in a line); (*b*) by the nature of the numbers to be used (whether they allow commutative multiplication, for example); (*c*) by the freedom of the assignment, that is the number of points of the figure for which the corresponding numbers may be assigned arbitrarily, the numbers belonging to any other point being then determinate; (*d*) which is in fact included under (*a*), by the character of the " infinity " of the figure (as whether the space of the figure is open or closed); and even then (*e*) it appears to be necessary to assume one or more definite limiting theorems of incidence.

In the way which has been studied most in detail, as being that which is most naturally suggested by the Euclidean scheme in which geometrical thought has developed, the numbers being taken to be those of ordinary arithmetic, it is possible to assume arbitrarily the numbers for three points of a line, so long as this is considered by itself, the numbers of four points of a plane regarded as isolated, and the numbers of five points of a three-dimensional space; this space is regarded as closed, the numbers belonging to a point are regarded as ratios of numbers, and infinite values of numbers are thereby excluded from consideration—and the assumption is made that four lines of which no two intersect have two common transversals. It is shown that the introduction of this assumption is equivalent (other things being equal) to assuming that the numbers used are commutative in multiplication. The number space of Descartes, in which each point is represented by three ordinary numbers, one or more of which may be infinite, may be regarded as a particular case of the so-called projective space thus described.

In his famous *Habilitationsschrift* (1854), when 28 years old, B. Riemann considered a Cartesian space in which each point is specified not by three but by n numbers or co-ordinates, and proposed to measure the distance between two neighbouring points by means of a quadratic function of the small differences of their corresponding co-ordinates. He remarked then that such a space has not necessarily any rigid bodies capable of movement without change of linear dimensions. For this to be possible it is necessary and sufficient that certain functions of the co-efficients in the quadratic form and their differential coefficients should be constant. The number of these functions is $n^2(n^2-1)/12$; for instance, for $n=2$, this number is 1, and for $n=3$, it is 6. When these conditions are satisfied the space is said to be of constant curvature. But it is to be remarked that a Cartesian space of n dimensions, such as that considered by Riemann, is in reversible, point-to-point correspondence with a quadratic manifold (also of n dimensions), in a projective space of $n+1$ dimensions. In such a space of $n+1$ dimensions, as was first remarked by Cayley, we can set up a measurement of distance between any two points by taking, quite arbitrarily, a quadric manifold of reference. It is then the case that Riemann's definition of distance, when his space is of constant curvature and allows rigid bodies capable of movement, is so obtainable after Cayley's manner.

These details appear to bring out very clearly that even when the difficult step has been made of passing from the descriptive properties of a geometrical figure to the assignment of co-ordinates, it is a further step of much artificiality to introduce a measure of the distance between any two points.

In recent years, under the stimulus of A. Einstein, H. Minkowski, H. Weyl and others, Riemann's dearest dream of a uniform formulation of all phenomena of physics, has, it would seem, been brought appreciably nearer to realisation, in what is known as a Theory of Relativity. An event, occurring in a definite place at a definite time, is regarded as depending on three co-ordinates for its position, and one for its time, and these four together are spoken of as its co-ordinates in a Cartesian space of four dimensions. As formulated by Einstein, there is an interval between two neighbouring events, given by a quadratic in the differences of their corresponding co-ordinates; this quadratic will then have 10 co-efficients. (*See* RELATIVITY; SPACE-TIME.)

It can be shown that there exist functions of these coefficients and of their derivatives in regard to the point co-ordinates, which are unchanged in value if calculated for the quadratic form into which the given one is transformed by any transformation of the co-ordinates; for instance, the 20 functions which, as has been stated, arise in the consideration of what is called the curvature, are such functions. It is clear that the vanishing of such an invariantive function expresses a fact which is not altered by any simplification that may be possible in the form of the quadratic expression. For instance, if the 20 functions above referred to all vanish, the quadratic expression has a form the same as in Cartesian Euclidean geometry; and if they are all equal to the same quantity independent of co-ordinates, the quadratic expression has the form considered by Riemann.

In Riemann's theory, following Gauss, account is taken of curves, called geodesics, which satisfy the condition that the integral $\int ds$, taken along such a curve, shall be stationary according to the ordinary rules of Lagrange's *Calculus of Variations*, where ds is the square root of the quadratic expression referred to. Einstein's suggestion is that the path of a particle under the influence of what we call gravitating masses may be represented as such a geodesic, provided the coefficients in the quadratic form are chosen to depend suitably upon these masses; and this has proved capable of verification in the case of the planet Mercury, and in the case of a ray of light passing near to the sun.

An analogous suggestion has led Weyl not only to the equations belonging to the theory of gravitation, but also to those which

express the phenomena of electromagnetism (and light). And it is very interesting from our present point of view to see the character of the modifications which Weyl has been led to make in Einstein's mathematical formulation in order to attain this end. For our present purpose we may state this in a twofold manner without entering into the logical connections. In the first place, in Weyl's theory, instead of the quadratic form ds^2 being regarded as definite for two specified neighbouring events, a product ϕds^2 is regarded as definite, where ϕ is a function variable from point to point, whose derivatives in regard to the co-ordinates are utilized to represent electromagnetic phenomena.

As Weyl writes (*Math. Zeitschrift*, ii., p. 397, 1918), "Riemann machte die . . . Annahme, dass sich Linienelemente nicht nur an derselben Stelle, sondern auch an zwei endlich entfernten Stellen ihrer Länge nach miteinander vergleichen lassen. Die Möglichkeit einer solchen ferngeometrischen Vergleichung kann aber . . . nicht zugestanden werden." This is precisely in the spirit which has moved geometers increasingly since the publication of G. K. C. von Staudt's *Geometrie der Lage* (1847). It introduces however evidently a wide arbitrariness which Weyl limits by adopting as a datum the possibility of the translation of a vector given at one point to another neighbouring point *without change of direction*. This conception, adopted from T. Levi-Cività (see Levi-Cività, *Palermo, Rendiconti*, xlii., 1917, pp. 173–205, and F. Severi, *ibid.*, p. 254), is as follows: The two elements of direction defined by (*a*) the vector at the first point P and (*b*) the displacement from P to the neighbouring point P′, define a family of geodesic directions through P, forming a surface; the parallel vector at P′ is that whose direction *on this surface* makes with the direction PP′ the same angle as that made by the vector at P. Evidently the assumption of the possibility of this determination of unchanged direction is fraught with large consequences or conditions. A suggestion subsequent to Weyl's (A. S. Eddington, *Proc. Roy. Soc.*, xcix., 1921, pp. 104–122), begins with Levi-Cività's differential equations for parallel displacement of a vector, but working backwards towards the quadratic differential form leads to a generalisation of Weyl's formulation.

So much of detail in regard to these remarkable contemporary speculations seems necessary in order to compare the geometrical aspects with those of older conceptions. In the so-called space of Einstein, still less in Weyl's space, there exist neither bodies, nor movement; and what are the fundamental geometrical conditions assumed prior to the establishment of the system of co-ordinates is as yet undetermined. The latter fact, which is equally true of any Cartesian space, may provisionally be evaded by regarding the space as being in point to point correspondence with a quadric manifold in a projective space of five dimensions; the former fact, which relates to the consideration of a quadratic differential expression, is most probably, if it proves finally to be possible to put the phenomena of physics into exact correspondence with geometrical considerations, suggestive of a physical theory which, given some fundamental relations of experience, shall be developed not by computation, but by descriptive methods. For the aim of geometry, towards which since Von Staudt's time, much progress has been made, is such a descriptive conception of the relations of figures in space as may render computation unnecessary.

II. GENERAL THEORY OF SURFACES

The older theory of circles and conics, or of rational curves in general, as also the theory of quadric surfaces, of cubic surfaces or of rational surfaces in general, can be placed in (1, 1) correspondence with the geometry of lines, or of planes, respectively; it deals ultimately with linear equations when viewed analytically. A consideration of cubic curves on a plane, or of the curve of intersection of two quadric surfaces, soon shows that these do not depend upon linear equations ultimately—or more precisely that the points of a plane cubic curve cannot be put into (1, 1) correspondence with the points of a line. And it further appears that a quartic curve in a plane is again of a higher category, and cannot be put into (1, 1) correspondence with a cubic curve.

This fact first emerges clearly in Abel's great paper on the integrals of algebraic functions. The general theory of the so-called Higher Curves was then historically subsequent to the theory of algebraic functions and the integrals of these; though, when this theory had received a sufficient development, it proved possible to elaborate a descriptive theory of these curves embodying the results obtained by the earlier analytical methods. In geometry, entities which can be put into exact (1, 1) correspondence are equivalent for geometrical purposes, and conversely, for purposes of a general theory, it is vital to know whether two entities have this equivalence or not. It is one of the most important recent developments of geometry to have made it clear that criteria can be given by which to determine whether two surfaces have this (1, 1) correspondence.

And it is interesting to remark that historically the development in this case has been on similar lines to that by which the corresponding result was obtained for curves; in the first place, over many years, Picard developed the theory of algebraic integrals associated with surfaces on lines as far as possible analogous to those which had been followed in the case of curves, therein in part carrying out a suggestion due to Klebsch and Noether, though the integrals which have proved most effective hitherto were not those suggested by Klebsch; after this the geometrical aspect of the matter was investigated by Italian geometers, more especially Enriques, Castelnuovo and Severi, who have succeeded in surpassing in beauty and generality even the distinguished contributions of their own countrymen to the theory of curves. It is impossible indeed to convey to a non-geometrical reader any idea of the interval which separates the development of geometry in Italy to-day from the development reached in England.

The new theory is under the disadvantage that an appreciation of it is impossible without sympathy and acquaintance with the theory of algebraic functions and their integrals, and it may be some time before detailed applications of it become the common property of mathematicians. But it offers a limitless scope for new work, its importance cannot be doubted and its permanence is assured.

BIBLIOGRAPHY.—For the question suggested by the Einstein-Minkowski work, ample material arises in attempting to sift into logical coherence many of the current writings on Relativity. An ample bibliography of these concludes the work of Hermann Weyl, *Raum-Zeit-Materie*, Vierte erweiterte Auflage (Berlin, 1921). The English reader will find much stimulus to geometrical consideration in Eddington's volumes, *Space, Time and Gravitation* (Cambridge, 1920) and *The Mathematical Theory of Relativity* (2nd ed., Cambridge, 1924); and should consult E. Cunningham's two fundamental volumes on *Relativity*, and A. A. Robb, *A Theory of Time and Space* (Cambridge, 1914). Emile Picard's work is summarised in his book, *Théorie des fonctions algébriques de deux variables indépendentes* (Paris, 1897–1906), which concludes with a summary by MM. Castelnuovo and Enriques (t.ii., pp. 485–522) of the results obtained by the Italian geometers up to 1906. The reader may also consult the article by Severi in vol. II of Pascal's *Repertorium of Higher Mathematics* (German Edition, pp. 741–782, 1922). Subsequent progress is recorded (and scattered) in the various mathematical journals, mainly of Italy. (H. F. BA.)

GEORGE V. (1865–), King of Great Britain and Ireland (*see* 11.745), succeeded to the British throne on the death of his father, King Edward VII., May 6 1910. By the Regency Act, 1910 (a temporary constitutional necessity in view of the fact that King George's eldest son, Prince Edward, was then not 16) his consort Queen Mary was at once nominated regent in the event of a demise of the Crown while the heir to the throne was under age. A new civil list fixed at £470,000 a year, was approved by Parliament in 1910. An important change in the King's accession declaration was also embodied in an Act of that year, the following short and simple formula being substituted for the old manifesto:—

I do solemnly and sincerely in the presence of God profess, testify and declare, that I am a faithful Protestant, and that I will, according to the true intent of the enactments which secure the Protestant succession to the Throne of my Realm, uphold and maintain the said enactments to the best of my power according to law.

The coronation at Westminster Abbey, on June 22 1911, was attended by representatives from all parts of the Empire and other countries and, in order to complete the public assumption of royal authority throughout the United Kingdom, the King and Queen, with the Prince of Wales and Princess Mary made state visits to Ireland, Wales and Scotland during July. Later in the year Their Majesties visited India, and coronation ceremonies took place at the ancient capital of Delhi (Dec. 12 1911).

From the very first King George and Queen Mary showed in all their actions their earnest desire to use their royal position

in the most public spirited manner. Great Britain was fortunate in the fact that so much had already been done, by Queen Victoria and King Edward VII., to establish the Throne in the hearts of the people as a central and unifying national and Imperial force, distinct from sectional interests of party or class. Under King George this tradition was steadily maintained. He and Queen Mary devoted themselves to the task of making the influence of the court a pure, useful and kindly one in the life of the country; they mingled with different classes of society and were ever active in accepting new opportunities of service. The personal tastes of both were known to lie in characteristically domestic directions. The royal stamp collection is the most complete in existence, and in 1920 the King assured the Junior Philatelic Society of his "unabated interest in stamp-collecting."

The War Period.—The value of the influence of the Crown, as standing above and outside domestic party politics, was emphasised by the Buckingham Palace conference of 1914 on the Irish deadlock; and by the conduct during the World War of the King and Royal Family who in various ways strengthened their hold on the affections of the British people. From the opening of the World War in Aug. 1914 the King and Queen jointly and severally set themselves to make the royal influence an encouragement to every form of national activity in aid of the fighting forces. The King and Queen regularly went in state to prorogue and open Parliament in successive sessions and on frequent occasions during the War royal visits were paid to important factories and workshops at the munitions centres throughout Great Britain, as well as to shipbuilding yards, hospitals and other institutions engaged in war-work of one kind or another. The King's inspections of provincial industrial establishments included visits to Glasgow and the Clyde, Coventry and Birmingham, Leeds and Sheffield, Nottingham, Liverpool, Manchester, Barrow and Gretna, Newcastle-on-Tyne, Hull and Rosyth, Bristol, Bradford and Huddersfield. Moreover, periodical visits were made by him to the Grand Fleet. In 1917 QueenMary accompanied the King to France. Finally, after the Armistice, the King made another visit to Paris and to the battle-fields, Nov. 27–Dec. 10 1918, and had an enthusiastic reception in the French capital (Nov. 28–30).

In other directions during the war period, the King's desire to set an example of patriotic self-abnegation was frequently apparent. The long record of royal attendances at notable ceremonies included such occasions as the funeral services at St. Paul's for Lord Roberts (Nov. 19 1914) and Lord Kitchener (June 13 1916); the commemoration service there on the entry of the United States into the War (April 20 1917); the Albert Hall commemoration of the first Seven Divisions (Dec. 15 1917); the thanksgiving at St. Paul's on Their Majesties' silver wedding (July 6 1918); the presentation to the King at Buckingham Palace by the special Japanese mission of the sword and badge of a Japanese field-marshal (Oct. 29 1918); and other events. On the occasion of Their Majesties' silver wedding, the King and Queen were received at the Guildhall (July 6 1918) and were presented with a cheque for £53,000, subscribed by the citizens of London, to be devoted to charities by Their Majesties' wish, together with a silver tankard once owned by Charles II.

On July 17 1917 it was announced that King George V. had abandoned all German titles for himself and his family. At the same time a proclamation was issued to the effect that henceforth the royal house of Great Britain and Ireland would be known, not as the house of Saxe-Coburg-Gotha, but as the house of Windsor. It had previously been announced (June 20 1917) that the King had decided that those princes of his family who were British subjects but bore German titles should relinquish those titles in favour of British names.

Post-War Incidents.—With the return of peace it was possible for the more normal activities of court life to be resumed, but in the long list of later royal functions some stand out as worthy of record for their special appeal to contemporary public interest. Immediately after the Armistice in 1918, the King and Queen on successive days made popular progresses through different sections of London, and received general ovations, in carriage drives through the city (Nov. 11), to a special thanksgiving at St. Paul's (Nov. 12), through the East End (Nov. 13), the south (Nov. 14), the north (Nov. 15), the northwest (Nov. 18) and the southwest (Nov. 22). On Dec. 27 a banquet was given in honour of President Wilson at Buckingham Palace, where he and Mrs. Wilson were staying with the King and Queen.

On June 21–2 1921 the King and Queen visited Belfast, where His Majesty inaugurated the new Parliament of Northern Ireland. The King, in his speech on that occasion, made an appeal to all Irishmen to pause and stretch out the hand of forbearance, to forgive and forget and to make for the land they loved a new era of peace, contentment and good-will. When, in the following Dec., an agreement was at last reached with the Irish Free State, the King in his telegram of congratulation to Mr. Lloyd George, ventured to hope that his own speech at Belfast might have contributed to bring it about.

On Feb. 28 1922 the King's only daughter, Princess Mary, was married in Westminster Abbey to Viscount Lascelles (*q.v.*), eldest son of the Earl of Harewood. The King and Queen paid a state visit to Belgium on May 8. Early in the following year (Feb. 7) a son was born to Princess Mary and on April 26 the Duke of York was married to Lady Elizabeth Bowes-Lyon, fourth daughter of the Earl of Strathmore and Kinghorne. Two days later the King inaugurated the new Stadium at Wembley, Middlesex, constructed in connection with the projected British Empire Exhibition, by attending the final cup tie of the English Football Association. On May 5 the King and Queen paid a state visit to the King and Queen of Italy, remaining in Rome for some days. They were received by the Pope at the Vatican on May 9, and on May 12 the King visited Montecchio to inspect the graves of British soldiers, who had fallen in Italy.

The outstanding event of 1924 was the opening by the King on April 23 of the British Empire Exhibition at Wembley. He and the Queen made frequent subsequent visits to the Exhibition, both privately and accompanied by their royal guests, the King and Queen of Rumania and the King and Queen of Italy, who made state visits to London during May. On Sunday, May 25, an Empire Thanksgiving Service was held in the Stadium, conducted by the Archbishop of Canterbury and attended by the King and Queen. On July 19 the King and Queen visited Liverpool and were present at the dedication of the new Cathedral. On Aug. 21 a second son was born to Princess Mary. Nearer the throne was the daughter born to the Duke and Duchess of York on April 21 1926 and named Elizabeth Alexandra Mary. On May 9 1925 the King and Queen opened the second year of the Wembley exhibition. (H. Ch.; J. E. C.)

GEORGE I. (1845–1913), King of Greece (*see* 11.746).—In 1910 King George promptly recognised Veniselos' rare ability and gave him his whole-hearted support, though the latter had long denounced the royal policy of *laissez faire*. Internal politics played only a secondary part in King George's reign; the Panhellenic idea had absorbed the thoughts and resources of the Greek people ever since the recognition of the independence of Greece. The King consistently strove to restrain the patriotic exuberance of his subjects on the one hand, while endeavouring, on the other, to use his great personal influence and family connections abroad in favour of the aspirations of the Greek people. His policy was consistently pacific. Even in Oct. 1912, when Greece was preparing to declare war against Turkey, King George made it clear to Veniselos that he only consented to the venture because of his obedience to the constitutional principle. He was about to celebrate his jubilee when he was assassinated by a Greek named Schinas at Salonika on March 18 1913. He was succeeded by his eldest son, Constantine I. *See* Capt. Walter Christmas, *King George of Greece* (1914).

GEORGE II. (1890–), ex-King of the Hellenes, eldest son of King Constantine, was born on July 20 1890 at Tatoi, the royal villa near Athens. On account of his supposed Germanophil tendencies during the World War, he was excluded from the succession by the Allies in favour of his younger brother, Alexander, upon the deposition of his father by the ultimatum of

June 11 1917. After his father's restoration to the throne in 1920, he married on Feb. 27 1921, Princess Elizabeth, elder daughter of King Ferdinand and Queen Marie of Rumania. Upon the second deposition of his father by the revolution of Gen. Plasteras, his younger brother Alexander I. having died in 1920 he succeeded to the throne on Sept. 27 1922. After the unsuccessful counter-revolution of Oct. 1923, his position became more difficult, although there was no proof that he had been a party to that rising. Republican feeling grew under the leadership of M. Papanastasiou and others, and, despite M. Veniselos' advice to await the decision of the National Assembly, a number of military and naval officers demanded the deposition of the Glücksburg dynasty. On Dec. 19 1923 the King and Queen left Greece. Next day, Admiral Condouriotes, for the second time, became regent. On March 25 1924 the Assembly deposed the dynasty and forbade its members to reside in Greece; and the plebiscite of April 13 confirmed the vote of the Assembly (*see* GREECE).

GEORGE, DAVID LLOYD (1863–), British statesman (*see* 16.832). The 1910 conference of British party leaders lasted from June till November. It was a strange pause of calm in the midst of the stormy events of that period. It is not true to say that the conference was a failure. The conferring leaders, on the contrary, nearly arrived at a very comprehensive and far-reaching scheme of agreement, affecting all the disputed issues—the House of Lords, Home Rule, tariffs and conscription. But the six months of secrecy ended in detaching the leaders from their followers. Perhaps the secrecy was overdone, because very few whispers came from behind the closed doors of the conference room to prepare the party followers for the agreements which required to be ratified by the parties before they could become valid. The result was that when the party leaders on both sides emerged from the conference room they found their followers quite unprepared to grant the concessions required from them. While the leaders had passed into a mood of conciliation, the followers were still living in an atmosphere of party warfare. On both sides the proposals put forward were regarded as surrenders.

Mr. Balfour (later Lord Balfour) and Mr. (later Sir) Austen Chamberlain found themselves in peril of being isolated, and Mr. Lloyd George was immediately denounced as an opportunist. Being party leaders themselves they were compelled to bow to the storm. Yet it is a fit reflection now that, but for the World War, this conference presented to Great Britain at that moment the last solid alternative to the civil war which even then loomed ahead. It is also interesting to observe that most of the conference proposals were adopted later, during the War or after. Mr. Lloyd George was among those who took a sanguine view of the prospects of the conference, and afterwards he always regretted its failure. He took a long view. He was ready to come to very bold settlements if they would save the country from civil strife. He and Mr. Balfour agreed in this attitude. But public opinion was not ready for compromise. Party tides still ran too strong.

SCHEMES OF SOCIAL REFORM

National Insurance.—The political conflict was resumed. In December there took place the second of the two 1910 general elections. It was, in effect, a test election on the Parliament bill. The Liberal Govt. had refused to go to the polls until they obtained the promise of the King that, if they were successful, he would consent to employ his prerogative of peer-making in order to carry the Parliament bill. That promise was reluctantly given by King George V. Mr. Lloyd George was returned for Carnarvon Boroughs for the seventh time with an enhanced majority (1,208). But a second national campaign within one year proved too much for his strength, and he was struck down by serious throat trouble for some months. During this compulsory retirement he prepared the National Insurance bill of 1911. This was the first of a series of measures for improving the condition of the British working class by the method of social insurance. The idea was first applied by Bismarck in Germany in 1893, and Mr. Lloyd George had made a study of the German insurance system during a holiday visit to Central Europe in the autumn of 1908. Old age pensions had been already passed into law before that visit; and thus it was that the British system of old age pensions originally took a non-contributory form.

Mr. Lloyd George's first general application of the contributory insurance principle was to sickness and invalidity, and the proposal produced a formidable social and political crisis in the autumn of 1911. Mr. Lloyd George was proposing a new habit to the British people, and at the first shock it was profoundly unpopular. All classes rose against it. There followed a succession of political revolts; and it seemed as if the combination of forces—of the Conservatives—of the Press and the public—opposed to the bill would be sufficient to swamp it. By-election after by-election was lost by the Liberal Government. The party managers were in favour of postponement; but Mr. Lloyd George held on. He eased the passage of the bill by a series of conferences with all the disturbed parties. Early in the year he won over the insurance societies. The trade unions were never definitely hostile. The doctors, after a series of protests and defiances, were finally appeased by a combination of firmness and concession. So at last, pushing the bill through the House of Commons with the aid of a strong closure time-table, Mr. Lloyd George achieved its third reading early in Dec. 1911. The House of Lords, tired of conflict with the House of Commons, allowed Mr. Lloyd George's insurance scheme to pass into law without serious amendment. This was followed by Mr. Lloyd George with an Unemployment Insurance bill which broke new ground. It was extended in subsequent years over the whole working class, and did much to carry the country through the dark years of unemployment which followed the World War.

The "Marconi" Affair.—In 1912 Mr. Lloyd George approached the reform of the English land system by way of a land committee, of which Sir Arthur Acland was the chairman. Two reports were published, one on the rural and the other on the urban side of the existing system; and Mr. Lloyd George had already announced his intention of bringing forward a series of bills in the House of Commons to carry out the proposals of his land committee. He sketched the main lines of his policy in a series of speeches throughout 1912 and 1913. But just as he approached this venture his way was barred by two events—one personal, and the other national. The first was known as the "Marconi Affair," which produced a grave crisis in Mr. Lloyd George's career. He had been persuaded by his friend Sir Rufus Isaacs (later Lord Reading) to take £1,000 worth of shares in the American branch of the great Marconi company at a moment when the British Post Office was discussing the terms of a contract with the British company. The two companies were separate, and there could in fairness be no accusation of anything beyond carelessness. But Mr. Lloyd George—at that moment Chancellor of the Exchequer—was too formidable a political figure to be let off lightly. The proceedings became the subject of an inquiry by a committee of the House of Commons, and he was gravely censured in the report of the chairman, Sir Albert Spicer, a prominent Liberal member of Parliament, although the majority of the committee acquitted him of serious blame. A majority of the House of Commons replied to the opposition attacks by a vote of confidence in Mr. Lloyd George. But for the moment his position was shaken.

The Curragh Revolt.—Already overshadowed by these events, the land proposals were now effectively blocked by the far greater crisis of Irish civil war. Mr. Lloyd George always took a mediating attitude in regard to the relations of Ulster and Southern Ireland, but he was now acutely involved in the coming passage of the Home Rule bill with its proposal of a single Irish Parliament under the Parliament Act. Ulster, organised by Sir Edward Carson (later Lord Carson), threatened an armed defiance of the Government. This defiance had now its first effect in the revolt of the officers at the Curragh against the orders issued for carrying out the prospective Home Rule policy. Faced with the possibility of a military revolt both at the Curragh and at Aldershot, Mr. Lloyd George took a very grave view of the situation and devoted all his energies to preserving civil peace. But at this moment, at the very heart of this Irish crisis, there came the vaster and more momentous challenge of the World War.

The First War Years

Mr. Lloyd George's Position.—Lord Grey of Fallodon in his memoir, *Twenty-Five Years, 1892–1916* (1925), gives a vivid account of the state of division that prevailed in the Liberal Cabinet in the fortnight before the outbreak of War. During that period the attitude of Mr. Lloyd George was deeply affected by his position as Chancellor of the Exchequer. On the Saturday before the declaration of war—Aug. 1 1914—the Governor of the Bank of England headed a deputation to 11, Downing Street, urging the policy of neutrality upon the Government. The same governor on Monday, Aug. 3, when the Germans invaded Belgium, telephoned to Downing street withdrawing the opposition of the City, and declaring that they were now in favour of war. This change of opinion in the City was highly dramatic, but it reflected the attitude of the Chancellor of the Exchequer. Mr. Lloyd George at first was not in favour of Great Britain being drawn into a contest between the two great warring groups of Europe unless some British interest or some British obligation were clearly involved. Accordingly during the previous week he did not take up the decisive attitude against Germany which he adopted in 1911, when he held the view that the claim of Germany to go to war with France over Morocco clearly involved a British guarantee (under the Entente). Once Belgium was invaded, however, and the neutrality treaty of 1839 defied, all hesitation left him; and never from that moment forward did he doubt that the military machine of the Central European Powers must be destroyed. Thus it was that Mr. Lloyd George entered upon a new phase of his career—that of war statesman.

The first great civilian duty of the War fell on Mr. Lloyd George. As Chancellor of the Exchequer, he had to secure the finances of the country. While Lord Kitchener at the War Office was organising the armies, Mr. Lloyd George had to see that the credit of the country did not collapse. At the very opening of the War he called together the governors of the leading banks and arranged a moratorium which prevented a panic. All the gloomy forecasts of the breakdown of finance so freely indulged in by the opponents of the War were in a moment dissolved into thin air. British finance, thus rallied at the start of the struggle, remained steady throughout; and the good faith thus engendered enabled the Government to borrow the immense sums which alone made it possible to endure and achieve victory. As long as he was Chancellor of the Exchequer, Mr. Lloyd George gave steady attention to this aspect of the war struggle. He knew that war, to be successful, depended, in Milton's phrase, on " two main nerves—iron and gold." His first attention was given to gold. During the first 10 months of the War he remained Chancellor of the Exchequer; and thus on him fell the main financial responsibility. By common agreement of all parties he placed British finance on an impregnable foundation.

The Ministry of Munitions.—It was in June 1915 that Mr. Lloyd George passed from the nerve of gold to the nerve of iron. It was brought to his knowledge that the insufficient supply of shells and guns at the front was exposing our armies to an intolerable inequality of loss. The crisis which followed on the general realisation of this fact in England broke up the Liberal Govt., May 19 1915, and substituted for it the first Coalition administration, of Mr. Asquith and Mr. Bonar Law. The Govt. was entirely reconstituted. Perhaps the most important change was the creation of a Ministry of Munitions—offered to and accepted by Mr. Lloyd George. This ministry was boldly entrusted with the whole function of providing war armaments, hitherto part and parcel of the duties of the War Office. It was natural that the War Office should resent this subtraction from their powers. But it was now quite clear that, in so great a war, the supply of munitions would be a function on a scale so large as to require a separate department. The new enterprise was rather a national movement than an ordinary office of state. The government workshops at Woolwich and elsewhere had been modelled to supply arms for a small peace army. Now that Lord Kitchener was calling forth from the nation by his magnetic appeal an army of 2,000,000 there had to be a corresponding effort to supply them with weapons. In order to achieve this, Mr. Lloyd George put forth all his powers as a democratic orator and organiser. He first called on the private armament firms to make a new and gigantic combined effort; and they gave him splendid support. But this was not enough. He was compelled to create a vast network of new factories and workshops, and to rally to his effort a huge army of workers, both men and women. He set out to supply the army not only with sufficient shells, but also with the great guns and explosives rendered necessary by Germany's extensive preparations. Above all, he had to create the machine-guns, hand grenades, trench mortars, and other equipments which were now absolutely necessary for the efficient conduct of a war which was from day to day taking on new types and forms.

Iron and gold were not, however, the only nerves destined to be necessary for the winning of the World War. It soon became evident that it was also to be a struggle of brains. As the War spread from end to end of Europe, and afterwards to Asia and Africa, it became clear that in this vast struggle statesmanship was just as urgently requisite as strategy for the full achievement of victory. Strategy on so vast a scale passed into the sphere of statesmanship. Much depended, for instance, on the moral appeal to the world against the aggression of Germany. There Mr. Lloyd George, with his golden gift of oratory, took a leading part from the beginning. He helped gradually to detach Italy, and widely affected opinion in all the neutral countries. It was one thing to raise so gigantic an army. It was another thing to apply it to its full use and value. On all these questions Mr. Lloyd George in 1915–6 held vigorous views. He was not content to confine himself to the function of creating guns and shells. In the beginning of 1915 he began to pour out to the Cabinet a succession of memoranda, in which he endeavoured to put before them the full seriousness of the military situation following upon the collapse of the Russian attack in the spring and summer of 1915. The theory of the " Russian steam roller " had proved very comforting to depressed Englishmen during the winter and spring of 1914–5. But when the German advance swallowed up Warsaw and Brest-Litovsk, it became clear that the " steam roller " was not even a good sickle, and that Great Britain would have to rely upon herself. The failure of the Gallipoli attack in the latter part of 1915 only emphasised the same point. It began to look as if victory would depend not so much on numbers as on skill; and all Britain's great armies and splendid armaments might only increase the magnitude of her defeat if such enterprises were repeated.

Mr. Lloyd George and the Eastern Front.—The policy and strategy laid before the Cabinet in the Lloyd George memoranda in the year 1915 were never fully adopted. In the language of the time, the Cabinet was divided between " Westerners " and " Easterners "—those who looked for a decision only on the Western Front, and those who believed that victory could be quickened by transferring part of our effort to the Near East. It all ended in a compromise which resulted in the expedition to Salonika. But Mr. Lloyd George aimed at something far larger—nothing less than a considerable diversion of armies from the West to the East of Europe. He proposed and contemplated the diversion of an army of at least 1,000,000 from the Western to the Eastern Front. With the development of the German submarine warfare Mr. Lloyd George's Eastern idea became less and less practicable; and with the increase of the German armies the danger of a German break-through on the West finally held the British armies to their task. But in early 1915 these facts had not been fully disclosed.

As the year 1915 advanced, Mr. Lloyd George's general discontent with the conduct of the War grew stronger with every month. It extended to home policy as well as foreign. He saw, for instance, that if the generals were to have their way and stake the whole issue on a break-through in the West they would require to be provided with an incessant flow of men. The first response to Lord Kitchener's appeal had been magnificent, and some 2,000,000 volunteers had flocked to the colours. But then came a pause in the recruiting; and yet the fearful wastage continued—and grew worse. The policy of frontal attacks begun at Neuve

Chapelle clearly meant a continual supply of vast armies. Such armies, Mr. Lloyd George now began to perceive, could not be secured by the voluntary principle alone. Having once made up his mind on that point, he became a vehement advocate of conscription in the autumn of 1915. But Liberal sentiment was against it, and Mr. Asquith hesitated. A series of experiments, known at the time as the "Derby Schemes"—distinguishing between married men and single—were attempted from month to month. Mr. Lloyd George advocated the American ballot. But the military councils were not in favour of it. Then came other plans—such as "starring" and "unstarring" of men according to their callings and occupations.

But all these makeshifts ended in leaving a sense of inequality and unfairness which could only be removed by a more comprehensive policy. So at last Mr. Lloyd George swung the Cabinet into conscription; and only one minister—Sir John Simon—resigned. Everything possible had now been done to supply the generals both with men and with munitions. But the question of policy remained, and there Mr. Lloyd George's discontent continued to grow. The tragic death of Lord Kitchener by the sinking of the cruiser H.M.S. "Hampshire" on June 5 1916 created a vacancy at the War Office which could only be filled in one way. So in that month Mr. Lloyd George passed from the Ministry of Munitions to the War Office. In this new position of power he obtained a firmer grip on the military machine at the front, and in particular he carried out a drastic reform of communications in France.

From these lesser tasks his mind was diverted to the main issue of victory or defeat by the tremendous tragedy that befell the Allied cause in the autumn of 1916. Rumania, tempted by Russia into the War on the side of the Allies at an unseasonable moment, was violently attacked by the great German general Mackensen and dramatically crushed before the eyes of her distant and helpless Allies. In vain Mr. Lloyd George appealed to the Cabinet to make some effort to save Rumania. Italy had entered the War in the previous year, and the Russian armies were still in being—could nothing be done? Nothing was done; and for the moment Rumania was blotted out. But the event had a profound effect on the mind of Mr. Lloyd George. It brought him to the parting of the ways. "Is it necessary," he used to say, "that a little nation should be laid on the altar of this war every Christmas? It was Serbia in 1915, now it is Rumania. What nation will come next?" Possessed with this dread, he decided to raise the issue in a definite form, and on Friday, Dec. 1 1916, he laid his views before Mr. Asquith.

Collapse of the Asquith Govt.—His main contention was that so large a War Committee as then existed could not conduct the War to victory. He proposed a smaller and more efficient body of three or four men, solely devoted to this one object of winning the War. What was wanted was unified and unsleeping control. But he proposed—and here was the crux of the political situation—that the existing Prime Minister should not be chairman of the committee. That was where the dividing line came. For frankly and definitely Mr. Lloyd George had ceased to believe in Mr. Asquith as war leader. Mr. Asquith's pride was touched to the quick; and it was quite clear that he profoundly resented the proposal, although he himself had first named Mr. Lloyd George as chairman of the new War Committee. On Saturday, Dec. 2, Mr. Lloyd George was under the impression that his proposal had been accepted. But friends intervened on both sides: the Northcliffe Press in favour of Mr. Lloyd George, and Mr. Asquith's friends in favour of a chief whose loyalty has always commanded a fit return of personal devotion. On Monday, Dec. 4 1916, *The Times* published a leading article displaying exultation over Mr. Asquith's defeat, and immediately Mr. Asquith wrote to Mr. Lloyd George breaking off the agreement. In the afternoon of that day Mr. Asquith resigned office. He received authority from the King to form a new Ministry. He wrote to Mr. Lloyd George asking him to join on condition that he—Mr. Asquith—as Prime Minister must be chairman of the new War Committee. Mr. Lloyd George refused that condition, and placed his office at the disposal of Mr. Asquith.

Already, on Sunday, Dec. 3, the Conservative rank and file had met. They had decided at first against following Mr. Lloyd George, whereupon Mr. Bonar Law had emphatically said that, in that case, they could not count on his leadership. He and his friends refused to join the new Ministry, and so Mr. Asquith's efforts to reform his Coalition without Mr. Lloyd George broke down. The King then sent for Mr. Bonar Law. But as some of the Liberals and the Labour party refused to support him, he too failed to form a government, although Mr. Lloyd George offered to serve under him. The King then called a conference at Buckingham Palace and tried to form a new Coalition Ministry under Mr. Bonar Law, with the offer of the Woolsack to Mr. Asquith. Mr. Asquith refused. Thereupon the King sent for Mr. Lloyd George, as he was clearly the only possible Premier.

Mr. Lloyd George as Premier

The New War Policy.—There was nothing left for Mr. Lloyd George but to accept the call. He attempted to rally all parties behind him. He succeeded with the Conservatives and the Labour party, and a certain number of Liberals. But the bulk of the Liberal ex-ministers stood aside and began to form a group known as the Independent Liberal party. Mr. Lloyd George was now in sole command of his own war policy. The small war committee which he instantly appointed fully carried out the hopes of its founders. It sat from day to day, and very often twice a day. It practically took the place of the Cabinet. Records were kept of its meetings, and Mr. Lloyd George formed a small Downing Street secretariat in order to keep in close touch with the various Ministries. The result was a general quickening up of war decisions and a more decisive control of the whole machine of government.

During the year 1917 Mr. Lloyd George pressed forward his idea of unified command of the Allied armies. He was now completely convinced that the War could only be won if the Allies were to face Germany with the same concentrated authority that Germany had established over her own partners. He was faced, however, with a very steady resistance from the high military command, now from time to time supported by the Independent Liberal party. There was a strong national sentiment against subordinating our armies to the control of foreigners, and there was a firm belief among the soldiers that they could win the War alone by pounding harder at the Western Front. But as the year advanced the sanguine expectations frankly thrown out in interviews in the spring by Sir Douglas (later Earl) Haig were not fulfilled. The Aug. fighting round Lens; the Sept. onslaughts on the east and north of Ypres; finally the assault on Passchendaele—all these battles displayed fully the inexhaustible valour of British, Australian and Canadian troops. But there was no break-through. The British armies were checked by the mud and rain of the Flanders autumn, and in too many cases heroism was literally choked in slime. Mr. Lloyd George contemplated this wastage of Brittish manhood with increased impatience, and on many occasions protested against the sacrifice of volunteers and conscripts.

On Oct. 24 1917 there occurred an event which finally decided him to force the matter of unified control to a decision. On that day the Austro-German armies under Von Bülow broke through the lines of the Italian armies dangerously stretched out between the Eastern Alps and the Adriatic Sea, and drove them back to the line of the Tagliamento with the loss of 300,000 men and 2,000 guns. Italy stood for the moment in peril of a defeat equal to that of Serbia and Rumania in the preceding years. Mr. Lloyd George was determined that this defeat should not take place. He himself journeyed immediately to Italy. By infusing new courage into the Italians he helped to check the confusion and flight of their armies. He compelled the Western commands to send an army of infantry and artillery, English and French, under Gen. Plumer through the Mont Cenis tunnel to northern Italy. These reinforcements arrived in the nick of time, checked the collapse of Italy, and aided greatly to save her from defeat.

The End of the War.—Having achieved this task, Mr. Lloyd George, with characteristic swiftness, determined to press on

with the matter of unified control. On his journey back to England he stopped in Paris on Nov. 12 1917 to make a speech in which he plainly announced that divided control meant defeat. But that speech for the moment only aroused fresh opposition, and when he returned to Parliament he had to face the vehement criticism of the Independent Liberals led by Mr. Asquith. Yet, later, in May 1918, when Sir F. Maurice, challenged his authority in a letter to *The Times*, the consequent vote of confidence in the Commons secured him a decisive majority of 187. But full unity of control was not really achieved until the terrible events of March 1918 brought home to all parties in England the nearness of the peril. During the winter the Germans brought across Europe a fresh army of 2,000,000 men released by the collapse of Russia after the Bolshevik revolution of Oct. 1917. This gigantic new army created a fresh situation in the West, and the first blow fell on March 21, when 40 German divisions attacked and broke through the British line west of St. Quentin. On the following days the British line withdrew 15 m., and the military struggle that followed lasted through five terrible months. Mr. Lloyd George threw into the fighting line all those youthful regiments which he had hoped to keep for home defence. Even so, the German pressure very nearly crashed through to the sea. There was a tense moment when some high military authorities were in favour of bringing the British armies back to England. But Mr. Lloyd George always strenuously refused to face such a possibility. He averted defeat by two principal steps of policy. One was the assertion of full unity of control, and the other was the bringing over of the American armies.

President Wilson had not contemplated sending his armies to Europe until they were fully trained and brigaded. But that process could not have been finished till 1919 at the earliest, and it was now clear that in that case the American armies would be too late. Mr. Lloyd George therefore made a definite appeal to President Wilson to send all he could immediately, and the President instantly responded by a promise to do so on condition that Great Britain provided the transport. Thus with the combined effort of the American command and the British Navy and Marine no less than 2,000,000 American soldiers were carried across the Atlantic, in spite of the submarines, during the months of April and May 1918. Those numbers now enabled the Allies to meet the Germans with a greater sense of numerical equality. But mere numbers were still useless without unity. Visiting France in the first week of May 1918, Mr. Lloyd George held a decisive combined meeting of the military and civil powers, in which, supported by Lord Milner and M. Clemenceau, he was at last able to persuade the British generals to accept the supreme command of the great French soldier Marshal Foch. During the final months of the War the British armies fought loyally under that command. It was by the combined attacks of British and French troops, storming the German lines east of Amiens, that the tide was turned on Aug. 8 1918. Seven great battles were fought after this event, but from Aug. till Nov. the German armies were steadily driven back. Finally, on Nov. 11, came the collapse of the German resistance and the acceptance of armistice terms of defeat by the new German Government. "Germany is doomed," cried Mr. Lloyd George, speaking at the Mansion House on Nov. 9 1918, and he proved a true prophet. The Allies had won the War.

The Peace Conference.—Victory having been achieved, it now remained to make peace. There were inevitable delays. Mr. Lloyd George deemed it necessary first to strengthen his position by an appeal to the country. The polls took place on Dec. 14 1918, and the results were declared on Dec. 28. The effect was an overwhelming victory for Mr. Lloyd George, he being returned to power by a majority of 249 over all the independent groups. He himself was returned for the eighth time as member for Carnarvon Boroughs with a majority of 12,898. These events filled up the pause rendered inevitable by the waiting of Europe for the arrival of President Wilson, who had decided to attend the Peace Conference as American representative. The next step was the choice of the capital in which to hold the Peace Conference. Paris was selected, the intention being to move on to Geneva after the first stage. But once settled in Paris it was found impossible to move so vast an assembly of nations. The first meeting of the conference took place on Jan. 18 1919 at the Palace of Versailles, and it proved an impressive gathering of the representatives of all the 30 countries who had taken part in the defeat of the Central Powers. Mr. Lloyd George took with him from England a joint delegation representing all parties, including Mr. Bonar Law, Mr. Balfour, Lord Milner and Mr. George Barnes. A powerful delegation came from the Dominions, including Mr. Hughes, Premier of Australia, Sir Robert Borden and Gen. Botha. Thus the whole British Empire was represented at Paris among the colleagues of Mr. Lloyd George.

It soon became obvious that so big an assembly could not really arrive at peace. There were too many conflicting views, there was no possibility of secrecy. The allied negotiators gradually narrowed to an inner council of ten, which was soon reduced to five; then from five to four; and finally from four to three—Mr. Lloyd George, President Wilson and M. Clemenceau. On them fell the full burden of making the peace. This numerical narrowing of the peace negotiators, together with the increase of secrecy, created widespread discontent among those who had been led to expect a peace by open diplomacy. What happened behind the scenes was this: roughly speaking, the position was that Mr. Lloyd George and President Wilson worked for a peace of conciliation, while M. Clemenceau worked for a peace of victory. The French started with a claim to extend their frontier up to the left bank of the Rhine. Wilson and Lloyd George together succeeded in moderating this claim. But they were compelled to hand over the Saar Valley for 15 years as part of the compromise. Smaller compromises took place in regard to Silesia and the Polish corridor. No one was completely satisfied, but every country had its say. President Wilson's unique contribution to the settlement was the League of Nations Covenant. Though Mr. Lloyd George took great interest in the framing of the Covenant, he left the chief British share in its moulding to Lord Robert (later Viscount) Cecil, who sat on the League Committee as the British representative. But when the crisis came, and President Wilson threatened to leave the conference unless the Covenant was placed first in the treaty, Mr. Lloyd George supported the view of President Wilson.

The Treaty of Versailles.—Mr. Lloyd George's freedom was much hampered by Press attacks from home, and at one moment Lord Northcliffe organised a mandatory telegram from over 200 members of Parliament rebuking him for a tendency to weaken on the demands to Germany. Mr. Lloyd George returned to London to face his critics in Parliament and secured a huge majority. There can be no doubt, however, that these symptoms of discontent at home diminished his authority and weakened his resistance to the military policy of France. At this point, for instance, he agreed to the French claim to occupy the left bank of the Rhine for 15 years, which he had hitherto attempted to limit to a much shorter period. On May 6 a draft of the treaty was completed, and was presented to the German Foreign Minister, Count Brockdorff-Rantzau on the following day. Germany instantly pleaded for various important modifications. During the six weeks of parley with Germany that followed Mr. Lloyd George played the part of conciliator. President Wilson hardened against Germany, and took the view that he was pledged to the treaty as it stood. Mr. Lloyd George secured the softening of many harsh terms, and in that way prepared the ground for the return of the spirit of conciliation to Europe. A political crisis in Germany followed, but on June 22 the National assembly authorised the signing of the treaty, and on June 28 it was signed at Versailles by the German envoys. Mr. Lloyd George returned to England and defended the treaty before Parliament, which unanimously ratified it on July 3. Shortly after he was awarded the Order of Merit.

Domestic Discontents.—Having made peace abroad, Mr. Lloyd George returned to restore peace at home, which was just as much in peril. The long strain of the World War and the terrible losses of men and material had left Great Britain gravely wounded and weakened. The impulse of patriotism passed

away; and the idea seemed to spread that every class was to be enabled to "get rich quickly" by the achievement of victory. The result was a series of industrial struggles, beginning with the London railway strike in Feb. 1919, followed a few weeks later by the first of the coal crises. Mr. Lloyd George averted a strike on the coal-fields by appointing a royal commission with Mr. Justice Sankey as chairman, with a promise that the commission should report on wages and hours by March 20. The Sankey commission reported on that day, recommending a two-shillings' increase in wage and an immediate seven-hours' day. The concessions were granted and a strike was averted. But when the majority of the commission went on to recommend nationalisation of the mines, Mr. Lloyd George refused to adopt the suggestion. In Oct. 1919 the railwaymen precipitated a national strike; and once more Mr. Lloyd George had to play the part of national conciliator. He brought the strike to an end by a compromised settlement fixing wages according to the scale of living.

During the next two years the Lloyd George Coalition Govt. passed a series of agreed measures on housing, suffrage and land. But as time went on it became clear that the country was financially more exhausted than had been supposed. The first after-War "boom" gradually passed into a "slump," and there arose from the whole country a cry for economy which expressed itself in an "Anti-Waste" campaign of the utmost vigour. By-election after by-election was lost to the Government, and the country was swept by financial panic. Mr. Lloyd George met it by a drastic measure. He appointed a small committee, with Sir Eric Geddes as chairman, to revise the whole of our national finance. As a result of its sweeping report—the "Geddes Axe"—widespread economies were effected in all departments. The agricultural subsidy was withdrawn and the agricultural wages boards were suspended. The housing scheme was held up: and all progress in education was checked.

Fall of the Ministry.—Those concessions weakened the Radical support of the Coalition. In the autumn of 1922 a similar weakening occurred on the Unionist wing of the Conservative party owing to the policy to which Mr. Lloyd George was driven in Ireland by the course of events. The Sinn Fein trouble which had broken out in the later period of the War worked up in 1920–1 to an actual rebellion. All Mr. Lloyd George's efforts to effect a compromise between Northern and Southern Ireland proved vain. In the spring and summer of 1921 the condition of Ireland grew rapidly worse. Murder and outrage were rampant. The Coalition Govt. initiated a special force, who received the nickname "Black and Tans," to deal with the violent methods of the Sinn Feiners by vigorous reprisals. This produced in England a divided feeling as to the equity of the struggle. In the autumn of 1921 peace overtures began to pass from one side to the other. Mr. Lloyd George decided to make a real effort after a settlement. A truce was declared, and the picked leaders of Sinn Fein came to Downing street, where, after several weeks of discussion, a settlement was reached, at midnight, Dec. 6 1921. This great concession to Ireland was followed by resistance to the Turks at Chanak on the Dardanelles (Sept. 1922), and the two events produced the downfall of the Lloyd George Coalition. The Unionist party, created on the principle of resistance to Home Rule, was riven asunder by so great a concession as that of Dominion Home Rule to Southern Ireland. The threat of renewed war with Turkey was profoundly unpopular, and presented the enemies of the Govt. with an opportunity. Mr. Bonar Law, who had retired from the Govt., returned to a meeting of the Conservative party at the Carlton Club on Oct. 19 1922, at which it was decided that the Conservative party should leave the Coalition. Mr. Lloyd George instantly resigned, and in the election that followed (1922) Mr. Baldwin—who succeeded on the death of Mr. Bonar Law—obtained a majority. (*See* ENGLISH HISTORY.)

AN OPPOSITION LEADER

Throughout the vicissitudes of the general elections which followed in the autumns of the following years (1923 and 1924) Mr. Lloyd George remained a leader of opposition. He reunited his followers with the Independent Liberals after the election of 1922, and devoted his energies to identifying the Liberal party with a policy of economic reconstruction. In 1924 he published *Coal and Power*, which outlined a comprehensive scheme for the more efficient utilisation of the natural resources of the country. Nevertheless the reunited Liberal party failed to gain strength and in the General Election of 1924 its numbers in the House of Commons, controlled by Mr. Asquith and Mr. Lloyd George, sank to 40 members. Mr. Lloyd George continued his active efforts to rouse the country to the need of further domestic reform to meet the home crisis: and in the early autumn of 1925 he issued a big land programme which he proceeded to advocate throughout the country.

By the elevation of Mr. Asquith to the peerage as the Earl of Oxford and Asquith (1925) Mr. Lloyd George earned the succession to the Liberal leadership in the House of Commons, and was elected to that office in the sessions of 1925 and 1926. In Feb. 1926 he carried his land proposals, with few modifications, through a Liberal Convention assembled at the Kingsway Hall in London. But the Liberal party still showed no signs of revival in the country, and in the by-elections of Jan. and March 1926 some of the Liberal candidates lost their deposits to the returning officer. Still, the personal position of Mr. Lloyd George in the country was growing steadily stronger: and his criticism of Sir Austen Chamberlain's new Locarno policy in the House of Commons in March 1926 created a profound impression. His national and parliamentary position was in strange contrast to the size of his following; and that created a strange diversity of opinion in the forecasts of his future. In May, during the course of the general strike, Mr. Lloyd George expressed opinions that were not in accord with those of Lord Oxford and the other Liberal leaders. His idea was that the Government should negotiate with the strike leaders without delay, instead of declining to do so until the strike had been called off. He ridiculed the view that the general strike was aimed at the constitution. A somewhat acrimonious correspondence between him and Lord Oxford followed, and the party, both in and out of the House of Commons, was acutely divided upon the question. (*See* LIBERAL PARTY.)

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GEORGE, STEFAN (1868–), German poet, was born at Büdesheim, Hesse, on July 12 1868. After attending the grammar school at Darmstadt, he studied philosophy and the history of art in Paris, Munich and Berlin. He travelled extensively in Italy, France, England, Spain, Holland and Belgium and became associated with the Baudelaire and Mallarmé School in Paris and the disciples of the Pre-Raphaelites in London. His early poems were first published privately for a select circle of friends, for whom in 1892 he founded the *Blätter für die Kunst*. George's poetry which is non-realistic, reflects a heroic and aesthetic world-philosophy; and possesses great beauty of form and an austere power. Among his works are *Hymen* (1890); *Algabal* (1892); *Die Bücher der Hirten* (1895); *Jahr der Seele* (1897); *Die Teppich des Lebens* (1899); *Tage und Taten* (1900); *Die Fibel* (1901); *Der siebente Ring* (1907); *Stern des Bundes* (1914); *Der Krieg* (1917); *Drei Gesänge* (1921). He also translated Baudelaire, Dante and the sonnets of Shakespeare.

See L. Klage, *Stefan George* (1902); F. Düberg, *Stefan George* (1908).

GEORGIA, U.S.A. (*see* 11.751).—The population of Georgia in 1925 was 3,058,260, as against 2,895,832 in 1920 and 2,609,121 in 1910, an increase of 17·2% for the 15 years. During 1910–20 negroes increased from 1,176,987 to 1,206,365, but relatively they decreased from 45·1% of the total population to 41·7%. The urban population was 25·1% as compared with 20·6% in 1910. The density of population in 1920 was 49·3 per sq. m. as against 44·4 in 1910. The census of 1920 revealed an important movement of population from the mountain counties of

the northern portion of the state and from central Georgia to south-central and southeastern Georgia, due to the presence of large areas of undeveloped and fertile land in the southern half of the state. The highest density of population, however, was still to be found in the northern half.

Agriculture.—Although scarcely perceptible in 1914, by 1916 the boll weevil had spread over the coastal plain of Georgia, and in the following years covered the entire state. The growing of long-staple cotton was abandoned and the production of the short-staple was sharply curtailed, falling from 2,718,037 bales in 1914, the largest crop in the history of the state, to an average of 30% less in the four years following. This situation gave a powerful impetus to diversified farming, the movement being aided by the high prices of foodstuffs due to the World War. The most important of the new crops is tobacco. Beginning with a production of 1,088,000 lb. in 1910, this crop in 1925 had grown to 47,880,000 pounds. Meanwhile there have been tremendous increases in the production of hogs, sweet potatoes, peanuts, melons and fruits, particularly peaches and apples, and pecans.

Education.—In 1910 the total enrolment in the public schools was 555,794; in 1924, 709,760; the state appropriation for elementary schools in 1910 was $2,237,000; in 1925, $4,500,000; there was raised by local taxation in 1910, $1,307,000; in 1924, $8,732,923. The total amount spent from all sources for elementary schools in 1924 was $22,701,973. Laws were enacted 1910–20 for the modernising of the educational system. A constitutional clause limiting the taxing power of the counties to taxation for elementary schools only was removed (1910). The state Board of Education, hitherto composed of state officials, was made a professional board (1911), and a uniform text-book law passed, the duty of selecting the books being placed upon the board. Compulsory education dates from 1916. The law, as amended by the new School Code of 1919 required attendance through the seventh grade. Provision was made for attendance officers. A training school for negro teachers was authorised in 1922. The Federal Smith-Lever Act of 1914, and the Smith-Hughes Act of 1917, both accepted by Georgia, provided for extension work in agriculture and home economics, and for the teaching of vocational subjects in the schools.

In 1919 the policy was adopted of setting apart one-half of the total income of the state for the schools. In the same year a constitutional amendment was adopted, by which the counties were required to levy local taxation of not less than one mill nor more than five mills for the support of elementary schools as a supplement to the state appropriation. To encourage the consolidation of small schools, the Legislature appropriated (1919) $100,000 from which the state offered to pay annually a bonus of $500 to any county which combined small schools into larger ones and where a four-year high school was provided, an additional bonus of $1,000 was authorised. This bonus fund was increased to $200,000 in 1924. An illiteracy commission was established (1919) to make a study of adult illiteracy and in 1920 local taxation for the support of schools for adult illiterates was authorised. Noteworthy progress was being made in the eradication of illiteracy. White illiteracy declined from 7·8 to 5·4%; negro from 36·5 to 29·1%. During the period 1905–25 the number of four-year high schools increased from 7 to 275. The total state appropriations for higher institutions, including the district agricultural schools, the academies for the blind and deaf, and various training schools for defective classes, was in 1910 $436,500; in 1924 $1,284,450.

Government.—The period 1910–25 in Georgia was characterised by legislation designed to further social progress and economic improvement. The standard of medical education was materially raised (1913); only four-year medical colleges were recognised and the requirements for entrance were increased. A new Board of Health was established (1914) to exercise control over the county boards of health. Provision was made for paid sanitary commissioners in all sanitary districts, which consist of one or more counties. A Vital Statistics law of 1914 provided for the registration of births and deaths and the publication of statistics. The employment of children under 14 years of age was prohibited (1914), and factory inspectors were provided in 1916. A Training School for Mental Defectives was established (1919); and a state Board of Public Welfare (1919) was set up, charged primarily with the duty of inspecting all state institutions for the dependent, defective, delinquent and criminal classes. An Act of 1920 provided for rehabilitation of persons disabled in industry or otherwise, assented to the Federal Vocational Act and pledged the state to equal appropriations made by the United States. A state Board of Vocational Education was created (1917), charged with the administration of the rehabilitation training. In 1922 a Commission was created to study the laws of this and other states and propose legislation to safeguard the welfare of children within the state.

A Dept. of Commerce and Labour was created (1911), in which was later (1917) included a free employment bureau. The Dept. of Insurance dates from 1912. The State Highway Dept. (1916) was reconstituted in 1919 to bring the state system into harmony with national legislation providing aid in the construction of rural post roads. A Bureau of Markets (1917) was created to gather and disseminate information of value to producers and consumers of agricultural products; and, in 1921 an Act was passed to encourage co-operative marketing of agricultural products, their storage, canning, packing, etc., the supplying of agricultural machinery, and the financing of these operations. To further the erection of modern warehouses for the weighing, grading and storage of lint cotton, a Warehouse Commission was authorised in 1918. A new banking code (1920), modelled on the National Bank Act, corrected many defects in the old banking system and provided for adequate inspection. An Employers' Liability Act (1920) set aside the common law defence of contributory negligence of fellow-employees and provided for compensation for industrial accidents, a commission being created to administer the Act. The Uniform Negotiable Instruments law was adopted in 1924.

Finances.—The assessed value of the taxable property of Georgia in 1910 was $766,000,000 and in 1924, $1,213,423,073. The yield of taxes in 1924 was $16,765,264. The principal source of revenue was the general property tax. In recent years two special tax commissions appointed by the governor have made reports urging the classification of property for taxation purposes, the adoption of the income tax, and other changes in the system; but the Legislature had up to 1925 failed to act. The bonded indebtedness of Georgia was reduced from $6,944,000 in 1910 to $5,284,202 in 1924.

History.—The governors of the state during the period 1911–26 were: Hoke Smith (Dem.), 1911–2 (shortly after his inauguration Smith was elected by the Legislature to succeed J. M. Terrell as U.S. Senator); Joseph M. Brown (Dem.), 1912–3 (elected at a special election to fill Smith's unexpired term); John M. Slaton (Dem.), 1913–5; Nathaniel E. Harris (Dem.), 1915–7; Hugh M. Dorsey, 1917–21; Thomas W. Hardwick (Dem.), 1921–3; Clifford M. Walker (Dem.), 1923–. (R. P. B.)

GEORGIA (*see* 11.758), a Soviet republic forming part of the Transcaucasian Federation of Soviet Republics. The capital is Tiflis (*see* TRANSCAUCASIA).

GERARD, JAMES WATSON (1867–), American lawyer and diplomat, was born at Geneseo, N.Y., Aug. 25 1867. Educated at Columbia University and at the New York Law School, he was admitted to the bar in 1892 and began to practise in New York City. In 1908 he became associate justice of the Supreme Court of New York, resigning in 1913, on being appointed ambassador to Germany. At the outbreak of the World War in 1914 he assumed the care of British, Japanese, Rumanian and Serbian interests in Germany, later visiting the camps where British and other prisoners were confined and doing much to alleviate their condition. His responsibilities were further increased by the fact that German interests in France, Great Britain and Russia were placed in the care of the American embassies in those countries, the American embassy in Berlin thus becoming a sort of clearing house. After the sinking of the "Lusitania" with many Americans on board, on May 7 1915,

the American ambassador's position became more difficult, and finally, on Feb. 3 1917, diplomatic relations were broken off by America and he was recalled. While in Germany in 1914 he was Democratic nominee in New York for the U.S. Senate, but without success. On his return to America he resumed the practice of law in New York City. He received the vote of several states in the Democratic National Convention of 1920 and 1924 and was Chairman of the Finance Committee of the National Democratic Campaign in 1920 and Treasurer in 1924. In 1917 he published *My Four Years in Germany* and in 1918 *Face to Face with Kaiserism*. For his services to England he was decorated with the G.C.B.

GÉRAULT-RICHARD, ALFRED LÉON (1860–1911), French journalist and politician (*see* 11.766), died Dec. 6 1911.

GERMAN LITERATURE (*see* 11.783), like every form of spiritual activity in Germany, experienced between 1910 and 1920 deep alterations in thought, feeling, values and form. Characteristic of the older generation was its pleasure in the external picture of the world. Man, with joy and confidence, felt himself a part of this picture. The younger generation seeks to reveal the inner meanings of the world. A time of suffering leads towards infinite horizons. Former standards of measurement are replaced by a sense of the immeasurable. We no longer tread our bit of the world as a solid piece of reality, but long for escape into the infinite. Its symbol is the horizon always receding, never attained.

The Forerunners of Expressionism.—But what appears at first sight to be a bridgeless gap made by disruption is really only the last stage of a continuous development already begun between 1890 and 1910. During those two decades the point of view had shifted, gradually but steadily, until by 1915 it already had come half-circle. All typical writers of the "impressionist" period had turned symbolists in their later works; Stefan George and his circle, or Rainer Maria Rilke, Gerhart Hauptmann himself in his later work (*Und Pippa tanzt, Emanuel Quint*) are only to be understood from this angle. Even when "impressionism" was at its height there were writers whose work was strange to their age, and only later became quite intelligible when they were seen as the forerunners of an age of "expressionism." In fiction, Hermann Conradi, Johannes Schlaf, Hermann Stehr and Jakob Wassermann looked towards new life and personality; while Julius Hast, Paul Scheerbart and Gustav Meyrink strove for new form and shape; and Heinrich Mann's evolution from Renaissance poet to Central European democrat meant increasing sympathy with the New Youth. Dramatists had already attempted to create a new drama of style to break the supremacy of the old naturalistic drama of situations or the neo-romantic drama of sentiment. Herbert Eulenberg and Wilhelm Schmidtbonn had dared to make a new drama out of passion or excitement; Paul Ernst in a hard struggle for dramatic form sought to create a new classical drama, and thereby was first in the far-reaching fight against the dominant relativist and psychological cult. Frank Wedekind had broken with every tradition and spoken with the voice of primitive impulse. While the lyric poets, Peter Hille, Alfred Mombert, Christian Morgenstern, had one foot in the field of the new art, others from 1900 onwards took their full stand on that ground. Instance the poets of *Charon*, particularly Otto zur Linde (b. 1873, *Collected Works*, 1910 *seq.*), Karl Röttger and Rudolf Paunwitz.

The Expressionist Movement.—The term "expressionism" as applied to the theory and practice of this new art came into general use between 1910 and 1920. The word is, on the whole, felicitous. It shows clearly how the new art contrasts with naturalistic impressionism which was all facts and feelings; as equally with aesthetic, neo-romantic fantasy; opposed thus to Zola and Hoffmansthal alike. Instead of the Impression received from without we have now Expression of the inward self. Instead of transcribing some trait of nature that awakens a certain state of feeling, we have relief of the spiritual tension that conceives all concrete things as signs and symbols devoid of separate meaning and even of incidental help towards the better recognition of the outward world. Instead of being the humble interpreter of any outer thing, the artist's idea now absorbs the object in order that he may free himself from its tyranny and find his own salvation in the Idea. Instead of pleasure in the object, pleasure that enlightens or transfigures, there is now torment from which respite must be won if life is to be borne. Eternal circumstance yields to the eternal act; the cool observer to the ardent believer and worker in a holy cause; the poet to the political leader; description and eloquence to pathetic appeal, even to the scream of pain. Earth and nature yield to Spirit, to the All, to God; positivism to metaphysics and rationalism to the irrational; logic to mysticism, understanding to use, potential ability to active will and decided opinion; form to matter; society to community, the logical and psychological man to the inspired. In short "I" yields to "You" and "One Another;" the mistrusting mood to the trustful. For: "Man is good;" "Man is the centre of his world;" "With man the world begins."

In the history of ideas the new sweep of tendency is thus a variety of those foaming, overflowing movements known in Germany as "Sturm und Drang" or "romanticism." Chronologically, it is the expression of the inevitable change from one generation to another. This new art had, indeed, leaders older than itself; but in the main it manifests the spirit of the New Youth—its will to live, its urge towards artistic creation.

The generation born between 1880 and 1890 or later breaks clean away from its predecessors born in the 'sixties or thereabouts. But what this fresh generation feels, and means to prove, is that its break with the immediate past is something fundamentally different from the new departures of 1880 or 1840 or 1800. This artistic revolution stands out against the world's more profoundly significant background. It begins with a far different spiritual atmosphere—itself only one aspect of a whole world's violent moral crises. Before this, the revolts of Youth against Age were familiar enough, but really meant bolder advance on lines marked out by the fathers, and by the forebears for 400 years. This time the standpoint is quite changed. It is impossible, says youth now, to link up with our predecessors. Their past is worthless; the present is a disgrace; our task to-day is to "break all bridges and begin again." The naturalistic revolution of its fathers is regarded as a false development by their sons who overthrow it. To them it seems merely the last stage of a process set up a century ago or even four centuries ago, when the epoch of Humanism began to make the world "measurable and ponderable." Now, the aim is to make a new beginning.

The former phase displayed the victorious advance of the natural sciences, their processional entry, as it were, into human life, their permeation of all its knowledge, feeling, thought, activity. The resultant rise of machine-industry and technical resources gave an unparalleled command of nature by man. The young generation proclaims the end of this era in a Europe that went to pieces in the World War. It mocks the so-called mighty achievements which only led to unexampled violations of the spirit. This is why they reject and execrate the idols of science and repudiate its votaries, the brain, the head. This is why they acclaim as prophets the idol-breakers Strindberg and Claudel. This is why they reject the "law of causality" in literature, together with the materialist theory of the soul, and the correspondent psychology. Hence, from their language, they banish logic and sweep away the parts of speech like articles and copulatives, which merely serve logical uses. They rather look to children and savages for instruction in the principles of true and direct existence.

Simple as these principles appear on the one hand, not all the young talents are fully able to adapt them, but, on the other hand, they lend themselves to many varieties of imaginative and reflective creation. There is room not only for the despisers of culture and civilisation, but also for those who, like the "futurists," hope to create a new art by the enhanced employment of all new technical possibilities; room no less for a leading expressionist writer of fiction like Alfred Döblin, who answers the almost fashionable derision of modern science by protesting that the need is for "more and more natural science." Besides expressionism of the Western types there is an Eastern cult; while one school is actively political another is mystical and abstract;

while an international school calls for a new humanity, a German school demands a new German type of humanity. These groups are not susceptible to such clear local distinctions as in painting, where the Munich set of the " Blauer Reiter " stands apart from the Dresden " Brücke " set. The Prague group, with Meyrink, Brod, Kafka and Werfel, is perhaps more Eastern and mystical, the group assembled in the *Aktion* in Berlin more " activist " and political. But Berlin is also the home of the poets of the *Charon* and of the *Sturm*, the one an essentially Nordic-Germanic cult of metaphysical " expressionism " while the other bears the stamp of abstract internationalism.

The First Phase of Expressionism.—In point of time, the new literary movement falls mainly within the decade 1910–20. It broke through in two main thrusts. With " manifestos " and " radical strophes " the " apocalyptic striplings " led the onset. Kurt Hiller in Berlin gathered adherents into the " Neuer Klub," the " Gnu " and similar associations; he collected their verses in the *Condor* in 1912. Franz Pfemfert welcomed them in the *Aktion*, Alfred Richard Meyer in the *Bücherei Maiandros* and in his *Lyrische Flugblätter*. So Paul Zech in *Das neue Pathos*, Ernst Blass, in Heidelberg, in *Die Argonauten*, Herman Meister in *Saturn*, and he also published in the *Flut* collection a first *Anthology of the Most Recent Belles Lettres*. In Munich two of F. S. Bachmair's periodicals were entitled *Die Revolution* and *Neue Kunst* respectively. But this poetry, especially at first, often betrayed the influence of George and Rilke in form, and still more in rhythm; although, straining out beyond it. Not for nothing were the new periodicals which Dauer began to issue in Berlin in 1910 and 1911, called *Der Sturm* and *Die Aktion*. After these two, the most important periodical of the new school was the Leipzig *Weisse Blätter*, which first appeared in the autumn of 1913. The many-voiced yearnings of the time, their yeas and nays, find their most emphatic, clearest and purest artistic utterance in Theodore Däubler's three-volume epic *Das Nordlicht* (1910), Otto zur Linde's *Collected Works* (1910 *seq.*), Franz Werfel's poems (*Wir Sind*, 1913), the verses of Georg Heym, Georg Trakl, Ernst Stadler, Gottfried Benn, August Stramm, Carl Sternheim's dramatic work, Reinhard Johannes Sorge's *Bettler* (1912) and George Kaiser's *Die Bürger von Calais* (1914). Already at this time, just before the War, a new publishing house on a large scale (Kurt Wolff) was founded in the interests of the new movement; and its collection, *The Newest Day*, gave a first survey of the new art and its chief authors.

The Second Phase.—The second main offensive, opened in 1914 with Walter Hasenclever's play *Der Sohn*, was held up at first by the War. The radical ideas of the new movement suffered under a rigorous government censorship. The *Aktion*, originally a " periodical for liberal politics and literature," became perforce for years a purely literary affair; the *Weisse Blätter*, of which René Schickele became editor in 1915, was issued outside Germany, in Zürich, where it served as a mouthpiece for young writers such as Johannes R. Becker, Albert Ehrenstein, Leonhard Frank, Rudolph Leonhard, Alfred Wolfenstein, Walter Hasenclever, Ludwig Rubiner. The more revolutionary ideas gained ground as the War dragged on, the more violently did the whole movement break through the dams, until the highest flood-mark was reached in 1918 and 1919. The breakthrough was signalled by a host of periodicals, usually shortlived, whose very titles flamed like beacons; and by new publishing firms. Besides the *Jüngster Tag* series, the *Neue Reihe* appeared, containing old and new names. From 1914 on, the breakthrough had visible effect on artistic forms. In lyrical poetry the change comes with J. R. Becker's *Verfall und Triumph* and August Stramm's *Gedichte*. The " analytic " drama of the immediate past gives way more and more to the new form of a " synthetic " series of pictures. Strindberg set the example. Originally lyrical and ecstatic, given to dramatic monologue—for monologue gives relief from the sober, practical methods or crude psychology of the preceding decades—the movement at the same time invaded prose-fiction. So, by the side of the new lyric and dramatic poets —Fritz von Unruh, Reinhard Goering, Paul Kornfeld—we find new novelists like Leonhard Frank, Gottfried Benn, Franz Kafka, Kasimir Edschmid, Alfred Döblin. The years 1919 and 1920 mark the close of an old period and the beginning of a new one. What real progress had been made was shown in the excellent anthologies and collections of this time. In the *Symphonie jüngster Dichtung—Menschheitsdämmerung*, put together by Kurt Pinthus in 1920, the *Anthologie junger Lyrik—Verkündigung*, issued by Rudolf Kayser in 1921; in Ludwig Rubiner's collections of poems *Weltrevolution—Kameraden der Menschheit* (1919) and in the *Novellen an die Zeit—Die Entfaltung* issued by Max Krell in 1921—in all these works an effort is made to assert the real value of the new achievements. A periodical such as *Der Genius*, which attempted to be for the expressionist era what *Pan* had been for the impressionist; such also as the two year-books of new creative and critical literature issued by Alfred Wolfenstein in 1919 and 1920 under the title of *Die Erhebung*—these were partly retrospective. Dramatic pictures like Alfred Brust's play *Die Schlacht der Heilande* or Arnolt Bronnen's *Vatermord* already indicated new developments, as did Wolf Przygode's series, *Die Dich*.[1]

In the period of naturalism, theory and criticism were the creative and directing forces; they created the novel of experience and frank " realism." Now it is otherwise; theory does not direct the work of art, but develops with it. *Charon* poetry preceded the theory of Charonism. Edschmid's famous discussions on poetic expressionism came after the early works which decided him. Kornfeld's studies of inspired man and psychological man appeared after his *Verführung*. The order is only reversed in the eccentricities of the movement, in the purely intellectual experiments. Yet here, as everywhere, will and deed fertilise each other. The most illuminating of the early books dealing with the movement are really those which treat of it in painting and sculpture; as Kandiusky's book on *Das Geistige in der Kunst*, Wilhelm Worringer's *Beitrag zur Stylpsychologie*, *Abstraktion und Einfühlung* and his *Formprobleme der Gotik*. Bergson, with his doctrine of creative development, takes the place of Taine. Siegmund Freud's teaching is greedily devoured; his psycho-analysis, the first real investigation of the soul, replaces the old dogmatism. Others are influenced by one who stands at the opposite pole from Hiller and Rubiner—the Zionist Martin Buber, the champion of every kind of belief in the vitality of myth and the redeeming strength of the soul. Rudolph Steiner's anthroposophic writings also have their effect. And if the new artist asks his hearer to rise to his level, to take a creative part in his work, yet two Austrian philosophers of the older generation, born in 1860—Alexander Meinong and Edmund Husserl—had already laid a scientific basis for these emotional demands in their *Untersuchungen zur Gegenstandstheorie und Psychologie*, in which they exploded the " Empiric bases of our knowledge," their *Ideen zu einer reinen Phänomenologie und phänomenologischen Philosophie* and their doctrine of pure " Wesensschau." Then between 1915 and 1920 appeared the publications which summed up what had gone before and laid down definite aims: Ludwig Rubiner's collection of fiery appeals, *Der Mensch in der Mitte* and his *Dokumente der geistigen Weltwende*, known as *Die Gemeinschaft*, Kurt Hiller's year-books of spiritual policy, *Das Ziel* and Kasimir Edschmid's voluminous collection *Tribüne der Kunst und Zeit*.

The New Lyric.—In the period of naturalism prose-fiction predominated, but in the decade 1910–20, the lyric. The drama is lyrical, and even the novel is steeped in lyricism; despite itself, the influence of the lyric gives it something of the ballad in this decade. As every realist drama bore the marks of its derivation from the story or sketch, so every drama of this period bears the marks of its lyrical origin, down to the very stage directions. The lyric poem itself in this period is generally an endless flow of melody; it is also characterised by a wealth of interjections; it relieves its emotions by an excess of O's, Ah's and How's, suggesting an elemental outburst of dark, shapeless, chaotic forces.

[1] Expressionism apparently began as a secret language for the initiated, but within a few years it had become the fashion, the current jargon of the literary market. Its divine fire, its exaltation and ecstasy were made ludicrous by the " Dada " movement; the artist, the prophet, the creator of values were succeeded by mountebanks who denied all values.

At first calmer, more harmoniously restrained temperaments believed fervently in evolution without end, in a new art not needing to renounce a noble heritage. This faith inspires the work of Ernst Lissauer (b. 1882), Leo Sternberg (b. 1876) and Georg Hadwiger. It is significant that these authors are closely bound up with the ballad and the ballad-mind, that when the War affects them it does so as the fate of the German world, German humanity, as a German war—not as a World War, as the murder of man's image as a whole.

But the thought that a new art can only be won at the price of a frightful world catastrophe, darkly foreshadowing itself in art, breaking in advance all moral laws before shaking the world of the past into chaos—this foreboding it is—shown in images, emotions, rhythms, not yet degraded into lyrics of war or revolution—that gives the poems of George Haym (1887–1912), Georg Trakl (1887–1914) or Ernst Stadler (1883–1914) their peculiar position. These are as yet no agitators; they are still pure poets, prophets; they were broken before the War began, or they broke in its first months. Only a happier star preserved Paul Zech (b. 1881) and Armin T. Wegner (b. 1886) from a similar fate; they too might have been broken by the irreconcilable antagonisms of their experience, pit and forest, country and town, had not a new consciousness of community preserved them. It is this same feeling of community, or the longing for it, that gives the analytic " brain poetry " of Hoddis, Lichtenstein, Boldt, Benn, Lotz and Klemm the strength and light which shines through the verses of the *Aufbruch der Jugend*. The same feeling in the poems of Franz Werfel, who as regards form is by no means always a " new " lyricist, accounts for their effect on a whole young generation, which gives him secure significance by taking him for a model. This is the feeling, enhanced by war and revolution, which fills the verses of Alfred Wolfenstein (b. 1888) and René Schickerle (b. 1883), till in the hymns of Johannes R. Becker (b. 1891), the poet of Utopias, it rises to boiling-point and evaporates. Yet it would be a mistake to suppose that this feeling of community, this creed of " Thou and One Another," is the only element in the poetry of the time. There are lonely brooders, like Else Lasker (b. 1876), Theodor Däubler (b. 1876), Albert Ehrenstein (b. 1886), whose poetry springs from quite other sources. Herwarth Walden's *Sturm* united all lyric poets who repudiate any continuity of thought as inartistic and wish to weld the lyric into a pure linguistic form of vowels and consonants, a pattern of " associated " sounds.

The New Drama.—German expressionist drama does not break quite such new ground as expressionist poetry. It has two models, Franz Wedekind and August Strindberg, and it rings continual changes on their themes. In their works they present the new problems, and at the same time solve these problems in the exemplary manner, whether as spectacular or interpretative dramatists. They create the new acting and the new staging. Strindberg and Wedekind are accepted as masters by many without tradition who cherish a confessed or unavowed longing for moorings and firm anchorage. These are lonely bearers of the message of community; the defeated who yet must seek to save either the world or themselves; the godless who yearn after God; slaves of impulse whose instincts are unsure; beast-men in the grip of dark forces, brain-men who have experienced in their own lives the curse of a purely intellectual estimate of all life; those oppressed by a sense of the meaninglessness of many a life, or of all life, who yet long to find a meaning. The votaries of this world, those who adore flesh and blood, live on Wedekind; those of the world beyond, who worship the spirit, live on Strindberg; but both alike are unredeemed victims following a way of the Cross. Whether calling themselves saints or penitents, they are torn by a torment which drives them through " heaven and hell." It is no mere chance that these latter words are the title of an essentially important work of this time, a play, by Paul Kornfeld.

But besides Wedekind and Strindberg there is a third originating ancestor and an earlier—Georg Büchner (1813–1851), the creator of *Woyzek*, that drama which is nothing but a Way of the Cross, nothing but a view of the world through the soul of a hapless martyr. There is hardly one expressionist drama without the Woyzek frame of mind, the Woyzek characterisation, the Woyzek life-blood. These outlines may suffice to show how inadequate is the term " expressionist dramatists; " how varied can be the world which an " expressionist " dramatist reflects. Halfway between the two periods stands Carl Sternheim (b. 1881). In his hatred of the bourgeois which inspired the comedies *Aus dem bürgerlichen Heldenleben* he is akin to Wedekind; but he despises the doctrine of brotherliness and love of mankind, he is dry and cold, crystal-clear, free from mist, a virtuoso of form, his every word plain and unmistakable. Georg Kaiser (b. 1878), the " cubist " of drama, is as true to form, but you cannot grasp him; the man is an enigma like each of his works.

They seem to come out of some other age than ours and to pass into yet another—creations of impassioned suffering or of pleasure in the " game of thinking," as Kaiser once termed his ideal of drama. What have Sternheim and Kaiser in common, beyond the joy in solid construction? Not even that connection exists between them and another pair, the poet of the blessed ego and him of the accursed ego, the poet of *Bettler* and the poet of *Himmel und Hölle*, Reinhardt Johannes Sorge (1891–1916), that pious disciple of Christianity; and Paul Kornfeld (b. 1889), the young apostle of an all-believing orientalism. Or what have these " philosophic politicians " in common with the real politicians, with Ludwig Rubiner (1888–1920) and Ernst Toller (b. 1893), the author of *Masse Mensch*, or with Reinhard Goering, author of *Seeschlacht* and *Scapa Flow*, or with Fritz von Unruh, the writer of *Louis Ferdinand* and *Ein Geschlecht*, whose whole work is inspired by the desire to show the symbolic meaning of the sorrows of mankind to-day in a myth of mankind future? The young humanity of Walter Hasenclever (b. 1890) revealed in his *Der Sohn*, what has it in common with the other young humanity of Hans Johst (b. 1890) in his *Der junge Mensch?* Or that other again of Anton Wildgans (b. 1881) in his *Dies Irae?* What is the link between the two artists from the sister realm of painting and sculpture, the terrified dreamer Oskar Kokoschka (b. 1886) and " Ernst Barlach " (b. 1870), that seeker after God? Or between legend-writers like Dietzenschmidt (b. 1893) on the one hand and Rolf Lauckner (b. 1887) or Alfred Brust (b. 1891) on the other? We see that expressionist drama, almost more even than the expressionist lyric, is the utterance of an age of confusion: it reflects the death-pangs of one world, the birth-pangs of another.

The New Prose-fiction.—The picture that we gain of expressionist prose-fiction is quieter. The reason is not far to seek; for if " the substance of the age "—all it " holds " of the past, present and future—is more clearly shown here than anywhere else, yet the novel seems alien to the " form of the age," the expressionist style. Expressionism is lyrical compulsion, dramatic impulsion, not epic propulsion. The longing of the age for the images of a new humanity and a new community offers many-sided satisfactions to the novelist. He is tempted to bring Utopias nearer our reach. But in conjuring up the picture of a future world, he forsakes to-day's world of chaos; out of its wreckage he makes a new world by new laws; but, above all, he sees one thing: that the spirit can create no world unless it begs Nature to assist it. Many a modern catchword is shattered by the restrictions of tale-telling art: among them phrases like " pure spirit " or " metaphysical space." There have been only isolated attempts to create pure " brain work." In fact, novelists like Gustav Sack, Kasimir Edschmid, Alfred Döblin, have proved, both by their work itself and by their own pronouncements on it, that they will have nothing to do with narrow-minded antagonism to nature. Certainly their work is no mere passive reflection of nature. Prose fiction of to-day requires scenic description, where life and its circumstances must be represented as in the historical or exotic novel; yet this is not now done at a leisurely length unbroken by action, but by a more concentrated method seizing on the decisive moments when significance springs out of circumstance.

Similarly, the outward and surrounding world is always being absorbed into the world within us; each man creates for himself a new outer world, which is nothing but his own soul projected

into external form, the representation of all its impulses, the laying bare of its inmost secrets. The manner of narration, too, with its terse words and concise sentences, the accents of unrest and agitation—this is the very opposite of the old descriptive mode. The impression which all this gives is heightened by an avalanche of incidents. Events come thick and fast to match the hurrying giddy frivolity of life to-day, a whirling vortex chafing nerve and spirit. The long-starved appetite for material is glutted. We have a variegated cinema-world shown often by a cinematic method in novel-writing—jerky, abrupt, tempestuous, with flickering lights. We may pass by the hangers-on and imitators of the true expressionist movement.

The weary search of this age after a meaning in existence is tragically uttered in the works of the best novelists of Expressionism. Metaphysicians and believers like Max Brod (b. 1884), unbelievers like Gustav Sack (1885–1916) and Gottfried Benn (b. 1886), exhaust themselves in struggles of joy or despair. Kasimir Edschmid (b. 1890) flies to adventure for a firm foothold and plain idea; " Klabund " (Alfred Henschke, b. 1892) ceaselessly changes his phases; Leonhard Frank (b. 1882), author of *Der Mensch ist gut* (a collection of short stories), believes that he can find salvation in a renewed feeling of community. Another, Franz Kafka (d. 1924) sees that in this world there is no salvation, that all we can do is to gain a glimpse of the heaven of another world through the artistry of pure literature. Others again, as " Mynona " (Salomo Friedländer, b. 1871), construct a fabulous realm of new forces and seek to prove that nothing is more fantastical, more like a Utopia than nature. The work of Alfred Döblin (b. 1878) is inspired by the same feeling and leads him to the same conclusion in his romance of the future, *Berge Meere Giganten*, which describes titanic battles between mankind and nature.

The Reaction.—As indicated above, the wave of expressionism reached its height in 1920 and then suddenly broke altogether. After the boundless over-conceit which every revolution brings came a moment when the artist paused to reflect while the public was sobered. Will and deed, claim and achievement, promise and performance had been taken as one. In expressionism men had seen the revolt of the spirit against matter, of liberty against mechanical slavery, of creative force against the receptive mood and formal reason. All this was regarded as a vision of the future illuminating the background of a shattered past. But the course of the political revolution, in particular, showed that new humanity, after all, was subject to the original sin of all existence, the luckless children of a luckless age which lets no man be without devouring him again as a victim. Expressionism, in its latest phase, is usually the tortured outcry of the mangled victims of an age who yet believe themselves its saviours.

It is thus not surprising that literature once more seeks and finds contact again with powers and forces to which artistic teaching just before had denied any importance whether for substance or form. In our survey of the development of prose-fiction we have mentioned the return to nature. In literature, as in all art, there was talk of a " new reality," a " new objectivity," a new kind of literal naturalism. This new realism was termed "Magianism," to signify that it had borrowed essential characteristics from expressionism, and like it satisfied metaphysical needs. The name " Verism " means much the same. Hand in hand with a new reverence for nature goes a new regard for science, even for technique where it is creative. A novelist like Josef Ponten (b. 1883) is struggling, consciously or unconsciously, towards a marriage of science and art. The new task appears to be to spiritualise, elevate, to mythify everything belonging to science and mechanism, and all the characteristic factors of civilisation in our time. In the same way re-arises respect for tradition. The consciousness of a culture, nourished by all ages and peoples, comes to its own again; it finds its highest expression in the writings of Albrecht Schaeffer (b. 1885) whose comprehensive three-volume *Helianth* (1920) is one of those romances of education peculiarly significant in German literature, while his *Parzival* (1920) is one of the equally typical poems of deliverance. But another part of German literature took new blood from new spiritual experience. The all-embracing international love which poets and playwrights, especially of Jewish origin, had proclaimed with particular fervour, was ruthlessly destroyed after the War by the events of foreign and domestic politics. Then writers began again to think of the elemental forces of race and nationality, out of which the super-national, super-temporal always sprang. Finally, a German neo-Catholic school of letters is undeniably growing up (R. J. Sorge, 1891–1916; Dietzenschmidt, b. 1893; Leo Weismantel, b. 1888).

This renewal of substance is accompanied by a revision of form. Here, too, faith in the tranquillising, uniting forces tends to gain the upper hand over faith in revolutionary and disruptive forces. Idiom is becoming fixed; dramatic and epic structure more coherent; the form of the lyric more crystallised. In close connection with the new thinking there is a fresh appreciation of workmanship, of ability, of technical mastery—things laughed at by a yesterday which had forgotten the " how " in its concern with the " what." The development of the novel and the drama show most clearly why the art of the most recent years is tending towards a compromise between naturalism and impressionism on the one side, expressionism on the other. How varied can be the forms of this compromise is shown by the work of novelists like Albrecht Schaeffer, Josef Ponten, Wilhelm Lehmann (b. 1882), Rudolf G. Binding (b. 1867), Otto Flake (b. 1882), Frank Thiess (b. 1890), Arnold Ulitz (b. 1888). A good survey of this modern art of prose-fiction may be obtained from the " Library " of modern stories *Der Falke*, which has been appearing since 1923. In drama the tendency to get lost in Utopian ideals, with the vagueness which often accompanied it, has given way to a method that comes nearer to earth with more sureness and firmness of outline. Where the dramas of Arnold Bronnen (b. 1894), Bertolt Brecht (b. 1894), Max Mohr (b. 1891), Otto Brües (b. 1897), Friedrich Griese (b. 1890), Rolf Lauckner (b. 1887), Hans W. Fischer (b. 1876), Paul Gurk (b. 1880) are in advance of the dramas of the pure expressionists is in their genuine feeling for the theatre itself. In lyric poetry the new purpose and the new faculty are seen in the work of Oskar Loerke (b. 1889), Friedrich Schnack (b. 1888), Anton Schnack (b. 1892), Fritz Walter Bischoff (b. 1896), Ina Seidel (b. 1885 and Ludwig Strauss (b. 1892). The word *World-Inwardness* (*Weltinnigkeit*), chosen by Ina Seidel as the title of a volume of poems, well defines the spirit of the new poetry.

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GERMAN OFFENSIVE (March–June 1918).—After the loss of the battle of the Marne, in Sept. 1914, and the abortive operations which followed it on the Aisne and in Flanders, the German higher command changed the idea which underlay their strategy. In Aug. 1914 their main blow was to be dealt against their strongest adversary, and France was to be crushed before Russia could develop her strength. The decisive victory of Tannenberg had, however, opened their eyes to the rottenness of the Russian Army, and from Oct. 1914 onwards until March 1918 the aim of the German General staff was to hit at weakness in order to isolate their strongest adversary, namely, the French. The series of battles carried out during the first six months of 1916 in the neighbourhood of Verdun was no exception to this crucial strategical idea, since its aim was defensive—that is, its intentions was not to gain a decisive victory in the West, but to dislocate the impending French and British operations and gain time wherein to defeat Russia.

The campaign in Russia, however, dragged on, the same conditions appearing as in 1812—climate, lack of communications and distance rendering every tactical victory abortive. To make up for this delay, in the autumn of 1916 Rumania is selected as the weakest point of attack, and is overrun. A year later Italy is selected, and the result is the Italian débâcle at Caporetto

Simultaneously Russia, to all intents and purposes, disappears as a hostile power, so that by the end of 1917 Germany could once again turn to the task she had abandoned in the autumn of 1914, namely, the defeat of the French now so strongly supported by the British Empire.

The political situation which faced the Imperial Govt. in Berlin was one which demanded a rapid conclusion of the War. Not only had unrestricted submarine warfare failed to produce the attrition expected, but the stranglehold of the British Navy was daily reducing the morale of the German people. Of her allies, Turkey was the only one who seemed to be in earnest. Bulgaria's interest in the War was waning, and Austria and Hungary were worn out, having lost nearly 2,000,000 men in prisoners alone. These conditions demanded immediate and decisive action if the War was to be won before America could develop her strength.

Whilst the Central Powers had been striking at weakness, Great Britain had been engaged in a similar strategy. The stalemate which had been established on the Western Front, and the abortive campaigns which had followed this stalemate, had forced her into seeking a line of least resistance by means of her navy, with the result that, by the end of 1917, a serious dispersion of fighting force had taken place, extensive operations being in progress in Palestine, Macedonia and Mesopotamia, without counting minor campaigns in Africa. Further, the British forces in France had been bled white, the Arras, Messines, Ypres and Cambrai battles having alone accounted for 650,000 men. The general situation was that whilst France had been recovering her strength the British forces had grown steadily weaker. The offensive initiated by Germany on the Western Front in March 1918 is here described as three main battles, namely, I. St. Quentin; II. The Lys; and III. Soissons-Reims.

I. THE BATTLE OF ST. QUENTIN

General Ludendorff, who by now had become the directing genius of the German war brain, was faced by the problem of where the decisive blow should be struck, and determining to strike at weakness he selected the British front for the decisive attack. This front may be divided into three sectors —Flanders, the Bruay area and the country southeast of it between Cambrai and St. Quentin. The first of these was obviously unsuited for offensive action of a decisive nature, as the British operations of 1917 had clearly shown. The second offered an opportunity of striking at the French coal supply, a vital factor, but the front of attack was restricted and difficult. The third included good offensive country, as it consisted of open field land and led to the valley of the Oise, a natural avenue leading to Paris.

Ludendorff's Opinion.—Though Ludendorff writes that "tactics had to be considered before purely strategical objects which it is futile to pursue unless tactical success is possible," a successful attack in this direction would not only isolate the British forces by severing their connection with the French, but, if pushed towards Paris, would jeopardise the line of communications of all the French forces situated east of Soissons. The strategical possibilities of such an attack are therefore closely comparable with those of the original plan of campaign worked out by Schlieffen long before the War. To deliver this blow Ludendorff proposed to muster every available man and gun and further to accentuate the force of numbers by surprise, for the tank attack at Cambrai and Hutier's gas attack at Riga had demonstrated the overwhelming power of an unexpected assault. He saw clearly that the forthcoming struggle would be no light one, and in an audience at Homburg with the Kaiser and the Chancellor he said:—

"The battle in the West is the greatest military task that has ever been imposed upon an army. . . . It cannot be successfully accomplished unless the authorities who conduct the War are relieved of all intolerable shackles, unless the very last man is employed in the decisive conflict, and is animated, not only by love for his emperor and his native land, but by confidence in the strength of the military leadership and the greatness of our country. These spiritual forces must not be underestimated, they are the foundations of the greatest deeds. . . . We must not imagine that this offensive will be like those in Galicia or Italy; it will be an immense struggle that will begin at one point, continue at another, and take a long time; it is difficult, but it will be victorious."

The Opposing Forces.—Between Nov. 1 1917 and March 21 1918 the German divisions on the Western Front were increased from 146 to 192, troops being withdrawn from Russia, Galicia, Italy and the East. By these means the German armies in the West were reinforced by no less than 18,492 officers and 553,794 other ranks. Finally it was decided to make available 62 divisions and 1,706 batteries for the main attack. These troops were carefully trained for mobile warfare on any sector of the French and British fronts, the greatest secrecy being maintained as to the actual area of attack, which extended from the south of Lens in the north to a little south of La Fère.

On the side of the Allies, except for a few miles in the north, this front was held by the III. and V. British Armies respectively, commanded by Sir Julian Byng and Sir Hubert Gough. The front of the III. Army extended from just south of the village of Gavrelle to half a mile north of Gouzeaucourt (26½ m.), and on March 21 was held by 10 divisions in line and seven in reserve. The V. Army front (42 m.) ran from the right of the III. Army to the village of Barisis, a little south of the river Oise, between the forests of Coucy and St. Gobain. On this extended front there were 11 divisions in line and three in reserve.

German Plans.—The plans of attack were issued by the Supreme Command on Jan. 24 1918. The attack was to be carried out by four armies:—

(*a*) XVII. Army (Below), comprising 17 divisions, was to attack on the frontage Gavrelle-Moeuvres.
(*b*) II. Army (Marwitz), comprising 18 divisions, was to attack from Moeuvres to Pontru (north of St. Quentin).
(*c*) XVIII. Army (Hutier), comprising 24 divisions, was to attack from Pontru to Vendeuil (south of St. Quentin).
(*d*) VII. Army (Gayl) was to demonstrate with three divisions against La Fère.

The various attacks were named as follows: XVII. Army, left wing attack "Mars" (south of Bapaume), right wing "Michael I." (north of Bapaume); II. Army, "Michael II.," to the north of the Omignon brook; XVIII. Army, "Michael III.," north and south of St. Quentin; VII. Army, "Archangel," south of the river Oise. The "Michael" attacks were to be delivered on the first day of the battle, followed a day or two later by the "Mars" and "Archangel" attacks. The object of the "Michael" attacks was to penetrate the enemy's front, and then, supported by the "Mars" attack, both were to push on through Peronne-Arras and Peronne-La Fère.

To bewilder the enemy as to the frontage selected for the main attack, subsidiary operations were prepared all along the Allied front, at Ypres-La Bassée, Reims, the Argonne and in Champagne. From March 14 onwards the crown prince was to bombard the enemy's headquarters on his front and make a show of bringing up reinforcements, and Gallwitz was to carry out an attack on Verdun up to the point of engaging his infantry.

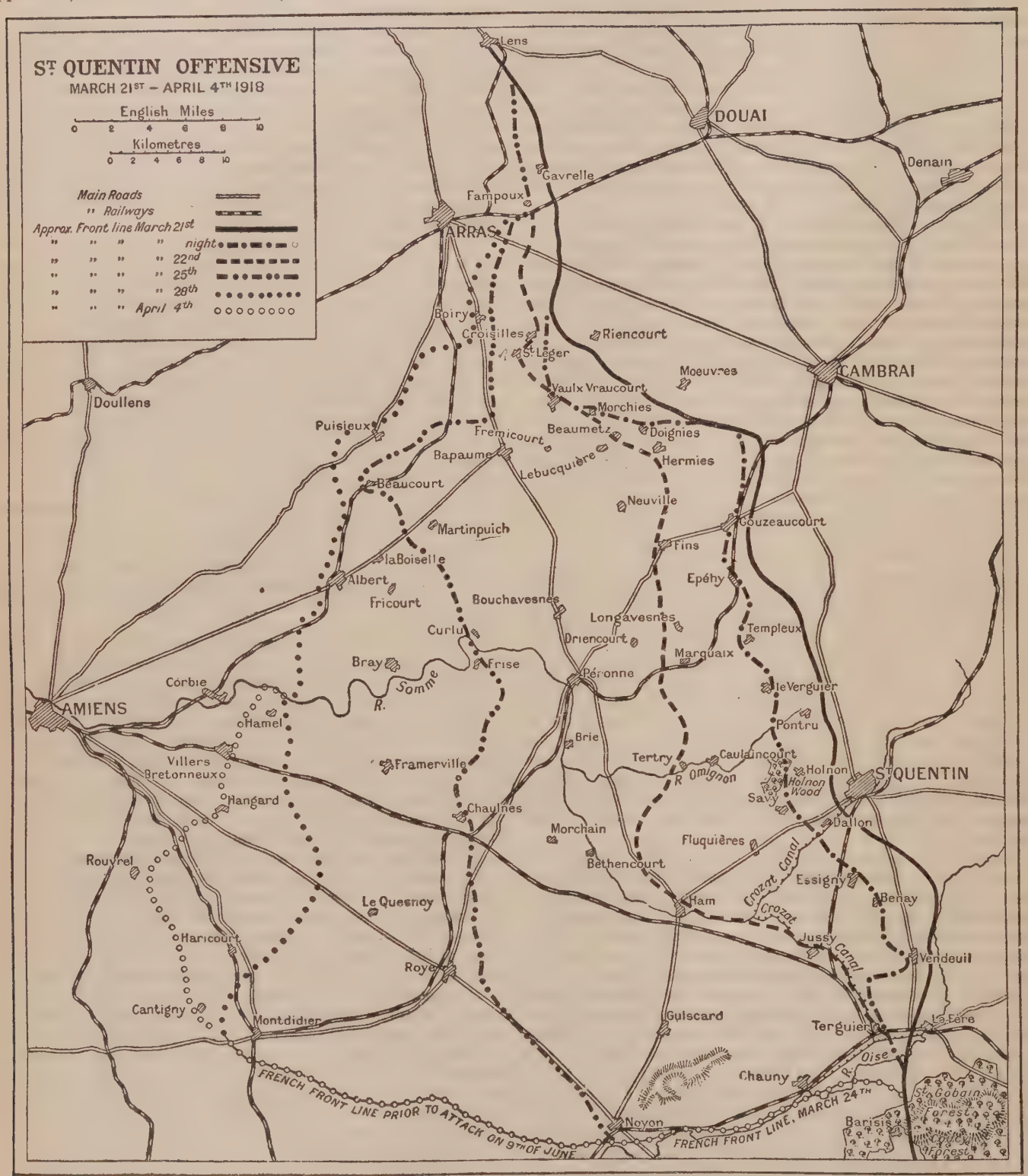
Preparations for the Attack.—The forming up for deployment of the attacking armies was begun on March 10, the divisions being organised in groups normally in a depth of three lines. The first or assault line was made the strongest, and was moved close up to the front on March 20. The second line of divisions was some three to five km. in rear, and the third seven to ten km. behind the second line; this third line was to be held in reserve under the higher command, and was only to be used as the operations developed.

On March 20 all was in readiness for the attack, which was to be preceded by a three hours' hurricane bombardment in which gas was to be employed extensively by the artillery and minenwerfers. By this means it was hoped to paralyse the enemy. On the 20th, however, the wind was at first unfavourable, but by midday conditions had sufficiently improved to permit of the bombardment taking place. It was opened at 3:30 A.M. on the 21st, the Allied batteries being first gassed.

The infantry attack did not, however, take place until 9:40 A.M., when a general move forward was made under a creeping barrage supplemented by low-flying aeroplanes.

March 21.—The attack of the XVII. Army was met by strong opposition, which was accentuated by the fact that the infantry were unable to keep up with the barrage. At Vaulx-Vraucourt and Doignies strong counter-attacks were launched against them, and by nightfall the German divisions had to be reinforced by second line troops. The II. Army advanced to the line Gouzeaucourt-Epéhy-Templeux-Le Verguier, a fierce struggle taking place at Epéhy, which throughout the day remained in British hands. The XVIII. Army was more successful. Its right captured Holnon and Holnon wood; its centre got to Savy and Dallon, and its left captured a part of Essigny and Benay, but was checked a little west of Vendeuil.

On the 22nd the attack was continued with vigour. The XVIII. Army was reinforced and was ordered to advance on Tertry to facilitate the operations of the II. Army, which had outrun its artillery support. The brunt of the fighting fell on the XVII. Army, which attacked the British second line of defence again and again, only to be met by vigorous counter-attacks supported by tanks. Towards the close of the day, but only after having been reinforced by third line units, it succeeded in capturing Croiselles, Vaulx-Vraucourt, Morchies and



Hermies. The II. Army pushed forward to Fins-Longavesnes-Marquaix-Caulaincourt, and the XVIII. Army captured Fluquières and crossed the Crozat Canal between Jussy and Terguier.

From the positions held on the 22nd the XVII. Army advanced on Bapaume and captured Driencourt, St. Léger, Beaumetz and Lebucquière. The II. Army reached the line Neuville-Bouchavesnes-Brie, and the XVIII. Army crossed the Somme at Bethencourt and captured the town Ham.

Between the 24th and the 26th the advance was steadily continued, and on these three days the German front was advanced to the following lines respectively: (*a*) 24th, Chauny—Guiscard—Morchain—west of Peronne—Curlu—Fremincourt—Fampoux; (*b*) 25th, Noyon—east of Roye—east of Chaulnes—Frise—Beaucourt—Boiry; (*c*) 26th, west of Noyon—Le Quesnoy—Framerville—Bray—east of Albert—Pusieux—Boiry.

Ludendorff's Second Plan.—The first great stage of the attack now drew to a close, for not only had British resistance stiffened, but the difficulties of supplying the advancing armies over the old Somme battlefield were so great that it was found impossible to maintain the leading troops. The result of this was that on the evening of the 26th Ludendorff determined on a change in plan. He now decided to separate the British and French forces by wheeling the II. and XVIII. Armies against the latter. The difficulty of supply was, however, too great for this change of front to succeed, consequently on the 27th Ludendorff made a further change. He ordered the XVII. Army to close down the attack, and the XVIII. Army and left of the II. Army to attack the French between the Oise and the Somme. By March 30 this attack advanced the huge pocket which had been found in the Allied front from a little south of Noyon to west of Montdidier, thence through Haricourt and Hangard to the Somme north of Hamel.

Between this date and April 4, further attacks, mostly of a minor nature, extended the pocket from west of Montdidier to east of Rouvrel, thence through Hangard east of Villers-Bretonneux to east of Corbie on the Somme. On April 4 the great battle to all intents and purposes came to an end. The initial success had been great; since March 21 from a base of 74 m. a penetration of no less than 38 m. had been effected; the ground lost in 1916 and abandoned in 1917 had been more than made good, and enormous booty as well as 90,000 prisoners and 1,200 guns had been captured. The British Armies had been seriously defeated, and 20 French divisions had been drawn into the battle; yet, in spite of the fact that 90 German divisions had been engaged, neither the transition to a war of movement nor the separation of the British and French forces had been achieved.

Causes of German Success.—The initial successes of this great battle were due to the length of front attacked; the comparative weakness of the British forces when compared with the length of line held by them; the rawness of these forces due to the losses suffered during 1917 which had been made good by hastily trained troops; and the surprise of the attack itself, for though the British higher command suspected an attack on the fronts of the V. and III. Armies, when the attack was launched many of the reserve divisions were still in the Flanders area. The failure of the battle was due to well ascertainable causes, the two most important being the comparative narrowness of the front when compared with the depth of penetration required in order to obtain a decisive result, and the insuperable difficulty of keeping an advancing front of many divisions supplied. The German front of attack on March 21 stretched from three m. south of La Fère to three m. south of Lens, a distance of about 74 m. and by April 4 the depth of the penetration effected was some 38 miles.

A study of the various pockets formed by frontal attacks throughout the War will show that the depth of penetration was approximately half the length of the front attacked. Consequently, if it was necessary to reach Abbeville, which is about 60 m. from the original German front, in order to effect a separation of the British and French forces, so as to enable a change of front on the line Abbeville-Soissons being made towards Paris, the initial front of attack should have been as least 120 m. in width. Though the German forces were insufficient to attack on such a frontage, had they been sufficient the second factor, namely, difficulty of supply, would in all probability have wrecked their plan.

We thus see that any attempt on the part of the Germans to win the War by an immense frontal attack before the Americans could develop their strength was, as long as the Allies resisted stubbornly, virtually an impossible operation. This by April 4 was realised by the German higher command, for the battle on the Amiens-Noyon front was closed down, save for minor operations south of La Fère, and other fronts of attack were sought, namely, those west of Lille, south of Laon and north of Compiègne, which were attacked on April 9, May 27 and June 9 respectively.

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(J. F. C. F.)

II. THE BATTLE OF THE LYS

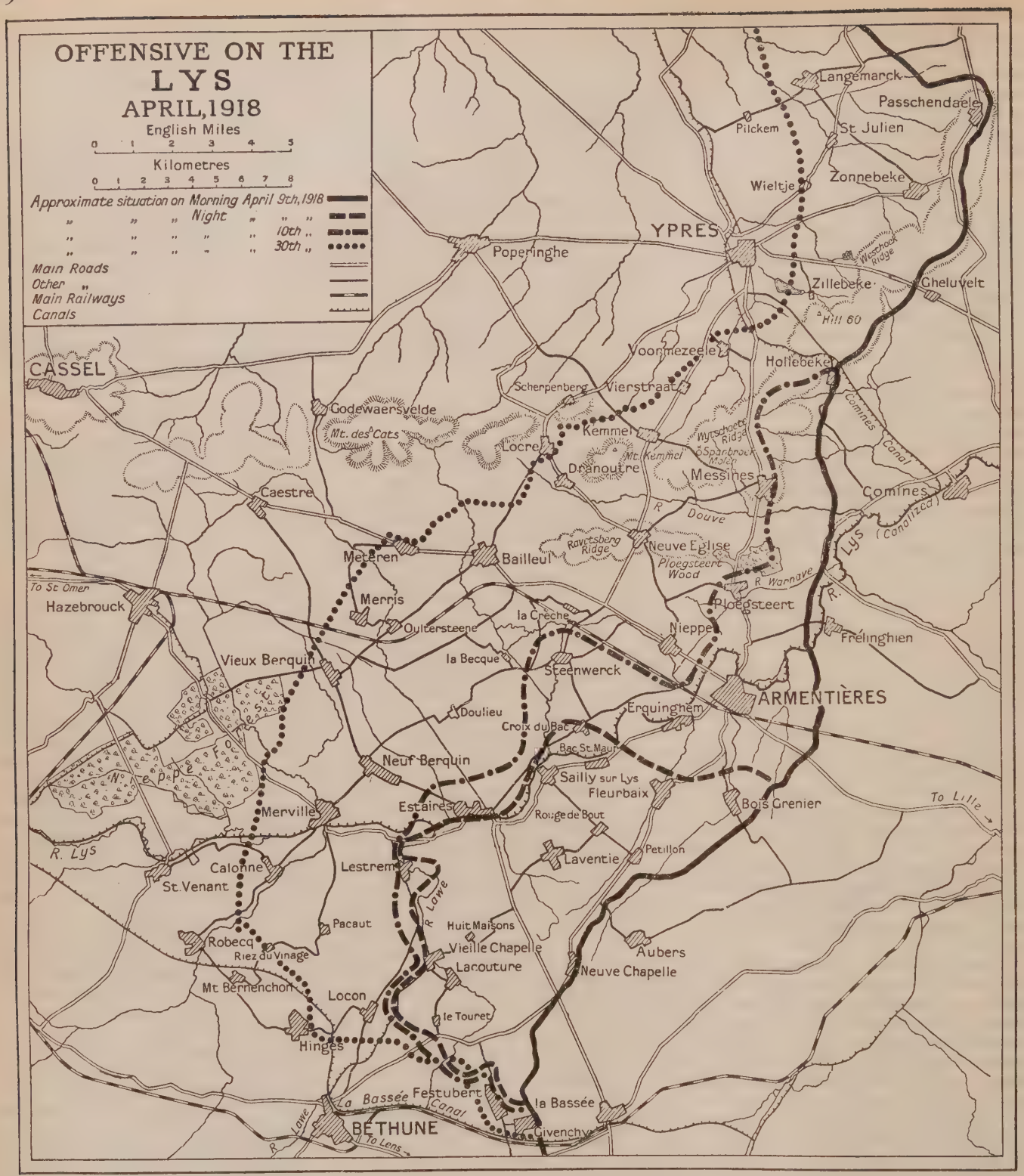
In the general scheme of the great German offensive of 1918, the idea of breaking through the British-Portuguese front in French Flanders was considered by the German High Command. Although this scheme became secondary to the great offensive further south, the preparations for it were carried out, firstly in order to mislead the British and Allied headquarters, and secondly that the Germans might be able to revert quickly to it in case the Somme offensive should come to a standstill.

When on March 30 it became obvious that no further progress was possible in the southern battle area, the German Supreme Command decided to put into effect the Flanders attack, the preparations for which were nearly complete. Although they did not anticipate that they would be able to force a decision in this area, there were certain definite advantages to be obtained from a successful blow in the direction of St. Omer-Hazebrouck and the local situation favoured, in their opinion, the prospect of success. This was to be the second blow struck against the British Army, a great proportion of which had already been employed on the southern front. The main weight of the initial blow was to fall on the Portuguese division, known to be less experienced and of less fighting value than British formations.

The abnormally dry weather gave good grounds for hope that the Lys valley would be practicable, a state of affairs which was not the case till much later in the spring in a normal year. The only lateral lines of communication in this sector of the British zone, other than the coast railway, ran through St. Pol-Lillers-Hazebrouck, and if the use of this could be denied to the British, problems of supply and reinforcement would be immeasurably complicated. It was above all important, in the view of the German Supreme Command, to retain the initiative, and to strike a second blow before the French could organise a counter-attack against the somewhat vulnerable southern flank of the salient which had been created by the success of the Somme offensive.

Plan of Attack.—The general plan of attack was that the main blow should be struck by Quast's VI. Army on the front between Armentières and the La Bassée Canal, in the direction of Hazebrouck. If the VI. Army's attack met with sufficient success, the IV. Army under Arnim was to advance north of Armentières, which was to be made to fall by envelopment, with the eventual object of securing the heights stretching from Kemmel to Mt. des Cats, south of the Ypres-Poperinghe road. If this were achieved the British and Belgian positions in the Ypres salient and on the Yser would be threatened from the rear. The extension of the attack southwards was a secondary consideration, but it was hoped that at least the destruction of the important mining area south of Bethune might be achieved.

Forces Engaged.—The forces available for the operation of the German VI. Army were four corps, from north to south, the Bavarian II. and German XIX., LV. and IV., to which were allotted nine divisions in the first line and five in corps reserve. Three more divisions were retained in army reserve. The sub-



sidiary attack of the German IV. Army was to be delivered by the X. and XVIII. Res. Corps, with three divisions in the first and one in the second line.

The initial blow fell on the left of the I. and right of the II. British Armies, under Sir Henry Horne and Sir Herbert Plumer, the point of junction between which was, on April 9, the Lys, east of Armentières. The XI. Corps (British 55th and Portuguese 2nd Divs.) and the XV. Corps (40th and 34th Divs.) held the front from the La Bassée Canal to the Lys, while the IX. Corps (25th, 19th and 9th Divs.) continued the line from the Lys to the Ypres-Comines Canal. With the exception of the 55th, all these British divisions had already taken part in the southern battle and had been rapidly made up with reinforcements from home. Three more battle-worn divisions were in corps reserve.

The Battle Opens.—At about 4 A.M. on April 9 the battle opened with an intense bombardment of the whole front from Lens to Armentières, with both gas and high-explosive shell. The front trenches were subjected to a rain of high explosive, while battery positions, cross roads, headquarters and railheads far in rear were treated with both gas and high explosive. Armentières itselt and the British position south of the La Bassée Canal were deluged with mustard gas. The foggy morning made observation difficult, and, according to German accounts, the counter-

bombardment was ineffective. Between 8 and 9 A.M. nine German divisions, with ample reserves at hand, were launched against the two British and one Portuguese divisions. In the centre the weight of the attack of the German XIX. and LV. Corps overwhelmed the Portuguese 2nd Div., and both corps advanced steadily towards their objectives. The right of the Bavarian II. Corps was held firmly by the 40th Div., but the left of the Bavarians succeeded in advancing past the right flank of that division. On the British right the 55th Div. held stoutly on to Givenchy and north of that place withdrew slowly from the outpost position to the main line of resistance which ran just east of Festubert.

All available British reserves were hurried up; the reserve brigade of the 55th Div. was employed to form a defensive flank facing north, from Festubert, south of Le Touret to the Lawe. The 11th Cyclist Bn. and King Edward's Horse were rushed up to Lacouture, Vieille-Chapelle and Huit Maisons and by their heroic resistance effectually prevented any extension of the break through to the south. The 51st and 50th Divs. were moved up from the back areas to the river Lawe and the neighbourhood of Estaires respectively. Meanwhile the 55th Div. continued to hold its position at Givenchy and Festubert throughout the day and in counter-attacks against elements of the enemy, which had penetrated into their position, captured over 750 prisoners. The magnificent fight put up by this division completely broke the attack of the Prussian IV. Corps.

On the northern flank of the battle, the Bavarian II. Corps succeeded eventually in occupying the forward posts of the right battalion of the 40th Div., and gradually worked their way northwards. By 10:15 A.M. on April 9 the Bavarians were in Rouge De Bout, some 2,000 yd. in rear of the headquarters of the right battalion of the 40th Div., which was still holding out in Petillon. By noon the division was forced back by pressure in front and flank to a position facing south from Bois Grenier through Fleurbaix to Sailly-sur-Lys. Owing to the rapid advance of the German centre the 50th Div. was unable to gain touch with the 40th, the right flank of which withdrew across the Lys at Bac St. Maur early in the afternoon. The remainder of this division, reinforced by troops of the 34th Div., successfully maintained their line covering the approaches to Erquinghem and Armentières from the south, till the evening.

The Saxon XIX. Corps had rapidly followed up the right of the 40th Div. and about 3 P.M. succeeded in passing small bodies of troops across the Lys at Bac St. Maur. During the remainder of the afternoon and evening the strength of the German force north of the river steadily increased, and they eventually reached Croix du Bac, where they were successfully counter-attacked and driven back by a brigade of the 25th Division. During the night the Germans established themselves firmly on the north bank, in the gap between the 40th and 50th British Divisions.

Renewal of the Attack.—On April 10 the attacks were renewed all along the line. Practically no progress was made by the IV. Corps on the left. It was only just before nightfall that the LV. Corps succeeded in gaining a footing on the west bank of the Lawe between Lestrem and Vieille-Chapelle, and at Lestrem itself. At Estaires the 50th Div. defended itself with great gallantry and inflicted very heavy casualties on the enemy in the street fighting which continued all day. It was only at nightfall that this division was forced to withdraw to a prepared position north and west of the town. East of Estaires the German Corps, which had now got up artillery in support of its infantry and machine guns, pushed back the thin British line to a position north of Steenwerck, where the arrival of reinforcements for a time effectually held up the German advance.

Meanwhile, after an intense preliminary bombardment of the British positions between Frélinghien and Hill 60 north of the Ypres-Comines Canal, the German IV. Army about 5:30 A.M. attacked the British VIII. Corps. The outposts of the 25th and 19th Divs. were driven in and under cover of mist the German X. and XVIII. Res. Corps worked their way up the valleys of the Warnave and Douve rivers on the flanks of the British positions in Ploegsteert Wood and Messines. By midday the village of Ploegsteert, the southeast corner of the wood and Messines had been captured. During the afternoon the German attack succeeded in capturing the outpost position as far north as the Ypres-Comines Canal, but was held up on the crest of the Wytschaete Ridge and in front of Hollebeke by the 9th Division. The South African brigade of the same division retook Messines during the afternoon. This further success of the Germans, combined with the progress made by the right flank of the German VI. Army, gravely imperilled the situation of the 34th Div. which was holding the original line east of Armentières and had not been attacked. A withdrawal to the north bank of the Lys was therefore decided on, and was completed by 9:30 P.M. when the Lys bridges were destroyed.

On April 11 the attack was continued. The German IV. Corps again failed to make any progress between Givenchy and the Lawe river. North of Locon the British 51st and 50th Divs., weakened by continuous fighting, were slowly pushed back by the German LV. and XIX. Corps. The British divisions fought with the greatest gallantry and inflicted very heavy casualties, but bodies of German infantry worked their way through gaps in the attenuated line and by nightfall they had reached Neuf-Berquin and were in occupation of Merville. Further east progress was checked by a counter-attack of the 31st Div., which had arrived from the southern battlefield, but the Bavarian II. Corps pushed forward through Nieppe to Steenwerck. Slight progress was made by the German IV. Army between Nieppe and Messines.

Renewed Attacks.—During April 12 the arrival of reinforcements, mostly from the southern battle front, began to have its effect. The right flank of the British still held firm, but the German LV. Corps, attacking before dawn in the mist, broke through the left centre of the 51st Div., and reached Pacaut and Riez du Vinage, where their progress was checked by two batteries of artillery. The British 3rd Div. had come into action about Locon, which village was lost to the German LV. Corps, but the German advance was checked and their troops suffered heavy casualties. The right flank of the same German Corps was checked in Calonne by the 61st Div., which, like the 3rd, had arrived from the Somme battle area.

Meantime the Bavarian II. and German XIX. Corps attacked in great strength between Vieux Berquin and Steenwerck. In spite of the gallant defence put up by the 29th and 31st Divs. they succeeded in occupying Doulieu and La Becque, forming a gap southwest of Bailleul, which enabled the Germans to seize the villages of Outtersteene and Merris. This gap was eventually blocked by a brigade of the 33rd Div. reinforced by a party of cyclists, a pioneer battalion and by every available man from the local schools and reinforcement camps. Further to the left the 25th, 34th and 49th Divs. maintained their positions against all attacks. During April 12 headquarters of Prince Rupert's group of armies issued orders for the continuance of the attack by the inner wings of the two armies, with the dual objectives of Hazebrouck and the range of hills north of Bailleul. The VI. Army was also to prepare to continue the pressure of their left wing towards Bethune. On April 13 the German attacks north of the Lys were continued with great vigour. On the left, elements of the LV. Corps, which had penetrated into the outskirts of the Nieppe Forest, were driven back by the British 5th Div., which, advancing by two roads south of and through the forest, soon established themselves on a firm line clear of the woods, and finally checked the German advance in this area.

The German XIX. Corps continued to attack the 29th and 31st British Divs., now greatly diminished in strength by continuous fighting, but these formations, reinforced by the 4th Guards Bde., held on with the greatest heroism to their extended lines of nearly 10,000 yards. Except at Vieux Berquin, which was captured by the Germans, who brought up guns to point blank range, those divisions carried out their instructions to hold their positions at all costs and cover the detrainment of the Australian 1st Division. The arrival of the Australians in the evening definitely closed the approach to Hazebrouck. Further northeast a succession of heavy attacks was driven off by the 33rd

and 34th Divs. about Meteren and La Creche. In the early morning the German 36th Res. Div. penetrated with heavy loss into Neuve Église, but before noon they were driven out by the British 33rd and 49th Divisions.

Early on the morning of April 14 the British troops withdrew without interference to a new line in front of the Ravelsburg heights between Bailleul and Neuve Église. The latter village, after intense fighting all day, was finally captured by the Germans by midnight on the 14th. Elsewhere all attacks were repulsed, and the British 4th Div., coming up east of Robecq, between the 61st and 3rd Divs., recaptured Riez Du Vinage with a number of prisoners. On April 15 the German attacks were renewed. By this time their troops had been reinforced by the Guard Res. Corps on the left wing of the IV. Army. The IX. Res. Corps had come in on the right of the IV. Corps, and the Bavarian III. Corps had replaced the Bavarian II. Corps. Heavy attacks developed during the day culminated in the capture of Bailleul and the Ravelsburg Ridge.

British Withdrawal.—On the night of April 15–16 a withdrawal of the British troops from the Ypres salient to a line east of Ypres through St. Julien and along the Westhoek and Wytschaete Ridges was completed without interference. This move had been commenced on the night of the 12–13 by direction of British G.H.Q. in order to set free additional troops, and to forestall any plans the Germans might be entertaining for the extension of the battle front to the north. The withdrawal was well timed, as the Germans were preparing an offensive from the Houthulst Forest, and the preparations were almost complete when the British withdrawal took place.

On April 16 strong local attacks were made at various points on the Metheren-Wytschaete front, all of which were repulsed by the 25th, 34th and 49th Divs., except on the extreme flanks, where both villages, after intense fighting, eventually fell into German hands. On the following day determined efforts to take Mt. Kemmel and to advance on the Meteren-Merris front were repulsed, and the Belgian Army achieved a notable success in defeating a powerful assault against their right flank about the Ypres-Staden railway, in which they captured over 700 prisoners.

Meantime the Germans had been preparing to renew the attack on the British right flank, and on the 18th, after a very intense bombardment, the IV. and IX. Res. Corps advanced to the assault of the British positions about Givenchy-Festubert and Mt. Bernenchon-Hinges. On the British right they penetrated at certain points, but were thrown back by the 1st Div. which had relieved the 55th. Everywhere else they failed to obtain even an initial success, and were driven back with great loss by the 4th and 61st Divisions. For nearly a week the battle died down. On the British right minor operations were successfully undertaken to improve the position of the 4th and 61st Divs., northeast of Robecq, which resulted in the capture of numerous prisoners. In the left centre of the British front French troops, which had been brought up from the south, relieved some of the wearied British divisions, and by the morning of the 21st had taken over the sector between Metheren and Spanbroekmolen.

New German Plans.—During this pause the German Higher Command readjusted their plans. On the 18th the Army Group suggested that the main operations should be abandoned, and it was finally decided on the 20th that further operations should be limited to the capture of Mt. Kemmel on the north, and the villages of Givenchy and Festubert on the south. No success whatever was obtained on the southern flank, but the attacks about Mt. Kemmel led to further bitter fighting.

At 3:30 A.M. on April 25 an intense bombardment was opened on the French and British positions extending from Bailleul to the Ypres-Comines Canal. The main object of the attack was the capture of Kemmel Hill by direct assault on the French, combined with an attack on the British right south of Wytschaete, intended to separate it from the French. The attack was entrusted to the XVIII. Res., Alpine and X. Res. Corps, to which were allotted nine divisions, five of which were fresh. Between 6 and 7 A.M. the German infantry advanced, supported by large numbers of squadrons of battle planes and bombers. After intense fighting they succeeded by 10 A.M. in wresting Kemmel Hill and village from the French, detachments of whom, however, though surrounded, held out till late in the day. The weight of the initial attack on the British front fell on the 9th Div., who inflicted very heavy casualties on their enemy but by midday were forced back to Vierstraat. Further north the 21st Div., after a gallant resistance, was in the afternoon compelled to withdraw to a line Hill 60-Vormezeele. On April 26 the attack was renewed, and many counter-attacks were carried out both by British and French troops, the latter recapturing Locre.

On April 27 and 28 local fighting continued without substantial alteration in the situation. During the night of April 26–27 the salient east of Ypres was further reduced by a withdrawal without interference to the line Pilkem-Zillebeke-Lake-Voormezeele.

Final Attack.—The German final effort took place on April 29. The action started with a bombardment of exceptional intensity at 3:10 A.M. At 5 A.M. powerful attacks commenced against the French and British troops from west of Dranoutre to Voormezeele. After very heavy fighting the Germans gained a temporary success north of Locre, but were driven back by the French troops holding the sector. On the British front the positions held by the 21st, 49th and 25th Divs. were again and again attacked by German infantry, which advanced with great courage in massed formation. The assaulting troops suffered the heaviest losses, but their valour was of no avail. The British artillery and infantry fought with magnificent bravery and this final German effort was repulsed with practically no loss of ground.

Results of the Battle.—Thus ended the battle of the Lys. The second great German offensive had succeeded in penetrating the British front on a front of about 20 m. to an extreme depth of about 12 miles. A large number of towns and villages had been taken and nearly 30,000 Allied prisoners and 450 guns had been captured. But the attack had failed to gain its main objects. The lateral railway communication between St. Pol and Hazebrouck was still intact, the mining area south of Bethune was safe. Except for the detached hill of Kemmel, the high ground dominating the Poperinghe-Ypres road still remained in Allied hands. A pronounced salient had been formed in the German front which was to cost them dear in the succeeding months. On the other hand, the British had been forced to abandon the almost equally pronounced salient east of Ypres, and with it all the ground which had been gained at so great a cost in the battle of Passchendaele the previous year. The losses on both sides had been very heavy. To achieve these results the Germans had employed 42 divisions, of which 33 were fresh; 25 British divisions were employed, of which only eight had not been engaged in the battle of the Somme.

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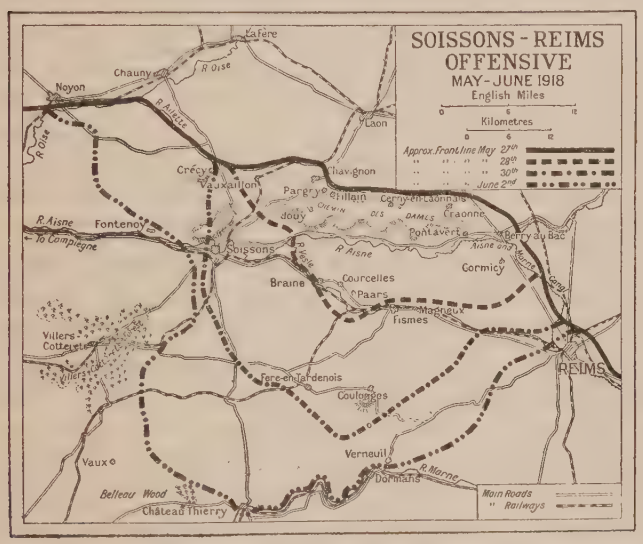
III. THE BATTLE OF SOISSONS-REIMS

After the relative failure of the German offensives of March and April it was incumbent upon the Germans, if they wished to preserve the initiative, to deliver another powerful blow without delay. The choice of the front of attack and the battle-ground fell on the oft-contested chain of heights between the Ailette and the Aisne, the Chemin-des-Dames.

Dispositions for the German Attack.—The German Supreme Command had decided to attack with the VII. and I. armies from the district southwestward of Laon—southwards of Berry-au-Bac in the direction Soissons-Fismes-Reims. If this attack proceeded favourably it was to be prolonged on the right over the Ailette to the Oise and on the left as far as Reims. Simultaneously an attack by the XVIII. Army was to be prepared westwards of the Oise with its centre of gravity in the direction

of Compiègne. The German Supreme Command hoped that the push southward would succeed in reaching the neighbourhood of Soissons and Fismes, and by this means attract strong forces from Flanders, so that it might be possible to continue the attack there according to plan. The army group under the Crown Prince Rupprecht was to remain purely on the defensive. On this front, as on other sections of the Western Front where attack was not intended, feigned preparations for attack were to be made.

Preparations began about the middle of May. The VII. Army under Böhm was charged with the main attack across the Chemin-des-Dames, the I. Army under Below with the neighbouring attack on the left, and the XVIII. Army under Hutier with the attack in the direction of Compiègne. The right wing of the main attack, the LIV. Corps and the VIII. Res. Corps, had the task of pushing forward in a southwesterly direction on both sides of Soissons. The XXV. Res. Corps was to make its way on both sides of Cerny-en-Laonnais direct towards Braisne, and on the east to take as much country as possible towards the south; the IV. Res. Corps was to attack the " Winterberg " (*i.e.*, the height



at the eastern end of the Chemin-des-Dames, immediately north of Craonne) with the main force and advance farther in the general direction of Fismes; in concert with this on the left the LXV. Corps was to occupy with its left wing the river bend north of Berry-au-Bac. Of the I. Army at first only one corps, advancing simultaneously with the VII. Army, was to throw the opposing forces over the Aisne-Marne canal. The corps was to provide itself with bridgeheads in order to take the heights of Cormicy if the attack of the VII. Army proceeded favourably. A further attack to the right of the main attack was prepared by the VII. Corps of the VII. Army, which was to push forward over the Ailette, making its way in a southwesterly direction towards the Oise. The number of divisions taking part in the attack was 41.

For success there were two essentials: the first, surprise; and the second, effective artillery preparation. Most elaborate and thorough precautions were taken to secure secrecy. As regards artillery preparation the ascent of the steep slopes on the heights of the Chemin-des-Dames was only possible if the Germans should succeed in silencing the bulk of the opposing guns. All registration was to be abandoned in order to surprise the enemy as much as possible. The first aim was to be a thorough gassing of the Allied position right down into the Aisne valley. Preparations were completed by the evening of May 26 1918.

In the night of May 26–7 at 2 A.M. the German artillery bombardment began, completely surprising the French and English. The whole valley of the Ailette, the steep slopes of the Chemin-des-Dames, the Chemin-des-Dames itself, and the country lying far behind down to the Aisne, were in a short time thoroughly gassed. After an hour and a half's bombardment, the opposing infantry and artillery were sufficiently subdued to enable the German infantry to venture the assault.

The Infantry Attack.—At 4:40 A.M., while it was still dark, the German infantry advanced to the attack. Without difficulty or delay they crossed the Ailette valley, which was covered with bushes in some places and marshy in others; during the ascent to the Chemin-des-Dames serious infantry fights only developed at Chavignon, Pargny and Fillain; on the other sections of the front the German infantry pushed forward almost without resistance on to the heights of the Chemin-des-Dames. Here the remarkable effect of the artillery preparations was already apparent; the steep slopes had been surmounted and the first lines were taken almost without firing a shot. By 7 A.M. the I. Army had already reached the canal, and part had crossed it. Since they were to await the left wing of the VII. Army before further advance, a halt had to be made there, and the opposing army gained time to reform their units and to rally, while those in front of the VII. Army were overrun by the advance of the attacking divisions so long as they felt the effect of overwhelming German artillery fire. This was an essential difference between the attack of the I. and VII. armies, and was to be of decisive importance. By 9 A.M. the German infantry had reached the line Vauxaillon-Jouy-Pontavert-Berry-au-Bac.

Soon after 11 A.M. the first German companies crossed over to the southern bank of the Aisne on bridges mostly intact. A vast and unexpected success had been gained. A wide and apparently impassable stretch of country, which had been for years the scene of the heaviest fighting, had been captured within a few hours after a short artillery preparation. Of the divisions of the defenders two English and three French had almost ceased to exist. The survivors streamed into the prisoners' collecting stations, while countless guns stood abandoned in their positions, some of them undamaged. In the afternoon and evening the attack on the principal fighting front of the VII. Army went forward without a pause farther in the direction of the Vesle valley. Engineering and road-making troops worked with the utmost effort to level a path for the columns following through the enemy positions and over the steep way up to and down from the Chemin-des-Dames. On the two wings the advance was considerably slower. The Vesle was reached by the XXV. and IV. Res. Corps, and sections of the XXV. Res. Corps passed southwards of Courcelles and Paars, while sections of the IV. Res. Corps occupied the steep slopes at Fismes and Magneux. On this very first day of fighting the Germans had penetrated the enemy positions over a front of about 60 km. to a depth of about 20 kilometers. Over 15,000 prisoners and vast army supplies had been taken. The German losses were proportionately small.

Allied Resistance Increases.—The second day of the battle, May 28, saw the first violent counter-attack of the opposing army against the right flank of the German attacking troops. Nevertheless the speed of the German advance was not lessened on this day. On the right wing the LIV. Corps, after repulsing French counter-attacks, captured the heights north and northeast of Soissons. On the left the German divisions pressed forward until midday, over the whole sector of the Vesle, as far as the northwestern fort of the fortress of Reims. The objective was thus reached after a day and a half's fighting. But in the ardour of the pursuit the troops stormed on without orders, though in agreement with the intentions of the Higher Command, in order to improve their success by determined pursuit. The order given by the Supreme Army Command at noon of the 28th to continue the attack as far as the line of heights southwest of Soissons-Fère-en-Tardenois—the heights south of Coulonges—reached the troops when they were already storming forwards. On the right wing of the VII. Army, the VII. Corps had already joined the attack on May 28 without waiting for the completion of the preparations begun at this point. Here, however, the resistance was so obstinate that it was only in the course of May 29 that the dominating heights at Crecy-au-Mont were captured.

On the following days the VII. Army pushed on with its centre in a southern direction as far as the Marne. The right wing of the I. Army, which had extended the attack towards Reims on the left, pressed forward between the Marne and the Vesle against the wooded hills of Reims, but soon met here with unconquerable

resistance. The right wing of the VII. Army took Soissons, and between the Aisne and the Marne gained ground towards the heights southwest of Soissons, and up to the eastern edge of the Forest of Villers-Cotterêts. On the 29th the occupation of the important road and rail centre of Soissons as well as of Fère-en-Tardenois was of tactical importance. In both places immense masses of material fell into the hands of the Germans. On the left wing all the roads and railways leading from Reims to the Marne lay under German fire.

French Counter-attacks.—On May 30 violent counter-thrusts by the French had held up the advance of the German right wing, while the German centre in a rapid advance had by midday reached the heights of the northern bank of the Marne between Château-Thierry and Dormans. On both days the pursuing German troops had passed beyond the objectives fixed by the Supreme Army Command, so that they reached the Marne earlier than had been thought possible. A further advance of the centre, pushed out southward like a wedge, beyond the Marne, seemed to involve great risk so long as the German wings on the east and west had not won further ground and thus been able to broaden the base of attack.

On May 31 instructions went out from the Supreme Army Command not to penetrate farther south over the Marne, but to extend the successes against the wooded heights of Reims and up the Marne towards the west in the direction of Villers-Cotterêts. On May 30–1, and particularly in the first days of June, strong counter-attacks were made by the French and later by the Americans. In the first days of June the fighting became steadily more severe, as the Allied resistance grew more obstinate and the counter-attacks progressively more violent and extended. The Germans therefore succeeded in gaining only little ground. The powerful impetus of the German attack had come to an end. On June 17 the German armies stood with their right wing and centre roughly on the line Noyon-Fontenoy, the eastern edge of the Forest of Villers-Cotterêts, Château-Thierry, and up the Marne to Verneuil; the left wing had penetrated to the outlying woods west of the wooded heights of Reims, and close to the west, north and east front of Reims, which was closely encircled.

Results of the Battle.—The tactical result of the battle of Soissons-Reims for the Germans was great beyond all expectation. Over 65,000 prisoners fell into their hands. The booty included about 700 guns and 2,500 machine-guns; in addition, the French and English losses in *matériel* were enormous. But there was a reverse side to the shield. The battle had brought home to the Germans that not only were there American troops now on the Western Front but that they possessed a fighting capacity and quality not hitherto suspected by them. The first notable appearance of American troops was at Cantigny on May 28. Here the American 1st Div., in taking and holding the village against the best efforts the Germans could make, had proved itself absolutely dependable. And within a few days the 2nd Div. had shown itself, in front of Château-Thierry, at Belleau wood and Vaux, to be a first class fighting unit. The conduct of these two divisions did much to hearten the Allies, whose morale had been somewhat depressed by the series of German successes since March.

The extent to which the fighting of the Americans impressed the Allied generals can be gauged from the change of opinion as to how best these reinforcements might be employed. For a time it had been thought that it would be too much to expect that America could produce, without a long probationary period, commanders and staffs capable of handling large bodies of troops in action under modern war conditions. By the end of June it was clear that American commanders and staffs were eminently competent to direct divisions in any battle. Early in July the American I. Corps took over a sector from the French VI. Army, a step amply justified by the resistance offered by the Americans at Château-Thierry in the middle of that month.

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(F. E. W.*)

GERMANY (*see* 11.804), a Republic of Central Europe (Das Deutsche Reich). The German Empire, formed in 1871, included 26 states: the states of the North German Confederation, the South German states and Alsace-Lorraine. Until 1918 Germany retained this form unchanged, having an area of about 208,830 sq. m. and a population (1910) of 64,925,993 (estimated population, July 1914, 67,800,000).

I. AREA AND POPULATION

In Nov. 1918 Germany became a republic, and her states free states and, later, under the Constitution of Aug. 11 1919, territories of the German Reich. There are now 18 of these territories in the Reich, viz.: Prussia, Bavaria, Saxony, Württemberg, Baden, Thuringia, Hesse, Hamburg, Mecklenburg-Schwerin, Oldenburg, Brunswick, Anhalt, Bremen, Lippe, Lübeck, Mecklenburg-Strelitz, Waldeck and Schaumburg-Lippe. Under the Treaty of Versailles (Jan. 10 1920), Alsace-Lorraine was returned to France with validity from Nov. 11 1918; large areas in West and East Prussia, Pomerania, Posen and Silesia fell to Poland; portions of Schleswig-Holstein to Denmark; a small province of Upper Silesia to Czechoslovakia; Eupen and Malmédy to Belgium; the town and area of Danzig became a free state, and the Memel region was allotted to Lithuania. Germany's outline was thus changed, particularly in the east. Part of Germany, consisting mainly of East Prussia, was severed from the remainder by the "Polish Corridor" to the Baltic. The Rhine became to some extent the Franco-German frontier. Direct communication with Russia was cut off by Poland and the border states. Germany's present area is 186,517 sq. m.; it is bounded, W. by Holland, Belgium, Luxembourg and France; S. by Switzerland, Austria and Czechoslovakia; and E. by Poland and Lithuania.

This area had a population of 59,800,000 in 1919. On June 16 1925 the population was 63,250,000 (including the Saar valley, where however the census was not taken). There has been a steady increase in the density of population in Germany from 123·1 to the sq. km. in 1910 to 133·2 in 1925. Apart from the three city states of Hamburg, Bremen and Lübeck, Saxony is the most densely populated area (332 persons to the sq. km.); then Hesse and Baden. The least densely populated are the agricultural territories of Mecklenburg, Waldeck, Oldenburg and Bavaria (97 persons to the square kilometre). Prussia, with 120, is not far below the average for the Reich.

Increase of Urban Population.—In 1871 17·4% of the population lived in towns of more than 10,000 inhabitants; in 1925, 46·1%. The 45 towns with over 100,000 inhabitants absorb 16,500,000 or one quarter of the total population of Germany. The trend towards the towns is identical with the trend towards the workshops. This was specially noticeable during the years 1914–8, when internal migration assumed enormous proportions, being directed away from those places where the conditions of war had restricted production towards the centres of increased production arising out of war requirements. After the signature of the Armistice, there were extensive movements of population, still governed by prospects of production and therefore of wage-earning. At the same time rural districts experienced a not inconsiderable increase in population, as did also the coal-mining districts, the region of the Ruhr, Upper Silesia and the lignite districts, on account of the coal famine and consequent increase in production. In 1926 Germany was in the midst of a new shifting of the population, caused by the excess of coal and the attempt to put industry on a sound footing; this movement would be more pronounced but for the housing shortage.

The proportion of foreigners speaking their own language is now very small. There are many Germans outside the boundaries of the Reich. The contiguous wholly or partly German-speaking areas of Europe cover 15 states and include over 80 million Germans. The present area of the German Reich contained 38·1 million Evangelicals and 19·3 million Catholics in 1910. For figures of emigration and immigration *see* MIGRATION.

The birth-rate from 1870 to 1900 was consistently high (36·8 to 42·6 per 1,000). About 1·8 million children were born alive each year. The average annual surplus of births over deaths was approximately 600,000. The death-rate was also high, fluctuating during 1870–1900 between 21·7 and 31·0 per thousand. From 1900 onwards the birth-rate steadily decreased, and in 1914 it was only 26·8 per 1,000 of the average population. The death-rate declined from 23·2 per 1,000 in 1900 to 15·8 in 1913, and infant mortality from 207 per 1,000 infants born alive fell to 151. From the middle of 1915 the birth-rate dropped rapidly, and reached its lowest point in 1917, namely 14·4 per 1,000 of the population. In this year only 912,109 children were born alive. The rate of mortality rose during the same period owing to the War and the blockade. The highest death-rate was in 1918, when it rose to 25·2, assisted by the influenza epidemic. After the Armistice, the birth-rate began to recover. In 1920 it stood at 26·7, but then fell steadily until in 1924 it reached 21·1. The rate of mortality improved, once the blockade had been removed and the population were again able to obtain adequate nourishment. In 1921 the death-rate stood at 15·6 and sank again to 12·9 in 1924. The year 1925 brought further improvement.

The rate of births and deaths was as follows:—

Year	Total Births (inclusive of still-births)	Deaths (inclusive of still-births)	Still-births	Per 1,000 of the population	
				Births (inclusive of still-births)	Deaths (inclusive of still-births)
1900	2,060,657	1,300,900	64,518	36·8	23·2
1910	1,982,836	1,103,723	58,058	30·7	17·1
1924	1,311,044	802,166	42,502	21·1	12·9

Infant mortality, which in 1913 was 151 per 1,000 born alive, was 131 in 1920 and 108 in 1924. See *Statistisches Jahrbuch des Deutschen Reichs* (Berlin, annual). (W. Gr.)

II. CONSTITUTION

From the Old Reich to the New.[1]—In the German Empire (Reich) the supreme authority was vested in the King of Prussia as German Emperor, the Imperial Chancellor (appointed by the Kaiser) as president of the Government, the Federal Council (*Bundesrat*) representing the individual states, and the National Representative Assembly (*Reichstag*) representing the nation. The states—kingdoms, duchies, principalities and free states—had retained their sovereign rights, which they exercised in a twofold manner: first, in internal politics, by maintaining their own diets or councils, and secondly through the Bundesrat, which, both in accordance with the rules of the Constitution and in practice, had a greater influence on the policy of the Reich than the Reichstag. Prussian hegemony in the Reich was not laid down as a principle of the constitution but was a natural consequence of the disparity in size of the states.

When the new Germany was constituted in 1919, the union of German-Austria and Germany was made impossible by the treaties of peace. This being so, Prussia's natural hegemony in Germany could be avoided only by the formation of a unified Reich or by the division of Prussia into a number of provinces equal in size to the other territories. But when the Constituent National Assembly was elected on Jan. 19 1919 the question of a unified or a federal constitution was overshadowed by other problems. The Communist party and a section of the Left Socialists regarded this election and the demand for a constitution by the other political parties as bourgeois opposition to a dictatorship of the Councils, and the Communists refrained from voting. The 185 Socialist deputies, who, like the Communists, stood for Centralism, were the strongest party, but could only form a majority with the help of the 75 Democrats, and, even so, they would have opposed to them the German Nationals (44 deputies), the German People's Party (19), the Catholic Centre (91) and the seven deputies of the small Agrarian parties. The Socialists and Democrats were obliged to join hands with the third great Republican party, the Catholic Centre, and thus there arose the so-called "Weimar coalition," supported by 329 deputies and over 23,000,000 votes, leaving out of account the Left Socialists, who still cherished hopes of a dictatorship.

The scheme for the new constitution was drafted by Dr. Hugo Preuss, former Secretary of State and at that time Minister of the Interior. It was then reconstituted, by a commission appointed by the territorial Governments (*Staatenausschuss*), in such a manner as to strengthen the position of the individual territories in relation to Preuss's unified Reich. In a special committee of the National Assembly, Erzberger, the actual leader of the Centre, went over to the side of those who advocated a strong central power for the Reich, and a resolution was passed which gave to the Reich the financial authority which had hitherto rested principally with the territories (art. 8). On Aug. 11 1919 President Ebert proclaimed the Weimar Constitution.

The Democratic Republic.—The preamble to the constitution lays stress on the fact that the German people has given itself this constitution as by sovereign right:—

[1] The words *Das Deutsche Reich* were, before the revolution of Nov. 1918, invariably translated "German Empire." But the word *Reich* has, for historical reasons, been retained by the German Republican Commonwealth as its official territorial and political designation. *Reich* is an old Germanic word found in Early and Middle English, and surviving in composition in the word bishopric. (Ed. *E.B.*)

The German nation, united in its peoples (*Stämme*) and inspired by the determination to renew and to establish its Reich in freedom and justice, to promote peace at home and abroad, and to further social progress, has given itself this constitution.

Between a monarchy and a republic there was no longer any choice. The choice lay rather between "direct" and "indirect" democracy.

"Direct" democracy is seen in the election of the president of the Reich by the most extended form of franchise in which "the whole German nation" takes part,[2] and in the Referendum which, however, is only admissible in the case of an adverse vote by the whole nation on a draft or a bill passed by the Reichstag [Initiative or Demand of the People (*Volksbegehren*), and Decision of the People (*Volksentscheid*), art. 73–6].[3]

"Indirect" democracy, on the other hand, is seen in the Reichstag, which has only one chamber, elected by the people entirely on the basis of proportional representation and with *scrutin de liste*,[4] that is, according to the party lists. No by-election takes place during the legislative period. The men at the head of the party list are replaced, when they go, by the men below them (art. 53, 54). The Ministry, which is nominated by the President of the Reich, must possess the confidence of the Reichstag; and, as the Reichstag is elected for a term of four years, and as a presidential election a national vote of censure or dissolution of the Reichstag only rarely occurs, German democracy is far more directly parliamentary than the Swiss or North American, both of which are frequently named as its models.

The President of the Reich may, after obtaining the countersignature of the Chancellor or other competent minister, dissolve the Reichstag, though such an expedient would of course only be resorted to in exceptional cases. Not only can the Reichstag force the Ministry to retire by a vote of no-confidence but, with a two-thirds majority, can submit to the nation a proposal for the deposition of the President (art. 43). A hundred members of the Reichstag can impeach president, chancellor or minister for having culpably violated the constitution or a law of the Reich. Judgment is then given after regular proceedings at law by a special Supreme Court (*Staatsgerichtshof*) (art. 59), not to be confused with the Supreme Court which sits at Leipzig.

The Reich and the Territories.—Of the 26 states which constituted the old Reich, 18 now (1926) remain and are called territories (Länder). The constitution prescribes a republican form of Government, but in other aspects the territories determine their own constitution, some of them having their own presidents. In their Parliaments the majority lies frequently with those parties who belong to the Opposition in the Reichstag. This is particularly the case in Bavaria where, since 1919, the Bavarian National party, belonging to the Right, has had a majority and forms the Government—and temporarily in Saxony and Thuringia, where in 1926 the Left Socialists and Communists held the majority.

The territories are represented in the central Government by the Council of the Reich (Reichsrat), to which their Governments (not their Parliaments as the Preuss scheme prescribed) send representatives. Each territory has at least one vote, but no one territory can have more than two-fifths of the total votes. In any case the number of votes is regulated according to the population (art. 61). Out of the 26 Prussian votes half are assigned to the Prussian provinces (of which Berlin is one) which are thus placed on the same footing as the other territories. On account of the peculiar majority regulations[5] in the provincial diets, these provinces sometimes vote against the policy of the Prussian territorial Government.

Unlike the old Federal Council (*Bundesrat*), the Reichsrat has no direct part in legislation.[6] The Government of the Reich lays its

[2] Hence the expression "plebiscitary president."

[3] President and people may also work hand-in-hand, as when the president lays a bill that has been passed by the Reichstag before the people's referendum (*Volksentscheid*).

[4] The list is chosen, not the single deputy. In each electoral district as many seats are allotted to the list as the number of times by which the number of votes cast for that list is divisible by 60,000. Remainders are worked out in two ways: either by associating the lists within the electoral districts or by crediting the remainder to the Reich list of the party; here again 60,000 votes are necessary to elect a deputy.

[5] A candidate, in order to be elected, must have received one more than half of the number of votes cast.

[6] Still less does the Economic Council of the Reich (*Reichswirtschaftsrat*) possess legislative powers. It consists of representatives of the employers' and workers' organisations and of economists. The Government is obliged to consult the Council before placing social and economic bills of fundamental importance before the Reichstag. The Council can itself prepare such measures and bring them before that body (art. 165).

bills before it in the first instance, but if the Council reject them they can still be taken to the Reichstag. The Council also has the right to veto bills passed by the Reichstag, but this, again, can be overridden by a two-thirds majority in the Reichstag.

In respect of legislation, the competence of the Reich *ipso facto* excludes the competence of the territories in such important spheres as foreign affairs, migration, the army, commerce and communications (art. 7). Taxation is almost entirely administered by the Reich: citizenship, penal laws and legal rights were administered by the old Reich for all Germany, likewise the social laws. Of these, education alone was left to the territories, but now the Reich is concerning itself with that also.

In administration the territories take a larger part. Their Governments are still allowed to nominate the greater number of the officials of the so-called interior administration. The appointment of the revenue officials has, however, been taken from them since Erzberger's reform of the finance department of the Reich, and the Reich has also taken over railway administration, while the post office officials were, with the exception of Bavaria, already under the Reich.

The Reich has power to coerce the territories (art. 48). If they fail in their duties to the Reich or endanger its safety by disturbances in their areas, the President has power to take up arms against them and temporarily to suspend their territorial constitutional rights ("Federal execution"). The Reichstag may insist on the repeal of such measures if it disapproves of them.

The Constitution and Foreign Affairs.—Accepted principles of international law have in Germany the force of laws of the Reich (art. 4). Decisions on war and peace can only be taken subject to a law of the Reich. Alliances and treaties with foreign states require the consent of the Reichstag (art. 45, sections 2, 3). The president of the Reich appoints the officials of the Foreign Office, in the same manner as other officials, with the countersignature of the Chancellor or the Foreign Minister. In the case of ambassadors and attachés the President may claim a personal right of choice. Thus President Ebert associated himself in the selection of new candidates for nearly all the important diplomatic posts after the World War. The Reichstag Committee for Foreign Affairs is permanent (art. 35).

The First Five Years of the Constitution.—The constitution stood the test of its difficult early years well. It gained in the general esteem by the effective use that was made of armed force (placed in the hands of the Government by the constitution) in various emergencies. Its reputation was further enhanced by the stabilisation of the currency, and by the fact that the prime mover in this—Dr. Schacht, president of the Reichsbank—was an avowed partisan of the Republic. It was realised that with such a constitution the economic life of the nation could be revived, in spite of the alarming art. 156, giving "authority for the socialisation of the Reich." The article which is most severely criticised, in North Germany especially, is art. 3, which orders that the colours of the Reich shall be black-red-gold; it is significant, however, that the majority of those who cling to the old Reich colours would be willing to accept black-white-red as the colours of the Republic.

The territories demand greater independence in relation to the Reich, particularly as regards the right to levy their own taxes. This demand was definitely formulated in the memorandum of the Bavarian Govt. on the revision of the constitution (Jan. 5 1924).[1] But even Bavaria, the ancient stronghold of federalism, only asks for the revision and not for the suppression of the constitution.

[1] A change in the constitution can only be made by a two-thirds majority in the Reichstag with two-thirds of the deputies present; in the Reichsrat a two-thirds majority is required, and in a referendum or people's decision a majority of the whole electorate, not only of the actual voters.

Two attempts made in the Prussian provinces to create independent territories by means of a plebiscite were defeated by the people themselves (Upper Silesia Nov. 3 1922; Hanover May 5 1924). On the other hand, Saxe-Weimar, Saxe-Meiningen, Saxe-Gotha, Saxe-Altenburg and four small mid-German states have united to form the free State of Thuringia; Coburg has joined Bavaria and Waldeck Prussia.[1]

The franchise and the one-chamber system have been widely criticised. The first presidential election showed that a candidate who had not figured in the first ballot at all might be elected on a relative majority in the second. But this President, though elected by a minority, had after a year in office gained the confidence of an overwhelming majority of the people, though losing, on the other hand, that of a portion of his electors. Similarly, President Ebert, who was elected by the Reichstag and not by the people, owed the strength of his position, even with the parliamentary parties, to the confidence with which his personality inspired large masses of the people. The franchise not only excludes strong action on the part of the people—a "landslide"—but returns the same parties again and again with only a slight alteration in the mandate, with the result that electors become weary and indifferent. By-elections would serve the purpose of indicating to some extent the political feeling that obtains among the people; and, further, as there is no upper house or senate, independent statesmen have no opportunity of voicing the public opinion of the country. Neither is this want supplied by the big newspapers, which are almost all in the employ of definite parties or definite economic groups.

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III. POLITICAL HISTORY

The Domestic Situation 1910–2.—When Th. von Bethmann Hollweg, the fifth Imperial German Chancellor, presented himself to Parliament as Prime Minister of Prussia[2] in Jan. 1910, he enjoyed the confidence of the Conservatives, while the Socialists, Liberals and Catholic centre all opposed him. His bill for the alteration of the Prussian franchise of Feb. 4 1910, which upheld the "three class voting system" and open ballot, was rejected even by the National Liberals, while the Left Wing Liberals branded it as an insult to the very principle of franchise, and it was rejected in May, a coalition of all the non-Conservative parties in the Chamber of Deputies having decided to vote for the secret ballot, while the Upper House rejected it.

In the Reichstag the opposition to the Chancellor was similarly composed of the Centre, Liberals and Socialists. The Catholic Centre was the great patron in Germany of the Polish Catholic minorities in the eastern provinces of Prussia. It therefore joined with the Left in embittered protests when disciplinary action was taken against certain non-political government officials (of the the postal and railway services) who had supported the Greater Poland party in the municipal elections in Kattowitz. The antagonism was the more violent since the Chancellor himself belonged to the Prussian Protestant official class which had used its social status to establish an unwritten monopoly over the higher administrative posts.

If Bethmann Hollweg, later in 1917, was the champion of the "great coalition," extending from the National Liberals to the Social Democrats, and the particular *bête noire* of the Conservatives, it was not he but the situation and the parties that had changed since 1910. He remained throughout a perfectly loyal and devoted public official, but stubborn and dogmatic, and contemptuous of the counsels of the outer world.

Bethmann's position, both at home and abroad, was difficult. The differences over the internal shipping dues had been laboriously composed, but the struggle still troubled the harmony of the confederated Governments. Saxony and Baden, in particular, as the two states lying on the upper courses of the Rhine and the Elbe, felt themselves overreached by Prussia, which, situated at the mouth, sought to abolish the traffic-dues on the great rivers in the interests of her schemes for canal construction. In Bavaria under the new Regent, subsequently King Ludwig III., the Government guarded the particularist rights and the parity of the state with Prussia far more jealously than it had done under King Ludwig II. or the Regent, Prince Luitpold. In the Reichstag, on the other hand, there was already a considerable majority which demanded stronger powers for the Imperial Govt. in its dealings with individual states. It called for the removal of the remaining restrictions imposed upon the Catholic Church in predominantly Lutheran states, and urged the Imperial Chancellor to take action in virtue of his imperial powers to abolish the old constitution of estates still in force in Mecklenburg, which entailed the domination of the great landed proprietors, and to establish a Diet with universal suffrage.

The question of framing a constitution for Alsace-Lorraine was particularly difficult. Those sections in the "Reichsland" most anxious for a permanent association with Germany—the German-speaking Old Alsatians and German Lorrainers, the industrialists and traders, the Centre party, official and university circles—demanded a "Home Rule" under which the Reichsland should become a federal state with full parity of rights, with powers to frame a state constitution by means of a Constituent Assembly, and representation in the Bundesrat proportionate to the population, the people electing deputies to the Reichstag and to the local Diet. This involved the question of the future position of the German Emperor, who had hitherto ruled as *de facto* sovereign, without a Diet, indeed often against the wishes of the Alsace-Lorraine deputies as expressed in the Reichstag. In any case, his powers as Supreme War Lord in a frontier and fortified region remained very effective even against the civil administration, and would outshadow those of another territorial ruler. Moreover, the mutual jealousies of the reigning houses made it hard to appoint a member of one of them to rule in Alsace-Lorraine. Yet if the Emperor, who was also King of Prussia, retained his position, with the right to appoint the Statthalter, the new state constitution would of itself entitle him to instruct the delegates of Alsace-Lorraine to the Bundesrat, so that their votes would simply strengthen the Prussian vote in that council. Finally, on May 26 1911, the Act embodying the constitution of Alsace-Lorraine was adopted as a compromise.

The territory was now to rank as a federal state; its constitution, however, was fixed by a decision of the legislative body of the Empire. Of the two Houses of Parliament, one was chosen by universal suffrage, while the other was in part nominated by the Government, in part composed of high officials. The Emperor remained reigning Prince, the votes in the Bundesrat thus deriving from his Government; but where a Prussian majority in the Bundesrat depended on the votes of Alsace-Lorraine the latter were not to be counted. Such an intricate constitutional instrument would probably never have been popular. It increased the confidence of the moderate middle-class parties in the Chancellor's domestic policy; but the Right and Left were equally dissatisfied. The Conservatives regarded any step towards constitutional Government in the Reichsland as unsound, and many of them would have preferred the continuance of rigid military rule in the "conquered" territory. Indeed, the hostility of the extreme Conservatives and of the Pan-Germans towards Bethmann Hollweg dates from this period. The Radical Left wing were alienated because they had hoped that the Constitution would do away with the dominance of the Prussian bureaucracy in Alsace-Lorraine and lead to parliamentary Government similar to that of the three South German States.

[1] Other small states will probably later join their greater neighbour states.

[2] He assumed that position in July 1909.

In other directions, also, in domestic politics the parties of the two wings began to move towards extremes. This process, at first interrupted by the War, was renewed with great violence afterwards, and still hampers the formation of anything like a two-party system, or, indeed, of parliamentary government at all. For the Right wing of the group of moderate parties which lies between these extremes cannot sit in the same cabinet with the extreme Left, whilst their Left wing cannot co-operate with the extreme Right. The Conservative party associated themselves with the agrarians, whose organisation, the Farmers Union (*Bund der Landwirte*), from the outset adopted demagogic tactics and appealed frankly to the power of the producers of indispensable foodstuffs. Heavy industry moved away from Liberalism and joined the agrarians; and the Pan-Germans, formerly recruited from the National Liberals, and the Anti semites drew closer to the parties of the Right, voting with them in questions of foreign policy and defence and collaborating with them at elections. In 1914 two of these Right parties, the German Party of Reform and the German Social Party, combined under an Anti semite to form the new Deutschvölkische Partei.

On Dec. 7 1911 the Reichstag was dissolved, the elections being fixed for Jan. 12 1912. The Government called for an alliance of the middle-class parties against the Socialists to " continue our present policy of commercial treaties and protection to German labour," and to " maintain our Army and Navy permanently in a state of the highest efficiency, and to fill up any gaps in our armament." The Association for combating Social Democracy issued the same message, which was indeed the same as had been used in the last elections by the Conservatives and National Liberals, but then against the Centre, to-day on behalf of the " blue and black bloc " of the Centre and Conservatives. The message was unconvincing, and in fact the elections brought the Social Democrats unexpected success. With 110 members they formed the strongest single party in the Reichstag, even as they had proved the largest single party in the electorate. They had gained 69 seats and lost 12. The three Conservative parties between them had gained 14 seats and lost 49, and even if with the Centre they still commanded about 170 votes, to 152 votes of the left, the decision upon tariff and fiscal policy now lay with the 45 National Liberal deputies.

The strength of the parties was tested in the elections of the President and Vice-Presidents of the Chamber. A Socialist—and that Scheidemann, particularly hated by the Conservatives on account of his speech in the Reichstag two years earlier, when he had said, " I am too well acquainted with Prussian history not to know that broken promises belong, so to speak, to the most exalted traditions of the ruling house of Prussia "—was for the first time elected first Vice-President. The President and second Vice-President resigned rather than work with him; in the end, after much juggling, the Progressives (who numbered only 41 deputies) secured the offices of President and first Vice-President, the second Vice-President being a National Liberal. Thus party intrigues perpetuated the curse of German political life, the exclusion of the Social Democrats from all positions of public responsibility; while the Centre, the second strongest party, was also excluded from presidential office. Another grave symptom was the fact that during these elections and in the work of the Reichstag organised commercial interests became an open political force. A vehement protest was made during the elections by an honest and uncompromising deputy, Count Posadowsky.

Foreign Policy before the War.—In foreign policy, too, Bethmann Hollweg had found a much more difficult situation than appeared on the surface. The secret documents of the Foreign Office, published as regards the years 1871–1912 in 30 volumes at the beginning of 1926, show where the key to the policy of the European Powers lay since the beginning of the 20th century, and why the Western Powers could consider themselves endangered by a threat of German hegemony at the same time that Germany could complain of isolation and " encirclement." The key lay in the unreality of the Triple Alliance, the southern partner of which could now only be considered an ally as a matter of form, not in reality. When Bismarck, after long hesitation and consideration, concluded the first treaty of the Triple Alliance in 1882 at Italy's request, relations between Italy and France in the Mediterranean were so strained that war between France and Italy was more probable than a French attack on Germany. The Triple Alliance therefore gave security for immediate mutual help in case of a French attack on Germany or Italy; it afforded Italy security and lent the necessary weight to its claims to the north coast of Africa and to equality of rights with France and Great Britain in all Mediterranean questions. When, however, Italy had come to an agreement with France on the delimitation of her spheres of influence in Tunis, Algiers and Morocco on the one hand and Tripoli on the other, and when the Egypt-Morocco agreement between France and Great Britain (1904) had drawn Britain also into this Mediterranean entente, all danger for Italy of a French attack vanished, and thus any support from Germany became superfluous.

It was remembered also in Italy that it was precisely the foreign ministers who had been true to the Triple Alliance who had complained that Germany was holding Italy back from her natural expansion in North Africa out of fear of being drawn into a Mediterranean conflict. This complaint over the passivity of the Triple Alliance policy, which was especially clearly put by Baron Blanc in his great " Aide-Mémoire " of July 14 1895 to Lord Salisbury and to the other two Powers of the Triple Entente is the direct origin of Italy's *rapprochement* with France at the end of the 19th century. Since 1901 the German Foreign Office and General Staff fully realised that even in case of unconcealed French aggression, if it took place on the Rhine, Germany could not reckon on the military assistance which Italy had promised to send her over the Brenner and through the Tirol and South Germany, and that no Italian Govt. would be able to let Italy fight with Germany against France, in the face of public opinion. It is clear from a communication of Von Schlieffen, chief of the German general staff,[1] that public admission of this fact was only prevented by fear that Austria-Hungary would lose all confidence in the Triple Alliance, and even in the alliance with Germany, if she learnt that in no circumstances could reliance be placed upon Italy's military assistance.

Even Prince Bülow, the most loyal friend of the Italian alliance deliberated whether it would not be better, in view of the real situation, to let the Triple Alliance lapse and openly admit Germany's isolation. He believed, however, that the agitation which such open dealing would at first provoke in Europe would bring such a great danger for peace that again and again he plastered over the rent. Consequently, whenever Germany was confronted with a proposal for conference of the Great Powers, her Foreign Office sought to avoid her participation. Such proposals always looked as though they would lead to an unbiased adjustment of views between two equally strong groups of which neither could outvote the other; for in every issue between the Great Powers, whether it arose over Morocco, the Near East, the Balkans or the Far East, a State of the Triple Alliance and a State of the Entente always at first appeared as adversaries. Their partners played the rôle of mediating powers, two against two, and their parity seemed specially to fit them to bring about a compromise. Such was the apparent position. But the German Foreign Office knew that Italy could not and would not stand by Austria in a German encounter with Great Britain or France, nor by Germany in a conflict between Austria and Russia, but that she would always have closer diplomatic contact with France and Britain, and even with Russia, than with her Allies, who on their side did not usually consult her before negotiating on Balkan questions with one another or with the Entente Powers.

When Germany did take part in the Algeciras Conference (Jan. 10–April 17 1910), in fact insisted against the wishes of France that this conference be held—the reason was that Germany believed that she would be supported outside Europe.

[1] It may be explained that Von Schlieffen retired towards the end of 1905. For the history of " the plan " up to the outbreak of War, see the official record *Der Weltkrieg*, compiled from the archives of the Reich, vol. 1, pp. 6–19 (Berlin, 1925). Ed. *E.B.*

Thanks to the ties which had been formed between the Emperor and President Roosevelt by the German Ambassador Speck von Sternburg, Germany expected that the United States would advocate the principle of the "open door" in the Moroccan question, and would join Germany in opposing the grant of a preferential mandate for France. Therefore Bülow did not then think that Germany's isolation in Europe was an obstacle to the conference. All the greater was the disillusionment when Germany and Austria-Hungary stood alone at Algeciras as elsewhere. Bethmann Hollweg directly experienced not only this disappointment but the effects of Bülow's subsequent procedure in the Bosnian annexation crisis of 1908–9.

The Agadir Incident and the Settlement in Africa.—Since the first Moroccan crisis the Emperor had acquiesced, though unwillingly, in the policy of the Chancellor and of the Foreign Office, particularly in Morocco and the Near East, and therefore the Foreign Office had always to strive to confront him with a *fait accompli*. The Chancellor, who was naturally extremely prudent, took the responsibility for the sensational "Panther leap" to Agadir (July 1 1911). If a conference was to be avoided because Germany was doomed to isolation (shared, at the very best, with Austria), an understanding made directly with France was essential. The Secretary of State, Von Kiderlen-Wächter, thought that this could be appropriately initiated by sending a warship to protect German commercial interests in Southern Morocco. He subsequently secured the Franco-German African Convention of Nov. 4 1911 after negotiations with the French Ambassador Jules Cambon.

Kiderlen was neither a Junker nor a Prussian; he came from Württemberg, home of the South German spirit of independence and democracy. He was, moreover, no militarist. He entertained a keen, even personal hostility towards Admiral von Tirpitz and the Emperor's military entourage, and was convinced that Germany could and must maintain her position by diplomatic means and without war. He claims for himself the credit of averting the danger of hostilities between Austria-Hungary and Russia over the annexation of Bosnia and Serbia's demand for compensation in Novi-Pazar. The Note of March 21 1909, in which Bülow informed the Russian Govt. that Germany would "let things take their course" if Russia did not accept her proposal for mediation, was drafted by Kiderlen; he had made its tone that of an ultimatum in demanding from Isvolsky "a clear and categoric answer, a precise answer—yes or no."[1] Kiderlen was at the time Ambassador at Bucharest, but in the interval he assumed office as Foreign Secretary, in spite of the Emperor's personal dislike of him. He was the more inclined to a repetition of surprise tactics in diplomacy as they enabled him to exclude the Emperor himself from the direction of policy. Incidentally, Kiderlen treated Parliament even more brusquely, if possible, than he did his Sovereign and his military advisers.

The dispatch of the "Panther" to Agadir became known on July 1 1911. On July 9 Kiderlen resumed his conversations with Jules Cambon. At the end of the month the press of the Right and Right Centre began to attack Bethmann Hollweg and the Emperor himself for weakness towards France in Morocco. Kiderlen, in order to conciliate nationalist opposition to negotiations with France, had created the belief that France would cede the French Congo entire to Germany; there was therefore deep disappointment when it became clear that Germany would only receive a strip of territory securing her trade communications with the Congo river and the Belgian Congo. Bethmann Hollweg and Kiderlen, however, continued the negotiations. The Morocco-Congo Agreement was signed on Nov. 4 and published on Nov. 7. Germany accorded a material recognition of the French protectorate over Morocco; France promised only freedom of trade and equality of treatment to the nationals of the European Powers, particularly as regards concessions for public works; but ceded to Germany 275,000 sq. km. in the north and northwest of the French Congo, receiving in exchange 12,000 sq. km. in the region of Lake Chad. Germany obtained access to the Congo river, while France acquired the right to construct military roads and a railway through the territory ceded to Germany, to connect the coast with the interior.

[1] *Grosse Politik*, No. 9,460.

The Morocco agreement was, in general, welcomed by the Left but censured by the Right. The critics designated the newly acquired strip of southern Cameroon as worthless, and qualified the recognition of French predominance in Morocco as a feeble withdrawal before England's menaces, as expressed in particular in Lloyd George's Mansion House speech (July 21). The Chancellor defended the agreement in a great speech before the Reichstag on Nov. 9, in which he dealt in particular with the charge of irresolute policy:—

> From the very beginning our programme has been: to accord increased political rights to France only in return for increased security for our commercial interests in Morocco, and for the acquisition of colonial territory. We have not at any moment sought for territorial acquisition in Morocco itself. Negotiations between ourselves and France *alone*, not before an international congress, nor with the inclusion of a third party—this is the programme which we have laid down, and we have carried it out.

Diplomatic representations had been made in London respecting Lloyd George's speech. In the meantime, the British Govt. itself had held back, not desiring to intervene in the Franco-German negotiations. A "vigorous policy," such as the Right wing critics demanded, was only possible for Germany if she were strong on the Continent and avoided untenable positions outside Europe. Morocco had proved a festering sore not only in Franco-German but also in Anglo-German relations. The cause of peace was served by closing the wound. And finally:—

> Others, gentlemen, would favour a preventive war, against France, or against England, or against both together. But preventive war was a mistake, war must be avoided whenever possible. No one can tell whether hereafter Germany may be called upon to carry on war with her neighbours. The responsibility to-day is mine, and I say that it is my duty to conduct affairs in such a way that a war which might be avoided, a war which is not demanded by Germany's honour, is indeed avoided.

The Conservative opposition was directed by Heydebrand, known as the "uncrowned King of Prussia," and it was observed that the Crown Prince applauded him from the tribune in Parliament. The Crown Prince's criticism was really personal to the Emperor, and so William II. took it; he transferred his son from Danzig, where he was commanding a cavalry regiment, to work on the general staff.

This agreement had removed Morocco from among the direct political causes of a European war, even as the Franco-British Mediterranean agreement had removed Egypt. It was to be expected that new unrest would now break out elsewhere, and since the termination of the Russo-Japanese War the Balkans and the Near East seemed destined for this part.

German foreign policy was now concentrated upon the peaceful settlement of the Baghdad railway question, first by means of the agreement with Russia of Aug. 19 1911, and then on the negotiations which resulted in the agreement with Great Britain concluded in July 1914. The death of Von Kiderlen, on Dec. 30 1912, and of Marschall von Bieberstein, ambassador in London, (Sept. 24) were serious losses to the German diplomatic service. The death of Marschall dangerously reinforced Austrian influence in Berlin. As the most energetic promoter of friendship between Germany and Turkey, Marschall, from his post at Constantinople, had strongly opposed all Austrian encroachments in the Balkans, particularly before and during the Bosnian crisis of 1908–9. Unlike Count Aehrenthal, he never allowed himself to be influenced by prejudices of domestic policy in his idea of the necessary co-operation between the three Empires. As Ambassador in London, a post which he had hardly assumed when he died, Marschall would probably also have easily found the right attitude towards English Parliamentary policy.

The Turco-Italian War, for which Emperor and people alike strongly condemned the Italians, would probably have injured the Triple Alliance more if any illusions had been entertained in Berlin. It was only because nobody expected Italy to have any regard for her Allies that Germany was content to look on while Turkey, the only Power with which she was in close and friendly relations, was deprived of one of her provinces and suffered heav-

ily from the war. During the war, on the occasion of the Emperor's visit to Venice in March 1912, the stability of the Triple Alliance was affirmed. In Dec. 1912 the Alliance was renewed without comment, its renewal on each previous occasion having been preceded by protracted negotiations. When the first Balkan War (1912) gave rise to a new and acute danger, and mobilisation seemed imminent on the Austro-Russian frontier, with all the results which it entailed in the summer of 1914, German policy, in close co-operation with that of Sir Edward Grey, brought pressure on Vienna, whilst the Emperor used his influence with the Archduke Francis Ferdinand, during the latter's visit to Springe (Nov. 22–3 1912), to dissuade Austria from threatening Serbia, and Russia from emphasising her rôle of Serbia's protector. The supporters of the policy of preventive wars were bitterly disappointed, and they spread broadcast an utterance attributed to the Emperor, in which he was said to have insisted that " the Austrians must not rattle the German sword."[1]

Home Politics 1912–4.—In the two years preceding the outbreak of the War, however, the foreign political situation was much less acute than the domestic. In the former field may be mentioned the characteristic incident of the Emperor's visit to Switzerland, with the sincere good feelings which it aroused, and his energetic commendation of the Swiss citizen army (Sept. 3–5 1912). The year 1912 brought the first ominous symptoms: the plans for strengthening the army and navy (the latter unhappily coinciding with the visit of Lord Haldane to Berlin); the resignation of Wermuth, Secretary to the Imperial Treasury, in March 1912, which was interpreted as an abandonment of the death duties; the miners' strike of March 1912, and the much more serious and enduring phenomenon of the rise in meat prices in the autumn and winter of 1912–3—a powerful weapon of agitation in the hands of the Left, for the Agrarians of the Right and Centre opposed the import of cheap foreign meat; the even more threatening insecurity of the Parliamentary majority, for a violent contest had arisen between the two Protectionist parties of the " blue and black " bloc since the campaign opened by the Centre (originating in Bavaria) to secure the abrogation of the Jesuit law. On that question the National Liberals voted with the Conservatives; the Left wing Liberals and Socialists, as opposed in principle to all exceptional legislation, with the Centre.

But, above all, the Emperor and the Prussian Court and military authorities were finding great difficulty in accommodating themselves to the new conditions in Alsace. Almost all the conflicts of this period arose among the German-speaking and German-bred Alsatians and not in predominantly French Lorraine. When the administration of Alsace withheld Government orders from a factory in Grafenstaden on account of the alleged provocative and anti-German conduct of the manager, it had the Landtag against it (unanimous vote of censure by the second Chamber on May 7 1912). At a dinner given by the Governor in Strasbourg the Emperor had expressed the intention of destroying the Alsatian Constitution and converting Alsace-Lorraine into a Prussian province if matters went on like this. This was not taken very seriously by the Alsatians themselves. The Alsatian papers even admitted that it was comprehensible that the Emperor should feel the opposition of the Landtag as ingratitude. In the Reichstag, however, Scheidemann seized upon the Emperor's pronouncement to remark that in any case to become Prussian was the harshest punishment Germany could inflict. The Chancellor and the Ministers walked out, and the President afterwards called the speaker to order. But the Social Democrats had moved a stage further Left.

Social Legislation.—The principal sufferers from stringent conditions in the German Reich were the numerous Government administrative officials (members of the post-office, railways, revenue office, clerks), although their loyalty made them slow to voice their grievances. The manual workers vented upon the big stores, the chief of which were in the hands of Jews, their anger at the high prices of necessaries and became anti-Semites. The workers who were organised in trade unions were materially not badly off. State insurance for disabled persons and dependants of the deceased, for the victims of accidents and for the sick, was now established on a uniform basis for the Empire (Imperial Insurance Act of July 19 1911). Considerable power was assured to the operatives, particularly in the establishment of the local sickness funds, so much so that the doctors constantly complained that they were at the mercy of the local officials concerned with the funds, who were almost all Social Democrats. For a time the doctors even threatened to strike on this issue. A new chapter of jurisprudence of great importance was opened: the " Labour Laws." This summed up in a comprehensive code the regulation of conditions of labour under public and civil law. There was also talk of establishing " labour courts " in which civil cases between workers and employers were to be decided. The court was to consist, on the model of the industrial and mercantile courts, of a lawyer as president and two assessors (one an employer and one a worker), elected by the employers and workers of the district. In these elections the principle of proportional representation was tried for the first time in Germany on a considerable scale. The formation of chambers of labour was also planned. These were to have the same standing in economic life as the chambers of commerce and of agriculture. They were, however, to be formed on a footing of equality—that is to say, workers' representatives were also to be included.

On July 1 1912 persons in receipt of disablement pay numbered 953, 057; in receipt of sickness benefit 15,866. Old age pensioners numbered 91,331; and the total pensions paid since Jan. 1 1900, 510,838. Under the provision for pensions for the widows and orphans of insured persons in the Act of 1911, 4,562 pensions had been paid by June 30 1912 and 1,059 single grants.

The Centenary Commemorations, 1913.—The year 1913 opened with festivals commemorating 1813, and what to the German people was the great war of liberation of its history. It was a genuine celebration of freedom and a national festival. The German dynasties, the governments and the political parties showed themselves ready to allay old quarrels. The betrothal of the Emperor's daughter to Prince Ernest Augustus of Brunswick, the grandson and heir of the last Guelph King of Hanover, brought about a reconciliation with the Duke of Cumberland, whose son ascended the throne of the federal state of Brunswick. It was announced on the Emperor's 25th jubilee (June 16) that he had destroyed a secret testament of Frederick William IV. in which the latter had enjoined upon all his successors to abolish the Prussian Constitution before assuming rule. On the occasion of the Emperor's jubilee, for which almost all the federal Princes assembled in Berlin, the Prince Regent of Bavaria, Ludwig, who in Nov. 1913 was empowered by law to assume the royal office in view of the persistence of King Otto's incurable mental ailment, pledged the loyalty of the states to the Empire. In reply, the Emperor styled the sovereigns of the German states and the burgomasters of the free towns his " allies," and declared that in their independence, as guaranteed by the Constitution, lay the strength of the Empire itself. In the Reichstag the motion of the Centre on the Jesuits was adopted on Feb. 19 1913, after a peaceful discussion. During the debates on the colonial budget, Erzberger, formerly the keenest critic of the abuses existing in certain colonies, supported the colonial policy of the Government.

Passing of the Army Reform Bill.—Even the Army bill, officially announced on March 1, encountered no very bitter opposition. The bill increased the peace strength from 544,271 men to 661,176, entailing the creation of 84 new battalions and squadrons. The total cost was to amount to an initial outlay of 1,050 million marks, and subsequently of 180,000,000 to 190,000,000 marks annually. The initial costs were to be covered by a capital impost for one year only, and in the case of high incomes by a single levy on income (" contribution towards national defence ") both non-recurring. The current expenses were to be met by an increase of the quota contributed towards the Imperial finances

[1] The official records of the conversations in politics between the Emperor and the Archduke at this meeting, and at the Emperor's subsequent visit to Konopischt in June 1914, will be published in volumes 32 and 35 of the collection of German archives: *Die Grosse Politik der Europäischen Kabinette.* Until their appearance it is wiser to suspend judgment.

by the federal states, which those states levied through their own taxation upon capital or income. The discussions in the Reichstag turned less upon the strengthening of the Army than upon the means of meeting the cost. The Left wing parties demanded, and in part secured, that property, particularly unearned increment, should bear the chief burden of the single levy, and further the introduction of a steep, progressive graduation of the rates of taxation. Apart from the fact that they were in general favourable to the Army bill, the parties of the Right found satisfaction in the abandonment, at any rate for the time, of the plan of permanent death duties. On the death on Aug. 13 of Bebel, the venerable leader of German Social Democracy, all parties united in a tribute of respect to his character, and integrity and none denied that he was a "good German."

The Zabern Incident.—Yet how delusive was this tranquility was manifested by the Zabern incident of Nov. 1913 (*see* ALSACE-LORRAINE); an incident so trivial in itself that its prodigious consequences can only be explained by the existence of a general state of political tension. The Government's position was weakened, for its attitude over the incident was censured by 293 votes against 54 in the Reichstag, unanimously in the lower Chamber of the Alsatian Landtag and by 33 votes against three in the upper Chamber. At the same time the Imperial Chancellor had incurred the definite hostility of the military party. In an important debate in the Prussian Upper House on Jan. 10 1914 Bethmann Hollweg developed his whole policy in a discussion with the spokesman of the Conservatives, Count Yorck zu Wartenburg. Zabern was not discussed, but it was present in the thoughts of every speaker. Bethmann defended the constitution of Alsace-Lorraine. He vindicated his right, disputed by Count Yorck, of calling a commission of inquiry with the co-operation of deputies of the Reichstag to report on the conditions and abuses in the army contracts' department. But he, on the other hand, admitted that precisely in the Empire with its universal and free suffrage and the social tendencies of its legislation a Prussia with a different "internal structure," that is without universal suffrage and without responsible parliamentary government and with a "firm military foundation," seemed essential.

The Government aimed at compromises between the Emperor and Parliament and between Prussia and the Empire. But the parties and the politically minded section of the nation all felt that alike in domestic and foreign politics the Government was lacking in decision. How little, however, the professional politicians knew of the reality may be seen from the fact that the appointment of Herr von Loebell, who during and after the War proved himself a leader of the reactionaries, as Prussian Minister of the Interior was characterised as a concession to Liberalism.

THE WAR PERIOD

The Sarajevo Murder.—When the news of the murder at Sarajevo on June 28 1914 became known in Germany, the horror generally felt was mingled in pacifist circles with a certain silent relief. Rumour had assigned the murdered man to the war party. From the new heir to the Austro-Hungarian throne a peaceful policy might be expected. It was anticipated that Austria-Hungary would take speedy action against Serbia, as far as possible in agreement with Russia. It was thought that the sympathies of the world were on Austria's side, even if she should undertake a short punitive expedition against Serbia.

The most recent and very meticulous examination of all the archives and the utterances of all witnesses have made it clear that in the early days of July the Emperor and his entourage had no thoughts whatever of a European war, and that neither a Crown Council, still less a Council of War—as the American Ambassador Morgenthau claimed to have heard from the German Ambassador in Constantinople—was held in Potsdam or Berlin. But when Von Tschirschky, the German Ambassador in Vienna, reported on June 30 that Vienna desired to use the opportunity to settle accounts with the Serbs thoroughly, but that he himself seized every occasion to "issue calm but very emphatic and serious warnings against precipitate action," the Emperor commented: "Who has authorised him to do so? It is very stupid. It is no business of his. What Austria thinks of doing is solely her affair." Thenceforward the Ambassador let the Austrians go their own way, and as on July 5 the Emperor had received a letter from the Emperor Francis Joseph and a memorandum drawn up by Count Berchtold, and the Chancellor had declared that in harmony with his obligations as an ally the Emperor would stand loyally by the side of Austria-Hungary (July 5 and 6), Vienna felt that it could rely on German aid in its Balkan plans. But the Emperor and the Chancellor merely intended that Austria should demand satisfaction from Serbia as speedily and energetically as possible, before the murder of the heir became a European question. It, therefore, implied no change of view that the Emperor received the Serbian answer to the Austrian ultimatum of July 23 with the comment:—

> A brilliant achievement for a grace of 48 hours. It is more than could have been expected. A great moral triumph for Vienna. But every reason for war now disappears, and Giesl ought to have remained quietly at Belgrade. On the strength of this I would never have ordered mobilisation.

When Austria rejected the Serbian reply, and on July 28 declared war on Serbia without having previously consulted Berlin, the Chancellor and the Secretary of State, Von Jagow, realised the danger of the position—no doubt much too late. On July 29 Bethmann telegraphed to Vienna:—

> I view the attitude of the Government in Vienna and its inconsistent attitude towards the different Cabinets with increasing discomfort. In St. Petersburg it asserts its territorial disinterestedness, it leaves us entirely in the dark as to its programme, feeds Rome with meaningless phrases regarding the compensation question, whilst in London Count Mensdorff gives away portions of Serbia to Bulgaria and Albania and proceeds to contradict the solemn declarations in St. Petersburg. From these contradictions I must draw the conclusions that . . . the Viennese Government harbours plans which it deems it wise to conceal from us, to assure itself in any event of German support and not by an open avowal to run the risk of a possible refusal.

For a conference, however, as proposed in particular by Grey, Berlin was equally disinclined, as conferences had always been unwelcome to her since Algeciras. The last hope, therefore, lay in successful direct negotiations between Vienna and St. Petersburg. When these broke down on July 30, Germany supported in Vienna (July 30) the final British proposal for mediation to the effect that after the capture of Belgrade, Austria should announce her intention of advancing no further until the Powers should have mediated between herself and Russia. Count Berchtold's temporising defeated this proposal. With the general mobilisations of Russia and Austria on July 31 and that of Germany on Aug. 1 a state of war was actually in being, although the declarations of war followed later. For in the three states immediately involved the chiefs of the general staffs were now unanimous in asserting that any further delay would endanger the prospects of success in the field, and no civilian Chancellor could take the responsibility of opposing this view. Moreover, the executive power had now passed in accordance with the Constitution to the supreme military authority. (*See* also EUROPE.)

The Invasion of Belgium.—The German plan of campaign for a war on two fronts, as framed by the elder Von Moltke, had envisaged defensive action on the west, offensive on the east. Subsequently for a short time there were two alternative plans. The official account of the War by the German general staff proves that in 1892 under Count Schlieffen the plan of an eastern offensive was abandoned, the offensive on the western front with the march through Belgium being retained as the sole plan. The Foreign Office was not consulted.[1] The Emperor made a single

[1] It is necessary, however, for the understanding of the Schlieffen plan, which originally contemplated the violation of Dutch as well as Belgian neutrality, to read *Graf von Schlieffen*, by Freytag-Loringhoven (Berlin, 1920), and also *Erinnerungen, Briefe, Dokumente 1877–1916*, by the second Von Moltke, especially pp. 429, 430 (Stuttgart, 1922). From before the end of the 19th century the manoeuvres were obviously based on the principle of a turning movement through Belgium and Luxembourg (Reichsarchiv, *Der Weltkrieg*, vol. 1, Berlin, 1925); the Kaiser's statesmen were aware that strategical railway facilities were continually developed in the same direction and provided for in the Budget. There is no doubt that the Schlieffen plan was officially regarded as a life-and-death necessity of German policy in case of war.—Ed. *E.B.*

allusion to the plan in a personal letter to Prince Bülow, who returned a dilatory answer. Bethmann Hollweg and his Secretary of State for Foreign Affairs, Von Jagow, were never asked whether they approved of the military plan which contemplated an offensive against France and the violation of Belgian neutrality. According to the Constitution, the Emperor, as Supreme War Lord, had to decide during war time in cases of differences of opinion between the civil and military authorities. But once set in motion, the machine of mobilisation revolved so rapidly that even the Emperor could no longer have interposed. Bethmann Hollweg declared in the Reichstag on Aug. 4 1914:—

We are now acting in self-defence, and necessity knows no law. Our troops have occupied Luxembourg and have perhaps already entered Belgian territory. This is in contravention of the behests of international law. It is true that the French Government stated in Brussels its intention of respecting the neutrality of Belgium, as long as the enemy respects it. We knew, however, that France was ready to march in. France could wait, we could not. A French flank attack on the lower Rhine might have proved fatal. We were thus compelled to disregard the justified protests of the Governments of Luxembourg and Belgium. The wrong that we are thereby inflicting —I speak openly—we will strive to repair as soon as our military objective is attained.

Early Stages of the War.—The parties concluded a truce, and the Social Democrats voted credits for the War, which they regarded as a defensive war against Tsarist Russia. The people everywhere accepted the situation very gravely. The immediate summons to the colours of the whole Landsturm up to 45 brought home the danger to all. The general nervous feeling during the first weeks was betrayed in the hunts after spies and transports of Russian gold. When the first prisoners of war arrived, the military authorities feared that the people would fraternize with them, and strictly forbade any intercourse. The civil authority at home was transferred to the Generals commanding Army Corps Areas in Germany, whose staffs consisted usually of superannuated and not always very intelligent officers, who were entrusted with all emergency defence measures and with censorship of the press and all other printed matter. Thanks to the censorship, the defeat on the Marne could at first be kept almost entirely secret. The war for positions was declared to be the deliberate plan of the general staff. Although Von Moltke was dismissed, and although it was already determined that the High Seas Fleet should not risk itself in open battle, General Headquarters still hoped for victory. The fatal effects for Austria of the failure to give her speedy help against the Russian army were not realised, especially in view of Hindenburg's striking success in the East.

It thus seemed clear that the prolongation of the War and all the accompanying distress was solely due to the blockade. This blockade, initiated by Great Britain, was regarded, like the sequestration of enemy property, as a violation of international law. Since the Anglo-American conception, which treated individual nationals of enemy states as "alien enemies," was new to Germany the opinion arose that it was the specific English mode of warfare—as distinct from the French or the Russian—which was inhumane and contrary to international law, particularly as the indignation aroused in Europe, and especially in France by the application of the same methods in the Boer War was not forgotten, while of course the decisions in British and American courts on which the blockade rested were unknown.[1] In the first year of the War the conviction had already arisen that the German army was invincible, and that the sole source of danger lay in the "war of hunger" which threatened women and children. If the population at home could "hold out," in the end the War must be won.

As the War dragged on questions of internal politics and economics revived. The people considered that their sacrifices in human lives—volunteers, officers of the reserve, substitutes as well as those on active service—and the privations which they had borne in meeting the costs of the War and in the internal loans, which had been in the first instance subscribed by the holders of small savings-funds, entitled them to claim full political rights. The Reichstag voiced this opinion and the rights of the civil authority with increasing firmness. The civil administration, however, was powerless against the military authorities. Since General Ludendorff had become Quartermaster-General, and a number of his personal adherents had converted the War Press Bureau, and later the "patriotic instruction" given to the troops, into an instrument of political propaganda, the Zabern episode was re-enacted on a large scale. The military authorities thought the Chancellor and the Foreign Office too weak in their attitude towards foreign countries and towards the Reichstag, and that when the civilian authority broke down the military must take over their duties.

The real test of strength came on the question of submarine warfare, to which the Chancellor, the Foreign Office and, of the other ministers in particular, Helfferich, the influential Secretary to the Imperial Treasury, stood opposed, when General Headquarters demanded it again in 1917 after the conferences at Pless of Aug. 30 1916 and Jan. 9 1917.[2] The supreme military authorities, supported by the chief of the naval staff, pointed out that the exchange of Notes between the German and the Entente Govts. with the United States and the other neutral Governments between Dec. 12 1916 and Jan. 12 1917 had proved that peace offers could not be negotiated through diplomatic channels.

The German Peace Offer, Dec. 1916.—That might be true, but the intrinsic weakness of the German Notes (*see* EUROPE) had resided in the fact that public opinion, the Reichstag, and possibly the Government itself, falsely informed by General Headquarters on the military position, considered the offers contained in them to be quite acceptable and even generous. In particular, no plain admission of a duty of reparation towards Belgium was made, because General Headquarters insisted that if Germany was to renounce territorial aggrandisement she must receive guarantees in the West and East. Moreover, heavy industry, at that time closely allied with General Headquarters, desired to see the economic predominance of Germany in Belgium and northeastern France established by the conditions of peace. Bethmann himself and after him Helfferich at length gave way to the military authorities Jan. 9 1917, and the Emperor issued orders to begin unrestricted U-boat warfare on Feb. 1. When on Jan. 23 1917 President Wilson proposed mediation to Count Bernstorff through Colonel House, and inquired the German terms of peace, the Chancellor, who received the communication on the 28th, lacked the strength to stop unrestricted U-boat warfare, and thereby destroyed his own position. He remained in office long enough to issue the so-called Easter message of April 7 1917 from the Emperor as King of Prussia, in which the abolition of the Prussian three-class franchise was promised, in order to reconcile the Social Democrats. But the new "Fatherland party" ("Vaterlandspartei"), which enjoyed the support of General Headquarters, and in particular its co-founder Kapp, attacked the Chancellor without mercy. When he fell at last, this was partly due to Erzberger's attack in the Main Committee of the Reichstag on July 6 1917 (recording the complete failure of U-boat warfare); partly to the military leaders who had come to Berlin on July 7 and, above all, to Ludendorff's *alter ego*, Colonel Bauer; finally, Ludendorff and Hindenburg extorted the resignation of the Chancellor from the Emperor by threatening their own resignation (July 13).

His successor, Michaelis, was nominated at the instance of the Emperor's entourage, without negotiations with the Reichstag. His restrictive interpretation of the peace resolution of the Reichstag, adopted on July 19 1917, deprived it of all value abroad (*see* EUROPE). His ambiguous attitude, moreover, was partly responsible for the failure of the pacific activities of Pope Benedict XV. in Aug. 1917. The Vice-Chancellor Helfferich was the most influential member of the Government. He en-

[1] For the general case *see* BLOCKADE.

[2] The first occasion was Feb. 4 1915, when the Government—this time against the advice of Tirpitz—declared the British territorial waters to be a war-area as from Feb. 18. Mr. Wilson's mediatory proposal, that Germany should recognise the rules in force for cruiser warfare as applying to U-boat warfare, and that in return England should permit the passage of American provisions, failed. When the "Lusitania" was sunk, the protest of the United States of May 15 resulted in the suspension of the U-boat war (July 8 1915; finally on May 4 1916).

joyed the special confidence of the Supreme Command, whose views he regularly imposed on the civilian authorities.

Economic Measures.—In the meantime, the economic structure of the German Empire had undergone a complete change. On Aug. 8 1914 Walter Rathenau founded the department dealing with raw materials for war industries in the Prussian War Office (" Kriegsrohstoffabteilung des preussischen Kriegsministeriums "), which for a considerable time met the demand for the chief imported raw materials of war industries, particularly metals, cotton, grease, india-rubber and glycerine, by economic handling of home supplies, organising imports from neutral countries (" compensation trade ") and by stimulating the discovery of substitutes (nitrogen from the atmosphere, raw material for textiles from nettles and wood, etc.). Foodstuffs were early rationed. The yield of the soil declined owing to the lack of manure and skilled labour. Ration cards were introduced, first for bread, then fats, sugar, milk, eggs, meat and potatoes. From the winter of 1916–7 onwards, the quantities allowed no longer sufficed to nourish children and young people. The home producers were also, in principle, limited to these rations; but watertight control was impossible, and smuggling and illicit sales became habitual. The sequestration of brass and copper articles in the smallest households excited much bitterness, since it was suspected that the treasures of the rich were being spared, those of the poor taken.

While the economic capacity of the individual, particularly of the lower middle-classes and officials, was thus physically and morally undermined and the mass of the population compulsorily socialised, on the basis of a bare subsistence rate, the economic capacity of individual industries expanded enormously, and the workers employed in them demanded a higher standard of living. The so-called " Hindenburg Programme " (Hindenburg's only in name) carried out by the War Department (*Kriegsamt*) founded on Nov. 1 1916 in accordance with the law of auxiliary services (*Hilfsdienstgesetz*), was a prime cause of the economic collapse. By an economically unjustifiable increase in munition workers' wages it disorganised other industries, in some cases brought about a stoppage and constructed at enormous expense blast furnaces which stood idle for lack of fuel. The " conscription of labour " provided welcome material for radical agitators, while the melting down of church bells offended the devout. War expenditure rose from two milliard marks a month in Aug. 1916 to more than three milliards in Dec. 1916, and to almost five milliards by Nov. 1918. Moreover, this programme laid the foundations of the political power of the great Rhineland-Westphalian industrials.

In the autumn of 1917 the civil authority reasserted itself. Helfferich was replaced by the Democrat Payer, from Württemberg. From Nov. 1917 the " Interparty Commission " of the Reichstag, in which Erzberger and Scheidemann were the chief figures, sat in permanence. On Jan. 24 1918 the Emperor stated to Hindenburg and Ludendorff that he himself and the Chancellor bore the sole responsibility for the direction of political issues. In reality, however, particularly since General Headquarters had forced on him a new Chief of Cabinet, the Emperor was entirely subservient to the military authorities. The Supreme Command took its revenge in 1918; the Peace of Brest Litovsk with Russia (March 3 1918) and of Bucharest with Rumania (May 7 1918) were purely military dictates, bringing no lasting goodwill; although it is true that only a dictated peace could bring Finland and the border states freedom and self-determination.

General Headquarters regarded the spring offensive of 1918 as the last chance of securing a peace " which should strengthen the monarchy and extend Germany's power." When it broke down, the War was lost from a military standpoint; even Ludendorff recognised this on the " black day " of the breakthrough at Villiers-Bretonneux (Aug. 8 1918). In Sept. and Oct. the Bulgarian, Turkish and Austrian fronts collapsed.

On Sept. 24 the Main Committee of the Reichstag brought Social Democrats into the Government as Secretaries of State, reformed the Prussian franchise and proposed full autonomy for Alsace-Lorraine. Prince Max of Baden became Chancellor; but General Headquarters retained their influence, especially as the Emperor always retired to their shelter at any decisive moments. The Supreme Army Command determined the specific character of the notes sent by the German Govt. to President Wilson in Oct. 1918, and demanded that the note asking for an armistice should be sent out on the night of Oct. 3–4 at the latest, in view of the threatened collapse of the German front; and were also responsible for the second note of Oct. 12, dictated by the necessities of the military situation. Only when Wilson's note of Oct. 14 had to be answered did the Cabinet withstand the views of Ludendorff, who now again asserted that the front line could be held, and themselves continue the exchange of notes with President Wilson.

On Oct. 26 the Cabinet obtained Ludendorff's resignation,[1] and Hindenburg thereby regained the simple and honourable position, free from the taint of politics, which had won him the people's confidence in the early years of the War, and now enabled him to lead the army home, in the face of the pursuing enemy, without the occurrence of mutiny or plunder. Ludendorff did not, indeed, leave his post as Quartermaster-General without first disseminating the contention later known as the " legend of the stab in the back," that it had been the slackening of resistance at home which had made it impossible to the army to continue fighting.

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THE REVOLUTION AND THE REPUBLIC

The fall of Ludendorff was deeply significant. The essence of Prussian tradition had always been the subordination of the civilian to the military power. In the first successful years of the War this tradition had naturally been fortified, and the military had assumed even more complete control over the conduct of politics. The Emperor and his entourage were entirely dominated by the Supreme Command, as was much of what ought to have been sensible Conservative opinion. When military defeat approached,

[1] For a fuller explanation of the circumstances *see* LUDENDORFF.

the Vaterlandspartei and similar circles, like the Emperor, attributed it, not to errors or weakness of the Supreme Command, but to the fact that civilian authority and opinion had not yet been entirely stifled.

In moderate liberal and democratic circles exactly the opposite process took place. Their leaders were driven by the intransigent and imperialist attitude of the extreme Right into strong sympathy with the Left. The great party of the Left was Social Democracy; but now when events seemed to be laying the future in its hands German Social Democracy found itself fatally disunited. Hampered by the undemocratic Prussian franchise and much frank repression, the German Socialist party had yet grown rapidly during the years of stress and rising prices which preceded the War. It had achieved a stake in the country, a complex organisation and considerable funds. Fear of losing these acquisitions, combined with natural patriotism and the dread of Russian autocracy, determined the attitude of the party leaders towards the War. On the crucial Aug. 4 1914 they abandoned the International; voted unanimously for the War credits in the Reichstag and concluded a " truce " with the other political parties. In return the Emperor, under pressure from the Government removed the restrictions on Socialist literature and admitted organised workmen into the state railway and other services. On Sept. 9 the Socialist leaders protested against the anti-German attitude of the International Socialist Bureau; and their spokesmen vigorously defended their national cause in the already vexed question of War guilt.

The moderate Socialists had really moved towards the left centre. A small fraction, however, dissented. In May 1915 one voice—that of Liebknecht—voted against a fresh War credit; and a group under Liebknecht and Rosa Luxemburg began to agitate for refusal of credits and a general strike to stop the War. In Nov. 1915, 18 Socialist deputies voted against the credits. The opposition now grew rapidly, but was itself divided. The larger group, under Haase, Kautsky, Ledebour and Bernstein, split definitely from the majority in March 1916 over the question of submarine warfare, and formed a separate group which at Easter 1917 took the title of the " Independent Social Democrat Party of Germany," with a programme of early peace without annexations. The extreme Left under Liebknecht (which in 1916 had begun to issue a secret paper named *Spartacus*) was already in touch with Lenin, Trotsky and Radek in Switzerland, and had adopted the programme of the Zimmerwald Congress. Both these parties were still largely heads without bodies, while the extremists were weakened by the imprisonment of Liebknecht in 1916. The Majority Socialists commanded the prestige and the organisation. But although the Russian revolution of March 1917 emboldened them, and at the International Socialist Conference at Stockholm in June 1917 they made a declaration against annexations and indemnities; and although the Emperor found it wise in his " Easter Message " of 1917 to promise a reform of the franchise, they might have been ignored had not Erzberger obtained and communicated to his colleagues of the Centre on July 6 a copy of Count Czernin's famous memoir in which he described Austria-Hungary as being on the verge of revolution, and victory as impossible.

Erzberger now propounded a resolution in favour of " peace by understanding," and the Centre and the Majority Socialists were definitely allied against the Imperialist aims of the Government and the Supreme Command. The latter were not yet ready for concessions; Bethmann Hollweg's successor, Michaelis, was their nominee. Only when Hertling succeeded him was a bill introduced which provided for a really democratic reform of the franchise; and the discussions on it outlasted the fall of the Empire. Certain concessions were, however, introduced; a minor electoral reform was carried on June 8 1918.

The Bolshevik revolution in Russia (Nov. 1917) widened the split in the Socialist camp. The Majority condemned Bolshevik methods in Russia, the Independent Socialists looked on them with much sympathy, and their following was strongly reinforced by unorganised labour, whose imagination was fired by the example of Russia and by the prisoners of war who began to return after the peace of Brest-Litovsk. The Spartacists were frankly out for the establishment of a dictatorship of the proletariat in Germany, and began to organise with the arms and money which the Russian agitators transmitted to them. All three groups, however, were alike emboldened by events in Russia; in Jan. and Feb. 1918 a series of munition strikes broke out in Germany which almost reached the scale of a revolution, their extent and order showing the vast power of the Majority Socialists, who, although they had not organised the strike, put themselves at its head to gain control of it.

The great munitions strikes, which were largely spontaneous, were symptomatic of an almost universal state of feeling. The almost intolerable strain and privations resulting from nearly four years of continuous war and blockade had affected practically the whole population. Hardly one man in a hundred saw in events in Russia the triumph of a new doctrine, the establishment of a new system, but those were innumerable who saw in it the end of a tyranny, of a driving of men beyond their powers, above all, of war and slaughter. The active policy of the Socialist leaders drew its strength from the great passivity of the over-driven masses; revolution was becoming the line of least resistance. The main motive in the German revolution, which substituted a Socialist for a monarchical Government, was to be anything but Socialist; it was the longing of workman and soldier to relieve themselves of the tyranny of the State in army and workshop.

In Sept. 1918 the general staff at last admitted the probability of defeat, and the Government prepared to make concessions to the moderates. Prince Max of Baden, the new Chancellor, asked the Majority Socialists to enter the Government. They made their acceptance conditional on far-reaching internal reforms; the liberation of Belgium; the evacuation of all occupied territory; and the abandonment of the treaties of Brest-Litovsk and Bucharest. Prince Max accepted the conditions, and took Scheidemann and Gustav Bauer, and later other Majority Socialists, into his Cabinet. The party then appealed to the Independents to re-unite; but the latter, who rejected all co-operation with bourgeois parties and demanded an immediate peace, refused brusquely.

The Outbreak of Revolution.—Prince Max filled the remainder of his Cabinet with liberals and democrats, including Erzberger. On Oct. 5 he propounded a programme containing a decided profession of democracy, with self-determination of nations. On Oct. 28, when Germany's allies had already failed her, he introduced a number of measures to democratise the Constitution and control the prerogatives of the Emperor, and especially to reduce the power of the military authorities. Meanwhile, however, Germany's own fighting forces had become infected. On Oct. 28 the fleet received orders to put out to sea " for manoeuvres." The crews, rightly suspecting that the real object was a last and desperate attack, refused to weigh anchor. Their ringleaders were arrested. On Nov. 5 a great meeting demanded their liberation. It was refused, and the demonstrators fired on. The next day the whole fleet was in uproar. There had been a naval mutiny in 1917, and a connection had been traced between the mutineers and the Independent leaders Haase and Dittmann. The situation was obviously critical. Noske, a Majority Socialist leader, was sent to Kiel to negotiate; he arrived to find a Sailors' Council in full control. He recommended that all their requests be granted, and remained in Kiel, where he was joined by Haase and Ledebour. Further Councils were formed. On the 6th the dock labourers in Hamburg revolted; a dictatorship of the proletariat was formed in Lübeck and demanded " immediate armistice and peace." Bremen joined on the same day; Hanover, Brunswick and Cologne on the 7th. The movement spread towards Berlin; revolutionary bodies took possession of Magdeburg, Leipzig and Dresden.

Thanks to the lamentable Socialist split, the whole of these movements were very confused. The Majority Socialists had still far the strongest organisation, but the movements in Northern Germany were largely spontaneous, the work of the unorganised proletariat. It was the outcome of a deep craving for peace

and a reaction against authority. Many concerned in it followed the lead of the Independent Socialists, who were not compromised by their connection with the Government, many that of the Spartacists, whose leader Liebknecht had been released from prison and was conducting a violent extremist agitation. The Spartarcists, numerically the smallest group, had the great advantage of a fixed programme, although, an unattainable one.

The most urgent question, in view of Germany's defeat, was how far continuity with the previous régime should be preserved. The parties of the Centre and Left Centre had not in the main gone further than the idea of a constitutional republic; and the Emperor had subscribed to the Constitution of Oct. 28, and on Nov. 2 had declared that the old order was destroyed and that the Emperor was the " servant of the people." But this declaration was issued from Spa, whither William had fled on Oct. 29. The servant of the people had made an unfortunate beginning in sheltering himself from them behind the bayonets of his soldiers in a town on occupied foreign territory. His conduct disheartened the monarchists and thinned their ranks, besides making it almost impossible for his loyal adherents to concert their policy, with its object away at the safe end of a long telephone wire. The republican movement received a great impetus.

The Majority Socialists were anxious not to break with the bourgeois parties, which enjoyed the confidence of the peasants and middle classes and commanded practically all administrative talent; while the Independents believed that a complete break with the past would ensure Germany better conditions of armistice. The Majority Socialists, carried forward on the tide of events, moved almost daily further Left, since to stand still would have meant losing their adherents to the Independents. On Nov. 4 they made up their minds in favour of a republic; and on Nov. 7 the rapid march of events outside Berlin determined them to present an ultimatum to the Government, demanding the abdication of the Emperor and the Crown Prince, under threat of withdrawing their members from the Government and proclaiming a general strike. The Emperor was still debating whether he could not lead the army back to restore order at home. The new Quartermaster-General, Groener, and Hindenburg pronounced this impossible on Nov. 9. The Emperor therefore telegraphed his abdication as German Emperor. On the 10th he fled to Holland.

Proclamation of the Republic.—Events had outrun him. Prince Max had announced the abdication on the morning of the 9th. His telephone conversations with William had given him the impression that the latter abdicated both as German Emperor and King of Prussia, and he still hoped to save the throne to the dynasty; but republics had already been declared on the 8th in Munich and Brunswick. The general strike was proclaimed; and Prince Max formally appointed Ebert, the leader of the Majority Socialists, as his successor, and retired. Almost his last act was to order the troops not to shoot on the vast processions already filling the streets of Berlin.

The power had thus devolved on the Majority Socialists, who made great efforts at once to preserve order—for which the collaboration of bourgeois parties was necessary—and to restore the unity of the Labour front. In Bavaria and some of the smaller states—every state in Germany, without an exception, was proclaiming the republic and forming more or less revolutionary Governments—this was effected without friction. In Berlin and the Government of the Reich it was more difficult. The Independent Socialists agreed to enter a Government, on condition that the Cabinet be purely Socialist. The heads of non-political ministries were allowed to belong to other parties, but each was " controlled " by a Majority and an Independent Socialist. The Government proper entitled itself a " Council of Commissioners of the People " and was composed of Ebert, Scheidemann and Landsberg for the Majority Socialists and Haase, Dittmann and Barth for the Independents. It exercised dictatorial powers. Scheidemann proclaimed the republic from the buildings of the Reichstag on Nov. 9. The new Government hurriedly passed a series of decrees abolishing the state of siege, with the various restrictions on freedom in force and proclaiming a general amnesty, but affirming the right to private property. Its chief task, however, was to conclude the Armistice; and Erzberger, who had remained in office as Secretary of State, had on behalf of the German Govt. received the conditions of Armistice from the Allies in the Forest of Compiègne on Nov. 8. The conditions made the resumption of hostilities by Germany impossible. As President Wilson had demanded, they laid down the evacuation of the left bank of the Rhine, the occupation of the bridgeheads of Cologne, Mainz and Coblenz, the restitution of prisoners of war without reciprocity and the continuance of the blockade. An answer was required by Nov. 11, and on that morning the Government was obliged to accept the terms without modification. At the same time they asked that peace negotiations should be initiated.

The Struggle Against the Extreme Left.—The severity of the terms was a blow to the Moderates and encouraged the extreme Left. Workmen's and soldiers' councils were already springing into existence everywhere; a last order of the Supreme Command had been to allow their formation unimpeded. Some were quite spontaneous, others organised by the Independents and Spartacists. Liebknecht had refused a generous offer to join the Government, and he and Rosa Luxemburg, assisted by Radek, representing Bolshevik Russia, worked furiously to proclaim a Soviet dictatorship on the spot. The Majority Socialists, on the other hand, considered themselves only mandatories till the real will of the people should have been ascertained by a Constituent Assembly. It was a struggle between dictatorship and democracy, and the issue hung in the balance. On Dec. 1 a " National Executive Committee of Workmen's and Soldiers' Councils " was formed under the Independent Daümig. The extremists in it regarded it as the supreme authority of Germany, which, since the Councils system *ipso facto* excludes the bourgeoisie, involved the dictatorship of the proletariat. On Dec. 16 the Committee met in Berlin. After a stormy debate lasting three days, the views of the Majority Socialists prevailed. The powers of the Committee were limited to summoning and dissolving the Council of Representatives, which received both executive and legislative powers. Elections for a Constituent Assembly to determine the future form of the German State were fixed for Jan. 19. The Independents condemned this decision as " social treachery," and a few days later the Spartacists appealed to arms. The Council called out troops against them, defeating the Spartacists, after heavy fighting, on Dec. 24. The Independents, in consequence, seceded from the Government on Dec. 29.

The Spartacists, who had adopted the name of " Communist Party of Germany " on Jan. 1 1919, prepared to renew the struggle. Meanwhile, however, Noske, who had been appointed Minister of National Defence, had hurriedly organised a force which again defeated the Spartacists after fighting which lasted from Jan. 5–13. Liebknecht and Rosa Luxemburg were arrested and murdered by their escorts, apparently in cold blood. During the next few months, Noske was probably the most powerful man in Germany. He was entirely ruthless. " Somebody," he remarked " must be the bloodhound." Till now, the change of system had been almost bloodless, and had indeed been accomplished with remarkable smoothness. No member of a ruling house was injured, some indeed were genuinely regretted by their subjects. The administration continued to function; the soldiers dispersed to their homes in order, largely thanks to the irreproachable conduct of Hindenburg. The Spartacists alone appealed to arms; and it is probable that in putting them down without mercy, Noske saved his country from much anarchy. But he did it by dangerous methods—although, indeed, these were the only methods open to him; he employed the old corps of officers to serve a republic which most of them loved but little. Thus only a few weeks after the revolution, officers of the former army were appearing as saviours of society against Socialists; and a revival of German militarism so obnoxious both to the Allies and to liberal and Socialist Germany was thus provoked.

The Constituent Assembly and the Treaty of Versailles.—The non-Socialist parties reorganised hurriedly. The Conservatives

founded the German National People's party (Deutschnationale Volkspartei) and announced their readiness to co-operate in "any form of Government in which justice and order held sway." Certain of the National Liberals under Stresemann formed the German People's party. The German Democratic party represented the middle-class electors, but was largely an organisation of leaders, with less backing from the electorate. The Centre styled itself the Christian Democratic People's party. The elections for the Constituent Assembly on Jan. 19 gave the Majority Socialists 163 votes, the Independent Socialists 22, the German Nationalists 44, the German People's party 14, the Centre 91, the Democrats, with the Peasants' League, 81. The Communists abstained from voting. The National Assembly opened its sitting in Weimar on Feb. 6. The Independents refused to enter a coalition with non-Socialist parties; a coalition was therefore formed of the Majority Socialists, the Centre and the Democrats. Scheidemann became Chancellor; and Ebert was elected President of the Reich. A chief task of the Constituent Assembly was the elaboration of the Constitution, which was proclaimed on Aug. 11 1919. Elections in the principal states took place shortly after those for the Constituent Assembly. In Prussia the results were very similar to those for the Reich, Berlin and the industrial districts voting strongly Socialist. In Saxony the two Socialist parties had a majority over all others combined. In Bavaria, on the other hand, the clerical "Christian People's party" formed the strongest group.

The spring of 1919 was accompanied by continued trouble from the Left. The Berlin Spartacists made a fresh attempt to set up a Soviet Govt. in March. It decreed a general strike throughout Germany, which reached considerable dimensions in Berlin. It was quelled with bloodshed in Berlin, Halle, Leipzig, Stuttgart, Hamburg and other cities. In Bavaria the Minister President, an Independent Socialist, Kurt Eisner, was murdered by a Nationalist officer. A violent struggle ensued, and a Soviet Republic was proclaimed in Munich and ruled there till May 1. Much of this unrest was due to the uncontrollable effects of the aftermath of the War, the continuance of the blockade, universal underfeeding and unemployment; some to foreign agitation and some to irresponsibility. The Weimar coalition had undertaken a far harder task than that of opposition; but it struggled manfully to preserve the unity of Germany, to prevent bloodshed and, by disarming and respecting the Armistice conditions, to allow the Allies no excuse for applying sanctions. Exaggerated rumours were current as to the prevalence of democratic feeling and brotherly love in Great Britain and elsewhere, and the Government hoped that the peace terms, when they came, would strengthen their hand. The publication of the terms aroused deep consternation in Germany. Scheidemann resigned, saying "let the hand wither that signs this treaty." The Democrats left the Government. The Majority Socialists and Catholic Centre alone, and they with dissentient voices, agreed to take the responsibility of signing, under threat of the continuance of blockade, an Allied march into Germany and possibly the loss of the country's unity. Germany signed the Treaty of Versailles on June 28 1919 (*see* VERSAILLES, TREATY OF), the National Assembly giving its assent to the signature on July 9 by 208 votes to 115.

The Policy of Fulfilment.—Even while signing Germany refused to admit the sole responsibility for the War, and made every effort to prove by history that the charge was unjust, in the hope that this would lead to a revision of the treaty. The Government hoped and long believed that such a revision would come. Immediately after the ratification of the treaty, on Jan. 10 1920, President Ebert circulated a message that "we shall honestly endeavour to fulfil our engagements towards the Entente according to the Peace Treaty, but if there are clauses which prove to be absolutely unrealisable, we must hope that the Entente will understand this and be able to meet us in our difficulties."

For the time, however, the Government saw no course but to make the best of a bad job, and meanwhile strengthen republican and democratic elements at home. Its position was dangerous. The extreme Left had relapsed into comparative quiescence after the failure of the spring disturbances, but the opposition of the Right now began to rally. They saw that Great Britain and America had favoured more moderate terms in the Treaty of Versailles, but that the die had really been cast against them by the presence of the great French Army. They declared that Germany had only been forced to accept the treaty by her own action in disarming; that the treaty was imposed by *force majeure* and involved no moral obligation; that any attempt to fulfil its terms was high treason; and that the duty of a patriotic German was sabotage of the treaty, to resist disarmament, indeed to re-arm and to repudiate the treaty at the earliest moment when Germany's military power allowed it. Anyone connected with the "policy of fulfilment" was a traitor, and in the views of the extreme secret organisations which rapidly sprang into being, it was a patriotic duty to murder such a person. The advocacy of assassination, disguised as patriotism, became common; and was responsible for the murder, first of Erzberger, then of Rathenau.

Owing to the number of Jews among the Democratic and especially Socialist politicians, this Nationalist agitation was also preached as the struggle of the pure-bred German against the "hidden hand" of Jewry. Finally, and in reality most essentially, it soon took the form of a conflict of Social Democracy against the anti-Socialist forces of the rural districts and capitalism. Unfortunately for the Socialists, they had been obliged to take almost the sole responsibility for signing the treaty; although refusal to sign had been out of the question. The association of Socialism with national treachery was thus as easy as it was unjust. The industrialists financed the Nationalist movement heavily; the influence of the Roman Catholic Church was generally anti-Socialist and no doubt helped to detach from Socialism the peasants and small tradesmen whose republican sympathies had led them into the enemy camp.

In the autumn the National Assembly returned to Berlin. The Democrats re-entered the Cabinet. The Right was already agitating for new general elections, on the ground that the Constituent Assembly had finished its task by passing the Constitution. The demand was unwelcome to the Social Democrats, who were losing ground in the constituencies; and they hastened to pass what legislation they could. The eight-hour day had already been decreed. A bill, providing for the formation of Works Councils, was now introduced. A Socialisation law laid down in principle the transference of the whole mining industry to state ownership; but the committees of inquiry had not finished their investigations as to how this was to be done before the opportunity passed. Moreover, the fear that the Allied and Associated Powers might take over the nationalised properties acted as a deterrent on the Socialists. Erzberger, as Minister of Finance, introduced some drastic measures of taxation on War increases of income and an emergency contribution which contemplated the sequestration of a considerable percentage of private fortunes. (*See* INDUSTRIAL RELATIONS; WORKS COUNCILS.)

Reactionary and Communist Outbreaks.—On Jan. 10 1920 the Treaty of Versailles came into force. Very soon afterward Germany had to face her first and most serious attempt at a monarchist reaction. What is known as the *Kapp Putsch* was short-lived, and in some aspects almost ridiculous; but it was inevitable that it should be made, and the fact that it failed was momentous. Only now was the German republic firmly established and the unsettled elements left stranded by the end of the War were forced to see that the new order was not merely provisional. Henceforward, gradually, and with an ill-will which is not incomprehensible considering their circumstance and traditions, they adapted themselves and began to look on the new Republican Reich as an established fact. The movers in the *Kapp Putsch* were the old officers who, their occupation gone, comprised a dangerous and unabsorbed element, which at this moment was reinforced by the return of General von der Goltz's formations from the Baltic States. The treaty had provided for the reduction of Germany's army to 100,000 by March 31 1920. This reduction had not been made. Germany desired permission to keep a permanent force of 200,000; but the Allies granted only a fur-

ther grace of three months in which to complete the full reduction. The officers were faced with starvation and ready for any adventure. Kapp, a founder of the "Vaterlandspartei" seized the pretext to agitate against Ebert's position as unconstitutional. On March 13 Kapp, Von Lüttwitz, Erhardt and Colonel Bauer, formerly Ludendorff's chief of staff, seized the public buildings in Berlin with the aid of the marine troops quartered at Döberitz, and proclaimed a "government of order, liberty and action" consisting mainly of themselves. The real Government fled to Dresden and thence to Stuttgart, the Socialists of Berlin proclaimed a general strike. The movement collapsed in a few days. The leaders alone were punished, but most of them made their escape.

The strike had been completely successful; but it soon got out of hand. The threat of a reaction infuriated the workmen; Russian propaganda accused the Majority Socialists of complicity. Instead of returning to work, the workmen formed Soviets. The Communist element had long been secretly organising a Red Army. It now came into action in many parts of Germany. In Leipzig the Government had to use aeroplanes against the city. In Berlin, Württemberg and Bavaria the troops put down the rioters easily, but in the Saxon Vogtland a Communist government maintained power for some weeks. In the Ruhr a Red Army 50,000 strong conducted regular operations. This was a demilitarised zone, into which German troops beyond a small permanent garrison might not enter; and when, after some hesitation, a force of the Reichswehr actually entered the zone, French troops immediately marched in and occupied Frankfurt, Darmstadt and Homburg, remaining until May 17, by which date the German troops had left.

Reorganisation of the Reichswehr.—As a sequel to this incident Noske retired. His place was taken by the Bavarian Democrat Gessler, who together with General von Seeckt reorganised the Reichswehr. Many reactionary elements were eliminated from the Reichswehr (and simultaneously from the civil service), and it was henceforward a sufficiently trustworthy arm of the civil government, although strongly conservative in feeling. Von Seeckt engaged in a prolonged if unacknowledged duel with the Inter-Allied Commissions of Control, which remained in the country for some years. Technically, few violations of the treaty were proved. Great masses of war material were actually surrendered and destroyed; only in July 1920 was Germany admittedly and demonstrably in arrears in this respect. On the other hand, it is scarcely denied that much remained concealed; that a very high proportion of the men of military age and youths of Germany received what was military training in all but name from their respective political party organisations; that Germany was at no time without the nucleus of a highly-trained army, and could at any time have put into the field a formidable force; while her rifles and artillery were short, her chemists and scientists were working hard to discover new offensive and defensive methods which the Treaty of Versailles had not anticipated.

The First Reichstag.—After the collapse of the Communist rising, the National Assembly considered its work as finished. The elections for the first Reichstag (June 6 1920) followed hard on those stormy events. The moderates of each wing feared the violence of the other, and voted in self defence for their own extremists. The Independent Socialists increased their votes to 81, the German People's party to 62, the German Nationals to 66. The Democrats were reduced to 45, the Majority Socialists to 112, the Centre to 70.

To avert the danger from the left, the People's party agreed to enter a coalition with the Centre and the Democrats. The Majority Socialists supported the Government without entering it. Herr Fehrenbach became Premier, Dr. Wirth Minister of Finance and Dr. Simons Foreign Minister. The Government followed the policy of its predecessor. Almost its first action was to meet the Allies at Spa (July 5), a somewhat stormy meeting, chiefly concerned—outside the question of German coal-deliveries and the Inter-Allied arrangements regarding the distribution of reparations—with Germany's failure to disarm. During the remainder of the year, however, Germany enjoyed comparative quiet, and really began to disarm. A number of minor questions arising out of the Peace Treaty were settled during this period. The plebiscites in Schleswig (*q.v.*) had been held on Feb. 10 and March 14; those in Eupen and Malmédy (*see* EUPEN) on July 24; those in East and West Prussia on July 11. The only important territorial arrangement outstanding was that of Upper Silesia.

The question of the trial and punishment of the "war criminals" aroused much ill-feeling. Holland's refusal in Jan., Feb. and March 1920 to extradite the ex-Emperor William probably robbed international law of many interesting decisions. The Allies had demanded the arrest and delivery of many hundreds of war criminals; but in face of German protests, the Allies agreed (Feb. 16 1920) to allow trial before German Courts. Twelve persons were finally tried at Leipzig (May 23—July 16 1921), six being convicted.

The year 1921 saw renewed trouble. A militia known as the Einwohnerwehr had been organised in Bavaria, and Von Kahr, the Bavarian Premier, declared himself unable to dissolve it in view of the Bolshevik danger. Already all the elements of reaction were concentrating in Bavaria. Von Escherich, the prime mover in the Einwohnerwehr, had also formed a second organisation, the "Orgesch" (Organisation Escherich) obscurely connected with the Einwohnerwehr but receiving no official recognition. The Orgesch was spreading throughout Germany and assuming the proportions of a secret army, while the Government professed itself unable to control it in view of its own weakness. The Allied ultimatum of May 5 1921 at last decided Von Kahr, the Bavarian Premier, nominally to disband the Einwohnerwehr under threat of an occupation of the Ruhr.

The Bolshevik danger was real enough. The Majority Socialists had adhered to the Second International at Geneva in Aug. 1920; the Independents had joined the Third International (a minority dissenting) and coalesced with the Communists as the "United Communist party of Germany" (V.K.P.D.). A small and even more radical group formed a section of the Fourth International as the "Communist Labour Part of Germany" (K.A.P.D.). In March 1921 Moscow considered Germany "ripe for revolution" and a widespread rising broke out in Central Germany. The V.K.P.D. maintained a Communist régime in Halle, Mansfeld and Eisleben for several weeks. The insurrection, which spread as far as Hamburg, was put down with great difficulty.

The Reparations Problem.—Meanwhile the question of reparations was assuming the overwhelming importance which it was to retain for four years. Germany's financial situation was curious. Apart from the effects of war and blockade, she had been permanently weakened by the losses of large portions of territory. Nevertheless, her currency was low and her exports cheap, her territory unravaged, her population industrious. The middle-classes and officials were suffering severely, and districts such as Saxony, where industry depended on imported raw material and coal, were badly hit, so that in Germany there were now some 2,000,000 unemployed and at least 4,000,000 working half-time. In other places, however, where raw material was available, industry was flourishing. Notably the great industrial centres of Westphalia were reorganising and expanding most rapidly. Here Germany's chief wealth was concentrating and accumulating, especially in the hands of a few enormous combines, the most sensational of which was that which was founded and directed by Hugo Stinnes.

So long as complete uncertainty reigned as to what sum Germany would have to pay in reparations, the industrialists, who were strongly opposed to any "policy of fulfilment" made no attempt to relieve the financial distress of their country as a whole; they concentrated on maintaining their own prosperity and that of the districts under their own control, transferring capital abroad, speculating *à la baisse* on the mark, and paying their taxes in arrears and incompletely. It must be admitted that by their policy the industrialists did not only amass fortunes for themselves, but also saved the workmen in their concerns from

otherwise inevitable unemployment, which would have had incalculable economic and political consequences. The Reichsbank, by granting the industrialists almost unlimited credit, encouraged this policy.

Enormous wealth had thus accumulated in Germany in a few private hands, while the Government was almost bankrupt. When the Allies, by Jan. 1921, had at last decided on the bill to be presented to Germany and its allotment among themselves, the difference between the wealth obviously present in Germany and that at the disposal of the Government was glaring. The essential problem was that of tapping the wealth of Westphalia. When the German Govt. declared the conditions of the Allied note of Jan. 29 1921 (*see* REPARATIONS) impossible of fulfilment, and Dr. Simons, on a visit to London, was unable to come to any financial terms with the Allies, besides arousing their hostility by again repudiating Germany's war guilt, the Allies occupied Duisburg, Ruhrort and Düsseldorf on March 8 as " sanctions " and drew a customs cordon between occupied and unoccupied territory. It was this move which made possible the later occupation of the Ruhr district and opinion in Germany did not doubt that it was deliberately taken with a view to such later occupation.

The Fehrenbach Cabinet resigned. The Allies threatened to occupy the Ruhr and apply other sanctions. The " policy of fulfilment " became again a burning question; but in order " to save the German Reich and its unity, to save German territory from invasion and to retain German freedom " a new coalition Government under Wirth, composed of the Centre, the Majority Socialists and the Democrats was formed on May 10 and accepted the Allied ultimatum. Germany, by exertions which jeopardised the stability of the mark, paid the first milliard of gold marks on Aug. 31.

An early result of the Nationalist agitation against the " policy of fulfilment," which broke out with renewed violence, was the assassination of Erzberger (whose financial policy was particularly unpopular with the moneyed classes) on Aug. 25. The Independent Socialist Gartis was murdered in Munich, and the publicist Maximilian Harden wounded in Berlin, and an attempt made to poison Stresemann. A monarchist demonstration took place in Berlin; but although monarchist feeling was reviving, it lacked unity owing to the personal unpopularity of the members of the Hohenzollern family.

The Plebiscite in Upper Silesia.—The murder of Erzberger was followed by a further fall of the mark, which grew more pronounced in the autumn. The plebiscite in Upper Silesia had been taken on March 20, and had given 717,122 votes for Germany, 483,514 to Poland. The Polish High Commissioner, Korfanty, had thereupon raised an armed revolt, and the French troops stationed in the district were less successful in dealing with him than with the German defence force raised by General Hofer. As the Supreme Council was unable to agree on the fate of Upper Silesia, it turned the question over to the League of Nations, which awarded practically all the important industrial districts to Poland on grounds which were recondite in the eyes of many. This decision, which was taken in Oct., caused a crisis, more especially as it came at a moment when the " Reichswirtschaftsrat " had just evolved a plan under which the rich landowners and industrialists at last consented to make heavy sacrifices in order to stabilise the financial situation. These offers were now withdrawn.

The Second and Third Wirth Governments —Wirth resigned, but formed a second Cabinet against the opposition of the extreme Right and Left. All other questions were now dominated by that of reparations, which in its turn brought fresh conflicts between Left and Right. The burden of reparations was being borne almost solely by the wage-earning and salaried classes, from whose pay the taxes were deducted on payment. As the fall of the mark accelerated, the proviso under which industry and agriculture were allowed to pay their taxes in arrears reduced their burdens to a trifle, while they were able to pay off debts and mortgages at a fraction of their real value. The reactionary agitation increased daily; but owing to emergency legislation passed in Aug. 1921 the year passed off without disturbance. In 1922, however, the state deficit increased enormously. The Government was obliged to beg for moratoria and to allow the Reparations Commission the right of scrutiny over German financial measures. On June 24 Rathenau, Germany's greatest statesman, was murdered by Nationalists. He was the one man in Germany who had shown himself capable of a positive policy. In June 1921 he had come to a direct agreement with M. Loucheur regarding the reconstruction of the devastated regions of Northern France. On April 16 1922, as one of the German representatives at the conference of Genoa, he had signed the Treaty of Rapallo with Russia. The treaty had slightly eased Germany's financial situation and had opened up a new field of activity to her industry, but by proving her unwillingness to remain a cypher in foreign policy it deeply irritated the Allies.

In Aug. Poincaré came to the conclusion that Germany could only yield reparations if " productive pledges " were seized; that is, if the Allies actually took the Ruhr districts and managed them for their own profit. France's Allies were unwilling to consent to this, but the threat overshadowed the situation. The financial distress and continued fall of the mark made stabilisation the most urgent necessity. But the Allies rejected Germany's suggestion to make this possible by reducing reparations; the Reichsbank was unwilling to risk its last gold reserves; the Socialists refused to increase production by allowing hours of labour to be lengthened, maintaining that the profit would go into the pockets of the capitalists. Thus Germany remained politically disunited.

On Sept. 24 1922 the Majority Socialists, who had revised their programme at Görlitz on Sept. 18 1921, re-united with the Independents.[1] As a counterpoise, the moderate bourgeois parties formed a " working agreement " with the People's Party. The Social Democrats having refused to enter a Government with the People's Party, Dr. Wirth resigned and on Nov. 23 1922 formed a minority " business government " of middle-class representatives and permanent officials. It carried on the financial policy of its predecessor, stabilisation through reduction of reparations.

The Occupation of the Ruhr.—On Dec. 26 1922 and Jan. 9 1923 the Reparations Commission, the British member dissenting, declared an " intentional default " on the part of Germany. On Jan. 11 French and Belgian troops occupied the territory of the Ruhr. The history of this struggle is told elsewhere (*see* RUHR). The population of the Ruhr adopted an attitude of " passive resistance " which was supported by the Government. For eight months the Government maintained as a charge on its finances the population which ordinarily yielded its chief source of revenue. It could only meet this expenditure by unlimited inflation, which was aggravated by singularly incompetent administration of the Reichsbank. By June the mark was quoted at 150,000 to the dollar; on July 30 at 1,000,000; Nov. 20 at 4·2 billions. Austria's financial collapse paled before conditions in Germany; starvation for the working and middle-classes, mushroom fortunes won by speculation, the rise of prices marked by a multiplication so that people entered a shop with a considerable sum in taper and found it too little to buy a crust of bread by the time they reached the counter.

In view of the growing unrest, the Social Democrats agreed to enter a Government on a broad basis, with Stresemann, known to be a strong man, as Chancellor and Foreign Minister. The " Grand Coalition " was at last formed in Aug. 1923. Hilferding, a Social Democrat, became Minister of Finance. An attempt to stabilise the currency under existing conditions broke down. On Sept. 26 the Government proclaimed the abandonment of passive resistance in the Ruhr, and relieved itself of the financial expenditure involved. On the following day, it announced its intention to use all means to put down any attempt to create disturbances, and proclaimed martial law throughout the Reich.

[1] The United Socialists joined the Second International at the Congress of Hamburg May 21–7 1923, when the " 2½ (Vienna) International " of the German Independents, the Austrian Social Democrats and the British I.L.P. ceased to exist (*see* SOCIALISM).

Political Unrest.—The appalling financial catastrophe had produced a most dangerous political situation. In the Rhineland and the Bavarian Palatinate (*see* RHINELAND), the French were working to create a separatist movement. In Bavaria proper the agitation was less artificial. There were two great movements in Bavaria. Von Kahr, who had been Premier in 1920 and 1921, based his power on the Bavarian People's party. He wished to transfer the " centre of gravity " of Germany to the Catholic South, and while he denied any aim further than revising the Weimar Constitution in the favour of federalism, he was an avowed monarchist—the Bavarian dynasty occupied a position in Bavaria little inferior to that which it had enjoyed up to 1918—his party had been compromised by revelations of their relations with the French, and he had involved himself in various schemes to create a Catholic Danube monarchy of the South to include parts of Austria. A second party was led by Hitler, an immigrant workman from Austria, and Gen. Ludendorff, supported by numerous refugees from the Kapp Putsch. Its adherents styled themselves " National Socialists " but were in fact not Socialists at all. The programme was to " regenerate the Reich through Bavaria." These two groups were constantly intriguing with each other and with various reactionary and Catholic parties outside Bavaria and outside Germany. A dangerous situation had been created in the summer of 1922, when Bavaria refused to recognise the legislation and tribunals of the Reich. It was smoothed over, and Von Knilling had since acted as Premier, with an unclear policy. Throughout 1923 the agitation of Hitler's " Völkische" party grew so rapidly that a coup was almost daily expected, which would have been accompanied by military reaction in North Germany. The Government considered the monarchists the lesser danger; on Sept. 26 civil law was suspended in Bavaria, and Von Kahr appointed General Commissary with dictatorial powers. He instantaneously consolidated his position by lowering the price of beer.

The state of Saxony and Thuringia were no less disturbed. A new Bolshevik centre had been established in Dresden and the Premier, an extraordinary figure named Zeigner, was ruling at the head of a coalition of Communists and Left Wing Socialists. A Red Army had been formed, and was only waiting for a reactionary outbreak in Bavaria, which would give it the sympathy of the workmen in Berlin, to establish a Soviet Govt. and Red terror. In addition, quite apart from the separatist movement, there were grave Communist disturbances among the unemployed in the Ruhr. The plans of the Third International, which was directing this movement, regarded Saxony only as a " jumping off place " and envisaged a general rising with the centre in West Germany. The Government had, however, searched the offices of the Russian Trade Delegation in Berlin on May 3; and although relations between Germany and Russia were in consequence very strained throughout the summer, the German Govt. had obtained valuable information on the plans of the Communists.

The proclamation of martial law by the Government was answered by defiant demonstrations by all the malcontents and an actual outbreak by the Separatists in Düsseldorf on Sept. 30. The Saxon Finance Minister, Böttcher, called on the proletariat to arm. Fortunately, each side waited for the other to move while the Government of the Reich passed through a fresh crisis.

The German People's party were alarmed at the presence in the Cabinet of Hilferding, who was known to be a champion of nationalisation. They desired legislation for increasing production without regard to the eight-hour day, and that the Government should receive dictatorial powers to issue orders of this nature with the force of law without consulting the Reichstag. The Socialists were determined to oppose any tampering with the eight-hour day. The parties finally agreed on the principle of a " new regulation of laws regarding hours of work, with retention in principle of the eight-hour day." The Stresemann Cabinet was reconstructed in early October. Hilferding left it, and Dr. Luther became Finance Minister. The Cabinet received the desired emergency powers on Oct. 13. It was now able to deal successfully with the Communists. The Military Commander in Saxony called on Zeigner to repudiate Böttcher's speech. Zeigner refused; troops of the Reichswehr then entered Saxony on Oct. 22, forced Zeigner to resign and restored order. Other troops occupied Thuringia and disbanded the Red Army, and a rising in Hamburg was put down.

In Bavaria the military commander, Von Lossow, sided with the Bavarian Govt., refused Von Seeckt's order to resign, and allowed the Bavarian authorities to appoint him Provincial commander. The Bavarian Govt., in defiance of the law, exacted a special oath of allegiance from the Bavarian troops. Many officers of the Reichswehr openly sympathised with Ludendorff against the government of the Reich, and Hitler and Ludendorff were encouraged to believe their hour had come. On Nov. 8 they seized Von Kahr and Von Lossow and proclaimed a government, consisting of themselves. Von Kahr at first appeared to fall in with their plans and announced himself as " viceroy of the King of Bavaria." But as soon as he saw that the Reichswehr would act against the insurgents, he called in troops, which fired on the revolutionaries. Ludendorff fell on the pavement and shammed dead till all was over. His much-enduring reputation could not stand this strain.

His fellow conspirators were arrested, and the pricked bubble of the " Völkische " collapsed. In the following spring the chief participants were tried. Ludendorff was acquitted. Hitler and other leaders imprisoned. The trial aroused great excitement on both sides. The separatist movement in the occupied territory reached its climax about the same time. The " Rhineland Republic " was proclaimed at Aachen on Oct. 31; at Coblenz on Oct. 25; and in other Rhineland towns at the same time. The movement then gradually decayed, and had disappeared by Feb. 11 1924, except in the Bavarian Palatinate. The official birthday of this Government was Nov. 11, and French support of it was more than usually tenacious. It finally vanished at the end of Feb. 1924.

Financial Reconstruction.—This proved to be the climax of Germany's troubles; but her internal political situation was still uncertain. The Socialists withdrew their support from the Government on account of the different treatment of the insurgents in Saxony and in Bavaria. Stresemann failed to secure a fresh vote of confidence and a new emergency powers Act, and resigned on Nov. 23. On Dec. 1, Marx formed a minority " middle-class " Government with Stresemann as Foreign Minister and Luther as Minister of Finance. The Government received a new emergency powers Act to carry through the work of stabilisation and reconstruction during a limited period. By the appointed date (Feb. 15 1924) the budget was balanced by means of these emergency decrees. The first reduced the number of officials, readjusted taxation and ordained pre-payment of taxes. The second stabilised the mark, introducing a strictly limited issue of " Rentenmarks," each equivalent to one billion paper marks, and limiting credits. The third carried through the principle of valorisation of public and private debts which had been inaugurated before the inflation period set in. At the same time the Ruhr industries reached an agreement with the M.I.C.U.M. (*Mission interalliée de contrôle des usines et des mines*) regarding deliveries in kind on reparation account which formed the transition to a new settlement of reparation obligations.

The Dawes Plan.—On Jan. 14 1924 the Committee of Experts for the examination of Germany's capacity to pay met in Paris under Gen. Dawes. Its relations with Germany were not unhappy, and it frequently consulted Schacht, the new President of the Reichsbank. A British Labour Ministry entered office on Jan. 22, and Poincaré gave way to Herriot in France in May. Germany's internal and foreign position now improved very rapidly. On Feb. 5 the British Prime Minister expressed the hope that Germany would join the League of Nations. Soon after, a German Ambassador was appointed to France, for the first time since the War. Von Kahr and Von Lossow retired on Feb. 18, and the powers of the Bavarian general commissariat came to an end. The state of siege in Saxony and Thuringia lapsed on March 1. The Dawes Plan (*see* REPARATIONS) was accepted in principle by the Governments of the Reich and of the Territories on April

14, and by the Association of Industrialists on April 24; but the new elections for the Reichstag had been fixed for May 4, and were fought almost solely on the Dawes Plan as an issue.

In view of the great distress following the sudden deflation, restriction of credit and rise of prices, the extreme parties of both wings gained votes at the elections. All the Government parties lost heavily, while the Communists secured 62 votes, the "Völkische" 32 and the German Nationals 96. Nevertheless a vote of non-confidence in the old Ministry, which had remained in office, was defeated on June 6 by 239 votes to 194 and Marx and Stresemann left for London on Aug. 4 as the representatives of Germany. The decisions of the Conference of London were initialled on Aug. 16. They provided for the restoration of Germany's fiscal and economic unity; the military evacuation of the Ruhr by Aug. 16 1925 (by separate agreement between Marx and Herriot); the issue of a banker's loan to Germany of £40,000,000; and the continuance of reparations deliveries in hand. The Dawes scheme was to come into full operation by Oct. 5.

The Government was just able to carry the acceptance of the Dawes Plan. The German Nationalists consented to allow its members to vote independently. The essential laws (the denationalisation of the state railways, the Bank law, the private Banknote law, the law liquidating the Rentenbank and the coinage law) were passed and the agreement on the Dawes Plan was ratified on Aug. 29. The laws in question came into force on Oct. 12.

The complaisancy of the Nationalists had been bought at a considerable price. They regarded their concessions purely as business arrangements, as facilitating the influx of foreign capital and reducing the danger of fresh Communist disturbances. But they were growing ever less ready to accept Germany's position as an outcast; and demanded from Stresemann a statement repudiating Germany's war guilt, as well as a place in the Ministry. A statement in accordance with the first demand was made in the Reichstag, while in the autumn Stresemann began to sound the ground regarding Germany's entry into the League of Nations. On Sept. 23 the Cabinet arrived at a decision in principle to seek the speedy entry of Germany into the League. As, however, the British and French Govts. could not give a definite answer to the memorandum which she addressed to them on Sept. 29 asking "whether the guarantees requisite for an application for membership and the status of Germany within the League, and also other definite and inseparable questions, were forthcoming," the matter was left temporarily in suspense.

The second Nationalist condition led to the dissolution of the Reichstag on Oct. 20, as it proved impossible to induce the Social Democrats and Nationalists to sit together. The general elections were held on Dec. 7. But by this time the general situation had grown much easier. The Régie railways and mines in the west, and the customs, were again in German hands. The customs barrier between occupied and unoccupied territory had vanished. The M.I.C.U.M. agreement had become void. There were general symptoms of a revival in trade. The extremists lost votes again; the Communists were reduced to 45, the "Völkische" to 14, while the Socialists rose to 131. The numerous parties of the Right Centre formed the strongest Parliamentary group. A Luther Cabinet, including four German Nationalists, held a precarious tenure in which it endeavoured to compromise between the demands of various interests. Protective tariffs for agriculture were introduced, the sales tax lowered, restrictions on deals in foreign currency for commercial purposes abolished, official salaries raised, the goods tariff and certain postal dues reduced, the tax-free limit of income raised to 60 marks a month, and old claims valorised in July 1925 by a law of the Reich. The middle-class Government of the Reich, was, however, confronted by the incessant hostility of the Prussian Govt., where the parties of the Weimar coalition were in power. Although her Parliament was a mass of small, jealous parties, Germany at large was divided into two broad groups of the Right and Left which attacked each other bitterly. Each raked up a series of scandals against the other; this unsavoury process culminated when a judge, in his summing up on a small case, stated that the President of the Reich had been guilty of high treason to the Reich by his part in directing the munitions strike in 1918. The Nationalist Press broke out into violent invective against Ebert; the whole legend of the "stab in the back" was revived. The campaign was the more cruel that it was directed against a sick man. He died after an operation on Feb. 28 1925. Few men have served their country so well.

Von Hindenburg's Presidency.—Seven parties chose to put forward candidates for Ebert's vacant post, and these included such names as Ludendorff and the Communist Thälmann. The first poll gave no candidate a sufficient majority. The Right then united to bring Hindenburg forward; the Left proposed Marx; the Communists stood apart.

On April 26 Hindenburg was elected by 14,639,000 votes against 13,740,000 cast for Marx and 4,900,000 for Thälmann. Many Socialist votes had been withheld from Marx on account of his Catholic tenets. Hindenburg's election aroused great apprehension outside Germany, but in point of fact the old field marshal preserved his dignity and his common sense as perfectly as he had throughout the War and the revolution.

Foreign Relations.—With the balance thus held evenly between Left and Right, the extremists discredited and the unity of the Reich established, the interest in German politics was now almost confined to foreign affairs. If little has been said hitherto on this topic, it is because the course of events in 1918 had assigned Germany an almost purely passive rôle. Of all her old friends or sympathisers, the only one which did not disown her in her defeat (if we except the small minority of die-hard generals in other defeated countries who dreamed of reversing the results of the War with fantastically inadequate means) was the little republic of Austria. The peace treaties forbade the union of Germany and Austria. The decision was a bitter one for Austria, but hardly awoke equal sorrow in Germany. Not only was Austria economically a heavily passive factor, but the inclusion of her would have made it impossible to centralise the Reich as was done by the Weimar Constitution, and that constitution would certainly have to be revised should Austria join Germany at some later date. For the rest, Allied and Associated Powers of older or more recent standing surrounded Germany as soon as the Armistice was signed.

With the Treaty of Versailles, which assigned the whole guilt of the War to Germany, was incorporated the Covenant of the League of Nations, which built up a great structure for the maintenance of the peace of Europe, which Germany was not invited to join. At first, indeed, she showed no anxiety to join. Hostility to the League was almost universal owing to its association with the Treaty of Versailles which even the advocates of the "policy of fulfilment" denounced as unjust in many respects. The feeling was aggravated by doubts as to the impartiality of the League's administration of the Saar basin and reached its climax when the decision of the Council of the League sanctioned arrangements in Upper Silesia which German opinion resented violently. Nor was it confined to the Nationalists. Soviet Russia repudiated the League as a capitalist institution. The German Communists followed the lead of Moscow, and the Socialists saw far more hope in a revival of the International.

After the first passions had cooled, Germany began to distinguish between the various territorial provisions of the Treaty of Versailles. The cessions to Denmark and Czechoslovakia aroused little resentment; those to Belgium were small. The justice of the loss of parts of Alsace-Lorraine was not greatly disputed. The three most important questions remained those of the Rhineland, of the frontier with Poland and of the German colonies.

The problem of Germany's western frontier differed from others, both by its urgent economic importance and by the fact that Germany could claim that here she was only defending her rights within the treaty. She contended that the occupation of the Ruhr was illegal, but so long as the threat of it, or its actuality, was not removed, it was impossible for her to initiate an active policy; it was equally unthinkable for either party that Germany and France could meet as colleagues within the Council of the League of Nations.

Thus up to 1924 Germany's foreign policy was almost entirely defensive. A number of minor treaties and agreements, mainly of commercial character, were concluded; the most important being the Treaty of Arbitration with Switzerland (Dec. 3 1921). But the only treaty of outstanding importance was that concluded with Russia on April 16 1922. The text of this Treaty of Rapallo (*q.v.*) was not in itself such as to justify the protests with which it was greeted. These were rather due to the fear that the treaty contained secret clauses of a political nature, and especially clauses aimed against the integrity of Poland. The existence of such clauses was denied and, in fact, no political developments could be traced as arising out of the treaty during 1923 or 1924. It was a tactical error in so far as it increased France's and Poland's nervous instinct; it certainly looked as though Germany was drawing her conclusions from the Treaty of Versailles with too much logic in associating herself with the second Great Power which remained by mutual consent outside the European concert. Germany, however, claimed that she had no quarrel with Russia.

With the advent to power of M. Herriot in France in 1924 the situation changed. Moderate opinion in Germany was willing to accept the permanent loss of Alsace-Lorraine in return for security on the demilitarised western frontiers. If Germany could become a member of the Council of the League, there was some hope that readjustments on her eastern frontier might prove possible at some future date, and this position would also give her a chance of acquiring some day a colonial mandate. The general improvement of relations between France and Germany made their collaboration within the League possible, while Germany was rapidly freeing herself from the restrictions imposed on her national sovereignty. A sudden shock was given to the improving relations by the report of the Commission of Control on June 29, that Germany had not yet fulfilled the disarmament conditions, and that the Cologne zone could consequently not be evacuated in Jan. 1925. During the year, however, the commission finished its work and the Cologne zone was evacuated on Jan. 31 1926. In July 1925 the troops had been withdrawn from the Ruhr, and in Aug. from the districts occupied in 1921. The question of giving Germany her proper place in Europe now became urgent.

The Pact of Locarno.—On March 4 1925 was published Stresemann's offer of a guarantee pact in respect of Germany's frontiers with France and Belgium and an undertaking to refrain from military means of revision of her Polish frontier. This policy occupied the attention of Europe throughout 1925, and was finally embodied in the Pact of Locarno, after discussions between the European diplomats which lasted from Oct. 5–16. At Locarno Germany concluded a number of treaties which practically guaranteed peace between her and her neighbours (*see* LOCARNO; SECURITY). The Pact was to come into effect on Germany's admission as a member of the Council of the League of Nations.

Stresemann's policy was not easily accepted in Germany. The widespread distrust of the League could not vanish in a day. The Nationalists objected violently to the permanent renunciation of Alsace and Lorraine involved in the Pact. But they had not gained in strength so much as they had hoped during 1925; in particular, Hindenburg's sensible attitude had deeply disappointed them. The Pact was ratified on Nov. 27 1925 and duly signed in London on Dec. 1. Luther's Cabinet then resigned, but after a prolonged crisis Luther formed a fresh minority Cabinet of the Centre on Jan. 19 1926. The Socialists promised him their support on condition that he pursued a republican policy and carried out the terms of Locarno. The Nationalists opened a violent campaign against him, while feeling between Right and Left was further embittered by revelations regarding the naval mutiny of 1918.

It was the more disastrous that, when Germany's application for admission came before the League of Nations in March 1926, Brazil vetoed her admission unless she herself were also given a seat on the Council. Speaking in the Reichstag, on March 22, Stresemann declared that Germany had received "moral rehabilitation" in Geneva, and that the policy of Locarno must not be allowed to lapse. Most of the German parties agreed to support him. The Nationalist spokesman found it easy to revile the League and Germany's attempts at reconciliation.

The Russo-German Treaty, April 24 1926.—Considerable excitement was aroused shortly after, when it was announced that Germany and Russia were again in negotiation for a treaty. This new treaty was signed in Berlin on April 24 1926 and published, together with an exchange of notes between the signatories (Stresemann and Krestinsky) on April 26. The basis of relations between Germany and Russia was stated to be the Treaty of Rapallo. The two Governments promised to remain in friendly touch with one another. Article 2 ran "Should one of the contracting parties in despite of its peaceful attitude be attacked by a third party or by several third parties the other contracting party will observe neutrality during the entire duration of the conflict." By Article 3 each party promised not to participate in any "economic or financial boycott" imposed on the other in times of war or peace. The treaty was to be valid for five years.

The third paragraph of the note for which Stresemann was responsible declared explicitly that "this fundamental attitude of German policy towards the U.S.S.R. cannot be adversely influenced by the loyal observation of the obligations (arising out of Articles 16 and 17 of the Covenant of the League and relating to the application of sanctions) which would come into existence for Germany as the consequence of her entry into the League of Nations," as such sanctions could only come into force if Russia were the aggressor, in Germany's own view, the views of other Powers not being binding on her. Whether Germany would take part in the application of sanctions at all, and to what extent, depended on the interpretation of the note of Dec. 1 1925 on the interpretation of Article 16 addressed to the German Govt. on the signature of the treaty complex of Locarno (the gist of this note being that no state could be held to undertakings manifestly beyond its powers). Germany maintained that this treaty was a necessary and proper adaptation of the situation under the Treaty of Rapallo to that created by the Pact of Locarno. Opinion in France and Czechoslovakia was inclined to question this view.[1]

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(C. A. M.)

[1] On May 5 the Luther Cabinet decided that a flag bearing the imperial colours, black, white and red, should be flown over the legations and missions of Germany, alongside with the black, red and gold of the Republic. The Democrats, dissatisfied with the attitude of Luther on this question, carried a motion against him on May 12 by 176 votes to 46. Herr Luther thereupon resigned, and Herr Marx succeeded him as Chancellor.

A serious difference of opinion arose over the proposal to confiscate the property of the former ruling houses, including the Hohenzollerns. Their large properties should, it was suggested, be devoted to benefiting the unemployed, war widows and other necessitous classes, while their castles and palaces should be used for welfare and educational purposes. The measure, which was opposed by President Hindenburg, was submitted to a referendum which took place on June 20. The total vote polled was 15,026,312, of which 14,441,590 were cast for confiscation, and 584,722 against. As, however, the constitution provides that more than one-half of the total votes—at that time 39,690,559—are necessary for success, the proposal failed. (ED. *E. B.*)

General Survey

The chronicler must not aspire to be a prophet. He may, however, reach a point from which he can survey the crowd of personalities and events grouped about him. How fares the Germany of 1925 in comparison with the Germany of 1910?

No such comparison can apply to economic life, since the inroads of the War have been too formidable and the consequences of the false economic policy which accompanied it could only gradually be surmounted. But it may be asserted that Germany has made a relatively rapid recovery from the unsound experiment of forming "vertical" trusts (liquidation of the Stinnes concern in Aug. 1925), and is striving by an energetic concentration of the operations of cognate industries to simplify the official organisation, to effect economies and to strengthen every enterprise included in the combine in its own capacity for output.[1] It is also a good sign that the influence of the most inventive and generally beneficent industry, the chemical industry, particularly the dyes branch (medicines, tropical therapeutics), has increased in industry as a whole.

Education and Justice.—As regards popular education, the arts and science, comparison is easier. For in these realms, where the War and revolution—which even in Germany party-life have strictly speaking only resulted in a change of nomenclature, produced a stagnation, a species of stupor, lasting indeed for years—development has been resumed at the point at which it broke off in 1914. One evil omen for the state is that popular confidence in the law has been shattered (in some cases through no fault of the judges) because during the period of inflation procedure in civil cases became farcical. There are others. The control of industry, which took the place of competition, benefited no one but the profiteers. In political trials the impartiality of the judges was often doubtful; in other trials, owing to the introduction of special courts, erroneous verdicts were laid to the charge of the law itself; young people only 14 or 15 years old, with unformed opinions, become members of contending political associations which do not subsist by their own strength but upon the funds of the adult party organisations. Finally, despite the diminished consumption of alcohol, popular amusements have become less harmless and "sociable." This is due in the great towns to the "revues," and in the medium-sized and smaller towns to the cinematograph, which before the most diverse audiences produces the same pieces and films, thereby destroying a healthy individual attitude towards art and recreation.

The relations between the German citizen and the state remain the same. He continues to regard himself as something distinct from the collective body. Just as during childhood he sees an enemy in the school and the teacher, so as a grown man he regards the State and the Government as an adversary rather than as something in which he himself bears a part and for which he is responsible. If "fiscal" morality is no worse, it is equally no better. The great problem of the schools has, moreover, not yet been solved, although attempts have been made in the Constitution itself and in a law of the Reich. It is sought to establish standard schools (Einheitsschule) providing an uniform education for the children of all classes up to the age of 10, and to give more instruction in German at the expense of the ancient tongues. But the problem of clerical influence in the school is still unsolved, and the process of converting purely scientific teaching into moral training for the young has been barely begun. The "movement of youth," which in the years before the War was making very great strides and led its members to the adoption of a simpler, more natural mode of life, to a greater readiness to help others, and, in many cases too, to a greater love of home, has split up into numerous sects. It has been ruined or impeded by the need for earning a livelihood at an early age by work in the towns.

In many respects, however, improvement is manifest. After the complete ruin of all means of communication in the last year of the War, order and punctuality have been restored within the services with astonishing rapidity. The credit for this belongs to a great extent to the minister for transport, Groener. The system of communications, so important an index for the modern state, is once more as efficient as before the War, and zealous efforts are being made to improve it. The police feel that they are there not so much to command as to render help to the public. Many old officers serve the state honourably as members of the force. The great mass of the official class has remained intact, and performs as much or more work for a salary which commands a purchasing power only equal to about half that of pre-War salaries.

The Arts.—Parallel with the progress made in the chemical industry, in products demanding accuracy of workmanship and in the construction of machinery, taste and the sense of form have undergone a universal improvement. Photography and its application to open-air subjects produce excellent films. Applied art, in which, however, German Austria holds the first place, besides producing masterpieces in the luxury trades and in the form of efficient advertisements, has once more called a genuine popular art into existence. Moreover, although in itself unimportant it is of excellent omen that Germany to-day possesses not only toys but also children's picture-books (E. Kreidolf, Else Wenz, Wanda Ebel, Elsa Eisgruber) such as no other country has. Since the death of Max Reger, Germany has no longer any composer to carry on the tale of her greatest creative minds. The musical tradition is, however, kept alive by distinguished conductors and performers.

Germany has found a new and more serious rendering of music than she possessed at the beginning of the century. In literature the books that are read are of more significance than those that are written. Side by side with Dostoievsky and the Scandinavians, the early German Romantics, Hölderlin and Novalis, are most read, but also Jean Paul, the object of enthusiastic admiration by the young. The writings alike of Goethe and Heine, treating of political and social topics, continue to exercise a powerful influence. The great national poet of German Switzerland, Jeremias Gotthelf, whom Ruskin admired, has been revived; and while young dramatists—Unruh, Toller, Brecht, Bronnen—in part powerfully influenced by Wedekind, espouse an exuberant "activism," Thomas Mann, taking up Theodore Fontane's subtle and genuinely realistic portrayal of North German society, has become, particularly by his last novel of contemporary life, *Der Zauberberg*, the undisputed master of prose narrative. The principal characters in this book, even if to some extent endowed with foreign traits, embody the whole of intellectual Germany in the same sense in which the spirit of English society lived and moved in the greatest novels of George Meredith. The clearest indication, however, of a turn for the better in Germany is given by town-planning and architecture. Even the terrible material stress of the War and post-War period has been unable to hold this in check. Examples may be found in Schumacher's town-planning scheme for Cologne, the railway station by Bonatz at Stuttgart and the Chile House in Hamburg.

(A. M.-B.)

IV. GERMANY'S NAVAL POLICY[2]

It has been frequently asserted that the creation of the German Navy was the main cause of the World War. Such an assertion implies not only that it was admittedly constructed on the right lines from a technical point of view—for no one would plunge into war for the sake of a negligible quantity—but also the admission that Germany's sea power was to be forcibly kept down. From the German standpoint a firm protest must be entered

[1] *E.g.*, the amalgamations effected since Feb. 1925: association of locomotive builders, of steelworks, of spirituous industries, the syndicate of Ruhr coal and mid-German brown-coal industries, of dealers in tubing, of wire-rolling mills, of dye industries, of aerial and shipping communications. In the autumn of 1925 an agreement was reached between the amalgamated German and the Belgian wire industries regulating the conditions of export on lines similar to the earlier Franco-German agreement respecting potash (*see* Cartels).

[2] Admiral von Scheer's article is full of disputable propositions, but is published unchanged in accordance with the principle of the Thirteenth Edition of *The Encyclopædia Britannica*—to allow each nation to state its own case through recognized spokesmen.—Ed. *E.B.*

against the view that as a political factor the German Navy constituted a menace to foreign interests which could apparently be removed only by warlike methods.

The tendency which emerges from the German naval laws, as carried into effect, is that of aiming only at the preservation of justifiable self-interests without encroaching too much on the maritime interests of other nations. " Defence is one of the most impressive and visible expressions of the State's will to independence." This pronouncement was made in 1922 by the Bundesrat of Switzerland, a country which can in no wise be accused of cherishing schemes for attacking its neighbours.

The preservation of independence is the predominant principle of state for civilised nations to whom the conception of liberty is their very life element, and Germany cannot be reproached for undertaking the construction of a navy proportionate to her economic requirements. For impotence at sea is an intolerable condition of weakness for a seafaring people, let their land defence be what it will. So much was made plain by the German-Danish war of 1848–9, when Prussia, with ten times more inhabitants than Denmark, was forced to yield for lack of a fleet to raise the Danish blockade of the Baltic ports, the economic losses sustained by her sea-trade being greater than the advantages obtainable by a land war against Denmark. It was with a view to readjusting the situation that the Prussian Navy came into existence. Founded in 1853, it passed in 1867 into the possession of the North German federation, established after the separation of the Habsburg dual monarchy from Germany.

This perfectly natural aspiration to escape from the German small state powerlessness and form a national state such as other peoples (England and France) had long since secured for themselves, had its origin in the progressive tendency of the age. The great state-making forces which gripped Europe in the beginning of the 19th century after the Napoleonic wars of conquest were the direct consequence of the overthrow, with British aid, of the French domination of that continent.

Although Germany's expectations of securing State unity by way of reward for her share in the war of liberation were, for the time being, dashed by the ruling of the Vienna Congress of 1815, her ambition, once aroused, left her no peace until she had secured the establishment of the Reich after the war of 1870–1 against France, who stood in the way of a united German state. With the reannexation at the peace treaty of Alsace-Lorraine, the Imperial provinces seized by Louis XIV., the German Empire became—in Bismarck's words—saturated. Territorial expansion in Europe was no part of the programme. Its efforts were directed towards keeping the peace in Europe so that its full strength might be devoted to building up the Reich. The productive capacity of the concentrated and greatly enlarged economic area represented by the Reich grew to considerable importance favoured by the progress of technical methods. International commerce provided goods in bulk, in particular raw material for an enormously expanding industry, and foodstuffs for the rapidly increasing populations of the civilised states. Some of these were utterly unable to supply the needs of life from their own resources, for example England, and also Germany, whose population of over 40,000,000 had risen within a few decades to over 60 millions.

The former large migration of Germany's surplus population to overseas had now ceased. The German colonies by reason of their inadequate development and geographical situation were ill-suited to absorb any numbers worth considering. The growing industrialisation of the country, on the other hand, offered new possibilities of livelihood to the increasing population. As early as the 'eighties, the annual emigration figures fell from 200,000 to one-tenth of that figure. At the same time Germany's dependence on other countries increased, as may be seen from the trade returns. The relations of the new state structure with foreign countries brought about the naval foundation-plan of 1873, which aimed at creating a sea power of the second rank within the space of 10 years. It was not until the close of the 19th century that the possibility of grave conflicts with other European Powers arising out of trade competition became a serious factor.

England, with a technical equipment decades in advance of the German and a predominant position in world commerce, could watch the new competitor the more coolly, in that the opening up of the world offered so many new sources of trade that she alone could never control them. In addition, her established commercial connections, large mercantile marine and colossal colonial possessions placed her in so favourable a position that the development of new trading enterprise could not but be welcome. Germany became almost her best customer, and English exports to that country always exceeded in value the imports therefrom, to which, by her free trade principles, she opposed no obstacle prejudicial to mutual relations.

Now while the great territorial Powers, with their armies pretty evenly balanced, at a time when those armies count millions of men not lightly to be unleashed, it becomes more important to be able to throw the power of a big fleet into the scales. For the personnel needed is small, the country will not be directly plunged into suffering and the population is able to go about its daily task almost unheeding, while the silent pressure of sea power can exercise a definite influence. It was on these grounds that England's influential position in the European concert was founded.

Her rôle emerged the more clearly after two definite groups of powers had been formed in Europe, which, while approximately well balanced, persisted in a state of intent hostility. It therefore became necessary to keep England from throwing her weight against Germany. The construction of the German fleet was a political move against this possibility in that it would prevent a shifting of the European balance to the detriment of the Central Powers.

After the carrying out of the naval programme of 1873 the German Navy had, between 1883 and 1897, fallen completely behind and become obsolete. This stagnation set in with the appointment of General Caprivi to the admiralty. Under his rule coast defence filled the picture. Obsolete ironclads were not replaced because no one had any clear views on naval tactics. The same uncertainty prevailed in other navies continually experimenting to find the best type of battleship. This state of things was brought to an end by the English Admiralty with the Naval Defence Act of 1889.

In Germany, too, it was realised that a coast defence consisting of fortifications and torpedo boats was but an incomplete form of armament, useless for any far-ranging operations at sea. From the time of Kaiser Wilhelm II.'s accession (1888), efforts to modernise the fleet were made, though with small success. Four battleships of the " Brandenburg " class with 10,000 tons displacement were authorised by the Reichstag in 1890, but after that construction again came to a standstill. In spite, however, of the bad quality and insufficiency of building material during those years, the time was well spent in the navy, for definite tactical and strategical conclusions were reached as to the manner of using a fleet.

On these conclusions was based the first navy law introduced after Admiral Tirpitz's appointment as Secretary of State for the Imperial Navy in 1897. This committed the Government as to the number of ships and the Reichstag to the necessary expenditure. The programme was to be spread over six years at an expenditure of 409,000,000 marks (about £21,000,000 sterling). England had thus an advantage of almost 10 years, and was building onto an existing fleet, whereas Germany lacked a working basis.

According to the new scheme the number of ships demanded was based upon their tactical division into two squadrons, each containing eight battleships (16), in addition to which there were to be a fleet flag ship and two reserve battleships, making in all 19 battleships. Besides, 12 large and 30 small cruisers, to serve as scouts for the home battle fleet and for service abroad, were asked for. A navy law in this sense was passed in 1898. The preamble declared that " as opposed to the greater naval powers the battle fleet will have importance solely in sorties." This was evident, both from the limitation in the number of vessels and from the circumstance that 12 of the old battleships were to be included in the figure to be reached in the course of six years.

The conflict of battleships now came to the fore as the strategic task of the fleet. This alone, according to the teaching of naval history, was the means by which command of the sea could be maintained. The limitation of the said control to Germany's home waters, the Baltic and the North Sea, was imposed by the relative strength of the German Navy to other navies. For a time, it is true, Germany was influenced by the young French school, which set forth the destruction of the enemy's sea-trade as the main task of a navy, but the principles were not only never applied but in the end definitely rejected in favour of the decision to build a battle fleet.

Adherence to this decision was the principle underlying the further upbuilding of the German Fleet, a measure that could no longer be delayed in face of the developments in foreign politics at the turn of the century. England's attitude towards Germany had become definitely hostile. The Franco-Russian alliance was obviously directed against Germany, and the clash between France and England over the Fashoda incident was smoothed out of existence by England's vigorous action. The pressure exercised by England through her Fleet on this occasion might well be regarded as a hint of what Germany might expect one day, especially as her interests at sea were definitely on the up-grade owing to the increase in trade. A comparison of the figures showing the rate of this increase for the two countries affords convincing proof of the possibility of peaceful parallel development.

The total foreign trade returns (export and import) amounted in millions of marks (20·4 M. = £1) to:—

	1890	1900	1910	1912	1913
Great Britain .	15,300	17,900	24,733	27,409·5	28,632·5
Germany . .	8,195	11,089	17,615	21,256·6	22,546·6

The increase over 20 years from 1890 to 1910 was thus 9,433 million marks for England and 9,420 for Germany. But the increase in England's population from 38,000,000 to 46,000,000 during the same period was only half that of Germany's, which rose from 50,000,000 to 66,000,000. In proportion to the population, the increase in England's trade returns was therefore twice that of Germany's.

The total foreign trade returns of the more important countries were as follows:—

	Milliard marks
In 1890 roughly	73
In 1900 roughly	92
In 1910 roughly	147
In 1912 roughly	169

Between 1890 and 1910 an increase of 100% is shown. Increase of population over the same period in England = 20%. As these 20% achieved a trade increase of 62% there could hardly be any serious question of Germany's crowding out England.

In Germany, the growing volume of trade was more and more sea-borne trade; the maritime proportion became 70% of the whole. In view of this development Germany had necessarily to think of the better protection of her sea connections. Accordingly, after taking the first step (in 1897) of modernising her out-of-date fleet, she took (in 1899) the second step of doubling her battleship squadrons from two to four on the basis of the declaration: "Germany must possess a battle fleet so strong that war with it would involve even the mightiest naval power in perils of such a kind as to jeopardise its own supremacy." Those who persist in regarding this extended naval programme and its basis as a proof of hostility to English supremacy at sea have misunderstood the development of Germany's economic position and ignored the change which had taken place in the international political situation.

At the time of the great colonial wars of the 17th and 18th centuries, England had to deal with only *one* sea-trade rival at a time—Spain, Holland or France.[1] The commercial centre of gravity in the course of centuries had been shifted by England's historic interventions from Cadiz, Lisbon and Amsterdam to London. But London was no longer all-important. New York, Antwerp and Hamburg were centres also. The trend of circumstances was towards the establishment of a sort of international balance of power. A struggle between England and one of her commercial rivals for the possession of the world's markets would no doubt have ended in her favour, thanks to the overwhelming superiority of British sea power; but the remaining competitors for the world's trade would have taken advantage of England in her inevitable exhaustion after victory to aim blows at her commerce which even she would have difficulty in repelling.

No one will deny that Great Britain, with her divisions of empire scattered all over the globe, with her leading position in international trade, with her dependence upon oversea communications arising from her insular situation and extensive industries, and finally with her strong hold on international commerce, has the right and the duty of maintaining a fleet considerably larger and more powerful than those of other nations. This supremacy is ungrudgingly allowed her. But should it lead to the prevention of free commercial competition, all the other nations interested in international commerce would presumably unite to safeguard themselves. This is the idea which found expression in the German navy law; in adopting it Germany only followed the example of other states.

The table below shows the battleships of over 10,000 tons and armoured cruisers of over 5,000 tons, not more than 20 years old, possessed by various countries in 1900.

With the respective strengths of the fleets thus distributed, England had no need to fear that she would be ousted from her position; but it was necessary for Germany to protect herself against the eventuality of England's weight being thrown on the side of the group opposing the Central European Powers. That England would supposedly risk little or nothing in so doing is indicated in Churchill's slogan "Business as usual"[2] at the

1900	Germany		England		United States		France		Japan	
	No.	Displacement	No.	Displacement	No.	Displacement	No.	Displacement	No.	Displacement
Battleships	7	73,300	40	543,800	9	110,550	17	105,920	5	71,030
Armoured cruisers . . .	1	10,690	10	75,580	2	19,270	5	35,910	3	29,720
Total	8	83,990	50	619,380	11	129,820	22	141,830	8	100,750

In 1910 the comparative strengths are shown by the following figures:—

1910	Germany		England		United States		France		Japan	
	No.	Displacement	No.	Displacement	No.	Displacement	No.	Displacement.	No.	Displacement
Battleships	28	360,990	56	859,990	29	451,320	16	207,430	12	174,630
Armoured cruisers . . .	9	95,590	38	475,880	15	208,980	17	172,320	12	125,000
Total	37	456,580	94	1,335,870	44	660,300	33	379,750	24	299,630

[1] In the 18th century and just after England usually had to fight France and Spain together, and had always to reckon with the probability of their combination.—Ed. *E.B.*

[2] This phrase was not Mr. Churchill's.—Ed. *E.B.*

beginning of the War; whether or not he was mistaken those in England can best judge.

The long duration of the War and the unexpected capacity for resistance displayed by the Central Powers affected the technique of the War, on sea as on land, to an extent that could not have been foreseen. Submarines, flying and the use of gas are new and terrible phenomena of great possibilities, still in their infancy. In future, technical power in these respects must play so great a part that insular security will be a thing of the past. The question whether a true insight into such changes in the conditions of power and security might have suggested a less light-hearted view of the consequences of the War is not for discussion here; neither can we discuss the possible results of a different course of English policy. None the less, one is tempted to imagine the reply of the Delphic Oracle if consulted by British statesmen before entering into the War: " If you cross the North Sea you will destroy a great empire "—not the German empire only being meant.

The growth of the fleet by no means represented merely military rivalry at sea; rather ought that development to be regarded as an insurance premium for the great increase in trade interests during the same period, and as one aspect of a general forward movement in all countries chiefly concerned in international commerce. The increase in Germany's naval establishment was probably the most steady and uniform, for the plan laid down in 1900 was strictly adhered to and no surprises were sprung upon the other sea powers. No essential alteration was made in the standard of strength which, up till 1917, was aimed at, viz.: a fleet of two double squadrons and 20 first-class cruisers (58 capital ships). It was also Germany's policy to refrain from such improvements in the ship types as would initiate a process of building. On the contrary, England was invariably allowed precedence in this respect, although Germany was obliged to guard against any inferiority in her material, especially after 1905 when the new type of super-battleship was ushered in by the building of the " Dreadnought." This event had the effect of accelerating the fixed rate of German construction (in 1900 we had eight ships; in 1910, 37, representing an increase of some 30 ships in 10 years), from three capital ships a year at the outset to four per year between 1908 and 1911, in order that, after the start of the new building phase, Germany should not lag too far behind. That England, annoyed by her mistake, should vent her ill-humour on Germany is only another example of the common tendency to make others responsible. To reach the standard set for 1917 (58 capital ships against England's 94 in 1910) it was necessary to lay down three ships yearly, the statutory life of a ship being fixed at 20 years.

The scheme by which the German Fleet was to be brought up to the required standard by 1917, providing for the gradual elimination of obsolete units, was known to all the world. On economic grounds alone, and also because the lines of construction had from the first been on a small scale, all over-haste was avoided. The latest addition to the navy law in 1912 provided for an addition of not more than three ships to the nominal strength. Its chief aim was to place the navy in a better state of readiness, an aim which the threatening political situation of 1911 appeared to justify. It is not to be denied that it was disagreeable to England's supremacy to watch the growth across the North Sea of a new naval power, whose strength she by no means underestimated. Whether the suppression of this navy has repaid England for her active participation in the World War, when she had the alternative of *not* placing the mighty power of her own Navy at the disposal of Germany's enemies on land, thereby in all probability preserving peace, must remain an open question. Low as Germany has fallen, she can still look back with pride on the fact that the glorious British Fleet did not beat the German in an open fight at sea.

The very regrettable enmity which exists between two racially akin nations who, during centuries of history, have been found side by side, but never as embittered enemies, will, it is hoped, become softened when an unprejudiced appreciation of the circumstances governing Germany's struggle for sea power has been shown; when time and a recognition of the common interest of these " two white nations " [1] have done their work.

(C. Ho.)

V. DEFENCE

The constitution of the armed forces of Germany has not been determined by the nation itself; on the contrary, its size, organisation and armament are fixed by the provisions of the Versailles Treaty.[2]

Army.—The enlistment must be voluntary, not on the basis of compulsory service. The recruit must bind himself to serve for 12 years or—if he wishes to become an officer—for 25 years. The strength of the army allowed is as follows: 3,797 officers, 20,297 N.C.O.'s, 74,499 privates, 1,407 administrative officers; in addition there are 300 medical and 200 veterinary staff. Of these (including N.C.O.'s) 51,506 are infantry, 15,767 cavalry, 10,644 artillery, 2,838 pioneers, 2,079 signalling troops, 5,572 communication troops and 2,800 medical service. The army is divided into seven Infantry and three Cav. Div., which are formed into two group commands.

Territorial Divisions.—Germany is divided into military regions, in each of which one infantry division is stationed. The seven regions are as follows:—

Region I. embraces the countries east of the Vistula (headquarters: Königsberg).

Region II. includes Pomerania, Mecklenburg, Schleswig-Holstein (headquarters: Stettin).

Region III. includes Brandenburg and Silesia (headquarters: Berlin).

Region IV. includes the country and the province of Saxony (headquarters: Dresden).

Region V. includes Thuringia, Hesse-Nassau, Hesse, Württemberg, Baden (headquarters: Stuttgart).

Region VI. includes Hanover and Westphalia (headquarters: Münster).

Region VII. includes Bavaria (headquarters: Munich).

The cavalry regiments are distributed over the whole Reich. The headquarters of the I. Cav. Div. is at Frankfurt-on-Oder, that of the II. Cav. Div. at Breslau, and that of the III. at Weimar.

Each divisional staff includes an infantry commander and an artillery commander. The pioneer battalions are under the infantry commander and the transport under the artillery commander.

Army Units.—There are 63 battalions with 189 infantry companies, 63 machine-gun companies and 21 trench mortar companies; 79 squadrons, of which 72 belong to cavalry divisions and 7 to infantry divisions; 72 batteries, of which 9 go to form the horse artillery brigades of the cavalry divisions; 14 pioneer companies; 14 signalling companies; 28 horse transport squadrons; 21 motor transport companies, and 7 divisional medical detachments. The infantry is armed with the 1898 rifle. It also carries 1,134 light and 756 heavy machine-guns, and 126 light and 42 medium trench mortars. The artillery is armed with 204 field-guns (7·7 cm.) and 84 light field howitzers (10·5 cm.). In addition, the fortress of Königsberg in East Prussia has 22 pieces of heavier calibre. Heavy artillery, tanks and aircraft are non-existent.

Administration.—The Minister of Defence is the highest authority for command and administration. At its head is a political minister, who is assisted in matters of military technique by the *Chef der Heeresleitung*, who, according to the Defence law, is a general and the superior of all soldiers. For training officer candidates there are one infantry, one cavalry, one artillery and one pioneer school. Enlistment is managed by the smallest units (company, squadron, battery). The proviso that soldiers may not leave the army until after 12 years' service is a great obstacle to maintaining the full strength. The Versailles Treaty directs that only 5% shall receive their discharge before the appointed time in any one year, and in practice this percentage hardly covers the discharges for sickness, incompetence and undesirability. An appeal for premature discharge can therefore only be granted in the rarest cases. This naturally deters many young men from joining, as they are alarmed at the idea of being forced to remain 12 years in the army whether promoted to the higher ranks or not.

[1] " The two white nations " was the toast whispered in the ear of the captain of the " Breslau " by the English admiral when dining on board his vessel, together with other commanders of all nationalities, off the coast of Albania in June 1913. (See Preface, *Kiel and Jutland*, Commander Georg von Hase, London,—*Author's note.*

[2] Part V. *Military, Naval and Air Clauses Articles 159–211.*

Recruiting and Training.—Recruiting is, in fact, influenced by the economic conditions of the moment; under present conditions (1926) recruiting is adequate. Recruits first spend six months at the depôts, one of which is provided for each regiment. Only after this half-year's training are they admitted to their companies, etc. Cadets receive at least four years' training before becoming lieutenants; of these, two years at least are spent with the troops and at least two in schools for the different arms. Anyone who has passed the prescribed cadet examination can become an officer. Soldiers who hold a school-leaving certificate can enter for this examination at the end of $1\frac{1}{4}$ years, others at the end of $3\frac{1}{4}$ years; that is to say, after they have acquired the necessary knowledge for passing a preliminary examination. Every cadet is promoted to officer's rank, irrespective of his origin and purely on the merits of his service, knowledge and his abilities.

The men are trained during their period of service for the calling which they intend to follow on discharge. They are assured of a post in the public service at the conclusion of their 12 years unless they prefer an independent career. In every unit some of the soldiers are elected by their comrades as proxies for economic affairs. A soldier takes no part in politics, but is allowed to join economic and non-political societies. The Defence law provides power, however, to forbid his association with such societies should they be subversive of military discipline and order in the army. For the protection of army interests there is an Army Chamber, which is elected by direct voting and is summoned from time to time by the Minister for Defence. Members of the army are under civil law, and only in case of war may courts-martial be appointed.

In view of the historical development of Germany and her army the Defence law takes specially into consideration the interests of the several states, and too rigorous an application of the centralising principle is not allowed to disturb the territorial constitution of the regiment. Regiments are required to draw their recruits from the inhabitants in the neighbourhood of their stations. Bavaria is allowed a special influence in respect of appointments to commands in the VII. Infantry Div., which is stationed entirely in Bavaria. The supreme authority is, however, vested only in the President of the Reich, who nominates, removes, promotes and releases both officers and administrative officials of the army.

On leaving the army the men receive—according to the Defence Forces Pensions law of Aug. 4 1921—a gratuity on which to live until they find other employment and, further, a civil service certificate which entitles them to apply for an official post in the imperial, state or municipal services. In addition, they receive outfit expenses and, on request, government security to assist them in settling on the land. Officers receive retired pay, which may also be commuted as a lump sum.

The Defence Problem.—The Versailles Treaty declares the aim of the German Army to be the preservation of order in the interior and the "control of the frontiers." In the first of these tasks the German Army has until now been successful; the attacks made by the Right and Left Radical parties on the Government at the time of the financial and economic crash of 1923 were defeated and greater disturbances nipped in the bud. The second task is not easy to carry out with the German Army of 100,000 men. Germany's frontiers are 5,000 km. long, exclusive of coastline; one province is cut off by the so-called Polish Corridor; on the west, the country on the bank left of the Rhine and a stretch of 50 km. east of that river may not be entered by German troops—and it is in this unprotected zone that the West German industrial district lies. Beyond Germany's frontiers lie, on the west, the French Army, with a war strength of some 5,000,000 and the allied Belgian Army, with a war strength of about 800,000; on the east the ring is closed by the Czech Army (war strength, 1,000,000) and the Polish Army, with a war strength of 2,000,000 men. All these armies are provided with excellent modern equipment, and are uniformly trained on the French model. The German frontiers are exposed, and have no protection from natural barriers. In the west, fortresses no longer exist, those in the east are out-of-date and without armament. The eastern frontier is only 170 km. from Berlin. The German Army has no possibilities of expansion, since all preparations for mobilisation are forbidden by the terms of the Versailles Treaty. Germany's military inferiority must therefore become greater after the outbreak of hostilities, for the losses could not be made good as fast as they occurred, owing to the absence of any draft organisation, and could in the case of a prolonged war hardly be made good at all; for the German Empire would speedily become the theatre of war and any possible sources from which reserves might be drawn would accordingly be blocked.

Navy.—By the terms of the Versailles Treaty, the German Fleet was allowed to retain 6 battleships not exceeding 10,000 tons, 6 light cruisers not exceeding 6,000 tons, 12 destroyers not exceeding 800 tons and 12 torpedo-boats not exceeding 200 tons. Battleships may be replaced 20 years after being launched, destroyers and torpedo-boats after 15 years. The material is now very much out of date; the battleships were launched in 1902–6 and the cruisers in 1899–1903. One light cruiser in replacement was laid down in 1920 and finished in 1925. In 1924 the first replacement destroyer was authorised, and in 1925 the second replacement cruiser and 5 replacement destroyers. The total personnel of the navy numbers 15,000 men. The control of the navy is vested in the Ministry of Defence (Reichswehrministerium). Under it are placed (1) The Fleet Command at Wilhelmshaven, with the "Braunschweig" as fleet flag-ship; the commander of the fleet also commands the battleship division, and has under him both the commander of the North Sea naval forces at Wilhelmshaven (battleships: "Braunschweig," "Hannover"; cruisers: "Amazone," "Emden" and the 2nd torpedo-boat flotilla) and the commander of the Baltic naval forces at Kiel (battleships: "Elsass," "Hessen"; cruiser:—"Nymphe"; surveying-ship "Panther"; 1st torpedo-boat flotilla and 1st mine-sweeper half-flotilla); (2) the naval stations in the Baltic and the North Sea; (3) the inspection of training at Kiel with the naval schools at Flensburg-Mürwik for training the supply of naval executive officers and quartermasters, those at Kiel-Wik for training technical and non-commissioned officers and also the training ships "Berlin" and "Hamburg" (cruisers) and the "Niobe" (sailing-ship); (4) the inspection of the torpedo and mines department at Kiel; (5) the inspection of the naval artillery at Wilhelmshaven, with the coast defence artillery school (Wilhelmshaven) and the naval gunnery school at Kiel-Wik; (6) the inspection of the naval depôts at Wilhelmshaven. Technical institutes are the naval dockyard at Wilhelmshaven and the naval arsenal at Kiel. Thus Germany has now at her disposal only the navy of a small Power.

Air.—Article 198 of the Treaty of Versailles prohibited Germany from maintaining any military or naval air forces. An inter-Allied aeronautical commission of control, paid by the German Govt. on Reparations account, took charge of the destruction of German aircraft, parts and apparatus. This commission was disbanded on May 5 1922. As civil aviation is allowed to Germany, an agreement was reached with the German Govt. by which certain technical points were enumerated as qualifying aeroplanes for use in warfare, and the possession of aircraft possessing these characteristics was forbidden. A new inter-Allied aeronautical committee of guarantee was established by agreement with the German Govt. (May 1 1922). It is paid by the Governments concerned, has branches in Berlin, France and Great Britain, receives lists of all German workshops in which flying material is manufactured, of machines and of pilots and sees that the provisions of the agreement are not infringed. (K. VON O.)

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VI. NATIONAL FINANCE

Financial Situation before the War.—The central problem of German Finance since 1871 had always been the difficulty of

delimiting the limits of the respective powers of taxation of the Reich and the states (the "Länder" of the Constitution of Aug. 11 1919). The financial policy of Bismarck had solved that problem, not formally but in actual practice, by allotting to the Federal Govt. the customs and excise duties, and to the states the power of direct taxation, which were also the main sources of income of local and municipal government. The income of the German Empire from indirect taxation was never adequate; therefore Bismarck made the Reich "a boarder of the states." The latter had to make good the deficiency by contributions (*Matrikularbeiträge*). Before the World War, this system failed once in 1913, when the requirements of pre-War armaments necessitated a larger revenue for the Reich, and the great defence contribution (*Reichswehrbeitrag*) of that year for the first time gave the Reich unprecedented powers in the field of direct taxation. One milliard of gold marks was raised by a non-recurring levy on all property.

Apart from this distinction of federal and state income by the nature of their respective sources, there was a further significant circumstance in the pre-War financial situation. While the Reich administered the postal service except in a few states, the railways belonged to the states; thus Prussia had a revenue of from 220,000,000 to 240,000,000 marks annually from the railways, amounting to from one-third to one-quarter of the total revenue of the state from taxation and state-owned property. The revenue of the Reich derived about 70,000,000 marks annually from the postal service, and every year a large amount of the net revenue of the state undertakings was reinvested. With regard to the railways, the real actual annual excess of revenue over expenditure for the whole of the German systems immediately before the War was estimated at not far below a milliard marks.

The total revenue of the Reich, the states and the municipal corporations from taxation amounted to about $4\frac{1}{2}$ milliards of marks in 1913. The total public expenditure was considerably larger, since the states and municipalities also drew considerable income from state and municipal land property, from water, gas, electricity, etc., works. Of the revenue from taxation about two-fifths went to the Imperial Govt., which, in 1913, failed to balance the budget, and had to carry over a deficit of more than 250 millions. This deficit would have been covered in normal times either by the states or probably by a loan. The total amount of the indebtedness of the Government of the Reich at the beginning of the War was about 4,900,000,000 marks. Thus, the Reich entered the War with a financial system which compared unfavourably with the high degree of economic development of the country at large.

The War Period.—No wonder that the strain of War expenditure broke down the whole system. The optimism, common to all the belligerents, based on the idea that "the others would pay" stimulated the policy of war loans and therefore of some inflation. The latter, tripling the amount of pre-War mark note supply, did not exceed the similar procedure in most of the belligerent nations. By the end of the War, the debt of the Reich had been swollen by 150 milliards of new debts, of which about one-half had been funded; the other half was floating debt in the form of Treasury bills, which after the peace, could only be met when due by printing new mark notes. The revolutionary period of 1919–20 favoured inflation, and the facts indeed made it sometimes even a necessity, the purchasing power of the mark being one of the expedients for the restoration and maintenance of public order under enormously difficult conditions. The requirements of demobilisation, the occupation payments and the numerous kinds of tribute demanded by the Allies added to the financial difficulties of the Reich.

The Erzberger Reforms.—Nevertheless, the whole system of finance was in 1919–20 remodelled by Minister Erzberger, whose work remains the basis of the present financial system. While the federal constitution of 1919 weakened the power of the individual "Länder" and strengthened the Federal Govt., the great financial reform of 1920 fundamentally changed the financial system of Germany, applying the new constitutional principle of unitarism in the field of taxation. Practically the Länder (Territories) became now the "boarders" of the Reich, the exact opposite of the pre-War position.

The first intention of the German republican government was to increase income and property taxes as much as possible. But after a short interval in 1920 inflation was renewed, as heavy reparation payments due under the London ultimatum spoiled any chance of balancing the budget. The bases of the German budget, in addition to the customs duties, which immediately after the War gave very low results, were: the income tax, and, especially, the taxation of wages and the turnover tax. The turnover tax began at the rate of $\frac{1}{2}$%, and was raised steadily until it reached $2\frac{1}{2}$% on any sale made in Germany, and in the occupied territories in 1923 even $3\frac{1}{2}$%. This tax proved to be an enormous burden on consumption, since any commodity on the average changes hands four times in Germany before reaching the consumer. But under a policy of inflation any such burden, heavy at the moment when it fell due, became light at the time of payment, because in the meantime inflation had depressed the purchasing power of money and especially of delayed taxes.

For a time certain taxes based upon the difference of the purchasing power which was high in Germany and lower abroad gave considerable revenues; *e.g.*, the coal tax, which was reckoned at 40% on the price of coal, and from 1920 onwards the newly created export tax which yielded in the most difficult times nearly one-sixth of all state revenues. Both were obviously only transitory in character, the difference between the interior purchasing power of a currency and its value in foreign markets being large during that slow development of a depreciation of currency; if the depreciation becomes rapid, internal prices tend to rise to a gold basis and the gap disappears. The difficulties of German finance were aggravated in the most unhappy manner by the first attempts to finance reparation payments (*see* the other sections of this article on CURRENCY and on ECONOMIC HISTORY). But far more important than the purely financial process of stabilisation was the energy of the Finance Minister, Dr. Luther, who stabilised the budget by strict refusal to pay anything else in other way than by raising taxes. The "miracle of the Rentenmark" is more due to this obstinate determination than to any technical means of stabilisation. Thus Germany entered on her new period of financial and economic life with a very severe taxation.

The mark was stabilised in Nov.–Dec. 1923, and in the beginning of Dec. 1923 the Finance Minister issued two tax decrees, introducing the gold basis for all tax payments and reorganising the whole system of direct taxation. The sales tax was placed on a $2\frac{1}{2}$% basis; income tax was to be paid by all business people on the basis of their turnover, and the tax-free minimum for wage-earners was fixed at 50 marks (£2 10s.) per month. The customs and liquor taxes were completed by a property tax and about a dozen taxes of minor importance. The bulk of the income of the Reich for 1924–5, *e.g.*, about 70% of all, was covered by wages taxes, turnover taxes, customs and indirect taxation of articles of mass consumption. It was a very crude system of taxation which was thus established, though the coal tax necessarily had disappeared with the vanishing difference between interior and world market prices. But it served its purpose. Revenue and expenditure were balanced, and in 1924–5 an unexpected excess of revenue over expenditure became visible. When the Dawes Plan was finally adopted (Sept. 1924) the financial situation of Germany was reasonably sound. The plan brought about two important changes. The railways, which had been forced by the Minister of Finance in 1924 to balance their accounts, were handed over to the Reich's railway company and burdened with a yearly payment for interest and sinking fund of about 660 millions of gold marks for reparations. The customs duties and most of the indirect taxes were to serve as a guarantee for the regular fulfilment of its obligations by the Reich.

Readjustment of 1924.—From Nov. 1924 a period of tax reductions began. Especially the limit of exemption from income tax was raised, and the sales tax rate was lowered, in addition to minor tax reductions. In spite of the reductions, the financial year 1924–5

closed with a large surplus of about two milliards of gold marks (£100,000,000). In July 1925, accordingly, the whole system of taxation was again revised. Income tax rates were lowered, and are now on a progressive scale ranging from 10 to 40%. The tax-free minimum of wage-earners was raised first to 80 marks per month in addition to certain family allowances, then, from Jan. 1926 to 100 marks (£5). The sales tax rate was lowered to 1% on Oct. 1, and in March 1926 to 0·75%. The so-called luxury tax almost disappeared. At the same time consumption taxes on tobacco and beer were raised.

Simultaneously the financial relationship between the Reich and the Länder (Territories) was ordered anew. The Territories receive a fixed amount of the revenue from the income tax and the sales tax, at least 2,300 millions. The most important taxes levied by themselves are the land and rent taxes; this latter tax is practically the only important remainder of a far-reaching price control system established during the War. Rents are fixed by the state Governments; about 50% of the rent goes to the owner of the house, while the states raise the remainder as rental tax; the total receipts are shared between the local authorities for these expenses under this head and the provision of capital for the building of new houses, which is still largely carried out with the help of subsidies financed by the rental tax.

The system of taxation of the Reich draws its most important resources from the income tax (2,200,000,000 marks), the sales tax (1,300,000,000 marks), the customs duties and consumption taxes (1,700,000,000 marks), amounting to about four-fifths of the total tax revenue of the Reich and to about one-half of the total of taxes paid by the German nation.

It is much more difficult to give accurate data with regard to expenditure. The most important change is the reduction of expenditure for the army and navy, which is, however, more than balanced by war pensions and the payments under the peace treaty amounting at present to about 600,000,000 marks annually, but ascending to 1,650 millions in the year 1926–7. The payments to be effected in the "normal year" of the Dawes Plan (*e.g.*, 1928–9) should be covered in the following way:—

	Gold marks
Railways debentures interest and sinking fund	660,000,000
Interest and sinking fund of debentures of industrial and commercial enterprises given to the reparation commission	300,000,000
Budget	1,540,000,000
Total	2,500,000,000

The total expenditure of the Reich, the Territories and the local authorities for 1926–7 is summed up in the following approximate figures:—

	Gold marks
Expenditure of the Reich	4,000,000,000
Reparation payments	1,000,000,000
Expenditure of the Territories:—	
(a) derived from the Reich	2,250,000,000
(b) raised by themselves	1,000,000,000
	8,250,000,000
Local authorities	3,000,000,000
Total	11,250,000,000

In the normal year of the Dawes Plan, *e.g.*, after Oct. 1928, this burden will be about 1,500,000,000 marks higher. Very probably additional expenditure will be incurred on account of unemployment.

(J. H.*)

VII. ECONOMIC HISTORY

The dominating note of Germany's economic development before the War was the growth of industrialism. Her population had increased rapidly. It had grown since the foundation of the Empire from 41 millions to 67·8 millions in 1914. The density per sq. m. had increased from 196.6 to 333.1. Emigration had fallen from about 142,000 in 1880–5 to scarcely 26,000 in 1913; Germany had even become a country of immigrants. Apart from the seasonal labourers who went there regularly mostly from Russia and Austria, returning at Christmas, there was a foreign resident population in 1910 of almost 1·3 millions. In 1882 42·5% of the people had been engaged in agriculture; this percentage had fallen to 27·1 in 1907. The growth of industrialism was accompanied by urbanisation. In 1910 over one third of the German people lived in cities above 20,000, nearly a quarter in cities over 100,000, and the drift to the towns was renewed after the War.

Industrialisation.—Industrialisation had become possible by the growing economic expansion of the world, in which Germany participated through her foreign trade. Her own but recently acquired colonies did not count for much in the actual growth. Though developing at great speed they were rather a reserve for the future than a present source of wealth. Notwithstanding tariffs, the growing development of North and South America, of the African countries and of the Far East, brought about by the great efflux of men, the export of capital and the application of the methods of capitalistic organisation to backward countries, enlarged the markets of the world.

Germany's import trade, which had averaged 19 million tons 1880–5, had risen to 72½ million tons in 1908–13, whilst her exports had grown from 20·8 to 64·9 million tons. Her progress was mainly due to the application of scientific discoveries to industrial purposes, to a very carefully planned out system of industrial and commercial organisation and to the intelligence and adaptability of the German working men. Her commercial policy favouring trusts and combines in industry facilitated exports at the cost of the home consumers who, having to live under a system of agricultural protection as well, would have fared badly if the general development of the world had not lowered the cost of living all round in comparison with days gone by, though after the beginning of the new century an upward tendency in the movement of prices was visible.

The Post-War Crisis

Treaty of Versailles.—The Treaty of Versailles caused a far-reaching disintegration of Germany's economic life. She lost 10% of her population, but over 13% of her territory in Europe. Large agricultural areas were cut off in the east; in the west important industries like the iron industry were deprived of their raw material. The 1913 home supply of iron ore had amounted to 35 million tons; it had fallen to 5·1 million tons in 1923. But for the great importance of scrap iron in after-War days, Germany would have been almost totally dependent on ore imports from abroad. A large part of the metallurgical industry domiciled in Lorraine and Upper Silesia was lost (26·7% of the blast furnaces and 15·8% of the rolling mills), also the important textile industry (5,866 works) mostly in Upper Alsace were lost. German owners were forcibly expropriated in the ceded territories; they had to be compensated by the German Government. The same principle of confiscation of private property was applied to German-owned bonds and shares and to German-owned ships. The total proceeds of these confiscations to the Allies have been valued at 6 milliards gold marks, whilst the actual losses to Germany have been figured at about 30 milliards. The old established relations between the producers of raw material and the manufacturers of finished goods were cut asunder, especially in Lorraine and in Upper Silesia. The German industrialists whose property had been confiscated were bound to use the money they received as compensation in rebuilding new works in Germany. They owned the coal needed for running them, whilst their French competitors had to rely on reparation coal delivered to them under the Treaty of Versailles from the pits of the same rivals, whose works they had bought cheaply. The productive capacity of the iron and the steel industry on the European continent was thus artificially expanded at a time when markets were contracting. The exchange of iron and coal ceased to be a natural process, and became part of international high politics.

The Allied Powers at Versailles assumed that Germany could quickly rebuild her economic life, as little physical destruction had taken place within her boundaries. To even up their own chances, Germany was to be handicapped. She was bound to grant the Allies most-favoured nation treatment for five years; she had to admit during that period the produce of the ceded territories, especially of Alsace-Lorraine and of Poland duty free in such quantities as she had drawn from them formerly. She herself was denied the most-favoured nation treatment, and her nationals were excluded or subject to severe discrimination; she was not allowed a moratorium. Though the total sum of her obligations was not settled owing to the inability of the Allies to agree amongst themselves, she had to pay within two years a milliard sterling.

As she had to hand over a considerable part of her implements of production (ships, mines, cables, etc.) and most of her foreign investments, her future capacity to make payments abroad was limited by the excess of exports over her imports as shown by her balance of trade. Not knowing her total liabilities Germany had no inducement to pay the first instalment as quickly as possible; her capacity to do so would have resulted in an increased burden two years later, when the definite settlement had to take place.

Effects of the War.—German economics were permanently influenced by the War. The cutting off of supplies, the loss of markets, the scarcity of labour due to the demands of the army, and the wear and tear to which the industrial plant had been subjected had forced a system of control on Germany which was more severe than that existing in other belligerent countries. Food and many raw materials was rationed, and the production of many industrial commodities was supervised by centralised authorities. In a country traditionally run by a bureaucratic hierarchy who considered themselves the born rulers of men, always eager for new activities, and where democracy was largely represented by socialists, imbued with the idea of state intervention in business affairs, that situation was bound to produce lasting effects. Though generally speaking the control of economics during the War was not oversuccessful the idea of state socialism appeared to be greatly strengthened.

The collapse of the old régime seemed to clear the way for its advent. But the internecine struggle between the small bolshevist element, who wanted to follow the Russian example and the mass of the organised working men who wanted to bring about socialism in a peaceful orderly way, occupied the revolutionary Government which ruled Germany from Nov. 1918 to Feb. 1919. They succeeded in defeating Bolshevism and in saving Germany (and with it Western Europe) from its ravages. They were very eager for "nationalisation," at least for the socialisation of monopolistic industries. Two commissions were appointed to inquire into this problem, especially into the nationalisation of mines. They issued some very interesting reports but could not agree upon a practical policy.

The Coalition Govt. which came into power early in 1919 was not very keen on nationalisation. They realised that it was easy enough to take over a smoothly running concern and manage it by Government officials; but it was extremely difficult to reorganise a broken-down plant. The more energetic part of the working class demanded nationalisation without compensation; they wanted syndicalised industries rather than Government-run concerns. In these circumstances very little was done. With the object of paying-lip service to the principle of nationalisation and to the council schemes lately imported from Russia, national councils for coal mining and potash mining were set up, where masters and men, producers and consumers, were allowed to sit, to talk and to vote, without being in a position to wrench control from the owners. The Weimar Constitution provides for the creation of a Central Economic Council (Reichswirtschaftsrat), provincial economic councils and works councils for individual concerns. These latter were to send two of their members into the board of the company so as to give the workers partial control of the business—a provision the only effect of which has been to deprive most boards of directors of their former influence, which was concentrated in the hands of some extremely uncommunicative executive officers working hand in hand with a few big shareholders.

Some kind of socialistic tradition survived however. Food prices were controlled for quite a considerable time. Rents even now are still being fixed; in the days of inflation they amounted to next to nothing when calculated in gold. The entire house-owning class was despoiled. Wages were lowered *pro tanto*, as rents did not enter into them, and the cost of production was reduced. In many cases foreign consumers of German exports were thus given the rent taken from the German house-owner.

The failure of socialism to bring about the nationalisation of monopolistic concerns and its success in despoiling the middle class and in irritating the farmers redounded to the advantage of industrial capitalism. Socialists had not dared to take over the broken down industries; industrial owners were quite willing to reconstruct them. They had to make concessions to the working class. They had accepted the eight-hour working day, collective bargaining, greatly improved wages for unskilled labour, the temporary abolition of piece work and the works councils. They did not mind this as long as they could keep the control of prices to themselves. Treaty clauses for delivering coal had put the execution of important peace terms into their hands; they had acquired a place on the international stage. With the continuation of inflation they seemed to wax rich, whilst the state got weaker and poorer. They embarked on a policy of industrial aggregation; whilst formerly there had been a tendency to horizontal trusts, they now aimed at vertical combines to create self-sufficing enterprises, where raw materials, semi-manufactured and manufactured goods were in the same hand.

As time went on economic power became separated from political power. A Coalition Govt. of Socialists, Democrats and Centrists ruled the state. They were held responsible for the humiliations inflicted on Germany, whilst the real power, the economic power, was in the hands of the industrialists and the slowly recovering landed interest, impeded but little by organised labour. As inflation progressed labour became less and less powerful, and when the infuriated middle class turned away from the coalition parties, the weight of political power was turned into the same direction into which economic power had gone before. The state was broken; big business seemed to rule.

Depreciation of the Mark.—From the summer of 1919 to the end of 1923 German economic life was mainly dominated by the depreciation of the mark. The dollar had risen from par (4·2 marks), to about 14 marks after the signing of the Peace in the summer of 1919. It went up continuously until it bought 100 marks by the end of Feb. 1920. After that it fell to 40 in May. Owing to the loan contracted at Spa it remained between 50–70 until early in 1921. The beginning of the Reparations payment under the London plan (May 1921) forced the mark down to 80 by the end of July. It stood at 100 late in September. Its downward movement was greatly accelerated in Oct. of that year, when the news of the partial loss of Upper Silesia became known. Before the Genoa conference the mark hovered round 300 to the dollar, to go down considerably after its failure, its downward course gathering speed after the murder of Rathenau (June 24 1922). The demand for a moratorium and the abortive conferences about it brought it down to 4,000 in Oct. and 8,000 in Nov., where it remained through the rest of the autumn of 1922. On the day after the occupation of the Ruhr (Jan. 11 1923), it quickly fell to 30,000, reaching 49,000 on Jan. 31. At that time the Reichsbank intervened, bringing down the dollar to 20,000 and keeping it there until April 18. But the dislocation of economic life and the great strain on the finances caused by the struggle of the Ruhr forced the Government to use the printing press at a formerly unheard of rate. The stabilised mark collapsed. By the end of Aug. the dollar had risen to 10·3 millions. And when currency reform was under way, just before the issue of the new Rentenmark, the price of the dollar was practically settled at 2·5 billion marks. No depreciation on such a scale had ever been known, save in Russia.

The primary cause of the decline of the mark was faulty Government finance. At the end of the War the funded debt was estimated at 103 milliards gold marks. Current expenditure had been met by treasury bills, which the Reichsbank was allowed to discount and to use as cover for its notes. From time to time the outstanding Treasury Bills were converted into a funded loan, nine different issues of which were placed amongst the public, bringing in a total of 98·5 milliards.

The War was followed by a revolution. Demobilisation had to be carried out under very difficult conditions. The revenue went down almost to nothing. So most of the expenditure had to be met by Treasury Bills. The Reichsbank became the chief support of the Government, issuing notes against such Treasury Bills as were not taken up by the public. Retrenchment was impossible. When armed insurrection is threatening the foun-

dations of the State, extravagance may be wise and saving may be foolish.

As soon as the worst danger was over, financial reform was undertaken. But the chances for its success were small. The organised working class who were the main support of the Government and on whose co-operation the maintenance of order depended were rather disillusioned. There was a great deal of privation all over Germany. The millennium which they had dreamed of had not come. They had not succeeded in wrenching the control of capital from the capitalistic classes. The least they could do to meet their supporters was to claim for them an enlarged share of the nation's income by way of increased wages. The revolution, it has been said, degenerated into a struggle for higher wages, short working hours, and overemployment in works and Government departments, so as to avoid dismissals. This meant increased Government expenditure, which could not be met by taxation of the working class. In a country where prices are rising rapidly and where there is an actual scarcity of commodities indirect taxation cannot be resorted to by a Government mainly dependent on the masses, the support of which is by no means certain. Taxation was bound to fall on the propertied classes.

As long as the socialistic movement was in the ascendant—even at the election of 1919 socialists failed to get a majority—the capitalist classes, including the landed interest kept quiet. They did not openly fight against taxation. But they naturally tried to save as much as they could. Notwithstanding all sorts of severe regulations a great deal of movable property left Germany in the revolutionary days 1918–9. The so-called "flight of capital" started—a movement quite legitimate in early days, when violent confiscation seemed imminent. Later on it developed into an effort to save property from the severe taxation involved in the financial reform proposed by Erzberger.

The Erzberger Reforms.—In Feb. 1919 a Coalition Govt. had been formed by the Majority Socialists, the Centre party and the Democrats. Differences of opinion about signing the treaty of Versailles led to the withdrawal of the Democratic party. The Majority Socialists and the Centre, who counted 253 in a house of 423 formed a new Government. And Erzberger, who up to now had been Minister without portfolio became Chancellor of the Exchequer. Being dependent on the Socialist vote and having been all his life the representative of a small, rather anti-capitalistic group in the Centre party, his scheme of taxation was bound to weigh heavily on the propertied classes. He introduced a capital levy originally devised to wipe out the deadweight debt and a thorough going taxation of War profits, which nearly wiped them out. He clearly saw that the Treaty of Versailles, which put a crushing burden on the Reich, necessitated the creation of a central Exchequer to which the individual States must be made subservient. All through German history the states have jealously guarded their rights of financial sovereignty. Even Prince Bismarck in the hey-day of his power had not been strong enough to make the central Treasury independent of their control. Erzberger made the Reich the dominant partner in finance. He deprived the states of the main sources of taxation, such as the income tax. He organised an imperial service for their collection and their administration, superseding the old state services. He amalgamated the railways, which hitherto had been the property of the individual states, into the imperial railways. Under the shadow of the Treaty of Versailles he succeeded where Prince Bismarck had failed.

Though part of this legislation was watered down while passing through parliament, it would have weighed heavily on the propertied classes, if the taxes had been paid immediately in stable money, with no interval for the further depreciation of money. But this was plainly impossible, as the new imperial inland revenue service could not start immediately. If properties were valued in marks at a time when the value of the mark was fairly high, and if taxes assessed on this value were paid at a later time when values were low, the burden of taxation could be easily shifted. At the same time the burden of the government debt would decrease automatically.

Reparations.—As the Treaty of Peace had not fixed Germany's total obligations before May 1921, the Budget did not contain proper estimates for reparation payments. This was not merely a grave technical hindrance to reform, it put a premium on financial procrastination. For it was clear that a country whose finances were sound and solid would be charged with a heavier indemnity than a country on the verge of bankruptcy. Balancing a budget after a long spell of inflation is always a difficult and very unpopular undertaking. If by balancing it early the total obligations are likely to be increased in the interest of hostile foreign creditors, the impetus to reform will be greatly weakened. And the same holds good of the taxpaying moral of the individual taxpayer. What good is it, he was bound to say to himself, to strain every nerve so as to enable the exchequer to square all its liabilities, if by doing so I am merely throwing on it new indefinite liabilities?

The London Ultimatum (May 6 1921) enormously strengthened this attitude. The total demands on Germany amounted to 132 milliards of gold marks; the yearly payments might easily rise to eight milliards, or twice the German exports and about double the total revenue of the Empire before the War. The outlook for financial reform became hopeless. Inflation proceeded, and the business world began to realise that the public's loss might be their private gain. They began to look upon the further depreciation of the mark as upon a fateful destiny and, being unavoidable, as quite a legitimate means for getting rid of their debts.

The Budget.—Some courageous efforts to balance the budget were made nevertheless. A plan of either valorising the taxes or revaluing the amount of taxes payable on the day on which they fell due was discussed in 1921. But as it was unwisely called "taxation of real values" and imbued with a certain amount of socialistic acerbity it could not be carried. It was transformed much later into a forced loan, levied from all property owners, but in such a stupid way that the owners could take up the loan in paper marks at a time when it cost next to nothing. When the loan was passed in July 1922 the owner of a property worth 100,000 gold marks, had to subscribe 1%, which at the then rate would have come to about 150,000 paper marks. If he did not pay in time he was subject to a fine. But if he did pay the fine and settled at the end of the year he had reduced his liability from 1,000 gold marks to 90 gold marks.

So the issue of Treasury Bills against which notes were printed, remained the chief prop of Government finance. As time went on and as the public became more sceptical the proportion of the bills taken up by the Reichsbank and those taken up by the public changed considerably. In Jan. 1921 the bank held 50.6 milliards and the public 104·9; in Oct. 1922 the figures were reversed: the bank held 477.2 milliards and the public 126·3. Moreover, political events continually upset the balancing of the budget. The equilibrium established at the rate of 300 marks to the dollar, would immediately be upset if, in consequence of some political action, the mark went down and prices went up.

There was no immediate parallel movement between the amount of notes issued and the depreciation of the mark, but there was a very distinct connection between political events and the fall of the exchange. The loss of Upper Silesia, the acts of the Reparation Commission, the murder of Rathenau, the occupation of the Ruhr, the speeches of Poincaré are the outstanding dates at which the mark took a headlong downward flight. Each new political crisis brought about a huge demand for foreign exchange in Germany. As the German business world had to get raw materials, or the means to pay for raw materials, or the chance for keeping part of their stock intact, they had to buy foreign exchange, whilst foreign purchasers of marks got frightened and sold out at any price. Notwithstanding stringent regulations capital fled from Germany in many forms.

In the autumn of 1922 the situation had become almost hopeless. The German Government had been asking for a moratorium. The Reparation Commission might have been willing to grant it, but the French Government proved recalcitrant. A conference of neutral experts was called to Berlin to consider the possibilities of stabilising the mark. It agreed with a small group

of German economists that the mark could be stabilised provisionally with the gold of the Reichsbank, and that an effort in that direction might be made the basis for a reasonable reparation settlement. Public opinion, however, greatly influenced by business interests, considered a previous agreement on reparations conditional to stabilisation. Nothing could be done; the last chance for bold action was missed.

Occupation of the Ruhr.—A few months later the Ruhr was occupied. The mark immediately responded by falling to 49,000 marks to the dollar. A tardy stabilisation effort was made in Jan. which succeeded for about eight weeks. But the Government expenditure for the support of the people in the Ruhr. whose works had come to a complete standstill, was enormous, By the end of July the total note issue had reached 43·6 billions against two billions at the end of Jan., the amount of Treasury Bills outstanding 57·8 billions, whilst private bills discounted by the Bank had risen to 18·7 billion marks. Selling bills to the bank had become a very profitable business. Debts were contracted in marks when the dollar was 30,000 and paid back three months afterwards when it had risen to 1,100,000; even a bank rate of 18% was of no avail. By the end of May the bank's gold fund had fallen from one milliard to 758 millions; on Dec. 1923 it was down to 467 million marks.

In the summer of 1923 social disorganisation had become imminent. The farmers refused to sell goods against depreciating paper; the big industrial works revised and paid wages bi-weekly, starting from a kind of dollar basis. But if the money received was not spent before the new quotations from New York had reached the shops its purchasing power might be halved. Whilst the country was drowned in a flood of paper money a scarcity in actual notes was frequent, for the printing press could not keep pace with the rise of prices.

For a long time wages had been below the level of the world market, as home prices had been rising more slowly than prices abroad. It was expected that this advantage in the cost of production would enable Germany to produce more cheaply than other countries and to flood the world market. Nothing of the sort took place. For 1922 German export reached 6·2 milliard gold marks and for 1923 5·4 milliard gold marks, against 10·2 milliard in 1913. Though the accuracy of these figures may well be doubted in some respects, there is no evidence whatsoever to assume a flooding of foreign markets, the total weight of German exports having dwindled from 74 million tons in 1913 to 22 million tons in 1922. As foreign trade was controlled by all sorts of semi-official syndicates, exports were often restricted with the object of keeping the home customer quiet. And as German exports depended on imported raw materials, the scope for expansion of industrial exports was small indeed, as imports were impeded by the fall of the mark. The fear of further depreciation induced the German exporters to keep part of their revenues abroad rather than return them to Germany. The McKenna report valued German assets outside Germany at about seven milliard gold marks. Such people as were unable to invest their savings in a foreign country bought dollar or pound notes; and though the ordinary citizen was forbidden by law to purchase these notes they circulated quite freely though, of course, clandestinely, all over Germany.

The Rentenmark.—At midsummer 1923 the mark as medium of circulation was doomed. An emergency currency such as "gold certificates" was suggested. To stave off the crisis, whilst currency discussion went on, taxation was put on a gold basis; for the first time for many years the landed interest had to bear its share. The plan of the reformers of Oct. 1922 to stabilise first and to settle the reparation business later on was taken up by its quondam opponents. But the obstacles to reform had grown enormously. The Reichsbank, which had not been willing to risk its gold in 1922 when there was a fair chance of success, had thrown away half of its holdings in the hopeless endeavour to raise the course of the mark at a time when the printing of marks proceeded at fantastical speed. A foreign loan, to ensure success, could not be had; a home loan, it was supposed, was out of the question.

A plan for the issue of a new money, to be guaranteed by mortgage bonds, inscribed on real estate, was broached. These notes—they were later called the Rentenmark—were to be secured by interest-bearing bonds; they could automatically be converted into them. The interest was to be a first charge on real estate. The total issue of the new money was to be limited to 4·2 millards, 2·3 of which were to be lent to the Government; the rest to private concerns. The plan which was to provide the Government with funds to carry on the struggle in the Ruhr would have failed lamentably if the Stresemann Govt. had not had the courage to stop the fight, thus doing away with the main cause for unlimited expenditure. It cut down the total issue to 3·2 milliards, and greatly modified the whole scheme. The Government succeeded, against all expectations, in floating a gold loan, which gave it a breathing space; it was echeloned in such small points that it could be used as stable currency during the period of transition. When Luther became chancellor of the exchequer the new currency, the Rentenmark, was issued, and the work of stabilisation began. It succeeded completely.

The cessation of passive resistance in the Ruhr was followed by the ruthless cutting down of expenditure, especially of salaries in Government offices, at a rate probably never heard of before in a civilised country. This brought about the equilibrium of the budget, the gold loan and the loan from the Rentenmark issue bridging over the temporary gap. The new president of the Reichsbank, Dr. Schacht, restricted the bank's credit facilities, thus cutting off business from their accustomed supply of cheap money. They had to rely on their own savings which they had invested in foreign exchange. These hoards played the part of a foreign loan usually contracted for stabilisation purposes. They constituted the foreign currency fund on which the bank could draw for maintaining the mark exchange. German business needing cash had to sell foreign exchange, against which the bank issued its notes, which thus became gold exchange covered. The flight from the mark, which originally had destroyed the German currency, later on provided Germany with the means of stabilising it. After the first quarter of 1924 the foundations for monetary reform had been safely laid. And on this basis negotiations for a reasonable settlement of the reparation problem were started which ended in the acceptance of the Dawes Plan.

The Dawes Plan.—As her economic life was at a low ebb, Germany could not be made liable for a lump sum anywhere within reach of French expectations. The experts had to fix Germany's obligations in such a way as not to sap her energy by incertitude, and at the same time give the Allies a chance of participation in her growing wealth in case she made a quick recovery. To do this Germany's obligations were, so to speak, divided in two halves; the one was to consist of 11 milliard gold mark bonds secured on the German Govt. railways and of five milliards bonds registered as obligations on German industrial property. At a rate of 5% interest and 1% sinking fund these bonds yielded 960 million marks a year, which were to come from the proceeds of the mortgaged properties. These 960 million constituted the minimum annuity to which Germany was liable. If these bonds could be sold at par their total value would be 16 milliard gold marks; the value of two milliard gold marks preference shares of the German railways might be added. This capital sum of nominally 18 milliard gold marks would be paid off within 37 to 38 years by means of a sinking fund of 1%.

The other half was an annuity not yet capitalised, the proceeds of the railway tax and of customs and excise yielding about 1,250 million gold marks a year. The administration of these revenues has to be supervised. An additional surplus was to be paid, in case Germany's capacity to pay increased, which was to be deducted from a carefully constructed index. If the contrary movement took place and if its transfer abroad affected the exchange unfavourably these revenues were to accumulate up to five milliard marks. When this figure was reached payments from these sources would be stopped, until an improved economic situation could permit the resumption of payments abroad. A transitional régime, including a kind of a diluted moratorium, was to be in force from 1924–7 when the yearly payments were to

be 1,000, 1,200, 1,220, 1,750 million gold marks, part of them to be defrayed from loans or from sales of railway shares.

The first result of the Dawes Plan was the flotation of a German loan of 800 million marks in the financial centres of the world, which enabled Germany to pay most of the reparation payments of the first year and to put the Reichsbank on a sound basis. Reorganisation was to furnish amongst other things the mechanism for the gradual disappearance of the Rentenmark.

The Country's Recovery

After inflation Germany was an empty shell. The middle class, the owners of mortgages, of state, municipal and industrial bonds were practically ruined; so were the house-owners who had received scarcely any rent. A tardy restoration was enforced by public opinion 1924–5: private debentures, especially mortgages, were to be valorised at 25% of their original value, the payment to be postponed until 1932. The owners of public securities were to receive but scanty compensation, owing to the prior lien of reparation claims. The loss of the creditors has not benefited the debtors. States and municipalities were, no doubt, relieved of their burdens, but the ruin of well-to-do tax-payers was a very heavy burden to them.

Agriculture.—As far as agriculture is concerned, no fundamental changes have taken place. The big estates have not been split up, though under the different closer settlement schemes 7,300 new holdings have been created in Prussia. Big entails (Fideikommiss) have been broken up. But until lately land has not come into the market in great quantities. It is only now, when an agrarian crisis is setting in, that estates, especially big estates, can be had for a song. Whilst inflation lasted agriculturists had a good time. They saved the money due on their mortgages; some of them may have relaxed their efforts and produced less; others raised their standard of living. The wiser ones—and there were many of them—spent largely on permanent improvements. The great progress in the chemical industry, especially the production of artificial nitrates, enabled them to intensify their production. With a good harvest prices were bound to fall. Working capital, especially for big owners, was rather scarce. As the rate of interest had risen considerably, the number of years' purchase to be given for an estate had considerably diminished, and the total assets capable of being mortgaged had shrunk, whilst the total interest remained the same. Moreover, mortgages were very difficult to get. So financing was done by bills of exchange, which fell due after the harvest and forced the owners to sell at low prices. The agricultural crisis imminent in the summer of 1925 was aggravated by an embargo on grain; its abolition brought prices to the level of the world market, a rise which has not been considered sufficient, inasmuch as a good world harvest depressed the general level. New corn duties of three marks per doppelzentner and a refund for exportation were clamoured for and granted; so far they have been a failure as a remedy for the crisis.

Industry.—The bonded debt of industry, from which inflation freed it, has been estimated at about five milliards of gold marks. Apart from that, the bank had granted huge credits to industrialists, which were paid back in valueless money and cost them very little. Many enterprises used these savings for purposes of expansion, thus increasing their productive capacity; though this is by no means true of all enterprises. Many works, not having been subject to competition for a long time, want modernisation badly; entire trades, like the textile trade, have greatly shrunk. The number of spindles in cotton mills fell from 11,186,000 in 1913 to 9,464,000 in 1924; the consumption of cotton from 486,000 tons to 271,000.

Changes all over the world have greatly affected the position of German industry. The production of bituminous coal is suffering from the competition of lignite, of electricity and of oil. The iron industry, quite apart from the structural changes brought about through loss of territory, has lost the armament market as well as the building market; the construction of houses is far below the pre-War output of 200,000 dwellings a year. The great use of scrap iron has diminished for the time the importance of iron ores.

Inflation greatly facilitated the concentration of industries in a few hands by all sorts of combines. Shrewd business men borrowed money from the banks to buy shares and plants, and repaid the loans in valueless paper money. Some of the new combines were mere amorphous aggregations which fell to pieces immediately when credit became dear. Others chose the so-called vertical combination, trying to concentrate in one hand works representing the different stages of production. This was the type which has been closely identified with the name of Stinnes. The home market was secure, as, owing to falling exchanges, foreign goods could not compete. Wages reckoned in gold were low, trading conditions profitable.

After the mark was stabilised, it was quite clear that industry as well as agriculture was a loser. The middle class, having been ruined, had no purchasing power. Wages, though considerably higher than during inflation days, were below the peace level. The average weekly wages of a skilled metal worker had been 36·36 marks in pre-War days; they were 31·27 marks in April 1924. As the cost of living index had risen to 111 (rent included), wages represented a good deal less purchasing power than before.

Foreign Trade.—Exports could not make good the deficit of purchasing power at home. Germany's total exports had fallen to 6·5 milliard gold marks, 1923–5, against 10·2 milliard gold marks in 1913, not making allowance for the rise of prices. As the purchasing power of neither the home market nor the foreign market equalled the productive capacity of increased plants, many works were running at half speed. And as overhead cost added an increasing proportion to costs when the output was small, prices needs must be comparatively high. Given the small purchasing power of the home market high prices were bound to lead to reduced sales, and reduced sales in their turn must bring about rising costs. Adjustment was very slow as for a long time there was no real free competition in Germany. Foreign competition was kept out by tariffs as well as by the use of import licenses (a practice which has almost disappeared by now). The sheltered home market was controlled by cartels whose policy was to give a chance of living to the most inefficient member-works. All this really meant a reversal of the old German business policy, which had insisted on a big turn-over and a small profit; the new policy aimed at big profits and small turn-overs. As the political power in economic affairs remained in the hands of the highly organised producers of raw materials and half-finished goods who insist on high prices, the general price level was driven up. By the end of 1925 the cost of living index had reacted, and nominal wages were above the pre-War level. The average for the metal workers in Dec. 1925 was 46·24 gold marks (skilled) and 31·16 gold marks (unskilled). In the midst of a crisis Germany had high prices and rising wages.

Most of the legal obstacles to exportation had disappeared in 1925. Germany was admitted to the most favoured-nation treatment, and the licence system was on the wane. But hostile tariffs and decreased international purchasing power have remained, affecting German foreign trade in a peculiar way. Whilst English exports have risen from 284 marks per head 1913 to 385 marks 1923, Germany's quota has fallen from 149 gold marks to 139·6 gold marks 1925. German industry clamoured for a tariff, with the double object of fighting hostile customs barriers and of enabling her to recoup herself on the home market whilst exporting cheaply abroad. The tariff was carried by a combination of the landed interest and the producers of raw materials and half-finished goods. It came into force on Oct. 1 1925.

Credit Position.—Generally speaking it has not achieved much. It may have facilitated the conclusion of minor commercial treaties. But the poverty of the consumer who can either buy goods or keep his money in the bank, but who is unable to do both as he did in days gone by, has deprived industry of its working capital, though the valuation of the plants is rather high. Capital is scarce, and rates of interest (long term) at 12% and more are even now by no means the exception. The Reichsbank was bound to restrict credit, as it had to protect the currency and

STATISTICS OF GERMANY'S PRODUCTION, INDUSTRY AND TRADE

	1913[1]	1913[2]	1920[2]	1921[2]	1922[2]	1923[2]	1924[2]	1925[2]
Agriculture:—								
Total area under cultivation (in thousands of hectares)	34,814	29,850[3]	..	..	..	..	..	..
Area (thousands of hectares) under:—								
Wheat	1,974	1,676	1,375	1,441	1,374	1,478	1,466	1,552
Rye	6,414	5,259	4,285	4,265	4,142	4,366	4,260	4,709
Oats	4,438	3,924	3,213	3,162	3,202	3,345	3,525	3,452
Sugar beet	569	467	326	389	417	384	394	403
Potatoes	3,412	2,802	2,422	2,647	2,721	2,727	2,761	2,809
Grass	5,992	5,361[3]	..	..	..	..	..	..
Total production (in thousands of metric tons):—								
Wheat	4,656	4,036	2,247	2,933	1,958	2,897	2,428	3,218
Rye	12,222	10,130	4,934	6,798	5,234	6,682	5,730	8,063
Oats	9,714	8,615	4,826	5,004	4,015	6,107	5,654	5,585
Sugar beet	16,919	13,986	7,935	7,980	10,790	8,696	10,267	10,326
Potatoes	54,121	44,013	27,874	26,149	40,661	32,580	36,402	41,718
Livestock (000's omitted):—								
Cattle	20,994	18,474	16,806	16,791	16,316	16,691	17,326	17,183
Horses	4,558[4]	3,807[4]	3,588	3,666	3,650	..	3,855	3,915
Sheep	5,521	4,988	6,150	5,891	5,566	6,105	5,735	4,742
Pigs	25,659	22,533	14,178	15,818	14,678	17,308	16,895	16,160
Industry:—								
Production (in millions of metric tons):—								
Coal	190·1	140·8	107·5	113·9	119·2	62·3	118·8	132·7
Lignite	87·2	87·2	111·9	123·1	137·2	118·8	124·6	139·8
Steel	18·3[5]	11·8	8·4	9·9	11·2	6·3	9·3	12·2
Tonnage launched (in thousands of reg. tons)	465·2	..	..	509·1	525·8	345·1	175·1	406·4
New Capital issues (in mill. marks) (Stock Exchanges)	2,351	..	..	..	..	..	14,927	2,321
Savings bank deposits (Dec. 31) (in mill. marks)	19,689	..	..	..	..	..	600	1,612
Unemployment (total) (excluding short-time workers (Dec. 31) (000's omitted)	..	..	410	165	85[6]	1,533[6]	536	1,488
Wages. Miners (hewers per shift. Dec. (black coal) (marks)	R.M. 6·51 (average)	..	..	..	..	..	7·51	8·30
Cost of living (Dec.) (marks)	100	..	1,158	1,928	68,506	1,247 milliards	122·6	141·2[7]
Wholesale prices (in gold marks)	100	..	105·8	82·7	82·0	95·1	122·5	130·4
Trade								
Railways:—								
Goods traffic carried (in millions of tons)	501·1	445·0	337·1	354·0	374·4	246·3[9]	271·3[9]	..
Waterways:—								
Goods traffic carried (in millions of tons)	99·6	..	43·3	41·6	58·8	34·3	70·9	..
Shipping clearances (in thousands of reg. tons) Arr.	34,772	..	12,545	19,169	26,488	30,860	29,692[8]	33,193[8]
Dep.	34,922	..	12,360	19,114	26,450	30,899	29,677[8]	33,516[8]
Special Trade:—								
Imports (home consumption) quantity (in thousands of tons)	72,832	..	18,842	25,663	45,868	46,685	38,647	51,982
Values (in mill. marks)	10,770	..	3,939[10]	5,732[10]	6,290[10]	6,150	9,083	12,428
Exports (Domestic produce) quantity (in thousands of tons)	73,714	..	19,838	13,804	21,650	12,740	15,841	38,325
Values (in mill. marks)	10,097	..	3,709[10]	2,991[10]	6,187[10]	6,102	6,555	8,798

[1] The pre-War area. [2] The present area excluding the Saar. [3] Including Saar. [4] Including army horses. [5] Including Luxemburg. [6] Unoccupied territory. [7] According to new basis. [8] 19 ports only. [9] Returns incomplete owing to occupation of Ruhr. [10] 1913 values. All the above figures are obtained from official German sources. (W. Gr.)

wanted to force down prices. Government increased the stringency by overtaxing the people from fear of failing in their obligations under the Dawes scheme. The surplus in the Treasury has either gone to States or municipalities which not always used it wisely, or lent it out directly or through the banks in rather an indiscriminate way. Foreign credits have been resorted to on a considerable scale. They have been estimated at $3\frac{1}{2}$ milliard marks, which accounts of course for Germany's unfavourable balance of trade (imports 12·5 milliard gold marks, exports 8·8 milliards gold marks). The lending capacity of the banks is very limited. The total capital of the four big Berlin banks before the War (reserves included) amounted to 1,059 million marks, their deposits to 2 milliards. At the end of 1925 capital and reserves have shrunk to 546 million marks and deposits to 1·76 milliards. The savings bank deposits have fallen from 18 milliards gold marks to 2·3 milliards.

The result of this scarcity of credit, which is really due to insufficiency of income, has been a crisis which is now at its height. Amorphous aggregations like those of the Barmats have long ago gone to pieces, but even vertical combines, like the Stinnes concern, had to be dissolved. And the typically German form of the horizontal combine, the cartel, which is an organisation of works producing the same class of goods with the object of getting a monopoly price high enough to keep the weakest partner going, has broken down. There is a tendency already materialised in the chemical trade, and on the way to materialisation in the steel trade, to form a real trust with its advantages of large scale production. Germany is on the way to recovery. But the transition is slow and painful. Owners are naturally unwilling to write down capital on the necessary scale, as indicated perhaps too pessimistically by the valuation of shares on the stock exchange. Bankruptcy is rampant. In Dec. 1925 commercial failures, which were as low as 30 a month in Jan. 1924, have gone up to 1,660, thus greatly surpassing the monthly average of 815 in 1913. Unemployment is spreading. Whilst during the hey-days of inflation (second half of 1922)

less than 50,000 people received unemployment benefit, their number had grown to 1,485,931 at the end of Dec. 1925. Emigration is starting again, notwithstanding all sorts of obstacles; 58,714 emigrants left Germany in 1925. Fortunately, trade unionism has regained its strength. The problem lying ahead of Germany is, how can she become a country with a low level of prices and a comparatively high level of wages.

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VIII. CURRENCY.

The New Bank Amendment Act.—On Jan. 1 1911 the provisions of the Bank Amendment Act of June 1 1909 came in force. By this Act the note issue privileges of the Reichsbank were extended for a further 10 years, and the tax-free portion of the issue was again increased (from 450,000,000 marks to 550,000,000 marks; at the end of each quarter to 750,000,000 marks). The note circulation was permitted to exceed the cash reserves by those sums without the Bank having to pay the 5% note tax. This measure was partly due to the severe economic and financial crisis of 1906–7, which had led to abnormally high official discount rates, and to the institution of a thorough inquiry into the working of the Central Bank and of the whole German banking and credit system. The committee of investigation, of which Dr. Havenstein, the president of the Reichsbank, was chairman, had recommended, firstly, that the gold holdings of the Reichsbank should be increased by a larger issue of small notes, by encouraging payments which did not involve the use of cash, and by corresponding measures in regard to foreign payments; secondly, that measures should be taken to diminish the demands for credit from the Reichsbank on the part of public and private bodies, and to strengthen the security and liquidity of the deposits in the banks. The new Bank Act gave effect to most of these recommendations. Bi-monthly balance sheets of the banks were published in the *Reichsanzeiger* from 1912 to Aug. 1914 and again from the beginning of 1925. The liquidity of the German banking and currency system was improved.

The average annual gold holdings of the Reichsbank rose from 827,600,000 marks in 1911 to 1,067,600,000 marks in 1913, the note circulation of the Bank from 1,663,600,000 marks to 1,958,200,000 marks, the gold cover from 49·7% to 54·5%, the holding of bills from 1,077,800,000 to 1,136,000,000 marks, and the total turnover from 377,500,000,000 to 422,300,000,000 marks.

The official discount rate was fairly high during the years immediately preceding the War owing to expanding trade and to the tension on foreign relations, the average rate for 1911 being 4·397%, for 1912 4·946% and for 1913 5·885%. Credit transactions both at home and abroad were regulated by the gold standard, and fluctuations were lessened by the intervention of the Reichsbank. The supply of and demand for capital were harmoniously adjusted, and the markets for short and long term loans were adapted to varying needs by the automatic operation of interest rates. The Reichsbank acted as the bankers' bank and as the ultimate source of credit in the country. The whole credit and currency system stood in the closest relation to the economic organisation of Germany and to its development as a great industrial and international trading centre. Though the balance of trade was adverse, as in other advanced industrial countries, the invisible exports were sufficiently large to enable a steadily increasing volume of capital investment abroad.

The War Period.—When the World War broke out the Reichsbank was faced with new tasks of unexampled magnitude. It also took over the management of the loan offices (Reichsdarlehnskassen) which were set up in 1914 to facilitate borrowing against goods, stocks, shares, etc. It was able to meet the tremendous demands for cash and loans during the mobilisation period and in the early stages of the War without any appreciable rise in its discount rate and without the necessity for a general moratorium. It is true that on Aug. 4 1914 its notes were declared irredeemable in gold, and the liability to pay note tax on excess issues was abolished. Loan office notes were recognised as a cover for Reichsbank notes, and Treasury Bills with not more than three months to run were admitted for discount at the Reichsbank, and accepted as cover for the note issue. This disregard of well-established currency principles would probably not have had very serious results if, as was at first assumed, the War had been of short duration.

As the Reich acquired control over an ever larger proportion of the economic system for War purposes its demands for credit became predominant, and the requirements of private industry and commerce, which at first were very great, fell increasingly into the background. The necessary sums were in the first instance made available by the Reichsbank in the form of Treasury Bill credits, and then converted almost completely into long-term war loans. By a successful collection of gold from the hands of the public, a fund was created for external purposes which proved of the greatest importance, both in the War and in the difficult post-War period, as a means of payment for vital imports. The Reichsbank discount rate, which at the outbreak of the War was raised to 6%, was reduced in the middle of Dec. 1914 to 5% and kept at that figure till the middle of 1922. But owing to the lack of a free gold market it lost a great part of its normal influence as a regulator of the economic system. The circulation of Reichsbank notes rose from an average of 1,958,000,000 marks in 1913 to 5,409,000,000 in 1915, to 9,010,000,000 marks in 1917 and to 13,682,000,000 marks in 1918.[1] The average gold holdings of the Reichsbank rose from 1,068,000,000 marks in 1913 to 2,387,000,000 marks in 1918. The highest figure reached was 2,550,000,000 marks on Nov. 7 1918 (including gold handed over by Russia under the Brest-Litovsk Treaty). The average gold cover of the note circulation fell from 54·5% in 1913 to 17·5% in 1918. The value of the mark remained near to parity during the first two years of the War, and even at the end of the War had only fallen to about half its pre-War value.

Legal Changes.—The most important changes in the legal provisions affecting the Reichsbank after the War were (1) the reduction in the minimum cover for the notes, by the Act of May 9 1921; (2) the authorisation of the Reichsbank to undertake forward exchange business, by the Act of Dec. 16 1919; (3) the inclusion of gold stocks held by the Reichsbank in foreign central banks as primary cover for its notes, by the Act of March 4 1922; (4) the so-called autonomy law of May 26 1922, which made the management of the Reichsbank independent of the Government of the Reich and entrusted it solely to the managing board of the Reichsbank, though this did not appreciably affect the policy of the Bank.

Inflation.—During the years following the World War the economic life of Germany declined, reaching its nadir in 1923. All attempts to stabilise the falling currency were unsuccessful in view of the various burdens imposed on Germany by the Allies. The value of the gold mark in terms of paper marks, as measured by the exchanges on countries with the gold standard, was 2·08 paper marks in Dec. 1918, 10·8 in Dec. 1919, 17·39 in Dec. 1920, 45·72 in Dec. 1921, 1,750 at the end of 1922 and after Nov. 20 1923 a million million. Since the printing press could not keep pace with the depreciation, emergency money was issued without proper control and utter confusion ensued. The money and capital market came to a complete standstill; interest rates rose to fantastic heights; the accumulation of capital ceased. There was a feverish chase after goods and foreign securities. The finances of the state lost all basis. The last phases of this evolution suddenly became catastrophic; the mark became useless as a medium of payment, for in many cases it was no longer accepted, and had already been largely rejected by the business community as either a measure of value or a basis of calculation.

The Rentenmark.—In the chaos of inflation there appeared the beginnings of the transition to a stable currency in the form of loans with a fixed value based on gold or commodities; mortgages, credit and insurance transactions, savings bank deposits, commercial contracts, etc., being reckoned in terms of gold or some other commodity standard. Finally, the Rentenbank was created by the Order of Oct. 15 1923 and was astonishingly successful in leading the way to the stabilisation of the currency. While the convening of the

[1] *Cf.* the figures for the end of each year on pp. 120–1 of *Memorandum on Currency and Central Banks, 1923–4* (Geneva, 1925).

Dawes Committee was still under discussion Germany succeeded, in circumstances of the greatest stress, in stabilising her currency unaided, and in resuming control over her finances. The success of the Rentenbank was largely due to the fact that with its help the finances of the Reich were supported until the collection of the revenue in terms of the new currency, and energetic measures of economy had enabled the budget to be balanced. The Reichsbank was able, on account of its credit policy, without legal regulation, to maintain the value of the Rentenmark at the equivalence of 1 Rentenmark = 1 billion paper marks = 1 gold mark, until the final currency reform was introduced.

In order to support the value of the currency in the meantime, the German Gold Discount Bank was created (April 1924) for the purpose of providing industry and commerce with gold credits, chiefly for export purposes. The unity of currency and credit policy was secured by entrusting to the Reichsbank the management of the Gold Discount Bank and the granting of Rentenbank credits for business purposes.

Acts Regulating the Reform.—The adoption of the Dawes Plan led to the passing on Aug. 30 1924 of four Acts—the new Bank Act, the Mint Act, the Private Issue Bank Act and the Act for the redemption of the notes in circulation of the Rentenbank. These Acts came into force on Oct. 11 1924 after the floating of the German foreign loan of 800,000,000 reichsmarks, in accordance with the proposals of the experts. The Rentenbank and the Gold Discount Bank were put into liquidation, but the latter subsequently resumed its activity as a credit institution in the guise of a department of the Reichsbank. The further issue of Rentenbank notes was prohibited, and the Reichsbank was required to withdraw Rentenbank notes in circulation, within a period of 10 years.

By the Mint Act the gold standard was again proclaimed with the reichsmark as the currency unit, and with the same gold equivalence as the pre-War gold mark, *i.e.*, 1 km. of fine gold = 2,790 reichsmarks. The old gold coins retained their validity and also the silver coins minted under the Act of March 20 1924, the rentenpfennigs and the copper pfennigs issued under the law of July 9 1873. All other coins previously minted of silver, nickel, aluminium, iron and zinc, lost their validity. The minting of silver coins to the value of 1–5 reichsmarks was authorised by the new Mint law. Apart from the Reichsbank notes only the gold coins were given unlimited legal tender. Silver coins were legal tender up to 20 reichsmarks and smaller token coins up to 5 reichsmarks.

Under the new Bank Act the essential features of the Reichsbank were retained, but important modifications were made in accordance with the principles of the Dawes Plan, one of which was the introduction of an element of foreign co-operation exercised through the General Council and the Commissioner of the Note Issue, who is a foreign member of the General Council. The management and administration of the Reichsbank was placed, as under the old Bank Act, in the hands of the Managing Board of the Reichsbank which consists exclusively of German nationals. The original capital of the Bank was contracted from 180,000,000 marks to 90,000,000 reichsmarks. The new Bank Act provides for a capital of at least 300,000,000 reichsmarks.

The functions of the Reichsbank, resulting from its position as the central bank of issue, were laid down in the same terms as in the old Bank Act, but the provisions in regard to credit were made more stringent. The power of the Bank to grant credit to the Reich, the Federal States and the municipalities were narrowly limited or forbidden altogether. The Reichsbank was also given the new function of holding on deposit the sums paid in reparations, for the account of the agent for reparation payments. The exclusive right of issuing notes was granted to the Reichsbank for 50 years. While on the one hand the note circulation was subjected to more severe conditions with regard to its cover, it was also made more elastic, and greater freedom of action was secured by the admission of foreign bills of exchange as cover for the notes in addition to gold. The obligation on the Reichsbank to redeem its notes in gold was for the time being suspended, and its reintroduction was made dependent on the approval of both the Managing Board and the General Council.

Quantity in Circulation.—During 1925 gold coins were not in circulation. The following tables show the volume and composition of the money in circulation in Germany at the end of 1913 and 1925:—

1913
(In Millions of Marks)

Gold Coins	Token Coins	Treasury Notes	Reichsbank Notes	Private Bank Notes	Total Circulation
2,750	850	100	2,593	160	6,453

1925
(In Millions of Reichsmarks)

Token Coins	Reichsbank Notes	Private Bank Notes	Rentenbank Notes	Total Circulation
582	2,961	190	1,476	5,209

Reichsbank Policy.—The Reichsbank was faced with very great difficulties in carrying out its economic functions after the stabilisation of the currency owing to the inevitable crisis of economic reconstruction, to the reparation payments and to the flood of foreign credits which came into the country following on the Dawes loan. Although the new Bank Act had re-established sound principles of banking policy it was not possible for them to be applied in the same way as before the War. As a result of the disrupting effects of war and inflation upon circulating capital there arose a grave discrepancy between the supply of and demand for capital, which only by degrees became less acute. The mechanism of the money and capital market, which had completely broken down, was at the beginning of 1926 still by no means normal, and the automatic regulation of the markets for short and long term loan capital was not yet restored. Under such abnormal conditions the Reichsbank (from April 1914 onwards) found itself compelled to put into force a drastic rationing of credit in addition to a cautious adjustment of its discount rate. It was not till the end of 1925 that it was able to modify in a tentative way the severity of its credit rationing. The discount rate was fixed at 10% after the stabilisation, but was then much below the rates of the private banks. Even when it was lowered in Feb. 1925 to 9%, in Jan. 1926 to 8% and in March 1926 to 7%, there remained an abnormal divergence between the official rate and the rates for private bank credits. By degrees, however, these rates have tended to come closer together.

The difficulties in the way of credit policy are enhanced by the restriction of the pre-War freedom of the Reichsbank in the control of its note issue, since the public funds, the reparation account and the foreign credits are more or less outside the direct influence of the Reichsbank, and are liable to lead to the withdrawal of considerable quantities of notes. The requirements of modern currency policy therefore compel the Reichsbank to watch most carefully the movement of the whole volume of purchasing power and its influence on prices, wages and other economic indices. It is incumbent on it to take or initiate the necessary measures to organise the money and capital market on sound lines, to encourage the formation of capital, and to secure the most economic use of all the available capital, including credits raised in foreign countries.

The Reichsbank augmented its gold holdings from less than 500,000,000 marks in 1923 to about 1,500,000,000 reichsmarks at the end of April 1926. The holdings of gold and liquid assets available for cover amount to 60% of the Reichsbank notes in circulation, but this proportion is not a decisive basis for credit policy as the circulation of Rentenbank notes has to be taken into consideration as well. From the middle of 1925 the total money circulation at the end of each month was in the neighbourhood of 5,000,000,000 marks. The total volume of private credit given by the Reichsbank, the private note banks, the Rentenbank, and the Gold Discount Bank, and including bills rediscounted by the Reichsbank to other bodies amounted in 1925 to about 3,000,000,000 reichsmarks.

After the stabilising of the currency German industry and commerce passed through a severe crisis, and thus heavy burdens were imposed on the Reichsbank as the guardian of the currency. In spite of these difficulties, it proved possible to maintain the value of the reichsmark, and from the beginning of June 1924 onwards all demands for foreign exchange were fully satisfied. It is not yet possible to foresee when the existing restriction on a free gold currency in Germany will be removed. In any case the fact that foreign exchange is available without limitation in exchange for Reichsbank notes is equivalent to the effective redemption of Reichsbank notes in gold. (K. No.)

GHENT, Belgium (*see* 11.919), had a population in 1923 of 163,877, and including the suburbs of Ledeberg, Ghentbrugge and St. Amand of 212,096. The city measures some 16 m. in circumference, much room being taken up by nurseries and gardens, for Ghent has become an important horticultural centre, especially for the cultivation of flowers under glass. Linen weaving has greatly developed, and schools of industry and mechanics have been established. A great international exhibition was held in 1913 in a Palais des Fêtes, specially built in the Parc de la Citadelle. The old cast-iron steeple of the belfry was rebuilt in 1913; subsequently most of the copper work from the new one was removed by the Germans. The hospital and almshouses for old men have been removed from the ancient Byloke, which has been fitted up to house the archaeological museum, previously in the old Carmelite church. The panels of the famous "Worship of the Lamb" by Hubert and Jan Van Eyk, dispersed since 1816, were brought together again in 1920 under the provisions of the Treaty of Versailles. A plaque in memory of Edith Cavell has been fixed on an inn, De Stad Ouden Aerde, where she stayed shortly before her arrest, and a memorial to the inter-Allied dead was unveiled in the cemetery in Oct. 1924. A new lock at Terneuzen enables vessels up to 26 ft. draught to pass at any tide into or out of the canal between that port and Ghent.

Ghent was in the hands of the Germans from Oct. 1914 till Armistice Day, Nov. 11 1918. The west part of the town suffered some damage in the final operations. The Germans published there the *Vlaamsche Post*, an organ professing Flemish sympathies and advocating the partition of Belgium, and made determined efforts to transform the University of Ghent into a purely Flemish institution, in order to widen the breach between the Flemish and Walloon elements. The university was reopened in Oct. 1923.

GIARDINO, GAETANO (1864–), Italian soldier, was born at Montemagno, Italy, Jan. 24 1864. He joined the army in 1882 and saw service in Eritréa (1889–94) and in Tripoli (1911–2). On Italy's intervention in the World War he was appointed chief of staff to the II. Army and was promoted brigadier-general in Aug. 1915. In June 1916 he was given command of the 48th Brigade and played an important part in the attack on Gorizia. In June 1917 he was promoted lieutenant-general but a few days later was chosen Minister of War and made a senator. He held office until after Caporetto, when he was appointed assistant chief of staff to the new commander-in-chief, Gen. Diaz. In April 1918 he was given the command of the IV. Army in the Grappa sector. At the battle of Vittorio Veneto (Oct. 24–Nov. 3 1918) he delivered a general attack on the Austrian lines and after a hard struggle forced the enemy to retreat. In 1919 he was promoted *generel d'esercito*. In Sept. 1923 as the Govt. of Fiume was unable to carry on, Giardino was sent to take charge of the town, where he remained until its annexation by Italy under the terms of the treaty between Italy and Yugoslavia in Jan. 1924.

GIBBONS, JAMES (1834–1921), American Roman Catholic cardinal (*see* 11.936), in 1916 published *A Retrospect of Fifty Years*. He died in Baltimore March 24 1921.

GIBRALTAR (*see* 11.938) has been largely increased in strength as a naval base; with the extension of the mole the deep harbour has an area of 260 ac. and affords anchorage for the largest ships. It was of great importance during the World War as a coaling station and port of call.

In 1922 an executive council was established, but all legislative power remains with the governor. A city council has replaced the board of sanitary commissioners, and currency notes have been issued by the local authority since 1913. Gibraltar is one of the most closely populated places in the world (9,888 to the sq. m. in 1921), but it is not unhealthy, the death-rate in 1921 being 17 per thousand. The population in 1924 was 20,638: 17,160 civilian, 2,932 military and 546 naval. There is a regular motor-omnibus service to La Linea, which has grown considerably and has a population of 63,000. A cross of sacrifice, in memory of those who died and were buried at Gibraltar during the World War, was unveiled in 1922, and a War Memorial in 1923. In 1915 a second reservoir was excavated, and the construction of another is contemplated. The Exchange in Commercial Square, which was burnt down in 1919, was rebuilt and opened in 1922. A public recreation ground was opened above the military school in 1920. The signal station on the summit of the rock has been dismantled. Since 1910 Gibraltar has been a Roman Catholic bishopric, independent of the Spanish hierarchy and subject directly to the Vatican.

GIDE, ANDRÉ (1869–), French essayist and novelist, was born in Paris Nov. 21 1869. Educated at the École Alsacienne and the Lycée Henri IV., he began his literary career with the *Cahiers* and the *Poésies d'André Walter* (1891–2). His first success was followed by a series of works resembling philosophical *causeries* in which an introspective method and great delicacy of expression were combined in an original manner. His dramatic works and criticism are characterised by the same sureness of touch and individual grace. He is considered one of the finest stylists in contemporary French literature, and exercised considerable influence outside his own country. As a novelist, however (as in *Les caves du Vatican*), he was less successful; he is more at home in the easy, discoursing flow of an essay.

Gide's works include: *Le voyage d'Urien* (1893); *Paludes* (1895); *Les nourritures terrestres* (1897); *Le traité du Narcisse* (1899); *Le Prométhée mal enchaîné* (1899); *L'immoraliste* (1902). Criticism: *Lettres à Angèle* (1900); *Prétextes* (1905). Drama: *Saul* (1898); *Le roi Candaule* (1898); *Les caves du Vatican* (1911); *Isabelle* (1911); *La symphonie pastorale* (1919); *Dostoïevsky* (1923, tr. 1925); *Les faux Monnayeurs* (1926).

GIDE, CHARLES (1847–), French economist, was born June 29 1847 at Uzès (Gard). Educated at the Collège d'Uzès, he entered the faculty of law of the University of Paris. He early took up the study of economics and became professor of political economy, first at Bordeaux, then at Montpellier, and from 1898 to 1920 at the University of Paris. He is the author of one of the best introductory treatises on political economy, *Principes d'Economie Politique*, first published in 1884 and since translated into English and other languages, and is joint author with Professor Rist of an excellent work on the history of economic theory, *Histoire des Doctrines Economiques* (3rd ed. 1920). Gide devoted a great deal of time and energy to the encouragement and furtherance of the co-operative movement in France, and wrote largely on this question. Professor Gide enjoys a wide measure of esteem amongst scholars in other countries, not only as an eminent economist, but also on account of his unremitting endeavours to maintain and promote harmonious international relations and especially to preserve co-operation amongst intellectual workers in different countries. (*See* FRANCE.)

GILBERT, CASS (1859–), American architect, was born at Zanesville, O., Nov. 24 1859. He studied at the Massachusetts Institute of Technology and in 1883 began his career as an architect in St. Paul, but subsequently moved to New York. He became perhaps most widely known as the architect of the Woolworth building in New York, which has 57 stories and is 760 ft. in height, and, with the exception of the Eiffel Tower in Paris, the tallest structure in the world. Other buildings designed by him include the Minnesota State Capitol, St. Paul; the Endicott building, the Dayton avenue church and St. Clement's Episcopal church, in St. Paul; the United States Custom House and the Union Club, New York; the Brazer building and the Suffolk Savings Bank, Boston; Art building and Festival Hall (for the Louisiana Purchase Exposition), and the Central Public Library, St. Louis; Ives Memorial Library, New Haven, Conn.; Public Library, Detroit. He also drew the plans for the university of Minnesota and for the university of Texas. He was appointed by President Roosevelt a member of the Council of the Fine Arts; and by President Taft a member of the National Commission of Fine Arts, being reappointed by President Wilson. In 1926 he was appointed design architect for the proposed bridge over the Hudson river at New York City.

GILBERT, GROVE KARL (1843–1918), American geologist (*see* 12.7), died at Jackson, Mich., May 1 1918.

GILBERT, SEYMOUR PARKER (1892–), American lawyer and financial expert, was born in Bloomfield, N.J., Oct. 13 1892. He graduated from Rutgers College in 1912, and in the same year entered the Harvard Law School, obtaining the LL.B. degree in 1915. After admission to the New York Bar, he practised in New York City from 1915 to 1918. In the latter year, on the initiative of R. C. Leffingwood, a former Associate Secretary of the Treasury, he joined the War Loan Staff as counsel. In June 1920 he became assistant secretary (later under-secretary) of the Treasury in charge of fiscal affairs. He resigned Nov. 17 1923, and became agent-general for Reparation payments under the Dawes plan Oct. 31 1924.

GILBERT, SIR WILLIAM SCHWENK (1836–1911), British playwright and humorist (*see* 12.9), was drowned at Harrow Weald, Middlesex, May 29 1911. His play, *The Hooligan*, was produced a short time before his death.

GILBEY, SIR WALTER (1831–1914), British wine merchant (*see* 12.11), died at Elsenham Hall, Essex, Nov. 12 1914.

GILDERSLEEVE, BASIL LANNEAU (1831–1924), American scholar (*see* 12.12), died at Baltimore, Md., Jan. 9 1924.

GINER DE LOS RIOS, FRANCISCO (1840–1915), Spanish philosopher and jurist, was born in Ronda (Andalusia) Oct. 10 1840. He graduated in Granada, and in 1867 went to the University of Madrid as a professor of jurisprudence and there came under the influence of Prof. Sanz del Rio, Krause's famous disciple.

In accordance with his belief that philosophy should have a concrete influence on practical life, he devoted himself to the educational question. Twice Giner resigned his chair, together with several of his colleagues, in a stand for liberty of thought in the university against a reactionary government, and was twice reinstated. He helped to found the Institucion Libre de Ensenanza, an educational institution which did much to improve teaching methods in Spain, by the application of philosophical thought to the problems of education. He many times refused election to the Cortes, and in 1873 declined a post in the Government. His greatest influence was personal and direct, for he was a born teacher, a man of refined sensibility, pure in his life as in his ideals.

Giner published several volumes of essays—literary, educational, philosophical and religious—as well as *Lecciones Sumarias de Psicologia* (1871); *Psicologia; Idea del Derecho*, with Alfredo Calderon, trans. from the German of Röder (1885); *Resumen de Filosofia del Derecho*, with Alfredo Calderon (1898); and other works. A complete edition of his numerous works was undertaken a year after his death.

See S. de Madariaga, *The Genius of Spain* (1923).

GINSBURG, CHRISTIAN DAVID (1831–1914), British Hebrew scholar (*see* 12.29), died in London March 7 1914.

GIOLITTI, GIOVANNI (1842–), Italian statesman (*see* 12.31). The elections of 1909 returned a strong Giolittian majority, but Giolitti as Premier found himself faced with the necessity for renewing the steamship conventions which were about to lapse. The Bill presented by his Cabinet on this subject was open to much criticism, having been designed to conciliate conflicting political interests rather than to solve the actual problem. The vigorous attacks of the Opposition, led by Baron Sonnino, induced Giolitti to adjourn the debate until the autumn, when, the Cabinet having been defeated on a point of procedure, he resigned (Dec 2). But he continued to play an active and in fact dominant part in Parliamentary politics, for the majority of the Chamber and of the Senate, being thoroughly Giolittian, the Sonnino Ministry and that of Sig. Luzzatti which succeeded it only remained in power at his discretion. When in March 1911 Luzzatti resigned in consequence of the hostile vote of the Radicals and the resignation of its two Radical members, Giolitti was again called upon to form a government (March 31).

The chief event of his fourth Cabinet was the Libyan War. Personally he was not enthusiastic over the African enterprise, as it introduced new and, to him, unaccustomed and unwelcome values into Italian political life; but he realised that public opinion demanded it and he did not care to run counter to the current. He was criticised by the vestals of constitutional tradition for having declared war without consulting Parliament and for not having summoned it until several months later. During the campaign, he was, moreover, severely blamed on the ground that he acted as though the war were merely an affair of internal politics and party combinations. When peace was concluded fresh elections were held on the new franchise law introduced by the Cabinet, which raised the electorate from 3,000,000 to 8,000,000 votes (Oct. 26–Nov 2 1913); although a Giolittian majority was again returned, his opponents, not only among the Socialists, but also the constitutional parties, were now more numerous, and he felt that opposition to his rule was growing in the country at large even more than in Parliament. The various awkward problems which now faced the Government and the divisions among its own supporters induced him to seize the opportunity of a hostile vote by the Radical group to resign (March 10 1914).

When the World War broke out his attitude was favourable to the absolute neutrality of Italy, as he believed that his country's interests lay in not siding with either group of belligerents, and on the eve of Italian intervention he made an attempt, by using his personal hold over the Parliamentary majority, to upset the Salandra Cabinet, but it was frustrated by an uprising of public opinion in favour of the war. During the progress of the campaign he avoided public affairs, although he assumed a Cassandra-like attitude in all his utterances, and his henchmen in the Press were frankly "defeatist." He consequently lost his influence over the bulk of public opinion and in many quarters was regarded as little better than a traitor. But after the Armistice the unsatisfactory consequences of the peace negotiations, the heavy burden of suffering and loss caused by the War, and, above all, the disputable internal policy of the Nitti Cabinet, which was accused of handing the country over to the Bolshevik Socialists, brought about the return of Giolitti.

When Nitti was forced by the impossibility of governing the country to resign for the third and last time on June 9 1920 a new Giolitti Cabinet was the inevitable alternative. He succeeded by June 15 in forming a Cabinet which comprised a number of non-Giolittians of all parties, but only a few of his own "old guard," so that he won the support of a considerable part of the Chamber, although the Socialists and the Popolari (Catholics) rendered his hold somewhat precarious. His policy of inactivity during the occupation of the factories by the workmen organised by Socialist leaders in Sept. 1920 provoked the indignation not only of the manufacturers but of all the middle-class. He appears to have acted under the impression that the Socialists were much stronger than they really were, and therefore gave them a free hand with the object of avoiding bloodshed, and also perhaps with that of proving to the workmen that they could not run industry without the capitalists and the technical experts. When he realised the strength of the national reaction, he allowed the Fascists free rein to re-establish order and practically exercise many of the functions pertaining to the Government, while he assumed an attitude of Olympic calm and posed as being *au-dessus de la mêlée*, so as to avoid compromising himself with any party.

In foreign affairs Giolitti succeeded in achieving a solution of the Adriatic problem less unsatisfactory than most of the previous proposals of the annexation of new provinces under the peace treaties and of the altered state of public opinion on internal policy, he dissolved the Chamber on April 7 1921, and was confirmed in power by the elections on May 15. But he resigned with his Cabinet at the end of June, being succeeded as Premier by Signor Bonomi.

He played no part in the subsequent events, until at the time of the march on Rome he was one of the statesmen who advised the Premier Signor Facta to resign. On the advent of the Fascist Govt., he expressed his approval of it and instructed his followers to support it. At the elections of 1924 he presented a list of his own in Piedmont, which was not in opposition to but independent of the Government, and in an election speech he attributed many of the achievements of Fascism to his own policy. After the Matteotti affair he definitely went over to the Opposition but did not leave the Chamber, and his hostility remained fairly moderate. In 1922 he published two volumes of memoirs entitled *Memorie della Mia Vita*. (L. V.*)

GIRL GUIDES, a movement for the training of girls based on similar principles to those of the Boy Scouts (*q.v.*). Its aims are: to develop good citizenship; to train girls in habits of observation; obedience, self-reliance, loyalty and thoughtfulness for others; to teach useful service and handicrafts; to promote physical development; to make them capable of keeping good homes and bringing up their children properly. The training runs mainly in four directions: character and intelligence; homecrafts and handicrafts; health and physical development; service for others. The movement is non-political and interdenominational.

Origin and History.—After the Boy Scout movement had been founded by Sir Robert Baden-Powell girls in different places began to copy its activities, and banded themselves together as Girl Scouts. To meet the needs of these girls, Sir Robert and his sister, Miss Agnes Baden-Powell, in 1910 started a separate movement for girls, and gave it the name of Girl Guides. The movement received a charter of incorporation in 1915 and a royal charter in 1923. Princess Mary became president in 1920. Lady Baden-Powell (wife of the Chief Scout) was elected Chief Guide in 1918.

Organisation.—The governing body of the Girl Guides is the council, which meets annually and elects an executive of nine members. Sir Robert Baden-Powell is permanent chairman of the

executive. The executive appoints county commissioners, who in turn appoint division and district commissioners to assist them. Under the latter come the captains, who do the actual training of the girls, grouped into companies. A guide company consists of from eight to 40 girls, and is subdivided into patrols, each under the charge of a patrol leader, who is herself a guide. She is either appointed by the captain or elected by the other guides, and has entire authority over her patrol, and entire responsibility for its conduct and efficiency. The affairs of the company are managed by the court of honour, consisting of the patrol leaders, who meet periodically, under the chairmanship of the captain. A company usually meets once a week, and goes to camp, if possible, for one week in the year.

Membership.—To become a member of the guide movement a girl or woman has to be enrolled. She makes a three-fold promise: to do her best to do her duty to God and the King; to help other people at all times; to obey the guide laws. There are 10 guide laws, namely: a guide's honour is to be trusted; a guide is loyal; a guide's duty is to be useful and to help others; a guide is a friend to all and a sister to every other guide; a guide is courteous; a guide is a friend to animals; a guide obeys orders; a guide smiles and sings under all difficulties; a guide is thrifty; a guide is pure in thought, word and deed.

After enrolment the members of the movement have the right to wear the guide uniform, navy blue with different badges to denote rank or proficiency. The badge of the guides is a trefoil, their motto is "Be Prepared." There are three main branches: the Brownies, aged from 8 to 11, the girl guides, aged from 11 to 16, and the senior guides, from 16 upward, who may be either rangers or sea guides. The officers are called guiders; they can receive training in guide methods at Foxlease Park, Lyndhurst, Hants, England, which was presented to the organisation by Mrs. Archbold Sanderson in 1922.

The guide movement has spread to the British Dominions and other countries. In 1924 a World Camp, attended by some 1,100 guides, from over 30 different countries, was held at Foxlease. At the end of 1925 there were some 613,209 members throughout the world. The Headquarters of the Girl Guides are at 25, Buckingham-Palace Road, London, S.W. The movement is financially self-supporting.

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GIRL SCOUTS: *see* BOY SCOUTS.

GLADDEN, WASHINGTON (1836–1918), American divine (*see* 12.63), died at Columbus, O., July 2 1918.

GLASGOW, Scotland (*see* 12.80), enlarged its boundaries in 1912 by the inclusion of Govan, Partick, Pollokshaws and several suburban districts, making it again the second city in Great Britain in population, and increasing its area from 12,975 to 19,183 acres. The number of wards was increased from 26 to 37, and the membership of the corporation from 80 to 113—three representatives of each ward, and two ex-officio members (the dean of guild and the deacon convener of the trades). Since 1918 Glasgow has sent 15 members to Parliament. A further ambitious scheme of enlargement of the burgh was promoted after the World War, owing to the congested state of the city and the fact that many of the housing schemes were situated outside the boundaries. It involved the incorporation of 22,000 ac., and met with opposition from adjacent counties and burghs; eventually, by an Act of 1925 (coming into force in May 1926), about half the proposed area, taken from Renfrewshire, Lanarkshire and Dumbartonshire, and including the important Yoker area near Clydebank, was incorporated. The population in 1921 was 1,034,174 and the rateable value in 1925 £11,040,693.

The Rent Strike.—Housing conditions have been extremely bad, and the new houses erected insufficient to accommodate even the normal increase in population; there has also been much unemployment. A legal campaign by the tenants, contesting the validity of notices of increase of rent under the Increase of Rent (Restriction) Acts, served without previous notice to quit, was supported by the decision of the House of Lords in a test case (*Kerr* v. *Bryde*) in 1922, and in the following year an amending Act to regularise the position was passed. Many tenants, however, refused not only the increased rent but any rent at all, and demanded a return to the pre-War standard. A large number of eviction orders were granted in 1924 and early in 1925, but their execution was rendered impossible in most cases by the violent tactics of the tenants. In June 1925 the unrecovered rents represented nearly a year's rental of tenanted houses in the borough, and the local authorities were seriously embarrassed by the non-payment of rates. A rent commission was then appointed which recommended the simplification of the form of notice required and other reforms in the working of the Increase of Rent (Restriction) Acts.

Public Buildings, Parks.—Additions to the municipal buildings, connected by two bridges with the older buildings, were completed in 1923. The Mitchell library, the largest of the public libraries, was removed to North street in 1911; 25 branch libraries have been established. Since 1913 14 new chairs have been founded in the university, and the western sections were being extended in 1926, to provide new classrooms and a memorial chapel. The block of the Royal Infirmary which contained the famous ward in which Lord Lister first applied the use of antiseptics was pulled down in the course of an extension scheme in 1924, in spite of widespread opposition. A new building for the Ear, Nose and Throat Hospital was opened in St. Vincent Square in 1926. In 1915 the corporation bought the Balloch Castle estate, of which 200 ac. were made into the Loch Lomond Park. Other purchases were the Linn Park of 180 ac. (1919); and the Ruchazie and Frankfield Park of 300 ac. (1920). The Newlands Park was given in 1913, the Glenconner Park in 1914 and the Dawsholm Park in 1920. In 1911, 121 ac. of the grounds of Pollok House were given for use as a public park for a period of 10 years. Statues of Lord Kelvin (1913), Lord Roberts (1916), Thomas Carlyle (1916) and a war memorial to men of the Cameronians have been erected in Kelvingrove Park; and a war memorial cenotaph was unveiled in George Square in 1924. Kelvingrove and College United Free Church and Kelvin Hall, a large building used for exhibitions, etc., were destroyed by fire in 1925.

In 1924 a beginning was made with the provision of further dock accommodation on an area of land acquired by the Clyde Navigation Trustees between Shieldhall and Renfrew. Contracts were signed for the construction of railway lines and a road to the new dock area from the new trunk road of the Glasgow corporation scheme. A big electric generating station was opened at Dalmarnoch Bridge in 1920, and the largest gasworks of their kind in Great Britain were completed at Govan in 1921.

GLASGOW, UNIVERSITY OF (*see* 12.82).—The following 20 new chairs have been founded since 1907: Mining, medicine (Royal Infirmary), obstetrics and gynaecology (Royal Infirmary), surgery (Royal Infirmary), pathology (Royal Infirmary), Scottish history and literature, French, German, organic chemistry, physiological chemistry, bacteriology, mercantile law, applied physics, theory and practice of heat engines, electrical engineering, public health, medical paediatrics, Italian, Spanish and accountancy. New lectureships have been instituted in Celtic, psychology, social economics, geography, dermatology, clinical medicine, clinical surgery, clinical obstetrics, diseases of the throat and nose, diseases of the ear (Royal Infirmary), materia medica and pharmacology, electrical diagnosis and therapeutics, Russian, clinical tuberculosis.

New Buildings.—Considerable progress has now been made with the extensions of buildings which were postponed owing to the World War. The new zoology building, erected at a cost of about £112,000, is now occupied, and the building which is to complete the west wing and includes the War Memorial Chapel is in course of erection. The estimated cost of this building is about £122,000.

The students themselves have been active in furthering the student welfare scheme and, including grants from the Govt., the Carnegie Trust and the proceeds of a bazaar, a sum of about £85,000 has been collected. Out of this fund there have been provided a union for women students and the necessary expenditure to convert the houses presented by Lord Maclay and Mr. Lawrence MacBrayne into men students' hostels and the house presented by Mr. J. M. Robertson into a women's hostel. The money, about £12,000, necessary for the erection of a pavilion on the athletic ground at Westerlands—which is now open—has also been provided out of this fund. Grants have also been made to the athletic club and the boat club. The accommodation of the present union for men students is quite inadequate. A site for a new building has been secured and steps are being taken to secure the remainder of the necessary funds.

Sir Donald McAlister became principal in 1907, and in the university itself, as outside in university matters generally, has exercised a remarkable influence.

Students

Session	Men	Women	Total
1910–1	2,108	682	2,790
1915–6	1,163	658	1,821
1920–1	3,576	1,132	4,708
1923–4	3,275	1,419	4,694
1924–5	3,069	1,529	4,598

The figures for session 1910–1 represent a normal year; 1915–6 a War year. The figures for the other years show the large increase in the numbers of students which has taken place since the War.

GLASS, CARTER (1858–), American politician, was born at Lynchburg, Va., Jan. 4 1858. He received his education in the Lynchburg schools and learned the printer's trade, which he followed for several years, eventually becoming proprietor of the Lynchburg *Daily News* and *Daily Advance*. He was elected to the Virginia State Senate for two terms (1899–1903) and was a member of the State Constitutional Convention in 1901. He was elected in 1902 to the national House of Representatives, and thereafter was continuously re-elected until his resignation in 1918. As chairman of the House Banking Committee he was active in framing and passing the Federal Reserve Bank Law. In 1918 he entered President Wilson's Cabinet as Secretary of the Treasury. Under his guidance the fifth Liberty Loan was floated in April 1919. In Nov. 1919 he resigned, following his appointment and subsequent election to the United States Senate. In 1924 he was elected for the term 1925–31.

GLASS (*see* 12.86).—Since 1910 considerable developments in the glass industry have occurred, both in the glass produced and in the varieties of glass manufactured. In the following article attention is, of necessity, given to the British glass industry. When the War drew attention to the British position in respect of glass generally, it was in the direction of scientific glassware and special glass for certain industries, that the deficiencies were realised. (*See* also Optical Glass.)

Laboratory Glass.—Before the War nearly all the glass and glass apparatus used in laboratories throughout the United Kingdom was obtained from abroad. The main kinds of glass required for laboratory purposes may be grouped thus: Soft glass for tubing, and for a number of articles and vessels where the highest resistance to chemical action is not required; glass highly resistant to chemical action; very hard glass for combustion tubing; glass for thermometers.

Soft Glass.—Such a glass must be soft enough to be readily worked in a flame, and must stand prolonged heating without showing the changes in appearance and working qualities generally described as devitrification. Before chemical glassware of foreign origin became practically universal in laboratories, vessels and apparatus in great variety were made from lead glass. The advantages claimed for non-lead glass as a material for laboratory apparatus have been proved, and there is no likelihood of a return to lead glass, which, however, can be made of such high resistance to the action of water, and of many solutions which also abstract alkali from glass, that in some special cases vessels made from it are only surpassed by silica in resistance to chemical change.

In the early days of the War it was recognised that there would be a serious shortage of laboratory vessels. A simple sodium-calcium-silicate glass was unsuitable since tubing made from it is practically useless to workers in laboratories. The immediate advance made was the addition of alumina, either as such, or preferably in the form of felspar. The use of alumina for retarding devitrification and for rendering a glass workable in the flame was known in Great Britain, and at least three British manufacturers had for some years produced glasses containing various percentages of alumina up to about 10%.

A sodium-potassium-calcium-aluminium-silicate type of glass has most satisfactory general properties. Arsenic is not permissible, and the only constituent other than those indicated which might be added was a small amount of manganese dioxide, to disguise the green colour due to the presence of iron in the material used. The formula given here shows the approximate composition of a batch mixture expressed in percentages of silica and oxides of the metals in the various ingredients of the batch: SiO_2, 68; Al_2O_3, 4; CaO, 7; K_2O, 6·5; Na_2O, 14·5. This yields a good glass, soft enough for flame-working while possessing good durability.

Use of Potash Felspar.—It became necessary to conserve supplies of potassium compounds, of which the amounts that could be apportioned for use in glass manufacture were sufficient only for the production of certain optical glasses. To some extent nitre was available and was used. Potash felspar, which for long had been an ingredient in certain glasses, was a convenient form of aluminium compound for introducing alumina. The amounts of this material employed varied between wide limits, and glasses of good working qualities were obtained.

Borax.—Varying proportions of borax were employed, and in this way sodium-potassium-calcium-aluminium-boro-silicate glasses of good working qualities and of marked durability were produced, which met many of the requirements of laboratory workers. The boro-silicate glass possessed many desirable properties when the glass was well made and the necessary technical skill had been acquired. It failed, however, when used for X-ray tubes. A glass of the general type indicated in the formula above is quite suitable for such work, and hence X-ray bulbs and tubing can be made from it in the course of working a pot for a variety of other articles.

Experience shows that the best type is on the lines of the formula given, and that the presence of notable proportions of the oxides of aluminium and potassium are essential. Potash felspar has been mentioned as a convenient source of alumina, and part of the alkalies may be usefully added as nitrates. In general, all the materials of the batch mixture should be as pure as can be obtained commercially, so that the composition of the glass may depart as little as possible from that which it is intended to have, and which has been proved to give satisfactory results. One or two remarks which are relevant for almost all glasses may be made here.

Anhydrous Materials.—As far as it is possible to obtain and to store them, all the substances for a batch mixture should be free from water. A glass made from anhydrous materials often differs from one calculated to give the same composition finally, but produced from a wet batch, or from one containing an ingredient having a notable proportion of combined water. In addition to some lack of general stability, the glass from a wet batch may show a greater tendency to devitrification when heated in a flame or by radiation. The amount of water left in a glass may be very small, but it affects the behaviour of the glass. However, the action of water to effect change in glasses either during their production or on subsequently heating them is an advantage in respect of the production of certain coloured glasses and apparently of some opal glasses.

Homogeneity.—All glasses for laboratory use should be made in such a way as to secure the greatest possible homogeneity. As a general rule, the long-founding so much insisted upon by many experienced glass manufacturers cannot be dispensed with if the nicest possible refinements of a good glass are to be realised. Stirring to secure homogeneity is a necessary operation in making optical glass. It is not customary to stir glass for laboratory use, but such glass would be improved by being stirred if it were economically possible.

Annealing.—The subject of annealing has, in recent years, been given much attention, and several investigations have been carried out. Results of much interest and importance have been obtained, dealing with the conditions for removing strain in glass and with the problem of annealing, both from the theoretical and a practical point of view. These results emphasise the importance of thoroughly annealing any glass articles which are required to withstand marked changes of temperature, and of arranging that any vessels, etc., which in the course of production are re-heated locally, shall be re-annealed. Tubing is not customarily annealed as part of the process of manufacture, but for certain purposes, notably with tubes which are to be ground, it is an advantage to anneal them.

"Resistance" Glass.—Laboratory glassware, to deserve this description, must possess great stability, and must part with only minute traces of any of its ingredients when it is exposed to the action of the majority of solutions and liquids used in a chemical laboratory. The chief varieties made can be included in two types: one containing compounds of zinc and the other free from this metal. In neither type is the inclusion of arsenic or antimony considered to be permissible.

The following formulae, illustrative of these two types, give approximate proportions for batch mixtures expressed in percentages of the oxides contained in the various ingredients of a batch:—

(A)		(B)	
SiO_2	66	SiO_2	66
B_2O_3	8	B_2O_3	9
Al_2O_3	9	Al_2O_3	2·5
CaO	5	ZnO	8
MgO	1	MgO	5
Na_2O	8	Na_2O	9·5
K_2O	3		

Adjustments of the proportions given can be made to suit different furnaces and also to fit in with the amount of broken-up glass from previous meltings (cullet), which is incorporated in the batch. Of these two types of resistance glass, (A) requires a rather higher temperature in the making and on the whole presents more difficulties than (B). It has also a somewhat higher coefficient of expansion, is less liable to withstand sudden changes of temperature and has been made of very high chemical resistance and of satisfactory behaviour when quickly heated or cooled through a greater range of temperature than it would usually be exposed to in a laboratory. It

is probably fair to give preference, on the whole, to glass of type (B) as inherently more capable of withstanding sudden changes of temperature, and, being the easier to make, there is less likelihood with vessels made from it of mishaps due to imperfect manufacture. Whichever class of glass is chosen, all vessels and apparatus made from it need thorough annealing.

Combustion Tubing.—Tubing of very hard glass is essential for many laboratory experiments, and is largely used in the analysis of carbon compounds by combustion, but in tubing of various diameters it is required for a number of other purposes. The general composition of Kavalier's combustion tubing is indicated by the following percentages to the nearest whole numbers: SiO_2, 78; CaO, 8; K_2O, 12; Na_2O, 2. Glass of this kind served many useful purposes in laboratories, but it was difficult to use in a blowpipe flame. The Jena glass which took its place possessed greater plasticity over a longer range of temperature. During the War very hard glass tubing was much needed, and as the result of experiments on a laboratory scale and in glass works, tubing of a type similar to the Jena combustion tubing was produced. With regard to hardness and suitability for working in the flame it fulfils its purpose most satisfactorily. Unlike the pre-War glass, it does not show anything like the tendency to become opal when heated for a long time. The following is the composition for a batch mixture, given as for other glasses in the percentage of oxides: SiO_2, 68·5; B_2O_3, 5·5; Al_2O_3,6; CaO, 8; BaO, 6·8; Na_2O, 3·2; K_2O, 2. With this glass there is not much latitude allowable if the full hardness of the glass is to be realised and difficulties in manufacture are to be avoided. The glass requires a high temperature for its successful production.

Thermometer Glass.—The manufacture of thermometers of all kinds has been carried on in Great Britain for many years, and British capillary tubing of high quality and technical perfection made both from lead glass and from various other types of glass, has been in constant demand. Jena thermometer tubing was largely used by British thermometer makers. During the War very great numbers of thermometers were called for, the greater proportion being for medical purposes, but many also for scientific and industrial use. Manufacturers of glass produced tubing to meet the demand, in lead glass, for the production of which they were ready and pre-eminent, and in other varieties of glass having properties closely similar to two Jena glasses of high reputation. One of these can be used for thermometers, capable of standing high temperatures up to about 500° C., and the other is for more general application. The following formulae, given as for other glasses in percentages of oxides and with similar reservations, indicate the nature of batch mixtures for these types of glass:—

High Temperatures		Ordinary Temperatures	
SiO_2	73·5	SiO_2	67·0
B_2O_3	9·7	B_2O_3	2·5
Al_2O_3	5·8	Al_2O_3	2·7
Na_2O	11·0	CaO	6·5
		ZnO	6·7
		Na_2O	14·6

Vessels and Apparatus.—Scientific glassware may be broadly classified as furnace-made and as lamp-blown. The former is for the most part produced by blowing into moulds molten glass gathered from the furnace on a blowing-iron. Before the War, lamp workers for laboratory apparatus were few in number in Great Britain and were chiefly engaged either in making a comparatively small amount of apparatus to special design or in repair work. Glass for such apparatus is supplied to the lamp blower in the form of tubing, in the production of which, therefore, there had also been a great development.

For glass for miners' lamps, a glass withstanding rapid changes of temperature exceptionally well was necessary, since the lamp glasses are thick and the flame of the lamp may often touch them. There was an urgent demand for them early in the War. It was successfully met, and such glasses of British make are now produced in large quantities. Another glass on similar lines, but differing somewhat in composition, was prepared for the production of chimneys for incandescent and high-pressure gas illumination, paraffin lamps, etc. In addition to withstanding heat changes well such a glass must be markedly resistant to the chemical action of hot products of combustion. Both these glasses consist chiefly of alkaline boro-silicates having a high percentage of boric anhydride. They need a high temperature for their successful production in a homogeneous state. When well founded their low coefficients of expansion render articles made from them highly resistant to sudden variations in temperature over a long range.

Glass rods for half-watt electric lamps were required, to hold the thicker tungsten wires which support the filament of this metal. They had to be made specially, since no existing glass of British make capable of withstanding heat changes was also sufficiently reliable in respect of not cracking round the sealed-in wires. This glass in most cases involved also the production of special rods to join with it and with the stem of the lamp.

Other glasses were needed which, while making safe joints with ordinary laboratory tubing, etc., would hold platinum, copper, iron or nickel wires. Such glasses are often described as sealing-in enamels. Several of these have been made, and, generally speaking, they are of the type either of a soft glass containing a high percentage of lead, or of one free from lead and containing a notable proportion of a fluoride, such as cryolite. The coefficient of expansion of the glass, in relation to that of the metal wire used, has to be taken into account.

Jars for Preserving Fruit and Meat.—Though numbers of these had long been made in Great Britain, about 80% of the total number used had been obtained from abroad. Great increase in the production of these vessels was required to meet the needs, enhanced as they were by the War, and the necessity for more economic production led to a review of methods and to the adoption of new machinery.

Glassware for Medical Purposes.—The War caused a great increase in the demand, and very large quantities of vials, tubes, syringes, graduated measures, etc., had to be made. Most of these could be produced from glass, and by methods familiar to manufacturers, but some requirements had to be met by investigation and experiment before suitable glass was produced.

There was considerable increase during the War in the production of coloured glasses, *e.g.*, for spectacles to protect the eyes of the great numbers of men working at steel furnaces. Coloured glasses in considerable variety were also wanted for other purposes, but in comparatively small amounts. Some of them needed investigation and a number of experiments before the conditions for their production could be determined.

Progress in the Use of Machinery.—The greatest advance in the economic production of certain types of glassware was in the direction of the introduction of machinery and minor labour-saving devices which was only rendered practicable by concurrent improvements in the means for assuring a continuous supply of molten glass in a suitable condition to permit of the machines being run continuously. The common practice in the past was to found the glass in pots in direct-fired furnaces. There has been a gradual tendency for tanks, some of them being of very large capacity, holding as much as 300 tons of molten glass, to take the place of the older pot furnaces. Those glasses which are only required in comparatively small quantities or of absolute purity, as in the case of optical glass, certain coloured glasses, and those liable to contamination from furnace gases, will still have to be pot-founded.

Automatic Machinery.—The development of machinery in glass manufacture has been by gradual evolution. In many American factories, neither the raw materials nor the glass is handled at any stage during the progress of manufacture. Conveyors transfer the raw material from the trucks to the storage bin; automatic weighers discharge the requisite quantity of material from the storage bin to a rotary mixer mounted on a trolley; another conveyor transfers the mixed batch to the batch storage bin in close proximity to the charging end of the tank, for the ready release of the batch down a chute at periodic intervals into the tank.

Types of Machines.—The types of machines may be conveniently divided into the following groups: pressing machines for the production of tumblers, meat and jelly jars, bull's-eye lenses, tableware and pavement lights; press and blow machines for all types of bottles, and many kinds of food containers; blow machines for electric lamp bulbs, lamp chimneys and similar articles; rolling machines for plate glass, figured and ribbed glass and reinforced sheet for sheet and window glass, and for drawing tubes and rods.

There are many other types for miscellaneous purposes, including cracking-off machines for severing the fashioned article from the waste glass, employing multiple fine jets of flame which impinge on the line of severance which is usually started by a short diamond cut at the predetermined point: calibrating machines for accurately dividing measuring devices such as thermometers, burettes, pipettes and cylinders; grinding and polishing machines for preparing and finishing the surface of plate glass; machines for forming the stoppers of bottles and for grinding the seating in the neck of the bottle; flowing devices and feeding machines, to withdraw from the pot or tank, by means of a gathering-iron, a sufficient quantity of molten glass to make the article required.

Press Machines.—A very limited number of types of article can be made with a solid mould. Only such as have both an internal and external taper, the diameter being reduced in the direction of the movement of the plunger, are suitable. In all other cases where the ware has external shoulders or ornament, the mould must be hinged. In semi-automatic and fully automatic machines the movements of the plunger and mould are operated by compressed air.

Refractories and Pots.—With the introduction of more efficient pot furnaces and tanks in which higher temperatures were reached it soon became evident that the question of refractories would have to be investigated in order that the pots, tank blocks and furnace parts, would stand up to the increased strain which was being put upon them.

In so far as concerns the majority of types of optical glass, and, if it were an economical proposition, for other glasses also, pots of a porcelain nature or of a composition approximating in relative proportions of alumina and silica to kaolinite have given the most satisfactory results. In connection with the manufacture of optical glass in America for war purposes it was found that a pot of the porcelain type was the best suited to their purpose. In other directions con-

siderable experimental work has been devoted to the production of pots by the ordinary casting and by the vacuum casting processes, and also of pots from osmose clay. In each case results of great promise have been obtained.

The tendency has been to adopt the recuperative principle, in which there are two sets of channels or passages, one for the air supply and the other to carry away the hot products of combustion; the temperature of the air is raised due to interchange of heat by conduction through the common party wall of the channels. As the flow of the secondary air and hot flue gases is constant in direction, there are, therefore, no reversing valves to be operated, as is the case in the regenerative type, and it is claimed that the furnace can be maintained at a more even temperature in the former than in the latter.

The recuperative type of furnace is producer-gas fired. The furnaces, according to the designer, differ in respect of the disposition of their elements; in one type both the producer and recuperators are situated immediately below the furnace, and both the air passages and hot flue-gas passages are disposed horizontally, whereas in another type the recuperators are at the sides, and the air passages are vertical whilst the flue-gas passages are horizontal. It is claimed for the latter type that glass from a broken pot can be more easily dealt with and is not likely to cause so much damage.

Oil firing has not been installed to any extent in the glass industry in England, and in very few, if any, cases has the furnace been designed specifically for oil fuel. During the first half of 1921 some optical glass furnaces in England were fired with heavy oil.

Better results were obtained with the heavier grades of oil, and tank furnaces lend themselves more readily to this type of fuel. In the case of pot furnaces the pots are liable to suffer on account of the irregular heating due to localised combustion.

As a result of efforts to improve the existing types of oil burners in the direction of better efficiency, etc., several oil burners are now on the market, in some of which atomisation is effected by steam under pressure. In others mechanical means and air pressure are utilised. Although more complete atomisation is obtained by the former means, yet the burner utilising air pressure with some mechanical means for assisting atomisation gives more complete combustion, higher temperatures and increased cleanliness without discolouration or deterioration of the glass, due to the effects of the flame coming into contact with it. Moreover, with oil fuel the temperatures can be more easily controlled.

Annealing.—Prior to the War in annealing optical glass an efficient system of well-lagged electrically heated towers ensured a satisfactory result. In other types, however, a primitive, straight-through tunnel (usually coke heated) formed the lehr. It was exceedingly draughty and the glass was hurried through in all too short a time. During the War, however, when the annealing needed to be above suspicion, close attention was devoted to the subject of improved lehrs. Considerable care was exercised to ensure efficiency in this operation. The site was well chosen, the system of heating was considered in relation to the necessity of a variation in the maximum temperature according to the class of ware being annealed, and of a gradual fall in temperature after passing the hottest zone. Precautions were taken to prevent draughts sweeping through the lehr and so defeating the object of the operation. [See W. Rosenhain, *Glass Manufacture* (1919); H. T. Powell, *Glass Making in England* (1923)].

"GOEBEN" AND "BRESLAU."—The escape of the two cruisers "Goeben" and "Breslau" from Messina on Aug. 6 1914 and their flight to Constantinople exercised a large influence on the attitude of Turkey.

Position in Aug. 1914.—When the World War broke out the various naval forces in the Mediterranean were as follows:—

TABLE I.

British forces under Vice-Adml. Sir A. Berkeley Milne:—
Battle cruisers.—"Inflexible," "Indomitable," "Indefatigable" (8 12-in., 25 knots), 1st Cruiser Sqn., Rear-Adml. E. C. Troubridge; "Defence" (4 9·2-in., 10 7·5-in.), "Black Prince,"; "Duke of Edinburgh," "Warrior" (6 9·2-in., 10 6-in., 22 knots).
Light cruisers.—"Chatham," "Dublin," "Gloucester," "Weymouth."
Destroyers.—5th Flotilla, 16 Destroyers.
French forces under Vice-Adml. Boué de Lapeyrère:—
Battleships.—One Dreadnought, six "Lord Nelson" type (4 12-in., 12 9·4-in.), nine older battleships.
Armoured cruisers.—Six.
Destroyers.—24.
Italian forces:—
Battleships.—Three Dreadnoughts, three "Lord Nelson" type.
Austrian forces:—
Battleships.—Three Dreadnoughts, three "Lord Nelson" type.
German forces under Rear-Adml. Souchon:—
Battle cruiser.—"Goeben" (10 11-in., 25 knots).
Light cruiser.—"Breslau" (12 4-in., 25½ knots).

The original orders for the Mediterranean fleet in the event of war were to concentrate at Malta and watch the entrance to the Adriatic, but these were overridden by a series of Admiralty telegrams. The British fleet was at Malta on July 29. On the 30th, Adml. Milne received instructions that his first task was to assist the French in the transport of their troops and to bring the "Goeben" to action if she attempted to interfere. These instructions were sent without reference to the French commander-in-chief, who had not asked for assistance, and the two admirals remained unaware of one another's plans. On July 31 the Italian Govt. informed the British that it intended to remain neutral, a communication of great import, which did not reach the commander-in-chief. On Aug. 1 the "Goeben" and "Breslau" left Brindisi for Messina, the rendezvous decided on in 1913 under the terms of the Triple Alliance.

Search for the "Goeben."—On Aug. 2, at 2:45 P.M., Milne received further orders from home to shadow the "Goeben," watch the entrance to the Adriatic and remain near Malta himself. He accordingly took up his station that evening in the "Inflexible" off Malta, and at 9 P.M. Troubridge sailed with the "Indomitable" and "Indefatigable," the four armoured cruisers and four destroyers to watch the approach to the Adriatic. About 8 P.M. that evening, Milne had been given permission to get in touch with the French admiral, but received no answer to his signals and remained ignorant of the French plans. That night (Aug. 2–3) Milne heard of the "Goeben's" arrival at Messina, and, in answer to his request for instructions, was told by the Admiralty to maintain his watch on the Adriatic, but the "Goeben" was his objective and was to be followed and shadowed wherever she went.

Meanwhile, in Messina, Souchon had received the warning telegram about midnight Aug. 2; he stopped coaling abruptly and put to sea at 1 A.M. Aug. 3 with the intention of bombarding the Algerian coast. The "Chatham" was ordered to look for the "Goeben" in Messina, and passed through the Straits at 7 A.M. (Aug. 3), only to find the harbour empty. In order to locate the "Goeben" and protect the French route, Milne at 9:40 A.M. ordered Troubridge, then on his way to the Adriatic, to proceed west with the "Indomitable," "Indefatigable" and 1st Cruiser Sqn., leaving the "Gloucester" and destroyers to watch the Adriatic. This order was modified at 3:18 P.M. (Aug. 3), when Troubridge was sent back to the Adriatic with the 1st Cruiser Sqn., while the battle cruisers went on to the west, with orders to cruise between Africa and Sardinia. Milne was greatly handicapped all this time by his ignorance of the French dispositions, and received no information from home on this point. Souchon on his way to the African coast received news at 6 P.M. (Aug. 3) of the outbreak of war with France from the Italian wireless station at Vittoria, but held on his way. The Admiralty, having lost sight of the "Goeben," assumed that she was on her way to attack the Atlantic trade routes, and at 8:30 P.M. (Aug. 3) ordered the "Indomitable" and "Indefatigable" to proceed after her to Gibraltar at high speed. They were then south of Sicily and went off at 21 knots.

"Goeben" Sighted.—At 3 A.M. on Aug. 4 Souchon received from Nauen, the great German wireless station, the Kaiser's order to proceed to Constantinople. Deciding to finish his venture, he went on to the African coast, fired a few salvoes into Bône and Philippeville at 6 A.M. (Aug. 4) and made off. At 9:15 A.M. on his way East, he narrowly escaped meeting the French 1st Sqn., which passed him only 24 m. away. Then, by a stroke of good luck, the "Indomitable" and "Indefatigable" on their way westward ran right into him, 40 m. north of Bône, at 10:32 A.M. (Aug. 4). The battle cruisers turned to the east and followed him at 11,000 yards. Their guns were loaded and manned, but war was not declared and they did not fire.

The day was misty, the "Goeben" was at least two knots faster, and by 4:35 P.M. was out of sight. The Admiralty, where it was thought that the "Goeben" was going west, asked the Foreign Office to agree to her being engaged if she attacked French transports, and the order to do so was sent, but did not reach Milne till 5 P.M. Meanwhile he had received during the

afternoon the news of the Italian declaration of neutrality and an order not to approach within six miles of the Italian coast. Italy in her declaration of neutrality had claimed a six-mile limit, which had been accepted without demur. Belligerents were thereby debarred from committing acts of hostility within this limit, but no convention of international law debarred them from entering neutral waters. Italy had not asked for anything of the sort, and the restriction was cancelled on Aug. 6 at 7:46 P.M.; but its immediate effect was to debar Milne from passing through Messina Straits, thus preventing the immediate concentration of any forces he might station at the two entrances.

Meanwhile, the "Indomitable" and "Indefatigable" were still going east on the "Goeben's" track, and were between Sicily and Sardinia when at 6:30 P.M. (Aug. 4) they received orders from Milne to steer west and go slow, and turning round they abandoned the pursuit. In giving this order Milne was evidently influenced, partly by the idea of covering the French transport route, partly by the Admiralty injunction against approaching the Italian coast. He did not know that the French admiral had his whole fleet guarding the route between France and Africa.

Declaration of War.—The warning telegram reached Adml. Milne at 7:02 P.M. (Aug. 4) stating that the ultimatum would expire at midnight. When hostilities commenced at that hour (Aug. 4–5), the "Inflexible" was in Malta channel, steering west to join the "Indomitable" and "Indefatigable"; the "Goeben" was approaching Messina, and Troubridge with the 1st Cruiser Sqn. was about 60 m. west of Zante. The "Goeben" arrived at Messina at 4 A.M. on Aug. 5 and started to get in coal, but on the protest of the British consul difficulties arose and the work was slow. News of her arrival was sent that forenoon by Sir Rennell Rodd, British Ambassador at Rome, to London, and though it did not reach Milne from London till 5 A.M. on Aug. 6, he had already received warning of it from the "Gloucester" at 5:30 P.M. on Aug. 5 and also a report from Malta. At 11 A.M. on Aug. 5 he was off Pantellaria in the Straits of Malta, and proceeded to Bizerta, where the "Indomitable" was sent in to coal. A still more important piece of information never reached the commander-in-chief, namely, that at 7 P.M. (Aug. 5) the Italian authorities had given Souchon 24 hours to leave the port. During the night of Aug. 5 Milne continued to patrol with the "Inflexible" and "Indefatigable" between Bizerta and Sardinia, while the "Indomitable" was coaling at Bizerta, and while Troubridge's cruiser squadron was patrolling on the route from Messina to the Adriatic ready to engage the German ships by moonlight.

"Goeben" Again Escapes.—About 6 P.M. (Aug. 6) Milne decided to close the northern entrance of the straits, and at 6:10 P.M. was 15 m. off Cape S. Vito (the northwest point of Sicily) when the "Gloucester's" wireless began to sound. The "Goeben" and "Breslau" were leaving Messina by the southern entrance. The "Gloucester" followed them closely, and at 8:30 P.M. Capt. John Kelly in the "Dublin," on his way from Malta to join Troubridge, received orders to attack them. He steered to intercept them, but the "Goeben" passed him in the night unseen. Milne was not conversant with the ticklish state of affairs in Turkey, and had merely been told that the Turks were mining the Dardanelles. He proceeded therefore at moderate speed (15 knots) to Malta, arriving there with the battle cruisers at noon on Aug. 7, just as the "Goeben" was approaching Cape Matapan. He was still uncertain of the exact movements of the French, and was still inclined to think of the safety of the western route.

Germans Make for the Dardanelles.—Souchon had been left at liberty to act as he might think fit. He saw nothing but a long spell of inactivity before him at Pola, and had decided to proceed to the Dardanelles. On leaving Messina he made a feint of steering north till about 11 P.M., but the "Gloucester" (Capt. William Kelly) followed him close, signalling his every move. Troubridge with the 1st Cruiser Sqn. was off Cephalonia at 6:10 P.M. Aug. 6, and, thinking Souchon was making for the Adriatic, steered at first for Fano Island (at the mouth of the Adriatic), but, concluding at midnight that Souchon's first course was a feint, turned round and proceeded south at full speed. He had already informed the commander-in-chief that he would not risk his cruisers in a daylight action with the 11-in. guns of the "Goeben," and had been told that the circumstances would not arise. From the positions signalled by the "Gloucester," he found that he could not hope to intercept her before daylight. He therefore abandoned the attempt and altered course to the eastward for Zante at 3:50 A.M. (Aug. 7). Like the commander-in-chief, he saw no great danger in the "Goeben's" course. Its vast consequences were beyond their ken.

At 4 P.M. Aug. 7 the "Goeben" was off Cape Matapan with the "Gloucester" still clinging doggedly behind. She had engaged the "Breslau" at 1:35 P.M. at 11,500 yds. but had received orders not to follow beyond Cape Matapan, and turned back at 4 P.M. The "Inflexible" and "Indefatigable" were then coaling at Malta 400 m. away, and it was not till 12:30 A.M., Aug. 8, that they left for the Aegean in chase. There was still time to do something, for difficulties had arisen as to the "Goeben's" entering the Dardanelles and she was still cruising

in the Aegean, where Souchon had arranged for a collier to meet her off the lonely little island of Denousa (near Naxos). But again an unlucky mischance occurred. A false alarm of war with Austria was sent out from the Admiralty at noon on Aug. 8. Milne received it at 1:30 P.M., when he was halfway to Greece, and, in accordance with the instructions for war with Austria, altered course to the northeast to concentrate the fleet off the Adriatic. The alarm was cancelled a couple of hours later, but as the admiral was informed that the situation was critical, he continued on his course.

At noon on Aug. 9 the " Inflexible " was 40 m. west of Zante, and it was only at 2:50 P.M. that the Admiralty sent him an urgent message to resume the chase. He had lost 24 hours, and did not enter the Aegean till 3 A.M. on Aug. 10. At 5:18 A.M. he passed Belopulon Light (36° 56′ N., 23° 30′ E.), just as the " Goeben," 120 m. to the eastward, finished coaling off Denousa. She had received orders by wireless through the German S.S. " General " at Smyrna to proceed to Constantinople, and shaped course at 5:45 A.M. for the Dardanelles. It was too late to cut her off, nor had Milne any intelligence of her whereabouts. All that day he was searching for her in the Aegean. At 5 P.M. she was off Cape Helles. A Turkish torpedo boat appeared flying the signal " Follow me." She entered the Dardanelles at 16 minutes past 5 on Aug. 10. All the hills of Gallipoli looked down on her as she passed. Milne, still searching for her, received the news at noon on Aug. 11 and was ordered to watch the exit. As the " Weymouth " approached the Straits the guns of the forts began to train. At the beginning of this most fateful chapter of accidents lay the unhappy telegram instructing the admiral to protect French transports, which did not need protection.

The escape of the two ships seriously affected the attitude of Turkey to the Allies. The " Goeben " in particular was very active, and by her operations in the Black Sea involved Turkey in hostilities with Russia. In Jan. 1918 the " Goeben " and " Breslau " left the Dardanelles and attacked British ships off Mudros. The " Breslau " was sunk by a mine, but the " Goeben," though damaged, escaped. She was again active in the Black Sea fleet; and, having been again damaged by a mine, remained crippled in the Sea of Marmora till located there by the Allies after the Armistice.

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GOETHALS, GEORGE WASHINGTON (1858–), American engineer, was born in Brooklyn, N.Y., June 29 1858. He graduated from West Point Military Academy in 1880 and received a commission as second lieutenant of engineers. In 1882 he was stationed at Cincinnati, where he was engaged in improving the channel of the Ohio. Later he taught engineering at West Point, but returned to Cincinnati in 1889. Afterwards he was in charge of the construction of the Muscle Shoals Canal on the Tennessee and of a canal near Chattanooga, Tennessee. On the outbreak of the Spanish-American War in 1898 he was commissioned lieutenant-colonel of volunteers and appointed chief engineer of the First Army Corps. In 1900 he was commissioned major in the regular army and three years later was engaged in planning fortifications near Newport, Rhode Island. He was then made a member of the General Staff in Washington, and in 1905 graduated from the Army War College. In 1907 he was appointed by President Roosevelt a member of the Isthmian Canal Commission, with the rank of lieutenant-colonel, and afterwards became chairman and chief engineer. Two years later he was promoted colonel.

The work, hitherto in charge of civilian engineers, was reorganised and directed by army engineers subject to the control of the President of the United States. Several changes of plan, such as widening the canal, were inaugurated, and after seven years' labour Col. Goethals completed his task. On Aug. 15 1914 the canal was declared open to world commerce (*see* PANAMA CANAL). Col. Goethals was appointed the first civil governor of the Canal Zone by President Wilson in 1914 and in the following year was made major-general. He resigned the governorship in 1916, and was appointed chairman of the board constituted to report on the Adamson Eight-hour law. In 1917 he was appointed state engineer of New Jersey, but after America's entry into the World War he was released to serve as manager of the Emergency Fleet Corporation. He had little faith in the plan for a wooden fleet, and resigned after three months. Toward the close of 1917 he was appointed acting quartermaster-general, United States Army, becoming in 1918 chief of the division of purchase, storage and traffic. He was also a member of the War Industries Board. At his request he was relieved from active service in March 1919.

GOITRE (Lat. *guttur*, the throat).—Goitre or Derbyshire neck (*see* 12.191) is a term used for abnormal enlargements, usually chronic, of the thyroid gland in the front of the neck. The enlargement may be general and uniform (parenchymatous goitre), or may be localised to one part of the gland or to the isthmus connecting the two halves or lobes. Local enlargements are either innocent, which are common, or malignant, which are rare; the innocent growths are known as adenomas (adenomatous goitre) which at first solid may soften down and become liquid-forming cysts; these cystic goitres or bronchoceles contain yellow, glue-like material (colloid); from bleeding into their interior may rapidly enlarge, otherwise they grow slowly, or may exist for many years without increasing in size or causing discomfort. They often arise in parenchymatous goitres. Malignant disease commonly starts in an adenoma and is generally a carcinoma which grows slowly but has a special tendency to produce secondary deposits (metastases) in bones. The other form of malignant disease, sarcoma, is much rarer, but runs a rapid course.

Simple Goitre.—This is usually endemic, *i.e.*, occurring in special regions, such as Derbyshire, the Thames Valley, the Yorkshire Dales, Hampshire and Sussex, in the neighbourhood of the Great Lakes in North America, in Switzerland, the Pyrenees and some mountainous parts of Asia, and is then due to some local condition, especially the water supply. In Kashmir Col. R. McCarrison correlated it with infection of the drinking water; " goitre springs " and " wells " are known, and fish and animals may also be affected in endemic areas. The observation that boiling the water prevents the incidence of goitre and the occurrence of epidemics of acute goitre in schools are compatible with this view. But that this is the only cause is uncertain, for simple goitre can be prevented by the administration of iodine and the water in goitrous regions is hard and poor in iodine. Goitre may also occur sporadically in areas where it is rare, but is seldom congenital except in endemic regions. It appears most commonly about puberty and is about seven times commoner in females than in males. Large goitres may give rise mechanically to difficulty of breathing by compressing the windpipe.

Toxic Goitre.—The adenomatous enlargement may remain latent without any symptoms for years, and then become active and produce an internal secretion which excites toxic symptoms resembling, but not exactly the same as, those of exophthalmic goitre, protrusion of the eyes being absent.

The preventive treatment of simple goitre consists in boiling the water, removal from an endemic district, and the administration of iodine, or iodide of potassium, in small doses. But in cases of adenomatous goitre iodine is said to lead to a toxic goitre. Exposure to X-rays may reduce the size of the goitre, but by producing adhesions renders surgical removal, should it become necessary, less easy. Surgical removal is necessary for pressure symptoms, toxic manifestations, and may be desirable for cosmetic considerations.

Exophthalmic Goitre. (Synonyms, Graves' or Basedow's disease.)—This has very striking symptoms—an enlarged thyroid gland, protrusion of the eyes, rapid action of the heart and palpitation, tremor, extreme nervousness, wasting, flushing, sweating and mental irritability. It is indeed the converse of myxoedema. The skin may be pigmented, and in bad cases diarrhoea,

vomiting and indigestion may be troublesome. Ninety per cent, if not more, of the patients are women. The basal metabolism (the minimal production of heat) is raised and this may be connected with the wasting and tolerance to cold. There is a structural change in the thyroid, probably due to poisons from the alimentary canal, but it may come on after mental shock or emotion. As a result of the change in the thyroid its internal secretion is altered (dysthyroidism) and causes the nervous symptoms. The disease is usually chronic; more than half the patients recover and others improve but do not become absolutely normal. Acute infections, such as influenza, are likely to prove fatal. In a few instances the morbid activity of the thyroid gland is followed by atrophy and myxoedema.

Treatment.—The patients should live a simple life in fresh, country air, avoid much protein (meaty) food, stuffy rooms and excitement. Bromides, quinine hydrobromate, belladonna, digitalis and X-rays or radium to the gland should be employed. If these measures fail, and the case is severe, operative removal of part of the gland or ligature of some of its arteries should be undertaken; the operative mortality of excision of half the gland is now about five per cent. Iodine in the form of Lugol's solution improves the patient's condition so that operation can be more safely undertaken. (H. Ro.)

GOKHALE, GOPAL KRISHNA (1866–1915), Indian politician, was born at Kolhāpur of a humble Chitpavan Brahman family. Graduating at the Elphinstone College, Bombay, in 1884, he joined, as professor of history and political economy, the group of teachers at the Fergusson College, Poona, pledged to serve for 20 years on a merely nominal salary. He remained on the staff finally as principal, until 1902.

Throwing himself fervently into politics, he was associated with the Indian National Congress from its start, and became for some years its joint secretary. In 1897 he paid the first of several visits to England, and gave evidence before the Royal Commission on Indian Expenditure. From then onwards he specialised as a critic of Indian official finance. In 1902 he became a member of the Bombay Legislature and was elected in 1902 to represent the non-official members thereof in the viceregal legislature. His persuasive eloquence, close reasoning, accurate knowledge of the subjects discussed, and instincts of statesmanship won him the Indian leadership, and Lord Curzon recognised his earnest patriotism by nominating him for the C.I.E. in(1904).

Consulting him freely in reference to his projected constitutional reforms, Lord Morley wrote of him to the Viceroy as appreciating executive responsibility and having an eye for the tactics of common sense (*Recollections*, vol. 2, p. 181, 1917). He was fiercely assailed by the extremist section, which never succeeded in his lifetime in capturing the congress machinery. In 1905 he became president of that body, on the occasion of its meeting at Benares. In the same year he founded at Poona his Servants of India Society, whose members take vows of poverty and lifelong service to their country in a religious spirit. In the enlarged viceregal legislature set up in 1910 Gokhale was the commanding Indian figure. His quickness in debate, the attractive literary style of his speeches, his studied moderation, and the care which he took to master his subjects, made him a most effective critic of the Govt. though he indignantly disclaimed the title of the leader of an opposition party.

Besides his brilliant handling of general topics, and more particularly of the annual budgets, he promoted measures for compulsory education on a basis of local option, but did not survive to see this principle introduced from 1918 onwards in all the large provinces. Though his last years were clouded by illness he went to South Africa to acquaint himself at first hand with the grievances of Indians in that country. His last public duty was to serve as a member of the Indian Public Services Commission 1912–5. His death at Poona Feb. 19 1915 was a severe blow to the Constitutional party at a critical moment in India's political history. His last political testament, entrusted on his death-bed to the Aga Khan, was published in Aug. 1917, and outlined plans of reform based on provincial autonomy.

Gokhale's intense patriotism, powerful grasp of facts and great industry raised him head and shoulders above his contemporaries; and his moderation, invariable courtesy and lofty personal character marked him out as one of the last and greatest of the old school of congress politicians before the age of non-co-operation.

GOLD (*see* 12.192).—Since the rise of the Spanish Empire in the New World, over £4,000,000,000 of gold has been produced. Only 15% of this amount was produced between 1493 and the Californian alluvial discoveries of 1848, and nearly half has been produced in the first quarter of the century. It is worth while to turn back to the earlier figures in order to measure the rapidity of the advance.

Value of World Output

Period	World's Output	Proportion %
1493–1600	103,000,000	2·5
1601–1700	125,000,000	3·1
1701–1800	259,000,000	6·4
1801–1900	1,568,000,000	38·4
1901–1925	2,026,000,000	49·6
Total 433 years	4,081,000,000	100

Of the total the United States has contributed 22%, the Transvaal 21% and Australasia 19%. The following table shows the value of the production in different areas:—

	Total amount	Amount produced in 1912–26
	£	£
United States (practically since 1849)	894,000,000	203,000,000
Transvaal (since 1884)	844,000,000	519,000,000
Australasia (since 1851)	709,000,000	92,000,000
Russia and Siberia (since 1814)	370,000,000	40,000,000
Mexico (since 1521)	140,000,000	40,000,000
Canada (since 1858)	116,000,000	58,000,000
India (since 1880)	67,000,000	29,000,000
Rhodesia (since 1898)	61,000,000	41,000,000
West Africa (since 1880)	26,000,000	17,000,000
	3,227,000,000	1,039,000,000
South America, etc. (since 1493)	854,000,000	113,000,000
Total 433 years	4,081,000,000	1,152,000,000

Mr. Eduard Suess has calculated that during the period 1848–75 the annual yield of £22,000,000 was obtained as to £19,300,000 or 88% from alluvial and as to £2,700,000 or 12% from lodes. By 1890 the output of £24,500,000 was derived as to £11,000,000 or 45% from alluvial, as to £11,500,000 or 47% from lodes and as to £2,000,000 or 8% from the stratified banket of the Transvaal. So productive has the last source of the metal become, that of the World's gold production of £81,500,000 in 1925, £41,000,000 or 50% came from banket, while lode mining yielded £34,000,000 or 42%, and alluvial had fallen to £6,500,000 or 8%. Thus has the day of the individual digger disappeared; much of the alluvial production is now obtained by dredging, and exploitation by organised capital has taken the place of earlier methods.

Though production has advanced so rapidly in the course of the present generation, there are indications that, apart from any new discoveries which may yet be made, the output reached its zenith in 1915. Thereafter, partly as a result of restriction of production due to the increased costs resulting from the World War, but partly also as a result of exhaustion of mines, the annual total fell from £96,400,000 to £65,500,000 in 1922 (a year exceptionally affected by a white miners' strike in the Transvaal), recovering to £81,500,000 in 1925. The principal figures of the output for the period 1911 to 1925 are given in tabular form on opposite page.

This table shows clearly the commanding position of the British Empire, which was responsible in 1925 for 70% of the production, and particularly of the Transvaal, which yields three-fourths of the Empire's and half of the World's total. It also indicates

World's Gold Production, 1911 to 1925
(In millions of pounds at 84s. 11½d. per fine oz.)

	Transvaal	Australasia	Canada	Rhodesia India, and W. Africa	British Empire total	United States	Rest of the World	World Total
1911	35·0	12·4	2·0	6·2	55·6	19·9	19·5	95·0
1912	38·7	11·2	2·6	6·9	59·4	19·2	17·3	95·9
1913	37·4	11·0	3·4	6·8	58·6	18·2	17·9	94·7
1914	35·7	9·8	3·3	7·7	56·5	19·4	14·5	90·4
1915	38·6	10·2	3·9	7·9	60·6	20·8	15·0	96·4
1916	39·5	8·3	4·0	7·7	59·5	19·0	15·0	93·5
1917	38·3	7·4	3·1	7·3	56·1	17·2	13·0	86·3
1918	35·8	6·1	3·0	6·1	51·0	14·1	13·9	79·0
1919	35·4	5·5	3·3	5·9	50·1	12·4	12·5	75·0
1920	34·7	4·7	3·3	5·4	48·1	10·5	10·7	69·3
1921	34·5	3·8	3·9	5·2	47·4	10·3	10·3	68·0
1922	29·8	3·9	5·4	5·5	44·6	9·7	11·2	65·5
1923	38·9	3·7	5·2	5·1	52·9	10·3	12·3	75·5
1924	40·7	3·6	6·5	5·3	56·1	10·7	13·2	80·0
1925	41·0	3·0	7·4	5·0	56·4	11·0	14·1	81·5
	554·0	104·6	60·3	94·0	812·9	222·7	210·4	1,246·0

that such countries as Australia and the United States are declining. So far as can be foreseen the recovery from the post-War year 1922 has largely spent itself.

The destination of the gold taken out of the earth in the period since 1493 can be fairly gauged and is given in the following table, the first line of which is necessarily conjectural:—

Consumption of the World's Aggregate Gold Output, 1493–1924, with Proportions of Production Consumed
(In millions of pounds at 84s. 11½d. per fine oz.)

	Industrial Arts (Europe and America)[1]		India[2]		China and Egypt[3]		Available as Money (difference)		World's Output[4]
1493–1834	? 300	53%	?66	12%	?		? 196	35%	562
1835–1844	25	73%	4	12%	?		5	15%	34
1845–1854	31	20%	10	6%	?		115	74%	156
1855–1864	52	20%	51	19%	?		160	61%	263
1865–1874	101	40%	35	14%	?		118	46%	254
1875–1884	112	52%	22	10%	14	6%	68	32%	216
1885–1894	102	38%	15	6%	8	3%	140	53%	265
1895–1904	144	26%	56	10%	25	4%	334	60%	559
1905–1914	216	24%	146	16%	20	2%	519	58%	901
1915–1924	180	23%	155	20%	10	1%	445	56%	790
	1,263	32%	560	14%	77	2%	2,100	52%	4,000

[1] Based on Soetbeer for 1831–80 and on the Bureau of the United States Mint for 1890–1913, the later figures being approximated by the writer on the Bureau of the United States Mint's incomplete statistics.

[2] Years to March 31 following. Net imports plus country's own production.

[3] Egypt from 1879 only and China from 1889 only, plus, in the case of the latter, the country's own production.

[4] Mostly based on figures supplied by the Bureau of the United States Mint.

The industrial arts and India have the first call on gold production. They largely increased their demands after the outpourings of gold by California and Australia after 1848 and 1851, thereby serving to moderate the great increase of prices of commodities which took place, and largely maintained their rate of absorption for some time after the gold output had commenced to decline. Again, after production in the 'nineties started its great climb to the height of 1915, they increased their demands exceptionally until for the 20 years to 1924 industry absorbed £20,000,000 and India £15,000,000 per annum. On the whole they have taken 46% of the aggregate gold production, and all of this has been effectively withdrawn from the amount available as money, for India's imports and its own production have been wholly turned into jewellery, possessions and hoards, gold not circulating. The proportion left for addition to the world's stock of gold money to date has been a little more than one-half.

The distribution and re-distribution of the aggregate output between the end of 1913 and the end of 1924 is as follows:—

Distribution of World's Aggregate Gold Production in 1913 and 1924

	Dec. 31 1913		Dec. 31 1924	
	£	%	£	%
State banks and Treasuries	960,000,000	30·8	1,750,000,000	43·7
Other banks	130,000,000	4·2	160,000,000	4·0
In circulation	497,000,000	15·9	110,000,000	2·8
Hoarded	..	..	80,000,000	2·0
World's stock of gold money	1,587,000,000	50·9	2,100,000,000	52·5
Absorbed by industrial arts (Europe and America)	1,062,000,000	34·0	1,263,000,000	31·6
Absorbed by India	398,000,000	12·8	560,000,000	14·0
Absorbed by China and Egypt	73,000,000	2·3	77,000,000	1·9
World's gold output (from 1493)	3,120,000,000	100	4,000,000,000	100

The figures set down for money in circulation and hoarded are necessarily guesswork and may be too high, but the table serves to show that while about £400,000,000 has been taken out of the pockets of the public as the result of the monetary changes produced by the World War, about twice that amount has been added to the stocks in Central Banks.

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GOLD COAST (*see* 12.203).—The British territory in West Africa known as the Gold Coast includes Gold Coast Colony proper (23,490 sq. m.), Ashanti (24,560 sq. m.), the protected Northern Territories (30,600 sq. m.) and the British mandated portion of the former German colony of Togoland (13,040 sq. m.) making a total of 91,690 sq. m., with a population of 2,298,383, of whom 1,173,439 are in the colony proper.

The colony, which is under a governor assisted by an executive and a legislative council, consists of an agglomeration of small, self-contained and mutually independent native states, each of which is under the immediate management of its own tribal organisation. The paramount chiefs are chosen by the tribesmen from families from among whose members alone a chief can be selected. Each paramount chief is the occupant of a stool, which is reputed to be the seat of office of the original founder of the tribe, and he is assisted by a number of sub-chiefs whose jurisdiction is personal rather than territorial. Permanent cultivation due to the extensive planting of cocoa has led to the definition of the territorial limits of tribal areas.

The remarkable economic advance of the Gold Coast has been accompanied by a great extension of the means of communication. Under Sir Hugh Clifford (1912–9), the railway extension from Mangoase via Koforidua to Tafo was completed, and numerous important public works were constructed. Under his successor, Brig-Gen. Sir Gordon Guggisberg, the railway was carried west-north-west to Kumasi, the capital of Ashanti (July 5 1923), which had previously been reached by the line from Sekondi (Oct. 1 1903).

Railways.—Railway communication now consists of the Sekondi-Kumasi line (167 m.), with branches and the Accra-

Kumasi line (196 m.); and a railway is being constructed from Huni Valley, on the Sekondi-Kumasi line, to the neighbourhood of Kade (120 miles). These railways are on the 3 ft. 6 in. gauge. There is also a system of good roads, 1,268 miles in length, maintained by the Department of Public Works, and other roads maintained by the chiefs. Motor transport has been introduced with good effect. The harbours at Accra and Sekondi have been greatly improved, but have not been adequate to the growing trade of the colony, which was valued at £17,408,075 (imports £8,448,862: exports £8,959,212) in the year 1923. In 1921 it was decided to construct a deep-water port at Takoradi, not far from Sekondi, at a cost of £1,600,000, and this work is now in progress.

Industries.—The chief agricultural industry is cocoa growing, and the United Kingdom now receives fully two-fifths of its cocoa imports from the Gold Coast. Cultivation is almost entirely in the hands of the native peasantry, who have made a great success of this industry; the value of the cocoa export in 1923 being £6,566,973. Other products are kola, timber (especially mahogany), palm oil and a small quantity of cotton. Mining is an important industry, especially of gold and manganese. The former is widely diffused throughout the Colony, Ashanti and some parts of the Northern Territories, while the latter exists in large quantities close to the railway line within 40 m. of the port of Sekondi. The shipments of manganese ore reached 181,623 tons in 1923–4, valued at £410,182, and the value of the gold exported in the same year was £852,548. Diamonds are also exported and valuable deposits of bauxite have been discovered.

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(P. E. L.)

GOLDIE, SIR GEORGE DASHWOOD TAUBMAN (1846–1925), the founder of Nigeria (*see* 12.211), from 1908 to 1919 was an alderman of the London County Council, on which he served as chairman of the finance committee. From 1905 to 1914 and from 1915 to 1920 he was president of the National Defence Association. He died in London on Aug. 22 1925.

GOLDMARK, KARL (1832–1915), Austrian composer (*see* 12.212), died at Vienna Jan. 2 1915.

GOLDZIHER, IGNAZ (1850–1921), Jewish Hungarian Orientalist (*see* 12.219), died at Budapest Nov. 13 1921. Since 1910 he has published "The Influence of Parsism on Islam," trans. in C. P. Tiele, *The Religion of the Iranian Peoples* (1912, etc.); *Die Richtungen der islamischen Koranauslegung* (Leiden, 1920).

GOLF (*see* 12.219).—Since 1910 the popularity of golf has increased steadily in Great Britain, while in the United States of America it has spread like a prairie fire. There could be no more striking evidence than the fact that the profession of the golf architect has now become an exceedingly busy and prosperous one. Tracts of woodland, where it would once have been deemed impossible to make a course, have been hacked and hewn into shape, tree stumps have been blown up with dynamite and on one famous course in America, the Lido, sand has been sucked up from the sea by giant engines and spread over a flat marsh in picturesque hills and valleys. The designing of courses has developed into an art requiring skill, experience and imagination.

This, which may be called the second great boom in the history of the game, began with the coming of the rubber-cored ball and is no doubt largely due to it. The ball made the game far easier and pleasanter for the average man to play, but it has had its disadvantages. The ball goes so far that there has been a constant cry that courses are too short. Consequently clubs have had to remake their courses, taking in more ground with great attendant expense. Some attempts have been made, though not with any conspicuous success, to limit the ball's activities. In 1920 there was passed a rule, still in force, which lays down that the weight of the ball shall not be greater than 1·62 oz. avoirdupois and the size not less than 1·62 in. in diameter. The "implements committee" of the U.S. Golf Assn., after exhaustive experiments, proposed a further slight limitation. At the autumn meeting of the Royal and Ancient Club in 1925 it was proposed that a ball thus further limited should be used in the open and amateur championships of 1926, but the proposal was rejected by a large majority.

The Game in the United States

In the United States, in the earlier years of this century, golf may be said to have altered largely the lives of the upper and middle classes there, by the introduction of the "country club" habit. Now it has spread to all classes of society. Many American towns have public links where anybody can play either on the payment of a small fee or for nothing. Chicago heads the list with nearly 20 of such courses, and all over the country they are growing rapidly. It is significant that there has been officially instituted by the U.S. Golf Assn. a public links championship which draws many entries and produces fine golf, the winner being often one who was a caddie in boyhood.

Standard of Play in the U.S.A.—In these circumstances it is only natural that the Americans should have produced very good players. Their standard of play is now unquestionably higher than Great Britain's. As long ago as 1904 Mr. Walter Travis, an Australian born who had become an American citizen, won the British amateur championship at Sandwich. Curiously enough, although the standard of play in America is now far higher than in Mr. Travis's day, no other American amateur won the championship until 1926, when the coveted prize fell to Mr. Jesse Sweetser. Mr. Travis's fine victory marked the beginning of the American challenge, but it was not until eight years later that the menace to British supremacy was fully realised. In 1913 Harry Vardon and E. Ray went touring through America and took part in the open championship at the country club at Brookline, Mass. They seemed certain to have tied for first place when almost at the end of the day Mr. Francis Ouimet, a young Boston player who had only lately played in his first amateur championship, managed to tie with them by means of a great finish. On the next day the tie was played off over holes in horrible conditions with sheets of rain and muddy ground. Mr. Ouimet held his two opponents all the way, gradually wore them down and beat them handsomely.

Changes during the World War.—A year later golf practically ceased in Great Britain owing to the War but it naturally continued to grow and flourish in America. Up till that time most of the professionals in America had been imported Scotsmen or Englishmen, but there was gradually arising a race of "home-bred" professionals and after the War they were both formidable and numerous. When the British open championship began again in 1920, the great British golfers, Vardon, Braid, Taylor and Herd, had grown a little too old. They were, as they still are, very fine players, but their youth is not perennial and the long strain of a championship had become something too much for them. Great Britain had then, as to-day, many very skilful professional golfers but none perhaps who combined skill with temperamental virtues as did those four.

In 1920 the series of American invasions began with Hagen, a "home-bred," and Barnes, a Cornishman who had gone to America as a very young man. Barnes did well, but Hagen failed on this his first visit and Duncan, for whom that year was an *annus mirabilis*, won the championship. Next year they tried again and Hagen was clearly becoming acclimatised to British golf; but the winner was Jock Hutchison, a St. Andrew's-bred player, professional to the Glenview Club near Chicago who, though a Scottish golfer, played a typically American game. He tied with Mr. Roger Wethered, who had the misfortune to lose one vital stroke by kicking his own ball, and then won easily on the play-off. At the third attempt in 1922 Hagen was successful, winning at Sandwich by a single stroke, despite a wonderful spurt by Duncan in the last round. The next year was one of encouragement for Great Britain, for Havers, a young professional of great power and promise who learnt his game at Norwich, managed to beat Hagen by one stroke. There were other invaders from America, Barnes, Macdonald Smith, one of a

great Carnoustie family, and Gene Sarazen, a young "home-bred" player of Italian parentage, who had suddenly come into prominence. Barnes and Sarazen failed to qualify but Macdonald Smith finished high on the list.

In 1924 all four came to Hoylake and Hagen won by one stroke, chiefly by means of a most gallant finish. Indeed he has shown himself to possess unique powers of recovering from difficulties and of turning defeat into victory. In 1925 he did not come but Barnes won, beating Ray and Compston by a stroke. Macdonald Smith appeared at one time almost assured of victory but failed badly in the last round, during which he was rather hampered by an enormous crowd. The names of American professionals already mentioned make up a large part of the history of the American open championship but there is a word to be said about one truly astounding golfer, Mr. R. T. Jones, commonly called "Bobby." Mr. Jones has actually won the American open championship only once, a feat equalled by Mr. Jerome Travers, Mr. Ouimet and Mr. "Chick" Evans, but in the championship since the War his aggregate of scores is better by 19 strokes than that of the next best man, Walter Hagen. That is an eloquent piece of statistics to which nothing need be added.

The Walker Cup.—The history of American and British amateur golf centres chiefly round the Walker Cup which was given by a well-known golfer, Mr. Walker, for matches between the two countries. In 1920, an American amateur team came to take part in the amateur championship at Hoylake, played a match against a British team, and won decisively. That was before the giving of the cup. Walker Cup matches have since been played on the National golf links, Long Island, in 1921, at St. Andrews in 1923 and at Garden City, New York, in 1924. The American team has won on each occasion, very easily in its own country, by a narrow margin and a most courageous finish at St. Andrew's. The American team won also in the two following years, 1925 and 1926. In Messrs. Jones, Evans, Ouimet, Guilford, Gardner and Sweetser they had the nucleus of a side stronger than any Great Britain could command; and it is certain that any American team will always be a very formidable one. The American amateur is invariably well taught and grounded in his boyhood and he has a steadiness and consistency to which very few British amateurs seem able to attain. This is the more remarkable because, unless he goes to Pinehurst or Palm Beach or other southern courses in the winter, he probably plays less golf than do British golfers, who can and do play all the year round.

Golf in France and Elsewhere

Before coming to British golf, something must be said of that in other countries. As long ago as 1907, Arnaud Massy, originally a Biarritz fisherman, won the British open championship. He has never repeated that feat, though he tied with Vardon in 1911 and has several times beaten strong fields of British players in the French championship and did so once again in 1925. There has been no other French professional as good as Massy, but there has been a number of very good ones, such as the late Louis Tellier, Gassiat, Laffitte, Daugé, and one most remarkable one-armed player, Yves Bocatzou. The French amateurs have hardly yet reached the same standard, but France has produced one extremely good lady player, Mlle. Simone de la Chaume. She is already a very fine player and in soundness of method probably comes nearer to the British lady champion, Miss Wethered, than any other lady.

There are to-day some very good courses in France. Paris has La Boulie, Chantilly, St. Cloud and Fontainebleau. Le Touquet, near Étaples, is excellent, a mixture of seaside sand and inland pine trees; and Wimereux, lately remodelled, promises well. In the Riviera English visitors have made courses of varying quality. Cannes has one very pleasant one among pine trees at Napoules and the new Cannes country club, rather further off at Mougins, is probably better. Sospel, in a mountain valley above Mentone, is very charming, and others that are at least pretty and worth playing on are Costebelle, Valescure and Cagnes, near Nice. On the Côte d'Argent there is La Nivelle, near St. Jean de Luz, where Massy is the professional, and Biarritz. Moreover, close to Biarritz a new course is being made of which its promoters think very highly. Nor must Pau be forgotten. It is a club of now almost venerable age, one of the oldest out of Scotland. Switzerland and Italy have courses which are at least very beautiful. Indeed there are courses wherever British people are to be found. Canada, if it has not yet quite attained to the American standard of skill, is almost as keen and spends almost as much money on its courses and club houses. Australia has some good courses, notably perhaps Seaton near Adelaide and Kensington near Sydney; and it has bred at least one first-class professional, Joseph Kirkwood, who has several times done well in the British open championship and is now one of the leading professionals in America.

Japan has taken to the game with enthusiasm although the turf of the country is not of the best kind. It possesses a golf paper, *Golfdom*, and has some good players, although none have yet reached the standard of its lawn-tennis players. In short, in regard to its world-wide character, the game is now only second to lawn tennis.

The Game in Great Britain

In Great Britain golf has become steadily more and more popular, and nowhere more markedly than in its original home, Scotland. In Scotland it is essentially the people's game and there are many municipal courses on which it can be played at the minimum of expense. In England it is still largely the game of the comparatively well-to-do, but municipal golf is on the increase and wherever it arises it is an instant success, as witness the public course in Richmond Park which is crowded with all sorts and conditions of players. There are to-day far more golfers than there used to be who have begun the game as boys. It is not a school game but many boys play in their holidays; and considering this fact it is rather surprising that Great Britain does not breed more good young players. The universities of Oxford and Cambridge are full of golfers, but only a few of them are good golfers and the standard of university teams is not noticeably higher than it used to be. The number of players who may fairly be called good has of course increased very greatly throughout the country as a whole, and championship fields have correspondingly increased.

British Amateurs.—It has already been said that when the game was resumed after the War, the leading British professionals were a little past their best. Much the same may be said as regards the amateurs. Mr. John Ball, Mr. Hilton and others of their generation had naturally begun to think of retiring and their places were left open. Two very brilliant young players, too young to be heard of before the War, at once made their presence felt after it, Mr. Cyril Tolley and Mr. Roger Wethered. Of all British golfers in late years, these two have been the most essentially dramatic, and have taken the largest share of public attention. Both can hit the ball enormous distances, both are on their day almost unapproachably good and both can be, on an off day, disappointing. They lack the consistency of such a player as Mr. John Ball, but the game as played by them is an exciting and attractive one. Each has won the amateur championship once. Mr. Tolley has won the French open championship against a strong field, and Mr. Wethered did the best thing which any British amateur has done for a long time when he tied for the open championship with Jock Hutchison.

A golfer of a rather different type, Sir Ernest Holderness, has twice won the amateur championship since the War and, though he has not the magnetic powers of a Tolley or a Wethered, he is beyond doubt a very fine player. In the matter of consistency and steadiness he challenges comparison with the best of the elder amateurs. In 1925 another eminently consistent player, Mr. Robert Harris, won the amateur championship. It was a most popular victory, for Mr. Harris has now been among the leading amateurs for a long time; he was in the semi-final of the amateur championship as long ago as 1907 and in the final in 1913 and 1923.

These two players, Sir Ernest Holderness and Mr. Harris, probably make the safest models for the young amateurs of the present day, for the reason that they are both essentially straight and accurate. There is some danger lest too much importance should be attached to length and that young golfers should indulge in an orgy of slogging. Still, in the last few years, there has been noticed a great increase of driving power. This cannot be wholly accounted for by the increasing skill in the manufacture of the rubber-cored ball. On the whole the amateur standard is going up; but there is still room for a combination of the elder and younger virtues.

British Professionals.—No one or two professionals have definitely succeeded to the throne left vacant by the "triumvirate," Vardon, Braid and Taylor. Duncan appeared likely to do so when he played so wonderfully well in 1920, but he has since been somewhat fitful and inconstant. He is a magnificent golfer but lacks something of solidity and stolidity. Much the same may be said of Abe Mitchell, who has never yet won the open championship, though he has been very successful in tournaments by match play. It is almost impossible to imagine anything better than Mitchell's golf when things are going well; his brother professionals always expect him to win; but he too seems to want that power of rising superior to circumstances, which Hagen so conspicuously possesses. The two Whitcombes, George Gadd, Ockenden, Havers and many others all play exceedingly well without quite rising to the greatest heights. In 1925, however, there appeared suddenly another player, Compston, who adds great determination and character to great physical strength and may possibly be the man for whom the British golfing world has been waiting. He was unquestionably the player of the year and appears, far from relaxing his efforts after a victory, to go from strength to strength. Late in the year he was rather heavily defeated by Abe Mitchell, who played golf of overpowering brilliancy, but this will not discourage him.

Golf for Ladies.—In its ladies' golf Great Britain is strongest. For the first few years after the War Miss Cecil Leitch was the outstanding figure. She has all the qualities of a great player; it is possible to criticise her rather unorthodox methods, but not their results. She is still as good as ever, but she has been surpassed by Miss Joyce Wethered, who to equal strength and courage adds a sounder method. Indeed she is so sound in everything she does that it is impossible to suggest even the smallest loophole in her armour. She won the English close championship five times in succession and the open championship three times in four years, the last time after a terrific struggle with Miss Leitch, in which both played superbly. She has now no worlds left to conquer. These two ladies have dominated ladies' golf since the War, but there are some other excellent players, such as Miss Fowler, Mrs. Macbeth, Miss Chambers, and amongst American invaders, Miss Glenna Collett and Mrs. Fraser, formerly Miss Alexa Stirling. Lady golfers, although they now drive a great deal further than their predecessors, have not yielded to the passion for big hitting as have some of their male contemporaries. For the most part they play very accurately. Their iron play is a great deal more forceful than it used to be and, generally speaking, the difference between good men's golf and good women's golf to-day is one not of kind but only of degree.

Some Golf Courses

The select list of championship courses has been slightly enlarged. Two amateur championships have been played at Westward Ho, and one at Deal, which had previously been only upon the rota for the open championship. The open championship has been played at Troon and is to be played in 1926 at Lytham and St. Anne's. The fixed rota has in both cases been abandoned and, as time goes on, other fresh courses will no doubt get their turns. The management of the two championship meetings is now in the hands of the championship committee of the Royal and Ancient Golf Club. Its members are appointed by the Royal and Ancient but are not necessarily members of that club. They are chosen from representative golfers in different parts of the country. It may here be added that England, Scotland, Ireland and Wales has now each its own Golf Union. There is also a large number of county unions, county matches and county championships. Mention may also be made of the Professional Golfers Assn. which does a great deal of useful work on its members' behalf and manages certain competitions, such as *The News of the World* and *The Daily Mail* tournaments open to its members.

It would be impossible to enumerate all the new and good courses which have come into existence since 1910. There are not so many new sea-side ones of quite the first rank, though there is certainly one, Prince's, Sandwich, which is as fine as any in the country, and another, Saunton, in North Devon, which promises to be so. The great increase is in good inland courses. This is largely due to the discovery that the country of fir trees and heather, such as is to be found particularly in Surrey, can be turned into the very best kind of inland course. The London golfer has consequently a wonderful choice of fine courses within easy distance, Sunningdale, Walton Heath, Woking, Worplesdon, West Hill, St. George's Hill and Addington are among the leading ones. Ganton and Alwoodley, in Yorkshire; Hollinwell, in Nottinghamshire; Sandwell Park, near Birmingham; and Gleneagles, in Perthshire, are perhaps the best outside the London district, but the list is really unending. Finally it has regretfully to be recorded that golf is no longer played on Blackheath, its earliest home in England. The classic heath is now given over to football players and its sacred turf has been largely kicked to pieces. The Royal Blackheath Club has, however, moved its home to Eltham, where it still flourishes and retains its proud claim to be the oldest golf club in the world.

Winners of British Championship, 1911–26

Year	Open	Amateur	Ladies
1911	H. Vardon (Prestwick)[1]	H. H. Hilton, (Prestwick)	Miss D. Campbell (Portrush)
1912	E. Ray (Muirfield)	J. Ball (Westward Ho!)	Miss G. Ravenscroft (Turnberry)
1913	J. H. Taylor (Hoylake)	H. H. Hilton (St. Andrews)	Miss M. Dodd (St. Anne's)
1914	H. Vardon (Prestwick)	J. L. C. Jenkins (Sandwich)	Miss C. Leitch (Hunstanton)
1915–1919	No Matches		
1920	G. Duncan (Deal)	C. J. H. Tolley (Muirfield)	Miss C. Leitch (Newcastle, Co. Down)
1921	J. Hutchison (St. Andrews)[2]	W. I. Hunter (Hoylake)	Miss C. Leitch (Turnberry)
1922	W. Hagen (Sandwich)	E. Holderness (Prestwick)	Miss J. Wethered (Sandwich)
1923	A. G. Havers (Troon)	R. H. Wethered (Deal)	Miss D. Chambers (Burnham)
1924	W. Hagen (Hoylake)	E. Holderness (St. Andrews)	Miss J. Wethered (Portrush)
1925	J. M. Barnes (Prestwick)	R. Harris (Westward Ho!)	Miss J. Wethered (Troon)
1926	Robert T. ("Bobby") Jones (St. Anne's)	Jesse Sweetser (Muirfield)	Miss C. Leitch (Harlech)

[1] After tie with A. Massy.
[2] After tie with R. H. Wethered.

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GOLITZIN, BORIS BORISOVICH, PRINCE (1862–1916), Russian physicist, was born on Feb. 18 (old style) 1862 in St. Petersburg (Leningrad). He was educated in the naval school and naval academy. In 1887 he left the active service for scientific studies and went to Strasbourg. In 1891 he was appointed *privat-docent* at the University of Moscow and in 1893 professor of physics at Dorpat. The same year he was elected fellow of the Academy of Sciences in St. Petersburg and in 1908 a member of the same. His early research was in spectroscopy, but his world-known work is on the methods of earthquake observations and on the construction of seismographs, which are used in all Russian and in many foreign observatories. His valuable book, *Lectures on Seismometry*, was published in 1912 and translated into German in 1914. He received the degree of D. Sc. from the University of Manchester in 1910. In 1911 he was elected president of the International Seismological Association. In 1913 he was appointed director of the Central Physical (now Geophysical) Observatory at St Petersburg and achieved good results in the organisation of the meteorological service throughout Russia, especially during the World War, but his work was cut short by his death from pneumonia on May 4 1916 at New Peterhof, near St. Petersburg. He took part twice in expeditions for observations of solar eclipses, once in 1896 at Novaya Zemlya and the second time in 1914 near Riga, where he obtained splendid photographs of the corona. (A. Fo.)

GOLLANCZ, SIR ISRAEL (1864–), British scholar, was born in London of a Jewish family July 13 1863. He was educated at the City of London School and afterwards at University College, London and Christ's College, Cambridge. From 1892 to 1895 he was Quain student and lecturer in English at University College, London and in 1896 was appointed university lecturer in English at Cambridge, becoming in 1906 university professor of English language and literature at King's College, London. He became secretary of the British Academy on its foundation in 1903 and was knighted in 1919. He was general editor of the *Temple Classics* and *King's Library* series and of the *Book of Homage to Shakespeare* which appeared in 1916. His published works include *Cynewulf's Christ* (1892); an edition of C. Lamb's *Specimens of Elizabethan Dramatists* (1893); *Exeter Book of Anglo-Saxon Poetry* (1895) and *Hamlet in Iceland* (1898).

GOLTZ, COLMAR VON DER (1843–1916), Prussian general, military writer and organiser of the Turkish Army (*see* 12.227). Gen. von der Goltz was made a field-marshal in 1911 and retired in 1913. In Aug. 1914 he was appointed Governor-General of Belgium, then occupied by German forces. In Nov. of the same year he was attached to the Turkish headquarters as aide-de-camp-general to the Sultan. In April 1915 he was placed in the chief command of the I. Turkish Army in Mesopotamia, and succeeded in investing Gen. Townshend's British forces at Kūt-el-Amāra in Dec. 1915. He died April 19 1916 at Baghdād and was said to have been poisoned by the Young Turks. His latest work was *Kriegsgeschichte Deutschlands im 19ten Jahrhundert*, 2 vol. (1910–4).

GOLUCHOWSKI, AGENOR, COUNT (1849–1921), Austrian statesman (*see* 12.227), died at Lemberg March 29 1921.

GOMPERS, SAMUEL (1850–1924), American labour leader (*see* 12.230), was convicted in 1907 and sentenced to 12 months' imprisonment for contempt of court in disobeying an injunction prohibiting *The Federationist* (the organ of the American Federation of Labour), from blacklisting the Buck Stove and Range Co. of St. Louis. On his appeal, the U.S. Supreme Court waived the conviction on technical grounds. New proceedings were instituted and another conviction and sentence in the lower court was set aside by the Supreme Court on the ground that the statute of limitations had expired before the second prosecution was launched. Although in theory opposed to all war, after the outbreak of the World War he resisted any tendency in labour unions to favour peace at any price. He was appointed a member of the Advisory Commission of the U.S. Council of National Defence in 1917.

Gompers represented the American Federation of Labour at the Peace Conference in Paris 1918–9, and was appointed chairman of the International Committee on Labour Legislation. He was also Chairman of the American labour delegates at the convention of the International Federation of Trades Unions at Amsterdam in 1919. He consistently opposed socialistic movements among the unions and favoured collective bargaining. He opposed compulsory arbitration in labour disputes and urged that labour unions be exempt from the anti-trust law. In 1921 he was elected president of the American Federation of Labour for the 40th time. In Dec. 1924 he was taken ill at Mexico City, whither he had gone after attending the annual convention of the American Federation of Labour at El Paso, Tex. As he had expressed a wish to die on U.S. ground he was placed on a special train, bound for New York City. He died at San Antonio, Tex., Dec. 13.

GOMPERZ, THEODOR (1832–1912), German scholar (*see* 12.230), died at Baden, near Vienna, Aug. 30 1912.

GOODHUE, BERTRAM GROSVENOR (1869–1924), American architect, was born at Pomfret Hill, Conn., April 28 1869. He studied architecture in New York City with James Renwick and in 1891 entered the office of R. A. Cram in Boston, Mass., later becoming a partner. In 1903 the firm opened an office in New York City of which Goodhue took charge. After 1914 he practised alone. He designed churches and cathedrals which were thoroughly modern yet Gothic in inspiration. At the same time he was one of the most prominent exponents of the sky-scraper building. Among the structures designed by him are St. Thomas's Church, the Chapel of the Intercession, and the Church of Saint Vincent Ferrer, New York City; the Nebraska State Capitol, Lincoln, Neb.; St. Mark's Church, Mount Kisco, N.Y.; St. Thomas's College, and the National Academy of Sciences and National Research Council in Washington, D.C.; Mandel Hall, at the University of Chicago; the California Institute of Technology, Pasadena, Cal.; and the Exposition buildings for San Diego, Cal. He was also the architect for the Cathedral of Maryland, Baltimore. He died in New York City April 24 1924.

GOODNOW, FRANK JOHNSON (1859–), American educationist, was born in Brooklyn, N.Y., Jan. 13 1859. Educated at Amherst College, Mass., he studied law at Columbia (LL.B., 1882), subsequently proceeding to the École Libre des Sciences Politiques, Paris, and the University of Berlin. He was appointed instructor in history and lecturer in U.S. administrative law at Columbia University in 1883, becoming professor in 1891, and Eaton professor of administrative law and municipal science in 1903. During 1906–7 he was acting dean of political science. He was legal adviser to the Chinese Govt., stationed at Peking, during the years 1913 and 1914. He was appointed president of Johns Hopkins University, Oct. 1 1914.

Among his published works are *Comparative Administrative Law* (1893); *Municipal Home Rule* (1895); *Municipal Problems* (1897); *Politics and Administration* (1900); *City Government in the United States* (1904); *Principles of the Administrative Law of the United States* (1905); *Municipal Government* (1910); *Social Reform and the Constitution* (1911); *Principles of Constitutional Government* (1916).

GOODWIN, NATHANIEL CARL (1857–1919), American actor (*see* 12.239), died in New York Jan. 31 1919.

GOODWIN, WILLIAM WATSON (1831–1912), American scholar (*see* 12.240), died in Cambridge, Mass., June 16 1912.

GORE, CHARLES (1853–), British divine (*see* 12.254), was, in 1911, appointed Bishop of Oxford, where he remained until 1919 when he resigned and settled in London. His recent works include *New Theology and Old Religion* (1908); *Orders and Unity* (1910); *The Question of Divorce* (1911); *The Religion of the Church* (1916); *The Epistles of St. John* (1920); *Belief in God* (1921); *The Holy Spirit and the Church* (1924).

GORGAS, WILLIAM CRAWFORD (1854–1920), American army surgeon, was born at Mobile, Ala., Oct. 3 1854. He was educated at the University of the South, Sewanee, Tenn., and Bellevue Hospital Medical College, New York, taking his M.D. in 1879. In 1880 he entered the Medical Corps of the U.S. Army. During the Spanish-American War he served as major in the Medical Corps, and was sent, after the Santiago expedition, to Havana, where he was in charge of yellow-fever patients.

From 1898 to 1902 he was chief officer in charge of sanitation measures in Havana, and there conducted many experiments in connection with the discovery that yellow fever was transmitted by the mosquito. Because of his success in eliminating yellow fever there he was made assistant surgeon-general, U.S. Army, with the rank of colonel, by special Act of Congress in 1903.

In 1904 Gorgas was sent as chief sanitary officer to Panama, where two of the main obstacles to building the Canal were yellow fever and malaria. Here again his methods were so effective that in two years he eliminated yellow fever from the Canal region. Malaria also was brought under control. In 1907 he was appointed a member of the Isthmian Canal Commission by President Roosevelt, and the following year was U.S. delegate to the first Pan-American Medical Congress, held at Santiago, Chile. He was president of the American Medical Association, 1908–9. In 1913 he was called to the Rand Gold Mines in South Africa to suggest means for combating the frequent epidemics of influenza. This he found was largely due to crowding the labourers together in barracks. In 1914 he was made surgeon-general, U.S. Army, with the rank of brigadier-general, becoming major-general in 1916. In 1918 he was retired. He then became the permanent director of the yellow-fever work of the International Health Board of the Rockefeller Foundation. He went to Central America, and under his direction investigations of yellow fever were made in Guayaquil, Ecuador and Guatemala. In 1919 he accepted a contract with the Government of Peru to carry out a sanitary programme in that country. He died in London July 3 1920, and was buried in the Arlington National Cemetery, Washington, D.C.

GÖRGEI, ARTHUR (1818–1916), Hungarian soldier (*see* 12.256), died May 21 1916.

GORST, SIR JOHN ELDON (1835–1916), British politician (*see* 12.261), died in London April 4 1916. His son, SIR JOHN ELDON GORST, died at Castle Combe, Wiltshire, July 12 1911.

GOSSE, SIR EDMUND (1849–), British critic (*see* 12.268), retired from the post of librarian to the House of Lords in 1914. In the previous year his autobiographical *Father and Son* (1907) was crowned by the French Academy, and an edition of his *Collected Essays* was issued. In 1917 he published his important *Life of Algernon Charles Swinburne*, the fruit of his great knowledge of the poet and many years' friendship with him. He received numerous honours from universities and governments, British and foreign, and was knighted in 1925. He continued to write weekly critical articles in *The Sunday Times*, and selections from these were reprinted in *Books on the Table* (1921) and *More Books on the Table* (1923).

GÖTEBORG or GOTHENBURG, Sweden (*see* 12.271), with a population in 1923 of 227,343, is now the first port of Sweden and the chief centre of the shipbuilding industry. The value of its foreign trade increased from 811,409,000 kronen in 1915 to 1,725,061,000 kronen in 1924. The harbour, which has been considerably enlarged, is the largest in Sweden, and was made a free port in 1922; a dry dock was in course of construction in 1925. Göteborg is now a port of registry for steamers to all parts of the world, and is no longer only a port of call. The town, which is an important industrial centre, with over 400 factories in 1920, has an area of 7,407 hectares. The first Swedish fair, held in the town in 1918, was later recognised by the Government as an international industrial fair. Among new buildings are a commercial institute, Lorensberg (1914); a Latin high school (1919); the Natural History Museum in Slottskogen Park (1923); a fine public school (1917); and Masthugget church (1916). The Navigation School was rebuilt in 1916, and a marine museum, with models of vessels, shipbuilding exhibits, etc., was opened in 1913 and endowed with over 1,000,000 kronen in 1917. A new botanical garden was opened in the Anggården in 1923. The restoration of the Kristine church was undertaken in the same year. The railway line to Stockholm was undergoing electrification in 1926.

GOTO, SHIMPEI, VISCOUNT (1856–), Japanese politician, was born in Iwate-Ken and studied medicine in Germany. As the first civil administrator of Taiwan (Formosa) under Gen. Kodama in 1898, and as the first president of the South Manchuria Railway in 1906, he laid the groundwork of Japan's colonial enterprises. He was Minister of Communications in 1908 and 1912; of Home Affairs in 1916; Foreign Affairs in 1918; and mayor of Tokio (1921–2). He exchanged conversations with M. Joffe regarding the reopening of Russo-Japanese relations upon his own initiative and personal responsibility in 1922. After the great Japanese earthquake in 1923 he became again Minister of Home Affairs and president of the reconstruction board.

GOUGH, SIR HUBERT DE LA POER (1870–), British soldier, was born Aug. 12 1870, a son of Gen. Sir C. Gough, and joined the 16th Lancers in 1889. In 1911 he became brigadier-general commanding the III. Cavalry Brigade at the Curragh, where his attitude with regard to Ulster and the use of the troops in 1914 caused a grave political crisis (*see* ENGLISH HISTORY). He took his brigade to France in Aug. of that year, and after successive promotions was given command of the newly constituted V. Army; with this he played an important part in the battle of the Somme. In 1917 he was for some time in charge of the Ypres offensive, where his conduct of the operations received considerable criticism. The brunt of the great German offensive of March 1918 fell on his troops, who were unable to withstand the pressure and fell back with heavy loss in personnel and material. Gough's dispositions under circumstances of the utmost difficulty were appropriate, and responsibility for the disaster did not rest with him; nevertheless he was deprived of his command by the Government—punished, as was commonly said, for the failings of 1917, that had now been amply balanced. In 1919 he was for some months head of the British Mission to the Baltic States.

GOUIN, SIR LOMER (1861–), Canadian politician, was born at Grondines, Quebec, March 19 1861. Educated at Laval and McGill universities, he was called to the bar in 1884, and became Q.C. in 1900. In 1897 he was elected to the Quebec Legislature and from 1905 to 1920 was Prime Minister and Attorney-General of the province. He declined to join Sir Robert Borden's coalition Ministry, subsequently declaring his allegiance to the Liberal opposition. Knighted in 1908, Gouin received the K.C.M.G. in 1913. Sir Lomer was included in the Cabinet formed in 1921 by Mr. Mackenzie King, as Minister of Justice. He was one of the Canadian representatives at the fourth assembly of the League of Nations at Geneva, when he succeeded in obtaining an interpretation of article 10 of the Covenant in the form of a resolution. In 1924 he attended the Imperial and Economic Councils in London as one of Canada's representatives, but later in the year retired from politics. Gouin's first wife (d. 1904) was a daughter of Honoré Mercier, a former Premier of Quebec.

GOURAUD, HENRI JOSEPH ÉTIENNE (1867–), French general, was born at Paris on Nov. 17 1867. He entered St. Cyr in 1888, and was commissioned to the infantry in 1890. In 1894 he was seconded for duty under the colonial administration; and thereafter he gained much experience of active service in the French Sudan, in which he served almost continuously for two years. In 1904 he was promoted lieutenant-colonel, made commandant of the Chari (Congo) territory, and an officer of the Legion of Honour. In 1907 he was promoted colonel. He next served in Morocco, where he remained until the outbreak of the World War.

On Sept. 17 1914 Gouraud was promoted temporary general of division, and the following Jan. was appointed commander of the Colonial Army Corps. On Feb. 15 1915 he was made a substantive general of division. In May he replaced D'Amade as commander of the force in Gallipoli, where he was so badly wounded that his right arm had to be amputated. He was awarded the médaille militaire on July 10 1915. On recovering from his wound he went to Italy in charge of a mission, and then in Dec. 1915 he was appointed to command the IV. Army. A year later he was sent temporarily, as commissioner general, to Morocco; but he again took command of the IV. Army in June 1917. From 1915 to the summer of 1918 the sector of the IV. Army was relatively quiet, save for one moment in the spring of 1917 in which it was drawn into the ambit of Nivelle's offensive

on the Aisne, and at that time Gouraud was in Morocco. Thus, when on July 15 1918 the Germans launched their last offensive on the Champagne front, Gouraud had had little executive experience as an army commander in battle, and before the "zero" day Pétain had had some difficulty in convincing him of the necessity of a "coil spring" defence. But when the time came Gouraud carried out its principles admirably, and brought the Germans' last effort to a standstill in his battle zone. Gouraud was awarded the grand cross of the Legion of Honour on Dec. 28 1918. In Oct. 1919 he became high commissioner in Syria and commander-in-chief in the Levant. He was succeeded by General Weygand in 1923 and was appointed military governor of Paris.

GOURMONT, RÉMY DE (1858–1915), French writer, was born at Bazoches-in-Houlme (Orne) April 4 1858. He was descended from a family of painters and engravers well known in the 15th and 16th centuries, and on his mother's side from the poet Malherbe. He settled in Paris in 1883, and entered the Bibliothèque Nationale. In April 1891, however, he was requested to leave, after he had published an article in the *Mercure de France* entitled "Le Joujou Patriotisme." He continued to contribute to this periodical and to numerous other papers. His work, which is of great variety and extent, is remarkable for its bold and flexible ideas and great erudition, and his wide range of subject is shown by *Sixtine*, a "*roman de la vie cérébrale*," his *Esthétique de la langue Française*, a notable essay on language and phraseology to his series of *Promenades Littéraires* and his notorious *Lettres à l'Amazone*. He died in Paris Sept. 27 1915.

In addition to the works mentioned above he wrote: *Le Pélerin du Silence* (1896), *Le Livre des Masques* (1896–8), *Le Problème du Style* (1902), *Physique de l'Amour* (1903) and *Pendant la Guerre* (1917).

GOVERNMENT (*see* 12.292).—Short as it is, the period since 1910 has been momentous in the development of government. The period divides itself into three parts: the years before the War, 1910–4, the years of War 1914–8, and the years of reconstruction after the War. But in the history of government the years 1914–8 stand out in large letters. War, and especially modern war, sees the state writ large. Yet, divided as it thus is, the period 1910–26 should be seen also as a whole. For the ideas of state organisation and control which were put into practice in 1914–8 were forming in the preceding years of peace.

The steady growth in the functions of the state, especially in the seven years before 1914, made easier the task of the mobilisation and control of national resources in time of war. So again after the War, while the years of reconstruction saw a reaction against control, yet the range and the boldness of state action in war, and the magnitude and complexity of the problems of resettlement, left both the theory and the practice of the state more advanced than in the pre-War years. Despite therefore, the exceptional conditions of the years of War, the period presents a unity in its development greater than at first sight appears. As events recede and the period can be seen from a greater distance this will become more evident.

The General Idea of the State.—In judging the position of the theory and practice of government at any period of time it is useful to ask three questions: (1) What changes have there been in the general idea of the state? (2) What developments stand out in the forms of government? (3) What is most noteworthy as regards the scope and functions of the state? The most fundamental question is, What change is there in the general idea of the state? Three things in this period deserve special emphasis. First, the remarkable growth in the sphere of government. The period might be called that of the changing state, with a great and on the whole steady increase in the functions of government. The movement of state and community control, which had been gaining momentum for over a generation, extends in a wide variety of directions. The movement is universal, inasmuch as it shows itself in varying forms and degrees in all countries with a developed system of self-government, and with a highly organised economic life.

Second, there is the growth in the moral idea of the state. Right not might is the valid basis of the state, but the significance of this wins recognition slowly. Yet this period will be seen to mark a great advance in this respect. The state exists to make life good. The idea of social justice reveals itself more fully both in the relations of the individual to the state and in the relations of states one to the other. The challenge to the crude theory of the state as might is made in deed as well as in word. There is a new emphasis on the truths that there can only be one morality for the individual and the state, and that, as the state exists to secure justice, its acts, as much as those of the individual, must conform to common moral principles.

The third aspect is the new emphasis on the value of the individuality or personality of the individual and of the group. The end of the state is the individual. The doctrine of sovereignty becomes less formal and dogmatic. The idea of the community transcends that of the state. For the community embraces the great family of groups and associations which the state must recognise as also sharing with it in the expression of man's social and political nature.

I. FORMS OF GOVERNMENT

There have been in the period very important developments in the structure of government, international, national and municipal. But of these by far the most memorable has been the great international constitution embodied in the Covenant of Nations 1919. The establishment of the assembly and of the council of the League, with their regular meetings and with their important array of permanent and special committees, the organisation of the secretariat of the League, the establishment of the international labour bureau under the Treaty of Versailles, and the creation of the Permanent Court of International Justice, (*q.v.*) are achievements of the highest significance in the history of government. The years 1899–1910, opening with the first Hague Convention, had seen a great advance in international arbitration and methods of peaceful co-operation; the crucial year 1914 had seen the ratification of the first of the treaties between the United States of America and other countries to submit all questions under dispute to a tribunal of investigation before recourse to war; but it is above all to the years 1919 and after that one must look for the foundations of the international polity.

Second, this period has been marked by the importance and variety of developments in government within the British Empire—in itself a league of nations, whose constitutional experience has had a peculiar value for the great world League. The Union of South Africa in 1910, expressed in a constitution distinctive in type from that of the other great federations within the British Empire; in the Government of India Act of 1919, embodying a bold experiment in diarchy; the constitution of the Irish Free State, under the Government of Ireland Act 1922, with the status of a Dominion; and the establishment of the Parliament and Government of Northern Ireland, under the Government of Ireland Act 1920, the first example of legislation and evolution within the United Kingdom, are events of great constitutional interest.

Meanwhile important developments have taken place affecting the general system of relations within the Empire. The imperial conference of 1911—the organisation and work of the committee of imperial defence, the development of the imperial War cabinet in 1917–8, and the conscious advance towards fuller equality of status with the mother country on the part of the Dominions—especially the world recognition of the Dominions and of India as member states in the League of Nations, and the efforts made by post-War conferences to provide more effective methods of imperial consultation and co-operation—mark the period as one of the highest importance in the constitutional history of the British Empire.

Third, this period will be notable for the advance throughout the world in the adoption of representative forms of government and in the progress of democratic ideas and institutions. The political constitutional changes since 1910 in China, including the establishment of a republican form of government, are the most striking indication of the changing East. However super-

ficial and subject to reaction many of these changes may be, they are evidences of the will to learn from the political experience of the West, and, with Eastern participation in international institutions of government, are part of the great movement which is bringing the world closer together.

In Europe itself the World War brought many changes in government, and the new constitutions in Germany, the Baltic States, Poland, Czechoslovakia and Yugoslavia mark the advance throughout Europe of common representative forms of government. In most cases these new constitutions show an acceptance of the cabinet idea of responsible government, but methods of direct popular judgment through the referendum and the initiative have also a wide place in modern European constitutions. Notable also is the widespread adoption, in new and old constitutions, of proportional representation.

It remains to be seen how far the organisation of government on these lines is going to provide a sufficiently strong and stable executive, and how far experience may lead those nations which have adopted the system of parliamentary government to study and follow more closely the British model, which has secured a greater measure of stability and of clearness of responsibility than has resulted from other types of parliamentary government.

Trend Towards a Working Harmony.—In this connection also it may be noted that the trend of opinion, based on experience during the period, has been in favour of the system which secures close harmony between the legislature and the executive. In states where the established system was based on a more marked acceptance of the division of powers, and where, as in Sweden, the constitution presented a "dualistic character," development has been steadily towards greater harmony between the parts of government, giving thereby a more unitary character to the constitution. Even in the United States of America, the great example of the separation of powers, there has been an increasing recognition of the value of closer relations between the parts of government, and the working system of the constitution seems to be moving towards the realisation of this object. In this connection one of the most notable developments has been the adoption of a budgetary system by the Federal Govt. in 1921, as well as by individual states of the Union. In general it may be said that the increasing body of comparative evidence on the practical efficiency of different methods of legislative and administrative organisation is bringing about a closer approximation of the different forms of government one to another, and a clearer understanding of the qualities and defects of each type.

While this has been happening in the progress of a representative government, it is also important to recognise that in this same period there has been a great increase in the critical attitude of mind in almost all advanced countries towards the working of representative institutions. Discontent with parliamentary and congressional institutions has been vocal, and the reaction has expressed itself in various ways. In Russia, with the revolution of 1917 a new system of government, based on councils of soldiers, workers and peasants, has been developed. The challenge of this type to the established representative system of parliamentary government has not so far succeeded in the states of Central and Eastern Europe which have given themselves new constitutions since 1918. On the other hand, especially in the Southern European states, the reaction against the weakness and corruption of government has led to the establishment of a series of dictatorships which, even when they maintained the form of parliamentary government have denied it the substance of power. These reactions from representative government are significant. War increases the strength of the executive, and the experience of the first years of peace emphasised the need of authority and leadership. But, apart from this, there has been a growing recognition that, even in normal times, good government in democratic States requires clearness of responsibility and the power to act, and that in many cases representative institutions, parliamentary and congressional, have dissipated power and obscured responsibility.

Functional Representation.—In another direction, closely related to the foregoing, the period has also shown interesting developments in the growth of ideas and of institutional forms expressing what is called functional representation. The school of thought which has given prominence to these ideas has in its more extreme expression challenged the authority of a parliamentary system based on regional representation, and has sought to replace this by methods which would directly reflect the opinions of the various economic and social groups within the community. The vogue of this school of thought has been due, not simply to dissatisfaction with the working of the existing forms of representative government, but also to a sense of the importance of securing the expert knowledge of the group mind and of giving to the groups the largest measure of self-government and control in the development of their functions.

In practice, the great increase in the organisation, not only of industrial and economic but of social and cultural groups within the body politic, extending often beyond national boundaries, has influenced the institutions of government, local, national and international. Nowhere is this more clearly seen than in the formation of representative councils or committees, usually consultative, but in some cases invested with considerable statutory authority, which have been associated with the public departments of administration in Great Britain. In Germany the place given in the new constitution to the economic council of the empire is an expression of the same tendency. This does not, however, involve the overthrow of the well-established forms of representative government. Gradually the adjustment of the new to the old order is taking place, and the theory of representative government is thereby enriched and strengthened. For there is no alternative to representative government if democracy is to survive in the modern world. Such at least seems to be the trend of progress through the changing complex of political, social and economic conditions.

It is worthy of note also that in this political evolution there is going on a process both of centralisation and decentralisation. In all federal states there has been during this period a marked growth in the power of the central government, while in states with a more unitary type of constitution, like Great Britain and France, methods of devolution and of regional reconstruction have been making headway. But in both types, centralisation and decentralisation are actively proceeding, a consequence of the growth in the functions of the state and of clearer differentiation of the powers which should belong respectively to local, national and international authority.

Nor should the increased attention in this period to local government, urban and rural, be overlooked. Nowhere have developments in this field been more significant than in the United States. The great amount of experiment in that country in the forms of municipal government indicates a more active period of interest in local affairs, while the progress of the municipal home rule movement is a further expression of the democratic idea that government must be decentralised, and that the sense of local responsibility has to be safeguarded in the great modern nation state. Thus this period has brought forth important developments in international, federal, national and local government. It will stand out also as one in which the nations have been coming nearer to one another in constitutional thought and in forms of government.

II. FUNCTIONS OF THE STATE

The years 1910–25 have seen a great extension in the functions of the state. In the last quarter of the 19th and to an increasing degree in the first decade of the 20th century the state has been abandoning the policy of *laissez faire*, and building up a constructive plan of community action, aiming at better social and economic standards of life. In education, in public health, in provision for housing, in factory and workshop standards, in the regulation of industrial disputes, in the development of municipal services, the new idea of the functions of the state was being progressively revealed. The years 1906–10 opened up rich fields of state activity; and 1910–4 saw further important developments, which, however, were checked by the outbreak of hostilities.

Extension of State Activity.—In Great Britain the establishment of the development commission and of the road board marked a new constructive policy of state aid. Thus, the resources placed at the disposal of the development commission enabled a comprehensive scheme of agricultural research to be undertaken, while later the establishment under the Privy Council of the committee for scientific and industrial research, and of the medical research committee were further recognition of the great and growing function of the state in this sphere. The road board was also the forerunner of developments of state policy in co-ordinating and controlling transport, culminating in later years in the establishment of a ministry of transport. So again the pre-War years saw the establishment of national health insurance and the first steps in the development of unemployment insurance under the National Insurance Act of 1911.

The outbreak of war led to a great extension of state functions. Voluntary methods gradually gave place to state control. The regulation of man power, the control of imports and exports, the nationalisation of the supplies of munitions, the regulation of agricultural production, the rationing of food supplies and of raw materials for industrial requirements—these and other measures of state action demonstrated the power of state organisation in time of war. Peace brought with it a reaction. Nevertheless, after the War there remained a wider idea of community right and obligation. The gravity of the problem of unemployment led to measures of relief by central and local authorities of a character and amount hitherto unknown. The state has also been called upon to exercise extended functions in relation to the national resources of coal, power and transport; while the development of a much more comprehensive policy for the assistance of agriculture and forestry and the establishment of the Food Council are indications of the steady growth in state function.

Voluntary Effort.—But side by side with the growth of governmental power is the increase in voluntary economic and social organisation, and in the association of voluntary with statutory bodies in the work of government. There is great significance for the future in this renascence of voluntaryism. It marks a new stage in the development of government, in which not simply do the people by their votes choose their rulers, but in which to an increasing extent they are associated with the administration of government in its many branches. The state is becoming more flexible. The organisation of the community is proceeding, not simply by bureaucratic efficiency, but by the democratic method of making the people experience to an increasing extent, through voluntary organisations, the part which they alone can fill in the work of government.

Just as the theory of *laissez faire* had to yield to changing conditions, so the theory of a socialistic state, meaning thereby state ownership, state operation and state control, is giving place, at least in the Anglo-Saxon countries, to a conception of community life, in which there is not only room for individual and voluntary organised effort, but in which it is seen that the increase of state action to be really effective and desirable has to be accompanied by a growth in the more flexible forms of association which come under the category of voluntary and self-help movements. It may well be that, as the Anglo-Saxon race has contributed beyond any other people to the development of representative institutions of central and local government, so the political genius of the race may reveal the part which voluntary associations have to play in the development of democracy and in the meaning of community life. In all these respects the period 1910–25 is significant in the history of government. (*See* SOCIAL SERVICE.)

BIBLIOGRAPHY.—The main sources of evidence for the study of modern governments are to be found in the official records of parliamentary proceedings in the several countries and in the reports of the administration departments and of special commissions on committees of inquiry. For the text of the constitutions W. F. Dodd, *Modern Constitutions* (1909) and P. Dareste, *Les constitutions modernes* (1910) are the most convenient collections while the most useful source for the post-War constitutions is the *Jahrbuch des öffentlichen Rechts* (Tubingen). As regards general studies of modern government, Viscount Bryce, *Modern Democracies* (1921); A. Esmein, *Éléments de droit constitutionnel français et comparé* (1921) and G. Jellinek, *Allgemeine Staatslehre* (1922) are of standard value. A wide range of studies of government in War time has been issued by the Carnegie Endowment for International Peace. A useful series of studies in governmental organisation is published by the Institute for Government Research (Washington, D.C.). (W. G. S. A.)

GRACE, WILLIAM GILBERT (1848–1915), English cricketer (*see* 12.308), died at Eltham, Kent, Oct. 23 1915. His elder brother, EDWARD MILLS GRACE (1841–1911), died at Thornbury, Glos., May 28 1911. See F. S. A. Cooper, *W. G. Grace, Cricketer* (1916), Lord Hawke and others, *The Memorial Biography of Dr. W. G. Grace* (1919).

GRAF, ARTURO (1848–1913), Italian poet and critic (*see* 12.315), died at Turin May 29 1913. *Poesie*, a collection of his best poems, appeared in 1915.

See Sartori Treves, *Arturo Graf, romanziere e poeta* (1904).

GRAIN ELEVATOR.—The term elevator has been universally adopted on the North American continent to describe a granary consisting of deep bins or silos, the grain being elevated to the top of these bins for the purpose of filling them. It is also commencing to be generally used by such other countries as have adopted this method of grain storage.

The grain elevator is the natural outcome of the bulk-handling

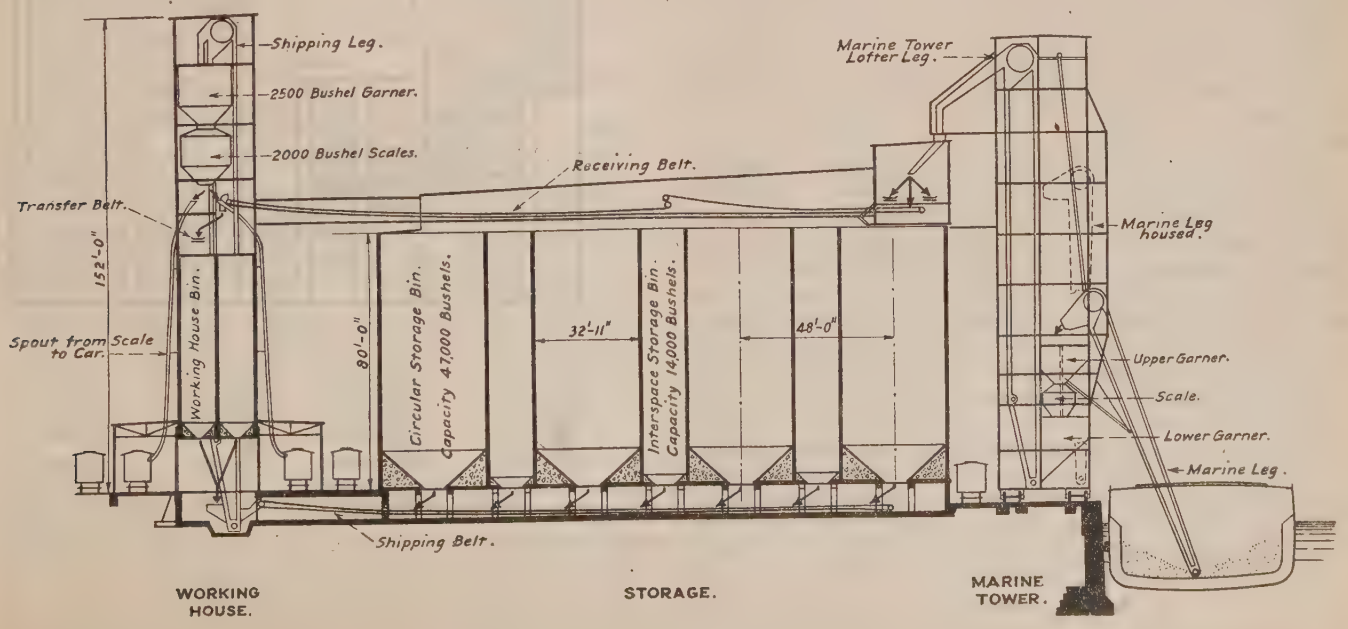

FIG. 1.—Canadian Pacific Railway Elevator, at Port McNicoll, Ontario, transferring grain from a lake vessel to railway cars. Its storage capacity is 4,000,000 bushels.

system as distinguished from the bagging system, and it is this that makes it possible for a port, equipped with up-to-date elevators and grain galleries, to receive and ship out such vast quantities of grain as are handled at Canadian and United States ports, of which Montreal holds the premier position with an export record of over 4,000,000 tons per annum. Previous to the introduction of the bulk-handling system, grain was, and still is, in many countries, handled in bags. To attempt to handle a large grain crop in bags is about as economical as supplying city water in buckets instead of water mains. Grain is a semi-fluid material, and the bulk-handling system uses this fact.

Distribution of Elevators.—Although Canada and the United States are still the only countries in which grain is handled entirely in bulk through elevators, there has been a noticeable movement toward this method in several other countries and already there are examples of up-to-date elevators in Europe, Australia and the Argentine. Russia has a few dotted over her vast grain territory, and South Africa has also made a commencement. The complete bulk-handling plan adopted by the New South Wales Govt. with its chain of elevators from the grain growing districts to the ports and a 5,500,000 bushel terminal elevator at Sydney, is the most complete example of a bulk-handling system of elevators outside North America, the entire system having been constructed under the supervision of the Metcalf Co. of Montreal. The two elevators at Manchester and also that at Dock One, Buenos Aires, are examples of this type by the same company.

Capacity.—The storage capacity of the elevators of the United States is approximately 1,000,000,000 bu.; that of Canada 250,000,000 bu. and the portion of the Australian system already completed 20,000,000 bu., whilst the entire up-to-date elevator storage of the remainder of the world probably does not exceed 5% of the totals of those countries.

Construction.—Until about the end of the 19th century, elevator bins were almost universally constructed of wood, but about that time a demand for a fireproof form of construction began to be felt, owing to the heavy losses by fire and, to some extent, to the increasing price of timber. Steel plate and also tile bins commenced to take the place of those of wood, but this era did not last owing to the introduction of reinforced concrete, which has become practically universal for this class of building.

Use of Concrete.—Since the adoption of concrete as a material of construction, the size of elevator bins has been considerably increased. Circular bins of over 30 ft. in diameter are quite common, and the depth has been increased to as much as 110 feet. The square form of bin, which was almost essential in wood construction, has been largely superseded by circular concrete bins. Another marked advance since 1910 is the general adoption of individual motor drives to all units of machinery, such as belts and lofter legs, and the substitution of silent chain or double-helical gears as a means of power transmission in place of the rope drives formerly used.

Car Dumpers.—One of the most drastic changes in American elevators for many years has been in the method of unloading grain from railroad cars. Until quite recently this was done by means of power shovels. The inner grain door of the car was removed by means of a crowbar and frequently destroyed in the process. Two large scoops or shovels were then carried to the ends of the car by hand and automatically drawn back by ropes operated by drums on the line shaft. This method, although still in general use, entails considerably more man power and more time than is at all in accordance with modern ideas on grain handling. The mechanical car dumper, which automatically opens the grain door without damaging it and dumps all the grain out through the doorway of the car without any manual labour, is being rapidly adopted in the newest types of elevators.

The operation of the Metcalf car dumper is as follows: The car to be unloaded is hauled on to a platform about 58 ft. long, over rails which are in line and continuous with the track rails at either end of this platform. The car, having been run on to this platform, is automatically clamped in position. The platform, with the car, is then raised 10 ft. by means of wire cables, and simultaneously tilted sideways through an angle of 14° and the grain door rammed in. The platform with the car upon it is then tipped endways, first in one direction and then in the other, until all the grain has run out into a pit with a hoppered bottom below rail level. The grain is drawn off from this pit on to a belt conveyor, is conveyed to an elevator leg, carried up to scales above bins, weighed and distributed in the usual manner.

One of these car dumpers is capable of unloading seven 2,000-bu. cars per hour, and as there are batteries of four dumpers at the Harbour Commissioners of Montreal Elevator No. 3, the Baltimore and Ohio Railroad Company's elevator at Baltimore and the Santa Fé Railroad Company's elevator at Kansas City, each of these plants has an unloading capacity of 28 tons per minute. (L. C. H.)

GRAIN PRODUCTION AND TRADE (*see* 12.322).—According to the official statistics furnished to the International Institute of Agriculture, the production of cereals in those countries for which figures are available during the period was as follows:—

World Production of Principal Cereals (Russia and China excluded) Millions of cwt.

	Average 1909–13	Average 1919–23	1923–4	1924–5	1925–6
Wheat . .	1,590	1,621	1,836	1,627	1,753
Rye . . .	503	410	447	357	491
Barley . .	486	415	487	442	520
Oats . . .	980	948	1,062	1,019	1,094
Maize . .	1,705	1,713	1,804	1,527	1,759
Total . .	5,264	5,107	5,636	4,972	5,617

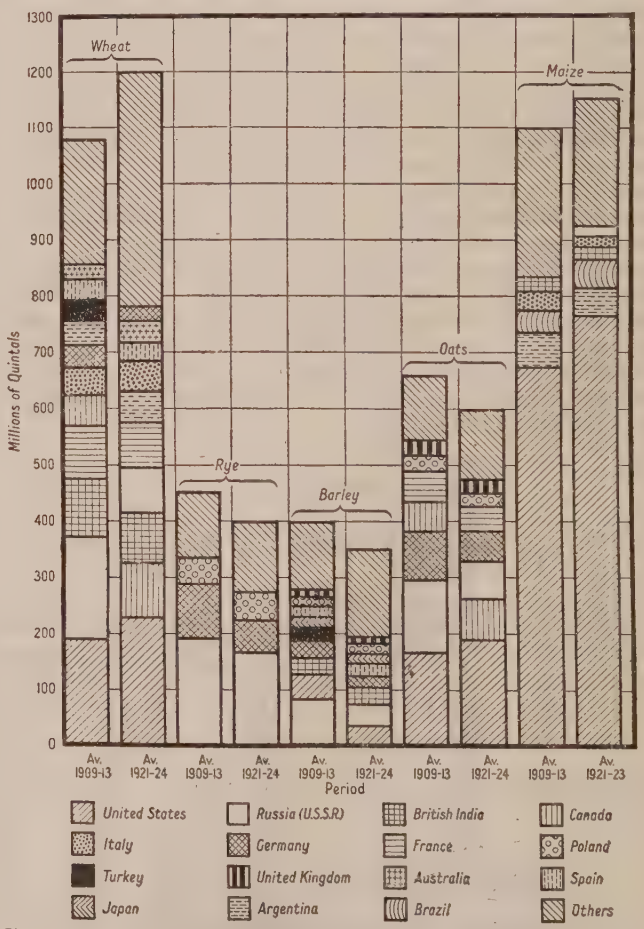

FIG. 1.—Diagram showing the average annual world production of Wheat, Rye, Barley and Oats, for the period 1909–13 to 1921–4, and of Maize for 1909–13 to 1921–3. The production in the principal producing countries for which figures are available is indicated. "Others" includes the production in Egypt, Hungary, Mexico, Rumania, Yugoslavia and the other minor producing countries, and an estimate of production in those countries for which no figures are available. The diagram is based on figures given in the International Yearbook of Agricultural Statistics for 1924–5.

These statistics do not include the crops of Russia or China, but they give an approximate indication of the yields in the rest of the world. Apart from those two countries, the world's production of these five cereals taken together on the average of the five years after the Armistice was nearly up to the pre-War average. In 1923–4 the world had an exceptionally good crop of cereals, 7% above the pre-War average, but in the following year 1924–5 the yield was poor, being 6% below the pre-War average. In 1925–6 the harvests were exceptionally good, 13% better than in 1924–5, practically equal to the good yield of two years before, and 7% above the pre-War average. According to official statistics furnished for Soviet Russia, its average yield of these five cereals for the five years before the World War was 1,247,000,000 cwt., in 1924 it was only 767,000,000 cwt., and in 1925–6 increased to 1,069,000,000 hundredweight. This last estimate was perhaps too sanguine, as the Russian harvests suffered from bad weather; but it may be said that for the world as a whole, including Russia, the yield of these five cereals in 1925 was much better than it was in 1924, and somewhat higher than the pre-War average.

These five grains form a large proportion of the food of the inhabitants of the temperate regions, but perhaps nearly as much grain in the form of rice and millet is consumed by the inhabitants of the tropical and sub-tropical countries. The world's yield of rough rice (excluding China) in 1924 was 1,613,000,000 cwt., as compared with 1,413,000,000 cwt., the pre-War average, and if statistics for China were available it would appear that in the world as a whole the weight of rough rice produced is greater than that of wheat. Of that quantity 132,000,000 cwt. was exported, as compared with the wheat export of 430,000,000 hundredweight.

I. THE WHEAT YIELD

Yield.—The yield of wheat in those areas for which comparable statistics are available was approximately as follows:—

Yield of Wheat in Millions of Quarters of 480 lb.

Area	Average 1909–13	Average 1919–23	1923–4	1924–5	1925–6
Europe (excluding Russia)	167·8	135·5	155·0	130·2	170·7
North America	112·3	145·1	160·7	143·2	137·7
Asia	48·7	49·0	52·0	50·8	46·8
Africa	12·5	12·4	14·1	11·4	14·5
Argentina	18·4	23·5	31·0	23·9	26·8
Australia	11·3	12·7	15·6	20·2	12·5
Total (excluding Russia)	371·0	378·2	428·4	379·7	409·0
Soviet Russia	94·2	..	..	47·7	82·7
Total (including Russia)	465·2	..	..	427·4	491·7

These figures do not include China and a number of unimportant countries, and it may be roughly estimated that on the pre-War average the whole world produced about 490,000,000 quarters. The statistics for Soviet Russia are not very trustworthy, but, if they be included, the totals indicate that, for the world as a whole, the wheat harvest of 1925–6 is considerably above the pre-War average. For the countries other than China and Soviet Russia, it appears that on the average of the five years after the War the yield of wheat was about equal to the pre-War average. On the average of the three years 1922–3 to 1924–5 their yield was 405,700,000 qr.—that is, 9% above the pre-War average.

If a comparison be made between the average pre-War yield and the average yield of 1922–3 to 1924–5, it appears that the average yield of Europe (excluding Russia) has decreased from 168 to 152 million qr., and there is a very large but indeterminate decrease in the yield of Soviet Russia. The average yields of Asia and Africa were much the same as before; but there was an increase in Canada from 25 to 48 million qr., in the United States from 86 to 97 million, in Argentina from 18 to 27 million, and in Australia from 11 to 16 million. These increases more than made up for the decrease in the average yield of Europe and Soviet Russia. The average yield of wheat in the whole world may be therefore roughly reckoned at about 500 million qr., of which about 50 million qr. are grown in the Southern Hemisphere and reaped in Dec. and Jan., while the remaining 450 million qr. are grown in the Northern Hemisphere and reaped at various times between March and October.

Import and Export.—As the production and consumption of wheat are much more important in the Northern than in the Southern Hemisphere, it is convenient to adopt for the world's cereal year the 12 months ending with July, just before the principal new harvests are reaped north of the equator. For cereal years so calculated the following statistics give approximately the net imports and the net exports of different areas, flour being reckoned as wheat at the rate of three of flour equal to four of wheat.

Net Imports of Wheat in Millions of Quarters

Area	Average 1909–14	Average 1914–9	Average 1919–22	1922–3	1923–4	1924–5
Importing countries of Europe	69	..	69	70	70	80
Non-European countries	13	..	12	17	30	13
Total imports	82	69	81	87	100	93
British Isles	27·0	23·9	25·6	27·0	29·0	28·3
France	5·5	10·1	7·2	5·7	6·5	3·9
Italy	6·6	9·3	11·7	14·4	8·8	11·2
Belgium	6·1	..	4·5	5·0	5·0	5·0
Holland	2·8	..	2·4	2·9	3·3	3·3
Germany	8·5	..	6·8	4·7	3·7	9·9
Czechoslovakia	..	..	1·8	1·2	2·5	2·6
Greece	0·9	..	1·4	2·0	2·3	2·7
Egypt	1·0	..	1·0	0·9	1·0	1·2
Japan	0·5	..	2·0	1·7	3·5	1·5

The figures for the War years are necessarily incomplete for some countries.

Net Exports of Wheat in Millions of Quarters

Area	Average 1909–14	Average 1914–9	Average 1919–22	1922–3	1923–4	1924–5
Russia	20·5	..	−3·0	..	2·9	−2·0
Danubian countries	13·2	..	1·5	1·0	3·0	3·2
Canada	11·8	19·7	18·4	36·4	43·1	23·9
United States	13·4	27·5	31·3	20·5	13·7	28·9
Argentina	10·3	11·9	18·7	17·4	21·5	15·3
Australia	6·6	6·4	12·5	6·1	10·5	15·3
India	6·2	3·7	Nil.	3·6	2·5	4·7
Total all exporting countries (including others not mentioned above)	82	70	81	87	100	93

Apart from the years of war, the demand for wheat from abroad of all the importing countries of the world was, on the average of the three years after the War, much the same as it was on the pre-War average, but on the average for the three cereal years completed in 1925 it increased from the pre-War 82 to 93, having risen to 100 in 1923–4, when wheat was cheap owing to the exceptionally good harvests of that year, and fallen again to 93 in 1924–5, when the price of wheat had risen owing to comparatively poor harvests.

The demand of the British Is., which import about 30% of the whole world's surplus for export, remained remarkably steady, notwithstanding great fluctuations in price, and averaged 28,000,000 qr. for 1922–5, *i.e.*, from Aug. 1 1922 to July 31 1925, as compared with the pre-War average of 27,000,000 quarters. Belgium and Holland taken together imported an average of 8,200,000 qr. as compared with their pre-War average of 8,900,000 quarters. The demand of France, Italy and Germany, which produce a large proportion of the wheat they require for their consumption, varies considerably. On the average of the years 1922–3 to 1924–5 France's import was 5,400,000

qr. compared with the pre-War 5,500,000, but it rose to 6,500,000 in 1923–4, when prices were low, and fell to 3,900,000 in 1924–5, when prices were high. Italy's import averaged 11,500,000 qr., against the pre-War average of 6,600,000 for a smaller population, but it was considerably higher in 1922–3 and 1924–5, when Italy had poor harvests, than in 1923–4, when she had a very good harvest. Germany's average import was 6,100,000 as compared with the pre-War average of 8,500,000 qr. for a larger population; and it was only 3,700,000 in 1923–4, when her own harvest was fairly good but her currency was disorganised, and rose to 9,900,000 in 1924–5, when her harvest suffered greatly from wet weather, and her exchange was on a better footing. Greece, with her increased population, has raised her average import from 900,000 to 2,300,000 quarters. Egypt's average is much the same as pre-War. Japan has raised her average from 500,000 to 2,200,000 qr., but this includes the exceptional import of 3,500,000 qr. in 1923–4, due chiefly to the effects of the great earthquake.

The many importing countries outside Europe, for which detailed statistics are not available, including China, Brazil and other tropical and sub-tropical areas, have apparently imported on the average of 1922–3 to 1924–5 about 20,000,000 qr. against the pre-War average of 13 million. They are even more ready than the European countries to increase their consumption of wheat when it is cheap and to lessen it when it is dear, and they imported much more wheat in the cheap year for wheat 1923–4, when rice was comparatively scarce and dear, than in the year before or the year after, when wheat was dearer and rice cheaper.

As regards the exporting countries, the most remarkable feature was the disappearance of Russia as an exporter. Before the War the Russian Empire on the average produced 102,000,000 qr. of wheat, more than one-fifth of the world's total yield, and exported annually 20,500,000 qr., one-fourth of the world's exports. On the average of the three years after the War, she imported 3,000,000 qr., largely as famine relief, and during the three years 1922–3 to 1924–5 she imported nearly as much as she exported. In the year 1925 she had a much better harvest. The Danubian countries also, Rumania, Bulgaria, Yugoslavia and Hungary, which before the War had an average export of 13,200,000 qr., on the average of those three years exported only 2,400,000, their average yield having fallen off from 39,200,000 to 30,000,000 qr., no doubt owing largely to the impoverishment caused by the War and to the partition among the peasants of the large estates, which formerly furnished a great part of the exports. India had before the War an average yield of 43,800,000 qr., and an average export of 6,200,000 quarters. During the five war years her average yield was 44,000,000 and she exported an average of 3,700,000 quarters. The three years 1919–21 included two poor harvests—the average yield was only 37,800,000 qr., and there was practically no net export; but the three years 1922–4 were years of good harvests, with an average yield of 45,600,000 and an average export of 3,600,000 quarters. This makes the average consumption of these three years about 42,000,000, against an average pre-War consumption of about 38,000,000 quarters. Apparently India utilised her increase of prosperity to increase her consumption of wheat, more especially as during part of that period wheat was unusually cheap and rice unusually scarce and dear.

While Europe and Asia thus failed to maintain their former supply of surplus wheat, the deficit was more than made up by North America, Argentina and Australia, although their exports varied greatly from year to year. During the five war years Canada increased her average export from 11,800,000 to 19,700,000 qr., the United States from 13,400,000 to 27,500,000 qr. and Argentina from 10,300,000 to 11,900,000 quarters. Australia's average export remained about 6,600,000 qr., the difficulty of transport over such a great distance in time of war having made it impossible to export the whole of her surplus. On the average of the three years 1919–20 to 1921–2 Canada exported 18,400,000, the United States 31,300,000, Argentina 18,700,000, Australia 12,500,000 qr.; and on the average of the three cereal years 1922–3 to 1924–5 their exports were, Canada 34,500,000, the United States 21,000,000, Argentina 18,100,000 and Australia 10,600,000 quarters. Thus on the average of these three years the requirements of all the importing countries of the world, amounting to 93,000,000 qr., were supplied approximately in the following proportions: Canada 37%, United States 23%, Argentina 19%, Australia 11%, India 5%, other countries 5%.

Consumption.—If it be assumed that the consumption of a country during a cereal year is represented by its yield plus or minus the quantity imported or exported, the following statistics give a rough idea of the consumption of certain countries for which comparable statistics are available:—

Consumption of Wheat in Millions of Quarters

Country	Average 1909–14	Average 1914–9	1922–3	1923–4	1924–5	Average 1922–5
British Isles	34·4	32·7	35·2	36·5	35·0	35·6
France	45·1	36·8	36·1	40·9	39·0	38·7
Italy	29·5	30·2	34·6	36·9	32·5	34·7
Germany	27·5	..	13·7	16·7	21·1	17·2
Canada	12·8	12·1	13·6	16·2	13·1	14·3
U.S.A.	72·3	75·2	85·0	83·5	82·7	83·7
Argentina	8·0	8·3	8·5	8·5	8·5	8·5
Australia	4·7	7·2	6·4	6·5	6·0	6·3
India	37·6	40·2	42·2	44·1	40·8	42·7

During the World War the importing countries of Europe had great difficulty in obtaining the wheat they required from abroad, and took special measures to reduce the consumption of wheat; and as a result of these measures, and of the great rise that took place in the price of wheat, several of those countries considerably reduced their average consumption. For the British Is. the pre-War average of 34,400,000 fell to an average during the War of 32,700,000 quarters. On the average of 1923–5 it rose to 35,600,000 qr., while the population increased from 45,200,000 in 1911 to 47,400,000 in 1921. During the War the French consumption was reduced from the pre-War average of 45,100,000 to 36,800,000 quarters. For 1922–3 to 1924–5 it only averaged 38,700,000 qr., although the population (including Alsace-Lorraine) was practically the same in 1922 as it had been in 1911. On the other hand, the people of Italy found it difficult to keep down their consumption of wheat, and during the War the average annual consumption increased from 29,500,000 to 30,200,000 quarters. For 1922–3 to 1924–5 it averaged 34,700,000 qr., the population having increased from 34,700,000 in 1911 to 39,700,000 in 1923. The consumption of wheat per head in Germany is much less than it was before the War, as, according to the statistics, the average consumption of 1922–3 to 1924–5 for a smaller population was only 17,200,000 qr. as compared with the pre-War average of 27,500,000 quarters. Canada and the United States, with an increased population, consumed correspondingly increased quantities. Australia during the War was unable to export the whole of her wheat surplus, and much of it was wasted or was still in the country at the end of the War. Her average consumption for 1922–3 to 1924–5 was 6,300,000 qr. as compared with 4,700,000 qr. before the War, owing chiefly to increase of population. India also had difficulty in exporting her wheat surplus during the War, and her consumption therefore increased. For 1922–3 to 1924–5 it averaged about 42,000,000 as compared with the pre-War average of 38,000,000 qr.; although the increase of population between 1911 and 1921 was only from 315,000,000 to 319,000,000.

The Question of Price

The price of wheat varies greatly according to its variety, cleanliness, purity, uniformity, strength and condition. It also varies, often very rapidly, with reported changes in the world's weather and expected changes in the relation between the world's supply and the world's demand. The cost of ocean freights is another factor in the calculation. The pre-War average freights on wheat imported into the United Kingdom were approximately per qr. of 480 lb.: from New York 2s., from Buenos Aires 3s. 6d., from Karāchi 4s. and from Australia 7s. The pre-War average prices of wheat, in importing countries, after deducting import duties, were approximately, per quarter of 480 lb.: Britain, home-grown 32s., imported 35s.; France 32s.; Italy 33s.; Germany 32s.; and Austria 37s.; and in exporting countries—Russia 33s.; United States (Chicago) 30s.; Canada (Winnipeg) 30s.; India (Karāchi) 31s.; Argentina (Buenos Aires) 31s. and Australia (Melbourne) 31s. Owing to the cheapness of ocean freights there was no great difference in the average prices in importing and in exporting countries; and hardly anywhere in the world, except in places far from the sea, or in countries where there was a high import duty, was the pre-War average price of wheat below 30s. or above 35s. a quarter.

During the War, owing to the destruction or immobilisation of many ships, to urgent military requirements and to the increase of risks, there was a great rise in ocean freights, and after a time the British Govt. took control of the whole merchant shipping of the

Empire and of the arrangements for the import of wheat, not only into Britain, but into the Allied countries also. At the date of the Armistice freight rates being paid for wheat per qr. to the United Kingdom were—from New York 50s., from Buenos Aires 48s. and from Karāchi 53s. After the Armistice the control of shipping was maintained for a considerable time, but the rates of ocean freight fell very rapidly, and by Dec. 1920 (when the movements of shipping were practically freed from control) the rates were approximately—from New York 8s., from Buenos Aires 8s. 7d., from Karāchi 9s. 1d. and from Australia 22s. 6d. After that date there was a further great fall in these rates, and in Nov. 1925 they were approximately—from New York 3s., from Buenos Aires 3s. 4d., from Karāchi 4s. 3d. and from Australia 8s. 9d.—that is to say, freight rates were not very much higher than before the War, and as prices were about 55% higher than before the War this meant that shipowners in 1925 brought wheat to Britain on payment of only about two-thirds of the pre-War value in commodities. This great fall in the commodity value of freight rates was no doubt mainly due to the fact that the world's gross tonnage of seagoing steel and iron steamers had increased since 1914 by 38%, while the quantity of merchandise requiring cargo space was less.

In order to trace the course of the world's price of wheat during the period 1913–25, it will be sufficient to quote the prices of wheat about the middle of Nov. (when it is usually possible to frame an approximate estimate of the yield of the harvests in the northern hemisphere and of their probable yield in the Southern Hemisphere) for Chicago and Winnipeg as representing the exporting countries, and for London or Liverpool as representing the importing countries, to which may be added the average price obtained about that date by farmers in England and Wales for home-grown wheat, according to the corn trade returns.

Price of Wheat about Nov. 15

Year	Chicago cents per 60 lb.	Winnipeg No. 1 Manitoba, cents per 60 lb.	London or Liverpool No. 1 Manitoba, shillings per 480 lb.	England and Wales Home-grown shillings per 480 lb.
1913 .	88	83	34	31
1914 .	114	119	48	35
1915	108	104	57	53
1916 .	184	200	77	69
1917 .	217	221	83	70
1918 .	223	224	80	72
1919 .	227	224	78	73
1920 .	188	211	116	90
1921 .	119	111	50	46
1922 .	117	106	49	42
1923 .	105	97	44	40
1924 .	156	167	66	54
1925 .	164	140	55	48

During the War the price of wheat rose rapidly both in exporting and in importing countries. After the Armistice, the price of wheat continued to rise for a time, and in July 1920 wheat sold both in Chicago and Winnipeg at about 280 cents per bushel—more than three times its pre-War price. Soon after that date government control began to be removed and freights and prices rapidly fell, and by Nov. 1921 the price of wheat at Chicago was only 119 cents per bushel and at Winnipeg 111—that is, only about 35% above the pre-War average. In the following two years there was a further fall, and in Nov. 1923 the prices quoted were at Chicago 105 and at Winnipeg 97—that is, less than 20% above the pre-War price. Similarly in the British Is. the price of wheat rose until in Nov. 1920 No. 1 Manitoba wheat was being supplied by the Govt. at 116s. per qr., and the British farmer was being paid about 90s. per qr. for home-grown wheat. These prices again were about three times the pre-War prices, but it must be remembered that they were reckoned in sterling, and that in that year the British paper pound was only worth about 75% of the gold sovereign. After control was removed there was a very rapid fall in the price, and by Nov. 1921 Manitoba wheat was selling in Liverpool at 50s. per qr. and British wheat was sold at 46s.—that is, about half the price obtained 12 months before. There was a further fall of price in the following two years, and in Nov. 1923 Northern Manitoba wheat sold at 44s. and British wheat at 40s. per qr. or only about 30% above the pre-War price.

These very low prices in 1923 were no doubt mainly due to the exceptionally good harvests of that year, both in Europe and in the world as a whole, and to the impoverishment of the importing countries of Europe. The low price continued through the winter of 1923–4; but after May 1924 drought developed in south and southeastern Europe, and Canada and central and northern Europe suffered a cold, wet summer, and it became evident that the harvest in the Northern Hemisphere as a whole would be a poor one. The world price of wheat accordingly rose rapidly until at the end of Feb. 1925 the price of No. 1 Manitoba in Liverpool was 76s. 6d.—61% above its price 12 months before. It then came to be realised that this price was higher than was justified by the prospects, and the price fell rapidly in March and April to about 60 shillings. In consequence of the good harvests of 1925 in the Northern Hemisphere it fell further to 55s. in the middle of Nov. 1925, but then rose again owing to the disappointing harvests in the Southern Hemisphere, and in Jan. 1926 was about 62s.—almost double the pre-War price, while the British farmer was getting 53s. a qr. for his home-grown wheat—about 70% above the price of 1913.

(J. Wi.*)

II. THE GRAIN MARKETS

Great Britain is the only country where the demand for imported wheat is constant and extensive. There are many others which import wheat from time to time, but merely by way of supplement to their home-grown food crops. These circumstances have resulted in the establishment of the London grain trade in the commanding position of the chief market of the world, primarily for wheat business, but also for maize, oats and barley. It is not only for delivery in London itself that this trade is done. A very large portion is for other destinations, and cargoes for ultimate discharge in Scotland, Ireland or Wales, at Dutch, Belgian or German ports, or even in the Mediterranean, are bought and sold by London brokers, on the accustomed basis of London contracts. A considerable business in grain from overseas which does not enter London is registered daily in the grain trade journals, cargoes of wheat and maize forming the greater portion.

The usages and terms of the London market are matters within the competence of the London Corn Trade Assn., a corporate body including members of all grain trade firms of consequence, in Great Britain, on the continent of Europe, and among exporters from North and South America, from India, Australia and Africa. Brokers and traders in all the principal towns of Britain, and millers with establishments in many parts of the world, find it advantageous to belong to the London Corn Trade Association. Most of those not strictly connected with London are also members of their own local associations, of which the Liverpool Corn Trade Assn. is the most important, and is followed by those of Hull, Bristol, Leith, Antwerp, Hamburg, Genoa, etc. The main object of these associations is the protection of the common interests, by defining terms of contract, by providing for arbitration in cases of dispute, and by taking measures to uphold the rights of traders against infringement. The predominance of North America among the grain markets of the world is an outstanding fact, and it is not too much to say that the wheat quotations of Chicago and Winnipeg are those most regarded as deciding the course of the world's grain trade from day to day. In some seasons the Chicago price is all-important, in others it shares supremacy with Winnipeg. The qualities quoted are so well known that is is needful only to mention No. 2 Winter or No. 1 Manitoba in order to afford a definite basis of transactions. In this respect the business in North American grain is done on terms differing from those adopted by other exporting countries.

In the United States and in Canada the system of government inspection of grain for settling grades is very efficient, and the certificate of the government inspector is accepted as final. By far the greater part of the grain business in the United States is in connection with produce intended for internal consumption or manufacture, and the terms agreeable to American buyers have therefore to be accepted by exporters from the United States. In Canada the relative size of overseas trade is much greater, but the system of inspection and grading is even more precise than in the United States, and is accepted by exporters. In dealing with Argentina, whence the tropical passage may cause the grain to deteriorate on the voyage, the contract basis throws this risk on the shoulders of the exporter in South America, and wheat is sold with a guarantee of natural weight to be verified at discharge of the grain. Wheat from Australia is sold as fair average quality at time and place of shipment, and similar stipulations are made in the special contract form for Indian wheat, with a guarantee in case of damage by weevil, or deterioration by the excessive mixture of barley or any other extraneous matter.

By far the larger portion of the world's wheat crops finds its way to the flour-mill, though some considerable quantity is used for cattle or poultry food. The miller, therefore, may be set down as the ultimate buyer of wheat. With the gradual consolidation of mills under the management of a few leaders of the industry, each of these millers has become, individually or in his corporate capacity, a very important factor in the grain trade. He is, in most cases, the original buyer of grain for British ports, to be discharged direct from the ship into his warehouse communicating with the mill by grain elevators and conveyors. In the British grain trade of to-day there is very little scope for the merchant who formerly purchased a wheat cargo for apportionment in suitable quantities amongst millers. The miller does not manufacture flour entirely from one cargo, or even from one sort of wheat. In the ordinary way, when supplies from various exporting countries are plentiful, he will probably mix three or four different kinds, in carefully defined percentages, in order to provide the baker with just such flour as he has been accustomed to sell to the public.

In most of the exporting countries there are well-established firms who employ agents to buy from the farmers, and thus collect adequate quantities for loading their chartered ships. In countries such as Canada and Australia the farmers themselves have formed pools or syndicates, with managers who negotiate with exporters. In the United States, grain export business is so interdependent with future trading that it may be more conveniently treated under that heading. With the exception of relatively small parcels of wheat, very little is sold on the corn exchanges after arrival. It has become the practice for millers to buy, even for their minor requirements, when the grain is still overseas or on passage. It is also customary for bakers to contract two or three months ahead for flour to be delivered, and these contracts are sometimes made with Canadian, Australian and American millers.

Futures.—Apart from direct sales of overseas wheat to millers, considerable business is done by traders who buy wheat for shipment and, either immediately or later, sell a similar quantity for delivery at a future period. This future delivery trading, known also as *marché à terme* or *mercado á término*, originated in the United States and has been established at Liverpool for nearly half a century. It was adopted at Buenos Aires in 1908 and is now carried on at Winnipeg. There are future delivery exchanges, including grain contracts, at Antwerp, Paris, Berlin, Genoa, etc. At Chicago and Buenos Aires futures trading is established for wheat, maize and oats; at Winnipeg for wheat and oats; in all three and in Liverpool wheat absorbs the chief attention. It may be considered as essential that, to avoid cornering, a future delivery exchange should have an ample available supply of such qualities of wheat as are in favour with millers; in other words, the exchange should be located on a main route of transit between the grower and the consumer. Unless this condition is fulfilled the business organisation seldom succeeds.

By means of one or other of these exchanges the farmer can, if he chooses to do so, sell his crop of wheat whenever the price suits him, months before it is ready for the reaper, and thus practically eliminate any risk of falling prices. The miller who has purchased a cargo of wheat can sell an equal quantity in the form of contracts for future delivery. Naturally, he will not find this course desirable unless there is an apparent profit between the price paid for his cargo and that obtainable for future delivery of wheat. He has also to buy wheat for his mill, and if he sells the contracts for future delivery his next enterprise is to sell the flour to be manufactured later, and as he achieves this to buy in his wheat contracts. He thus makes four transactions in place of the simple purchase of wheat abroad and the sale of flour at home. He has safeguarded himself against market losses, and is ready to continue his day-to-day disposal of the flour. It will be noted that in selling wheat for future delivery in a given market he has to rely upon others for fulfilment of these wheat contracts, for he does not intend to deliver from his purchased cargo; hence it is clearly his aim to deal only on markets where there is a steady influx of wheat.

This series of transactions needs only to be multiplied indefinitely, and attributed to traders who are not millers, in order to form a basis of opinion on the grain futures markets. Speculation of course exists, and may carry prices too high or too low. Fluctuations in quotations for future delivery are often extreme and very rapid, for on receipt of some information affecting crops the first interpretation of its meaning is shown in the future delivery market. Sharp fluctuations are not, however, always misfortunes. The purchaser of a wheat cargo who has duly sold futures against it may find that his contracts for sale can be repurchased at a discount of say 3 %, and that he can resell his cargo at a discount of 2 %. He may probably do the business both ways and come out with a net profit of 1 %; he has sacrificed 2 % on the original price of the cargo, but the sacrifice is more than compensated by the 3 % gain on the future delivery side.

Future trading involves, in effect, a daily settlement by seller and buyer alike of difference in price arising from market fluctuations, and a payment by both parties at the time of making the contract of a cash margin according to the regulations which form part of the contract stipulations. In all four markets, Chicago, Winnipeg, Buenos Aires, Liverpool, the grain trade clearing house attends to these matters, keeping a registry of the contracts entrusted to it by members of the association which carries out the future delivery business; non-members are not recognised by these associations as entitled to obtain this security of position. The penalty for non-payment of differences at the appointed time is the immediate sale or purchase, as the case may be, of all contracts standing in the name of the defaulting member in the clearing-house registry. These powers are entrusted by their own members to the Liverpool Corn Trade Assn. to the Chicago Board of Trade, the Winnipeg Grain Exchange and to the Buenos Aires *Mercado á Término de Cereales*, respectively.

At Chicago, which is by far the greatest grain futures market, there has always been an avoidance of strictness in procedure as regards details, and a resulting immense business in contracts for future delivery. The trade is in contracts for future delivery, not in wheat for future delivery, and it is not surprising that this business in contracts should annually reach an aggregate far exceeding the U.S. yearly wheat crop. The tenderable descriptions of wheat comprise many varieties; in practice, Hard or Red Winter wheat is the effective basis. There are certain specified places where delivery may be made, and American farmers make great use of the Chicago Board of Trade.

At Buenos Aires the Mercado á Término not only registers the contracts submitted to the clearing house, but in consideration of a small fee takes up the contracts with buyer and seller respectively, accepting the responsibility towards each party during the currency of the contract. It therefore devolves upon the Mercado to call for sufficient margin, and to collect the day-to-day differences. Naturally the Mercado, in its own interests, keeps strict watch over the extent of trading done by its members, and the managers can call for increased margins if they are dissatisfied with the position created. The basis of the wheat contract is the typical wheat of the country in sound condition, with the proviso that the natural weight attains the requisite standard. Delivery may be made at any railway station in the republic, with adjustments for transport expenses just as is customary in transactions for immediate delivery.

In Liverpool wheat may be delivered from any of the following descriptions: American winter or spring Manitoba, Argentine or Australian, provided that the sample fulfils the requirements of grade.

Maize.—The trade in maize is a very large one, though not equal to that in wheat; except in Mediterranean and Danubian lands all maize consumed in Europe is imported, chiefly from Argentine and South Africa. Although the enormous maize crop in the United States comprises three-fourths of the world's yield of maize, very little of it is sent abroad; the United States are not usually sellers of maize on European markets, though it is generally possible to buy this grain from them for special requirements, by paying a moderate premium. The course of prices for maize is governed by quite different factors from those which affect the wheat market. The extent of consumption in some European countries varies greatly at different seasons of the year, for droughts may reduce the hay and fodder crops and throw the demand on maize, or a season favourable to field growth may curtail requirements seriously. The United States maize crop is chiefly consumed locally, for hog or cattle feeding, and most of it is therefore never sold as maize on the open market. Any examination of market conditions in the United States is therefore incomplete unless the meat and provision trades are also studied. Of all the varieties of grain brought from overseas, maize requires the most care in selection for an ocean voyage. It contains a larger percentage of water than does wheat, and is also more likely to spoil by heating, if put on board soon after harvest or in the summer weather of six or eight months later.

Barley.—Most of the oversea trade in barley is in the varieties suitable for malting or distilling; compared with wheat or maize the business is small, and in few hands. On the British markets, the supplies of home-grown barley and those of all kinds of foreign barley are about equal in quantity, so that brewers and maltsters can select the desired quality from either source. The suitability of barley for malting is one of the technical studies of the grain trade, and a really accurate judgment on a particular sample is not an easy matter. California and Canada are the main exporters of good malting barley, but these crops are seldom equal in quality to that of England. Russian and Danubian barley are classed much lower down than Canadian, but generally contain a valuable percentage of grains fit for malting, separable by machine.

Oats.—The British trade in oats is chiefly in home-grown grain; of the country's ordinary requirements over 80 % is produced in the British Is., and a very large proportion is used locally for dairying or other cattle food, or horse provender. Imported supplies are chiefly from North America.

Rye.—Finally, rye enters little into trade in Great Britain. The great producing countries are Russia, Poland and Germany, whence supplies are drawn for Belgium and Holland also. Germany is sometimes a buyer and sometimes a seller, while Russia, with an immense production, did not offer to sell for export in 1925, except during harvest time. Except under the stimulus of high post-War prices the United States has not grown rye at all freely, and now exports but little. (J. H. Hu.)

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GRAMOPHONE: *see* PHONOGRAPH.

GRAND RAPIDS, Mich., U.S.A. (*see* 12.350), had a population of 137,634 in 1920 of whom 28,355 were foreign-born, including the largest colony in the country from The Netherlands (11,422). In 1925 the official estimate was 153,698. Annexations of territory in 1915, 1924 and 1925 increased the area to 22 square miles. While the city kept its title as "the furniture capital of America," the manufacture of aeroplanes and other essential products during the World War led to the permanent expansion and further diversification of industries. The commission-manager form of government was adopted in 1916. The aggregate value of manufactured products rose from $42,231,100 in 1909 to $109,135,000 in 1919, and, after a slight decrease in 1921, to $130,277,997 in 1923. In 1925 a reconstruction of the city was under way in conformity with a comprehensive city plan, adopted in 1922. The public schools were in process of reorganisation and a junior college had been added; there was a supervised playground within half a mile of every child's home; the filtration plant, built in 1914, had been doubled in size; a sewage disposal plant was under construction; several fine hotels, hospitals and office buildings had been erected. Grand Rapids is second only to Des Moines in the proportion of homes owned (50·2% in 1920). It has a high proportion of children at school, a small amount of child labour, a low percentage of illiteracy, a low general death-rate and a low infant mortality.

GRANT, DUNCAN (1885–), British painter, was born at Rothiemurchus, Inverness-shire, son of Major Bartle Grant, and was educated at St. Paul's School, London. He early showed his remarkable decorative sense, working with Roger Fry at the Omega Workshops, London, and at the same time produced some highly individual painting. His early work included "The Lemon Gatherers" (1911), now in the Tate Gallery, and the "Seated Woman" (1912). Modern French influences, particularly those of Cézanne, made themselves strongly felt in his design and brushwork, as may be seen in the "Tightrope Walker" (1918), "Snow Scene" (1921), "The Hammock" (1923) and many still-life pictures of this period. Grant, who became a member of the London Group, also carried out interesting domestic and scenic, decorations and designs for embroideries. See Duncan Grant, *A Collection of Plates*, with introduction by Roger Fry (1923).

GRANVILLE-BARKER, HARLEY GRANVILLE (1877–), British playwright, was born in London Nov. 25 1877. At the age of 13 he was sent to the Theatre Royal, Margate, then a combination of stock company, theatre and dramatic school. He first appeared in London in the following year, at the Comedy Theatre, under Charles Hawtrey. His first play, written in 1893, was produced by amateurs. From 1895 onwards he acted in a variety of plays, in Shakespeare with Ben Greet, and, with William Poel, in *Richard II.* and Marlowe's *Edward II.* In 1899, his play *The Weather-hen* (written in collaboration with Herbert Thomas) was produced in London. In 1900 he became interested in the newly formed State Society, first as actor, then as producer, and his own play, *The Marrying of Ann Leete*, was produced by the Society in 1901. In 1903 he collaborated with William Archer in the framing of *A Scheme and Estimates for a National Theatre.* In 1904 he joined J. E. Vedrenne in the management of the Court Theatre, London. There, during three years he produced, and at first acted in, a variety of plays by Ibsen, Bernard Shaw, St. John Hankin, John Galsworthy, John Masefield, Maurice Hewlett, Gilbert Murray (translations from Euripides) and his own *The Voysey Inheritance* (1905). In 1906 he published *Prunella* in collaboration with Laurence Housman. A later play, *Waste* (1906), was banned by the Censor, but was privately performed by the Stage Society. *The Madras House* (1909) was produced by the Frohman Repertory Company at the Duke of York's Theatre in 1910, and a revised version of it was revived in 1925. By 1910 he had given up acting, but until 1914 produced plays in London, including two by Shakespeare upon a platform stage with "conventional" decoration. After the War he maintained no active connection with the Theatre. He published various other works, including *The Exemplary Theatre* (1922), dramatic criticism, also translations of several foreign authors. He was public lecturer on the art of the theatre to the University of Liverpool in 1921–2 and he delivered the British Academy Shakespeare lecture in 1925.

GRAPHS: *see* STATISTICS AND GRAPHS.

GRAVITATION: *see* ASTRONOMY.

GREAT BRITAIN.—The following article is a continuation of the one on the UNITED KINGDOM (*see* 27.598). The change in title is rendered necessary by the altered political status of Ireland. As the change took place during the period under review reference must necessarily be made to Irish affairs, but primarily the article is concerned with Great Britain only (*i.e.*, England with Wales and Scotland), with the lesser islands belonging thereto. It deals with seven matters: (I.) Constitution; (II.) Local Government; (III.) Defence; (IV.) Finance and Banking; (V.) Population; (VI.) Industry and Trade, including agriculture; (VII.) Communications. (*See* also BRITISH EMPIRE; ENGLISH HISTORY; IRELAND, NORTHERN; IRISH FREE STATE; SCOTLAND; WALES.)

I. CONSTITUTION

The years 1910–25 were momentous in the history of the British constitution. They opened with an acute struggle between Lords and Commons which has left a permanent mark on the constitution, in the shape of the Parliament Act. Four years later, with the outbreak of the World War, the country entered on a period of arrested development; a truce was called between the two great political parties and a kind of constitutional moratorium declared in which the operation of the Parliament Act, alike in its application to the duration of Parliament and to the machinery of legislation, was arrested; two statutes, the Welsh Church Act and the Government of Ireland Act, which had been forced through under its automatic action, were suspended.

During the same critical period many rules of the constitution—some statutory, others conventional—were also in abeyance; the re-election of Ministers, on acceptance of an office of profit under the Crown, was one; the cabinet system, in its normal aspect, was another. A kind of super-cabinet, known as the War Cabinet, came into existence, and with it another constitutional novelty, the "Cabinet Secretariat" as a liaison between the Government departments. The liberty of the subject, as the result of that *lex regia* the Defence of the Realm Act and its successors, coupled with a latitude of judicial interpretation which reached its high-water mark in *Rex* v. *Halliday* (*ex parte Zadig*), underwent severe restrictions, and, for the period of the

War and some time beyond it, the country lived under a kind of statutory martial law as unprecedented in its history as the tremendous struggle which necessitated it.

Return to Constitutional Principles.—With the end of the War and the return to normal conditions of existence, constitutional principles reasserted themselves. The courts of law, always jealous of the liberty of the subject, administered severe and salutary checks to the encroachments of the executive, and a series of remarkable judicial decisions, most notably *Chester* v. *Bateson* ([1920] 1 K.B. 829) declared one "D.O.R.A." regulation after another *ultra vires*, while at the same time, in the great constitutional case of *De Keyser's Royal Hotel* v. *the King* ([1920] A.C. 508; [1919] 2 Ch. 197), the courts asserted, if they did not actually extend, the right of the subject to sue the Crown by petition for losses sustained as the result of the exercises of the prerogative in the matter of requisitions. The Defence of the Realm legislation lapsed with the efflux of time, though not the bureaucratic temper to which it ministered, and Parliament, in endowing the executive with somewhat similar powers, in cases of "emergency," under the Emergency Powers Act 1920, was careful to impose the most stringent parliamentary checks upon their exercise. As the result of the De Keyser case, the executive found itself threatened with thousands of claims for compensation, and an Indemnity Act, imposing a time-limit upon such claims and establishing a special procedure for dealing with them, was placed on the Statute Book. The Act had been most jealously scrutinised in its passage through the legislature, and it soon became apparent that Parliament was as little inclined as the judiciary itself to tolerate a continuance of the usurpations of the executive, whose sole justification had been their temporary character. With the fall, in Oct. 1922, of Mr. Lloyd George's Coalition administration, the conventions of the constitution resumed their sway.

Statutory and Other Changes.—It would, however, be a great mistake to regard post-War conditions as testifying to a mere reversion to type. Great statutory changes of a permanent character took place, the most notable of which were the Representation of the People Act 1918, the Parliamentary Qualification of Women Act 1918, and the Sex Disqualification Removal Act of 1919, statutes which, among other things, effected a complete revolution in the civic position of women, removing, as they did, all disqualifications of sex for admission to the franchise, to a seat in the Commons, to service on juries and all public functions. Constitutional changes of equal magnitude were effected by the grant of self-government and Dominion status to Southern Ireland, and by the establishment of representative legislatures and, in some measure, of self-government in India (*see* INDIA). Equally important were the developments in the status of the Overseas Dominions (*see* BRITISH EMPIRE; CANADA, etc.).

Many statutes of considerable constitutional importance, dealing with legal procedure and the administration of justice, were enacted during the years 1920–5, such as the Administration of Justice Acts 1920 and 1925, the Judicature Act 1925, the Criminal Justice Act 1925; and for a long time two such fundamental rights of the subject as procedure by indictment before a grand jury and trial by jury in civil actions at common law were seriously threatened as the result of innovations during the War, which, long after its termination, appeared likely to perpetuate themselves by statute. Another Act of considerable constitutional importance was the British Nationality and Status of Aliens Act 1918, which amended the British Nationality and Status of Aliens Act of 1914. The period under review was also notable for the number of leading cases in constitutional law. Moreover, the growing political consciousness of the working classes had, even before the War, been productive of new conditions, some permanent, others transient. One was the judicial decision known as the Osborne case (*Osborne* v. *Amalgamated Society of Railway Servants* [1909] A.C. 87), resulting in legislation (the Trade Union Act of 1913) for the protection of minorities against the political levy on members of trade unions; another, of which the issue has yet to be seen, was the claim to the active exercise of political power. The policy of direct action, *i.e.*, the exercise of political pressure upon the Government of the day by resort to the weapon of a general strike, was the immediate cause of the action of Parliament in conferring drastic powers on the executive, in case of emergency, to deal by proclamation with any such threats to the normal economic life of the community. The Govt. exercised this power effectively during the general strike of May 1926.

The appearance of a minority Government in 1923 raised a constitutional question, long dormant, namely the right of a Prime Minister, even though in a minority in the House of Commons, to ask and receive authority from the King to dissolve Parliament. This was a question as to which there could be no real doubt in the minds of those acquainted with constitutional developments since 1858, but none the less it had been the subject of much dispute when Mr. Ramsay MacDonald accepted office in Jan. 1924. His exercise of this prerogative of the Crown in the following Oct. may be said to have settled the question beyond further dispute.

The Parliament Act and Other Measures

Parliament.—The enactment of the Parliament Act in 1911, consequent upon the rejection of the Finance Bill by the House of Lords in the preceding year, limited the authority of the House of Lords. (*See* ENGLISH HISTORY.) It was an emergency measure, designed to secure the immediate passage into law of a Liberal Govt's. legislation. The preamble recognised this to the extent of admitting the necessity of further legislation "to substitute for the House of Lords as it at present exists a second chamber constituted on a popular instead of a hereditary basis." The implied promise has never been redeemed and the problem still awaits solution, a solution that has become all the more imperative in view of the vast extension of the franchise effected by the Act of 1918, the peculiar sensitiveness of post-War governments to public opinion, and the appearance on the political scene of a new and powerful party whose avowed object is to revolutionise the economic basis of society by legislation. Nor did the authors of the Act foresee its constricting effect upon the legislative procedure of the House of Commons itself. The confusion in which the Government of the day found itself involved in its financial legislation during the session of 1914 was an indirect consequence of the Parliament Act, for new questions as to the legitimacy of tacking non-financial provisions on to finance and revenue bills were raised.

The discretion given to the Speaker under the Act, of deciding whether, in giving or withholding his certificate, a bill comes within the new statutory definition of a money bill, has invested his ancient office with a judicial authority the particular exercise of which no government can foresee. That authority has hitherto been exercised with the complete independence characteristic of the Speaker's office, but the new powers conferred upon him, constituting as they do the sole constitutional safeguard against sudden and revolutionary legislation by a party temporarily in a majority in the House, may yet expose the office to political capture—to quote the expression of the Trade Union Congress in Oct. 1924.

The effects of the provisions of the Parliament Act confining the Lords to a suspensory veto in ordinary, as distinct from financial, legislation have been less apparent, as only two measures had, up to the end of 1925, been forced through under their operation; but they have invested the process of legislation in the Commons with a new rigidity, owing to the necessity of any bill, which is to take advantage of the automatic machinery of the Parliament Act, retaining the character of the same bill in each successive session. An incidental result is the restriction of the right of private members to propose amendments to a government bill, by way of suggestion, in its later and automatic stages.

The constitutional crisis of 1910–1 was productive of another statute, equally novel but much less revolutionary in its character—the Provisional Collection of Taxes Act. That crisis disclosed the fact, long known to constitutional lawyers, that the budget resolutions under which duties are collected have no legal force, and, as the result of the case of *Bowles* v. *the Bank of England* ([1913] 1 Ch. 57), it was found necessary to enact a statute giving, for the future, statutory effect, for a limited period of time, to Ways and Means resolutions varying or renewing taxation imposed during the preceding financial year.

The procedure of the House of Commons during the period under review has undergone little change and the problem of how to secure more effective control of the House over the estimates remains exactly where it was. It is essentially a problem of parliamentary time, which is limited, and the increasing devolution of the legislative functions of the whole House to standing committees has, with the increasing demand for legislation, not solved the question. A new departure was made in 1921 by the appointment of an estimates committee, but it is confined by its terms of reference to considering what economies can be effected "consistent with policy," which in practice means that it had no power to deal with questions which Ministers choose to regard as outside its jurisdiction. The mere fact that its reports are presented after Supply is concluded has deprived it of any effective voice in the control of expenditure.

An interesting departure in the grant of legislative autonomy to the Established Church was effected by the Church of England Assembly Powers Act of 1919. Under the Act powers of legislation are delegated to the newly constituted National Assembly of the Church, but subject always to the control of Parliament to be exercised through an "ecclesiastical committee" consisting in equal numbers of members of both Houses. Upon the report of this committee, measures submitted by the Assembly shall, if approved by a resolution of both Houses, be presented to His Majesty for the royal assent in the same form as a bill. The co-ordinate authority assured to the House of Lords by this Act, and the legislative independence secured to members of both Houses, is a noteworthy departure, but the legislation contemplated does not, of course, partake of the character of a government bill. None the less the Act is a noteworthy experiment in devolution.

The Electorate.—The electoral changes effected by the Representation of the People Act were immense, far surpassing in magnitude the three Reform Acts of the preceding century. Not only did it enfranchise women and add no less than 13,000,000 electors to the register, but it also altered and simplified the law of registration, effected a redistribution of seats, abolished the property qualification and, much more questionably, removed the pauper disqualification. At the same time it reduced the qualifications for the exercise of a vote, in the case of men of 21 years of age, to the simple requirement of six months residence, or, in the alternative, occupation of business premises, either or both of which might confer the right to vote, not more than two votes being so conferred. In the case of women the minimum age is 30, and the basis of qualification has to be sought in the local government franchise. Innumerable other changes in the machinery of registration and election were effected by the Act. Taken in conjunction with the two Acts previously mentioned its effect is, except in the matter of age, to assimilate the civic status of women entirely to that of men. A curious anomaly exists, however, in regard to the position of peeresses. The wife of a peer may be elected to the House of Commons, but a peeress in her own right may neither be elected to the Commons nor take her seat in the Lords: this was the decision of the Committee of Privileges in *Viscountess Rhondda's Claim* (1922).

The Cabinet and the Ministry.—An important, if limited, change in the law governing the acceptance of office by Ministers was effected by the Election of Ministers Act 1919. Temporary measures had been passed during the War relieving new Ministers on appointment from the necessity of seeking re-election; the Act in question perpetuated this departure, to the extent of providing that no member on appointment should in future vacate his seat if his acceptance of office should take place within nine months after the issue of a proclamation summoning a new Parliament. For such a measure there is much to be said, in that it dispenses with the necessity of a whole Ministry, constituted on the resignation of its predecessor after a defeat at the polls, from being subjected to the hazards of a by-election. In 1926 the House of Commons passed a measure designed to dispense altogether with the necessity of seeking re-election on the acceptance of office.

Some of the new ministries created during the War disappeared, but four became permanent—Pensions, Labour, Transport and Air, the last being responsible for the creation of a new Secretaryship of State. The number of Secretaries of State was further raised to seven by the Secretary for Scotland being raised to that dignity. The status of the Dominions overseas has been recognised by the creation of a Secretaryship of State for the Dominions, but though legally distinct from the Secretaryship for the Colonies it is united with it in the person of one and the same minister. The Local Government Board was reorganised and renamed the Ministry of Health. With the establishment of the Irish Free State the Irish Office was abolished and Irish affairs were transferred to the Colonial Office.

The immediate result of the War appeared to be the exaltation of the position of the Prime Minister to a personal ascendancy incompatible with the principles of cabinet government. The institution of the War Cabinet, whereby a small inner council of Ministers freed from all administrative duties decided all questions of policy—other Ministers being summoned to these deliberations at the discretion of the Prime Minister communicating with them through his own secretariat—could only be justified in time of grave national peril. The result was to place in his hands an almost exclusive power of initiative in Cabinet business, and to undermine the time-honoured principle of the collective responsibility of Ministers. The evil results of this system were manifest long after the War, with effects upon ministerial discipline which were forcibly illustrated by the circumstances attending Mr. Montagu's resignation of the seals as Secretary of State for India.

The disappearance of the War Cabinet, and of the Coalition Govt. of which it had been the offspring, marked a return to normal procedure. In two respects, however, the ascendancy of the Prime Minister would appear to have become permanent: one is that the Permanent Under-Secretary to the Treasury has come to be regarded as the head of the whole civil service, and as an official through whom the Prime Minister may exercise a certain degree of authority over all departments otherwise than through the Ministers in charge of them—possibly an anomalous position; the other is the precedent created by Mr. Asquith when he obtained from the King before the dissolution of 1910 a contingent guarantee that if the Government were successful at the polls such a number of peers would be created as the Prime Minister might think necessary to secure the passage of the Parliament Bill into law.

In one important respect the precedents created by the War Cabinet have left their mark on the constitution. The Cabinet Secretariat, although completely disestablished as an instrument in the hands of the Prime Minister, survives to the extent that minutes of Cabinet proceedings are now kept by a permanent official, who is thus placed in a position of peculiar delicacy if not of peculiar authority. The tradition of "Cabinet secrecy" is to that extent changed. The departure has been much criticised by constitutional purists, but the exact position is obscure.

The Executive.—The outstanding constitutional problem is the continual encroachment of the executive either by using the prerogative or by the presumed exercise of statutory powers, upon the rights and liberties of the subject. The only safeguard against this tendency is the vigilance of Parliament and the independence of the judiciary. The term of office of the Labour Govt. was marked by an attack by the Prime Minister upon the independence of the judiciary in the person of Mr. Justice McCardie, who in the case of *O'Dwyer* v. *Nair* (reported in *The Times*, May 1–June 6 1924) had made certain observations on the attitude of the executive in the case of General Dyer. For this Mr. Justice McCardie was severely criticised in the Commons by Mr. Ramsay MacDonald. On behalf of the judge it was urged that the subject-matter of the judge's remarks was directly raised by the defendant in his plea of justification, and was therefore such as the judge was bound, by the duties of his office, to deal with. The claim put forward by the Prime Minister to the immunity of the executive from judicial criticism was a far-reaching one.

In the *Board of Education* v. *Rice* (1911) the court of appeal and the House of Lords had reminded a department that "it is not an autocrat free to act as it pleases," and had granted rules for the issue of writs of *mandamus* and *certiorari* to control its arbitrary disregard of the law in the exercise of the semi-judicial powers conferred upon it by the Education Act. In *Dyson* v. *the Attorney-General* ([1911] 1 K.B. 410, and [1912] 1 Ch. 158), the Court laid down for the first time that a subject threatened with penalties by the revenue authorities, for non-compliance with interrogatories which were *ultra vires*, had the same right of access to the courts for a declaration of the law against the executive as if the defendant were a private person. These cases are only two out of many. The whole subject is both too large and too technical to be dealt with here, but reform is urgent in two directions: (1) in the assimilation of the rights of the subject to sue the Crown to his rights against a private defendant, (2) in the restoration of both judicial and parliamentary control over the exercise of powers of "subordinate legislation" by Government departments. In one respect there has been a notable reform—namely, the Acquisition of Land (Assessment of Compensation) Act of 1919. This statute provides that where, in the pursuance of any statutory power, land is acquired compulsorily by any government department or local authority, the right of the owner to the assessment of compensation by an independent arbitrator, instead of an official valuer, is to be restored.

The Liberty of the Subject.—For some months during the War the subject was deprived of his rights to trial by jury even in criminal cases, under the Defence of the Realm legislation, but the suspension of this right was short-lived. In the case of the right to a jury in civil actions the situation was much more serious. For seven years, from 1918 to 1925, this right was taken away, and it was the exception, instead of, as hitherto, the rule, that a litigant in a common law action should, on demand, have the right to have his case tried by jury. In the case of *Ford* v. *Blurton* (38 T.L.R. 801) this invasion of an ancient right of the subject was vigorously criticised by the Court of Appeal itself, and the old rule was eventually restored by the Administration of Justice Act of 1925. So too the ancient process of indictment by grand jury was abolished during the War, and for it was substituted, as the accusing authority, the attorney-general. After the War, however, it was restored.

In the case of *R.* (*ex parte O'Brien*) v. *Secretary of State for Home Affairs* ([1923] 2 K.B. 361; A.C. 603), the executive, acting under an order in council which purported to be made under Defence of the Realm legislation, reincarnated as late as 1923 in the form of regulations under the Restoration of Order in Ireland Act, had

arrested, with a view to summary deportation to Ireland, an Irishman resident in England; he applied for a writ of *habeas corpus*. The Court of Appeal, in an exhaustive survey of this "subordinate legislation," severely criticised the action of the executive, declared the legislation in question *ultra vires* and granted the rule for the issue of the writ. The judgment may be regarded as the classical authority on the scope of *habeas corpus*, and the House of Lords, on appeal, upheld it, at the same time laying down the important principle that their appellate jurisdiction, while always available against a refusal of the writ, does not extend to an appeal against the grant of it—in other words, the right of the subject to summary release, on the determination of an inferior court that he is illegally detained, is established.

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(J. H. Mo.)

II. LOCAL GOVERNMENT

There have been no radical changes in the system of British local government since 1902, when the *ad hoc* education authorities, the school boards, were abolished and their functions transferred to the county and town councils. The hierarchy of local authorities stands in general as it was reorganised in the last two decades of the 19th century. In England and Wales the chief administrative units are counties, county and non-county boroughs, urban and rural districts and parishes.

The county of London has a unique subdivision into the city and the 28 metropolitan boroughs, and there are also in the metropolis and elsewhere a number of joint authorities for special purposes—asylum boards, hospital boards, water boards, burial boards, etc. Scotland has counties, burghs—royal, parliamentary and police—and district committees of the counties in place of the English rural districts. It also has *ad hoc* education authorities and lunacy authorities (district boards of control). The Scottish parish council is the poor law authority, corresponding to the board of guardians in England and Wales. Northern Ireland in the main follows the English system, while in the Irish Free State local government in 1926 was in the melting pot.

The principal reforms of recent years in Great Britain fall under four heads:—

1. The old central authorities, the Local Government Board and the Scottish Local Government Board, were abolished in 1919 and their functions transferred to new creations, the Ministry of Health (for England and Wales) and the Scottish Board of Health;
2. The local government electorate was enlarged by the Representation of the People Act 1918, which extended the vote to women and to certain classes of men hitherto disfranchised;
3. The Rating and Valuation Act 1925 remodelled the machinery of assessment and rating, abolishing the parish overseers and putting their duties in the hands of the county borough and urban and rural district councils;
4. Apart from these specific reforms there has been a general tendency to enlarge the powers of the local authorities, especially in the sphere of the social services. Acts dealing with maternity and child welfare, tuberculosis, venereal diseases, mental deficiency, housing and town planning and education, have all added considerably to the work of the county and town and district councils. At the same time the big towns have grown still bigger, not only by increase of population, but often by extension of their area through the absorption of surrounding districts.

All these developments have revealed grave defects and inconveniences in the system, and have led to a widespread demand for reform. The counties have struggled against the constant encroachments of the county boroughs. The county boroughs and the more important non-county boroughs and urban districts complain, and with reason, that while their functions have been increased they are still unduly controlled and thwarted by the central authority and Parliament. And the absorption of surrounding districts by the big towns and the expansion of public needs have made it more and more difficult to administer effectively such services as transport, water supply, electricity, regional planning, police, etc. This problem is particularly acute in the metropolitan area, and in 1921 a royal commission, under the chairmanship of Viscount Ullswater, was appointed to inquire into the local government of Greater London. The majority of the commission, however, reported unfavourably to any substantial change. They contented themselves with recommending:—

(*a*) Some redistribution of functions inside the administrative county;
(*b*) A reduction in the number of the petty local authorities in the outer districts;
(*c*) The creation of a statutory advisory committee to assist central departments in dealing with questions of transport, housing and town planning and main drainage;
(*d*) A scheme for further equalisation of rates within a 10-mile radius from Charing Cross.

There were two minority reports. The first proposed that Greater London should be made into a congeries of county boroughs with certain services reserved for administration by a centralised authority. The second recommended a new authority, popularly elected, for the governance of the whole area. This body would be directly responsible for all the large central services, and would require to have carefully defined powers of co-ordination and supervision of the work of the minor local authorities within its area.

In 1923 another royal commission was appointed, with the Earl of Onslow as chairman, to inquire in particular into the question of the creation and extension of county boroughs and generally into the constitution, areas, functions and mutual relations of all local authorities. It issued a first report in 1925, which proposed certain reforms in the machinery for creating or extending county boroughs. The most important of these were:—

1. All proposals for the constitution of county boroughs should be made by private bill instead of by provisional order. Proposals for the extension of county boroughs should also be made by private bill, unless the county borough concerned prefers the provisional order procedure and no other local authority concerned objects.
2. The minimum population entitling a borough to apply for county borough status should be 75,000, instead of 50,000.

This somewhat conservative report was generally regarded as a compromise, designed in the main to ease the friction between the counties and the towns. In 1926 the commission was preparing to deal with the second part of its reforms, which it was clear would be considerably affected by the proposed legislation for the break-up of the poor law.

The main problems, therefore, remain unsolved. New wine is bursting old bottles, and no general agreement has been reached as to the kind of new bottle that is wanted. On two points, however, there is a growing consensus of opinion. A concession must be made to the demand of the great municipalities for decentralisation—for local discretion, that is to say, to carry on their services or extend their enterprises, including "municipal trading" schemes, with less interference from Westminster and Whitehall. This power they claim in the interest alike of efficiency, economy and democracy. On the other hand, there is urgent need for a large measure of local centralisation, for the constitution of areas and authorities adequate to the performance of services which transcend existing boundaries. The attempt may be made to meet this need either

(*a*) By special joint committees of neighbouring local authorities for various services such as transport, water supply, electricity and so on; or, better, (*b*) by a more drastic reorganisation which would set up new authorities—"super-local authorities," so to speak—for these services, as well as for the general supervision of local government throughout their areas.

This was what the second minority report of the Ullswater Commission recommended for London, and it is obviously capable of application in other parts of the country. It is in principle the line of reform advocated by the "regionalists." Regionalism implies a re-organisation in which the whole country would be divided into a number of regions or provinces, say seven or ten or a dozen. These provinces would be natural and not merely artificial units, since different parts of the kingdom have distinct ties of common interest, both economic and "cultural" (*e.g.*, London and the Home Counties; East Anglia; the West Country; "Lancastria"). They would, it is claimed, be the most efficient possible units for administering the larger services; and on them would be devolved the bulk of the present central

authority's powers in respect of the supervision of the work of the subordinate, but largely autonomous, local authorities within each region.

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III. DEFENCE

In 1913 an important investigation was held by the Committee of Imperial Defence into the principles which govern the defence ot Great Britain. For several centuries there had been two schools of thought. The one, supported by several eminent soldiers, held that it was necessary to maintain a large army for defence against invasion. The other, supported by the majority of great seamen, held the view that it was essential to the economic life and prosperity of the population to maintain a navy of sufficient strength to keep open their sea communications against any single foreign navy, or any anti-British combinations at sea; and that a fleet, strong enough to achieve that purpose, would also be in a position to secure the immunity of British territory from invasion by a foreign army. The invasion school met this plea with the argument that the British Fleet might be "enticed away" from home waters and the opportunity then seized to pass a foreign army across the Channel or the North Sea; and, furthermore, that the larger the home defence army, the greater the force that must be employed by prospectively hostile foreign countries for effective invasion, and the easier the task of the navy, upon which "freedom to manoeuvre" would thus be conferred during the lengthy process of assembling the hostile invading army, and transporting it across the intervening sea.

The Question of Invasion.—The invasion school was particularly active during the years immediately preceding the World War, partly in order to maintain the proposition that the recently-established Territorial Force was required mainly for home defence, as the terms of enrolment of its members seemed to indicate, and partly in order to support a widespread movement for the introduction of national service for a similar purpose. The controversy came to a head during the years 1913–4, when the Committee of Imperial Defence devoted much time to an exhaustive inquiry into the question whether invasion by a German army, bearing in mind the size of the German mercantile marine, was a more feasible proposition than invasion by a French army, which had been ruled out of court some years before, after a similar investigation by the Committee of Imperial Defence, mainly on the plea that French merchant shipping did not suffice for the purpose. The inquiry of 1913–4 resulted in the conclusion that invasion, defined as a military operation on a large scale intended to conquer the country, was not a danger against which it was necessary to make special provision under the then existing conditions of relative seapower, but that the landing of military "raiding forces" upon British shores was a possible contingency, against which military forces must be provided.

The situation was thus summed up by the late Sir Julian Corbett in his official history of the War:—

> The truth is that, with rare and special exceptions, as when the enemy's chief naval force was not based in the Home Area, our main or Grand Fleet always operated from its home station. Its paramount duty was to secure the command of Home Waters for the safety of our coasts and trade . . . . For defence against invasion the system was obviously the only one possible; for control of trade it had been found efficacious, and never more so than proved to be the case in the War of 1914.

In order to draw up definite plans to meet the assumed danger from military raiding forces in time of war, the War Office required definite estimates of the strength of such forces which might succeed in slipping past the naval dispositions. As the strength of these forces must depend upon the number and size of the transporting vessels, this was clearly a question for the Admiralty. The maximum strength agreed upon and accepted by the naval authorities was a military raiding force of 70,000 men, and Sir Julian Corbett has told us that, in naval opinion, no such raid was likely to be attempted except across the North Sea. In the actual event, the coasts of Great Britain were immune from military raiding forces in the World War, although on several occasions definite rumours of their probability caused the authorities to make dispositions for which considerable military forces were employed, at periods when there was an urgent need for their services beyond the seas. For instance, in March 1918, during the time of greatest anxiety for the safety of the British Army on the Western Front, over 41,000 officers and nearly 130,000 other ranks of the army, classed as "fit for general service in any theatre of war in all respects, both as regards training, physique and mental qualifications," were retained in the United Kingdom, while the total strength of the home army, mostly of men in lower categories, reached a total of nearly 2,000,000. In that connection it is also necessary to bear in mind the need to maintain military forces in Great Britain in aid of the civil power, should such a demand arise. The attitude of the population of parts of Ireland, which necessitated the presence in that country of British troops during and after the War provides an example.

There was yet another demand for soldiers in the United Kingdom, to guard, against "evilly-disposed persons," certain vulnerable points of which the loss or destruction would adversely affect the navy, army or air forces. Large numbers of men belonging to the combatant forces, most of them unfit for service abroad, were employed upon work of this nature, besides strong forces of police.

Personnel.—It was also necessary to provide military personnel, especially artillery and engineers, to man the defended ports and naval bases and anchorages, essential for the use of the navy, mercantile marine, and troop transports. The arrangement between the Admiralty and War Office was that the army should be responsible for the fixed defences, guns, forts, electric lights, and so forth and for defence of the land fronts, while the Admiralty provided floating booms as obstructions, and, at some places, submarine mines and the personnel connected therewith. The Admiralty also made arrangements for an examination service, to visit and examine vessels before they were allowed to enter British harbours. A few places, including Scapa Flow in the Orkneys and Cromarty on the east coast of Scotland, received special treatment, the Admiralty providing marines to man the coast batteries and lights. Another important task which fell upon naval personnel was mine sweeping, to keep free of enemy mines the channels leading to and from British ports and anchorages, and there was an additional and only partially foreseen demand for coast watching, in aid of the coastguard. This task was performed to a great extent by volunteer watchers, the boy scouts taking a very active part in the movement.

Coast Defences.—In connection with the general question of fixed coast defences, it is important to realise their limitations. "People often say," wrote Admiral Mahan, "that such and such an island or harbour will give control over such a body of water. It is an utter, deplorable and ruinous mistake." The same author explains further that "control of a maritime region is ensured primarily by a navy, and secondarily by positions, suitably spaced from one another, upon which, as bases, the navy rests, and from which it can exert its strength," and that "in a naval war coast defence is the defensive factor, the navy the offensive. Coast defence, when adequate, assures the naval commander-in-chief that his base of operations—the dockyards

and fuel-depôts—is secure. It also relieves him and his Government, by the protection of commercial centres, from the necessity of considering them and so leaves the offensive arm perfectly free." On the whole it may be said that British defences adequately performed these functions in the World War, but it is necessary to take note of the point that they did not secure complete immunity for the coastal population; Scarborough, Hartlepool and other places suffered from bombardment by hostile war vessels. Owing to popular demands, these bombardments affected both the movements and the distribution of the sea forces in home waters.

Attacks During the War.—Reviewing the situation, from the defence point of view, of the British Isles in the World War, it is found that naval strength and dispositions secured the country from military invasion or raids, but that some places on the coast, which were considered to be immune under international agreements arrived at in conferences at The Hague, were subjected to bombardment from the sea. The special provision referred to is to be found in Article 25 of the 1907 Hague Conference, which forbids the bombardment, "by any means whatsoever," of undefended towns.

Air Raids.—This is a new feature in warfare, which affects very seriously the defence of Great Britain. The situation was thus described in Aug. 1914:—

> It seems safe to assume that the few hundred aircraft at present at the disposal of any military power would be unable to bring serious pressure to bear upon a hostile nation numbering many millions, spread over wide areas. The moral effect which would be produced by highly mobile aircraft dropping bombs first over one city, and a few minutes afterwards over another city a hundred miles away, would no doubt tend to produce local panics, but, given the right spirit, the material effect would not suffice to produce concerted action amongst the population to force their government to stop the War. (*Sea, Land, and Air Strategy*, 1914.)

This prediction was borne out in the years 1914–8, but considerable damage was suffered in the United Kingdom from air raids. These raids provide the only precedent, derived from actual experience, of the effect of air raids upon the civil population of Great Britain. Putting aside the comparatively trifling loss of naval and military personnel, 619 civilians were killed by aeroplane raids and 498 by air-ship raids, the numbers of injured being 1,650 and 1,236 respectively. Of the total of 1,117 killed, 618 were women and children. Of the 2,986 injured, 1,562 were women and children.

There was no question of pressure being put upon the Government for this reason to end the War without victory. The tendency was to stiffen the determination of the nation to endure all things rather than accept defeat. The deductions to be drawn from the statistics are (1) that airships, owing to their vulnerability, do not afford cause for anxiety, provided that the experience of the World War is studied and adequate defensive measures are adopted; but (2) that the menace from aeroplanes is more serious, though strictly limited in radius. Whether this radius can be increased much beyond the estimate in 1924 of 200–300 m.[1] is a question for the future. The point has been advanced that a reduction of bombing-load, and therefore an increase of fuel-radius, can be effected by substituting lighter and more deadly chemicals and gases for heavy explosive bombs. The increase in range of artillery fire was yet another development which may affect the future defence of Great Britain, for certain ports on the East Coast, and even inland towns, could now be subjected to bombardment from positions on land.

Comparison Between Pre-War and Post-War Conditions.—The situation in 1925, as compared with that in 1910, can thus be summarised. As long as a sufficiently strong navy is maintained, immunity from invading armies can be ensured in the future, as it has been in the past. The menace from the air would depend upon the country with which Great Britain might be engaged in hostilities, and would not be very serious except in a war against countries within the radius of action of bombing aeroplanes starting in large numbers from land aerodromes. Long-range bombardments of certain places near the East Coast could be effected by heavy ordnance in similar localities. The navy, and the merchant shipping under its protection, would be open to air attack when carrying out their task of keeping up the transport over the high seas of essential goods to and from Great Britain; air forces, under naval control, would be essential to meet this menace. The general effect of the air menace, as a factor in the problem of British defence, may be gathered from the attitude of successive British Govts., which have found it necessary to adopt a "one-power" standard of strength in the air, to establish a separate air force controlled by an Air Ministry and to appoint an air officer as commander-in-chief of the home air forces, a step which, in time of peace, has been considered to be against the best interests of the nation if applied to the military forces.

Irish Free State.—The grant of self-government to the Irish Free State has a considerable effect upon the defence of Great Britain. This quasi-political question cannot be dealt with exhaustively in an article devoted exclusively to defence. Its main features are (1) the control by the Free State Govt. over its own forces; (2) the loss of a large number of recruits, of a wide area of recruitment for the British Army, and of important training grounds; (3) the prospect for Great Britain in future emergencies of having a friendly population in southern Ireland, in place of one bitterly hostile and requiring the presence of a strong British garrison; (4) the continued provision of a small nucleus of British troops in certain defended ports, and also the question of the ability, if not the eagerness, of the Irish of the Free State to deny their harbours to war vessels hostile to Britain, and to provide an organisation for coast-watching to ascertain and report, as was done by British coastguards in 1914–8, the movements of such vessels within sight of the Irish coast. Unless these services are adequately fulfilled, the establishment of a Free State in Ireland would, in a grave emergency such as the World War, affect adversely the defence of Great Britain.

Conclusion.—In conclusion, we have noted that the principal change between 1910 and 1925 in the defence of Great Britain has entailed the provision of a large localised Air Force, controlled by an Air Ministry and an air officer commanding-in-chief, in addition to the air forces needed to accompany British fleets and armies upon their world-wide mission. Nevertheless, the burden of home defence may bear less heavily upon the British people than their responsibility for defending people of other races and nationalities, spread over both hemispheres (*see* AIR FORCES; ARMY; COAST DEFENCE; NAVY; etc.).

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IV. FINANCE AND BANKING

The years immediately preceding 1914 were a period of rapidly growing expenditure, due (1) to the increase of the navy and (2) to social reforms.

National Expenditure

	1908–9	1914–5 (Estimates)
Debt	£28,000,000	£23,500,000
Army	26,840,000	28,885,000
Navy	32,188,000	51,550,000
Old Age Pensions	..	12,710,000
Insurance of Working Classes	..	9,312,000
Other Expenditure	65,264,000	81,064,000
Total	£152,292,000	£207,021,000

The growth of £15,800,000 in other expenditure was largely natural expansion, *e.g.*, an increase of £8,000,000 in the post office. The increase in total expenditure (after allowing for the reduction of £4,500,000 in the debt charge) was £59,000,000, to which defence contributed £21,400,000 and social legislation £22,000,000.

So great an increase in expenditure had naturally involved additional taxation. The extensive measures of new taxation imposed by Mr. Lloyd George's budget of 1909 (which was rejected by the House of Lords and was only passed after a general

[1] Report of Sub-Committee of Committee of Imperial Defence (Cmd. 2029, 1924).

election) provided the greater part of what was required. The feature in that budget of greatest permanent importance was the institution of a supertax, that is to say an additional income tax on large incomes. Incomes above £5,000 were taxed at 6d. in the pound on the excess over £3,000. At the same time the rate of income tax on unearned income was increased from 1s. to 1s. 2d. After the great effort of 1909 the natural expansion of revenue sufficed to cover expenditure till 1914. In that year further taxation became necessary, and the budget as finally adopted (before the War crisis) provided for an increase in estate duties, a rise in the income tax on unearned incomes from 1s. 2d. to 1s. 3d. (the earned still remaining at 9d.), and an important extension of the supertax. Supertax was applied to all incomes over £3,000, and was more elaborately graduated (the rate on the excess of an income over £8,000 was 1s. 4d. in the pound). The estimated yield for a full year was thereby raised from £3,300,000 to £7,770,000 (*see* INCOME TAX).

The War Period.—From the beginning of the War in Aug. 1914 it became impossible to dissociate the budget position from the state of credit generally. In the first place, the Government had to come to the assistance of the financial world and support credit through the initial crisis. Secondly, expenditure on the War soon grew to such dimensions as to put an almost unbearable strain on the financial fabric of the country.

The outbreak of the War threw first the stock exchanges and then the foreign bill markets of the world, but above all of London, into utter disorder. The machinery of remittance to London broke down almost completely and the London accepting houses found themselves faced with bankruptcy. The Government was forced to step in and to proclaim a moratorium for debts, statutory power was taken for the Treasury to issue legal tender currency notes for £1 and 10s. and the Government guaranteed advances by the Bank of England to acceptors to pay off pre-moratorium bills (*see* STOCK EXCHANGE).

WAR BORROWING AND INFLATION

It was in the midst of this state of confusion that the early stages of the War were financed. For the initial expenses, advances of £14,720,000 were obtained from the Bank of England on "Ways and Means" (*i.e.*, under the powers annually conferred by the Consolidated Fund Act and Appropriation Act). The War was costing about £1,000,000 a day. There followed half-a-dozen issues of Treasury bills of £15,000,000 at a time. In Nov. 1914 additional taxation was imposed and a loan of £350,000,000 (3½% at 95, redeemable 1925–8) was decided on. By that time serious unsoundness was already developing in the situation. The issue of £90,000,000 of Treasury bills did not in itself overstrain the market. But the advances made by the Bank of England for the pre-moratorium bills, with its advances to the Government and large imports of gold, destroyed the Bank's power of controlling the money market. Bank Rate had been reduced to 5% on the reopening of the banks on Aug. 7, but in Sept. it ceased to be effective and the market rate fell to 3%. In Nov. it fell below 3. Part of the 3½% loan was taken by the banks, and in any case the loan was not applied to strengthen the position of the Bank of England. In Feb. 1915 the market rate of discount fell below 2%. The private deposits at the Bank of England exceeded £130,000,000.

At last, in March 1915, severe measures were taken to counteract the growing inflation, which had already caused a considerable rise of prices. The Bank of England came into the Money Market as a borrower at call on the same footing as the discount houses, and lent the proceeds to the Government. The money was accumulated in balances, and public deposits at the Bank rose from £27,000,000 at the end of Feb. to £114,000,000 at the end of March and other deposits fell to £90,000,000. On April 13 a new departure was made, in that Treasury bills in unlimited quantities were placed continuously on sale at fixed rates of interest to all comers. But the rates were still low (2¾% for 3 months, 3⅝% for 6 months, 3¾% for longer maturities). Public deposits rose to £130,000,000 and more. It was the Treasury bill rate, and not bank rate, which regulated the money market.

By that time the cost of the War had risen to £3,000,000 a day and exceeded one-third of the national income (even if this be assumed to have risen in proportion to prices, which were 25% higher than in 1913). This outlay (after deducting a modest contribution from the tax revenue) far exceeded the amount that the people could save. But inflation only made the situation worse. That the cost of the War was itself swollen by the high prices was the least part of the evil. Easy credit makes trade profitable, because it encourages buying and consumption. It directs savings away from gilt-edged investments into trade. In 1915 conditions were extremely abnormal, but, for all that, this tendency was at work. Lavish expenditure by the public on consumable goods was competing with the Government, not only for the investment of the available savings, but for the employment of the available labour and productive power. Inflation, once started, continued throughout the War and for some time afterwards and only spasmodic and half-hearted steps were taken to check it till 1920, when prices had risen to three times the pre-War level.

Mr. McKenna, in June 1915, brought out the second war loan (4½% at par, redeemable 1925–45). It was for no specified total amount. The banks again undertook to subscribe for a very large amount, but the loan was planned much more for the ordinary investor and less for the money market than the 3½% loan of November. It also remained open longer, and there was more propaganda. Subscribers were given the right to convert their holdings into any future long-dated war loan. Holders of 3½ per cents or of consols were allowed to convert these securities into the new loan if they subscribed in addition a certain amount of cash to it. The loan yielded £587,000,000 of cash, but £200,000,000 came from the banks, and the balance was but a modest contribution from genuine savings towards the growing expense of the War.

While the loan was still being subscribed, ominous signs of weakness began to appear. The rise of prices was resumed. The exchange on New York fell below $4.80 to the £1 sterling; at the end of Aug. it dropped to $4.50. The Government sought a remedy in the sale of gold and securities in New York. Gold received in 1914 and deposited at Ottawa, gold displaced from circulation by currency notes, gold extracted from the precious reserves of France and Russia, all were drawn upon. The total net imports of gold into the U.S. in 1915 were $420,000,000, of which two-thirds came in the second half of the year. The British Govt. collected American securities from British holders, and either sold them or pledged them in America. There was also direct borrowing in America, starting with the Anglo-French loan of Oct. 1915 ($500,000,000, five-year 5 per cents at 98).

By means of these resources it became possible to "peg" the exchange at 4·76½. That measure made inflation more ruinous to the country than before. Inflation creates an excess of imports, which can be corrected, if the gold standard is abandoned, by an adverse movement in the exchanges. If the Government prevents that adverse movement by undertaking to sell foreign currencies to all comers, the excess of imports continues, and the Government has to pay for it. There were obstacles to imports in 1916 (especially lack of shipping), but the burden assumed by the Government was still a formidable one. The British Govt. also had to supply the necessary resources for pegging the French franc.

What was needed above all was the cessation of inflationary finance. The 4½% war loan had been of some assistance. In Aug. 1915 the lowest rate for Treasury bills was fixed at 4½%. In Sept. new taxation was imposed calculated to yield over £100,000,000 in a complete year, and in May 1916 further increases brought the revenue for the year 1916–7 above £500,000,000. But the cost of the War had risen to £4,500,000 a day and the rise of prices above the peace-time level exceeded 50%. In Dec. 1915 five-year 5% Exchequer bonds were put continuously on sale from day to day, but yet in March 1916 the floating debt (Treasury Bills and Ways and Means Advances) was almost £600,000,000.

In July 1916 Bank Rate was raised to 6%, and the Treasury bill rate to 5½. The effect of Bank rate on borrowing depends on the profits of trade; 6% is by normal standards a very high rate,

but in face of the profits promised by an orgy of inflation it counts as low. At any rate it was not high enough to have much effect in 1916. The sale of five-year Exchequer bonds (raised to 6% in Oct. 1916) continued till Jan. 1917. Mr. Bonar Law, who had become Chancellor of the Exchequer in Dec. 1916, then decided on a third World War loan.

This took two forms: 5 per cents at 95 (redeemable 1929–47) and income-tax free 4 per cents at par (redeemable 1929–42). A "Depreciation Fund," equal to ⅛% per month, was to be applied to buying up stock in the market whenever it was below the issue price. The amount asked for was unlimited, and the zeal of the public was stimulated by intensive propaganda. It was wisely decided to ask for no direct subscriptions from the banks. The cash raised was £816,000,000, and Treasury Bills subscribed amounted to £124,000,000. In addition holders of 4½% war loan and of the Exchequer bonds since issued were entitled to convert into the new stock. The total amount created was £2,067,000,000 of 5 per cents and £52,000,000 of 4 per cents.

Even after this great effort the floating debt at the end of the financial year (March 31 1917) amounted to £680,000,000. Prices were almost double the peace-time level. Growing difficulty was experienced in providing resources for the support of the American exchange. The vast quantities of gold sent to the United States (whose net imports of gold from Jan. 1915 to March 1917 amounted to $1,192,000,000) not only paid for goods, but brought about a credit inflation and rise of prices there. Indeed otherwise the discrepancy in value between the pound and the dollar would have been far too great for any pegging operation to be feasible. But the effect of the credit inflation in America was to make borrowing there more difficult in face of the insistent demands of trade for all available supplies of capital. It was found possible to raise loans of $250,000,000 in Aug. 1916, $300,000,000 in Oct. 1916 and $250,000,000 in Jan. 1917, but the market was growing more and more reluctant.

All such anxieties were dispelled by the entry of the United States into the War in April 1917. Thenceforward the necessary resources both for supporting the exchange and for buying food and materials were advanced to the British and Allied Governments by the American Govt. itself. The British Govt. continued to provide funds to enable the Allies to buy goods in England, but the amount lent was about equal to the amount borrowed from the American Government. Inflation in the United States was accelerated and the export of gold thence was prohibited. The price index rose from 162 in March 1917 (100 being the average of 1913) to 203 in Nov. 1918. The English price index in Nov. 1918 was 229. The cost of the War to the British Exchequer had risen to £7,000,000 a day. Bank Rate had been reduced to 5½% on Jan. 18 and to 5% on April 5 1917.

After the 5% war loan, borrowing was effected through Exchequer bonds, re-christened in Sept. 1917 "National War Bonds." They were 5 per cents, but were repayable on maturity at a premium (2% on the 5-year bonds, 3% on the 7-year and 5% on the 10-year), and were convertible at the holder's option into 5% war loan at 95 (*i.e.*, a £100 bond would buy £105 5s. 3d. of war loan). There were also income-tax free 4% 10-year bonds, repayable at par, and convertible into 4% war loan. National War Bonds were continuously on offer till the Armistice and thereafter till May 1919 (those issued after Jan. 1919 having no conversion rights).

Much attention had been given to the attraction of savings from the working classes. Special facilities were given for the purchase of the 4½% war loan of 1915 in bonds of small denominations. In 1916 a special issue of War Savings Certificates was started. The subscriber paid 15s. 6d. for a certificate entitling him to £1 after five years, and he could obtain repayment at any time at the sacrifice of a part of the accumulated interest. The interest accumulating, and not payable periodically, was not liable to income tax, and to prevent too extensive an evasion of income tax by well-to-do holders, the amount of certificates which could be held by any one person was limited to £500.

On March 31 1919 the National Debt amounted to £7,481,000,000, an increase of £6,775,000,000 since March 31 1914. The external debt was £1,365,000,000, or, if certain items which could be set off against debts due to the British Govt. from Canada, France, Italy and Russia be omitted, £1,179,000,000. The internal floating debt was £1,339,000,000[1] including £455,000,000 of Ways and Means Advances; the latter included sums lent by Government Departments (partly from the Currency Notes Account, partly from trading accounts and many other sources). But a large part was money borrowed at call through the Bank of England from the Money Market, extra interest being paid for foreign-owned balances.

[1] Exclusive of Treasury bills amounting to £73,000,000, included in external debt (see Cd. 1648).

War Taxation.—Though there were heavy increases in indirect taxation, far the greater part of the war taxation was direct, as the following comparison shows:—

Taxation in Peace and War

Source of Revenue	1914–5 (Peace Estimate)	1918–9
	£ millions	£ millions
Customs and Excise	73·3	162·2
Income Tax	48·1	255·6
Supertax	5·8	35·6
Excess Profits Duty	..	285·0
Other Direct Taxes	42·1	45·9
Other Revenue	35·8	104·7
	207·1	889·0

The rate of income tax had been raised to 2s. 6d. in 1915–6 and to 5s. in 1916–7. In 1918–9 the rate was raised to 6s.; the effect of this last increase was not fully seen till 1919–20, when the yield was £317,000,000. Supertax rates had likewise been raised, and the highest zones of income paid 4s. 6d. The biggest tax of all was the Excess Profits Duty, which had been imposed by Mr. McKenna in Sept. 1915. This was a tax on the excess of the profits made by any firm or company in the year of assessment over the annual profits made before the War (computed in the case of a business established since the outbreak of war from its capital). Administratively it was an off-shoot of the income tax, for the income tax assessments disclosed both the current profits of a business and its pre-War standard. The rate of tax was at first 50%, and was raised in 1916 to 60% and in 1917 to 80%. Excess Profits Duty was a powerful corrective of inflation. It provided £645,000,000 revenue in the three years 1916–7 to 1918–9, and £540,000,000 more in the difficult years that followed. It diminished the evil tendency of inflation to accentuate the inequalities of wealth. By it the extravagant profits which made trading enterprises unduly attractive to capitalists, in competition with the needs of the Government, were materially reduced. Excess profits duty was never anything but a makeshift. It was full of anomalies and minor injustices. But these, in the emergency of the time, were as dust in the balance compared to its advantages.

The indirect taxes imposed included import duties on motor-cars, clocks and watches, musical instruments and cinema films—officially known as the new import duties, but more commonly called the McKenna duties. They are noteworthy as being the first protective duties imposed since the days of the Peelites.[2] They were ostensibly intended to support the exchange and to economise tonnage.

The Cost of the War

An exact calculation of the cost of the War to Great Britain would be impossible, and what follows can be regarded as no more than an approximation. The day after the declaration of war with Germany the Government obtained from Parliament a vote of credit of £100,000,000, for "expenses, beyond those provided for in the ordinary grants of Parliament, arising out of the existence of a state of war." Certain services, such as naval and military operations, maintenance of trade, relief of distress, were specifically mentioned, but the total was not divided into subheads like an ordinary vote. Till March 1919 the cost of the War was met from successive votes of credit. The total audited expenditure from votes of credit was £8,417,000,000. The table on the opposite page shows the principal details.

Civil Departments drew on votes of credit for any expenditure in excess of their own votes, attributable to the War. Some items so met (*e.g.*, for cost of living bonus to civil servants) were not part of the cost of the War. But on the other hand the ordinary votes bore many war charges such as the civil pay of staff absent on military service, or the cost of administrative work arising out of the War. The total includes £1,665,000,000 of loans to Allies and Dominions. These were an immediate burden when advanced, but the ultimate burden is only such part as is never repaid. The immediate burden was relieved by the advances received from the Canadian and American governments.

[2] Except the ephemeral corn duty of 1902.

Vote of Credit Expenditures
(£ Millions)

	1914–5	1915–6	1916–7	1917–8	1918–9	Total
Army	211·9	526·7	587·8	725·8	824·7	2,876·9
Navy	51·7	205·7	209·8	227·4	334·1	1,028·7
Air Force	..	..	..	2·5	85·4	87·9
Munitions	·7	224·6	504·9	641·0	458·3	1,829·5
Railways and Canals	6·8	5·9	16·9	26·4	49·6	105·6
Shipping	..	..	8·1	110·9	100·4	219·4
Food	9·7	7·3	22·4	79·3	41·5	160·2
Loans to Allies and Domns.	51·8	316·0	544·7	488·3	264·6	1,665·4
Exchange Account	..	53·1	..	..	3·7	56·8
Pre-moratorium Bills	..	30·6	..	..	..	30·6
War Pensions	·1	2·2	7·8	23·7	46·6	80·4
Old Age Pensions	..	..	1·5	5·2	6·0	12·7
Other Expenditure	4·0	11·6	59·1	101·4	87·0	263·1
	336·7	1,383·7	1,963·0	2,431·9	2,301·9	8,417·2
Receipts	..	2·5	10·3	5·1	3·6	21·5
	336·7	1,381·2	1,952·7	2,426·8	2,298·3	8,395·7

	£ millions	£ millions
From the net total of		8,395
Deduct:		
Peace establishments of Army and Navy for four years say	500	
War pensions paid during the War	80	
Allowances to old age pensioners	13	
Exchange account (working balance)	53	646
Net Cost		7,749

In the years following the last vote of credit, there were large outlays and also large receipts due to the War, as shown in the following table (in £ millions):—

War Expenditures and Receipts

	1919–20	1920–1	1921–2	1922–3	1923–4
Army	411·8	165·7	86·4	50·2	46·1
Navy	154·1	92·5	76·0	57·5	54·1
Air Force	54·3	20·7	13·6	9·0	10·5
Middle East	..	..	27·0	9·8	7·2
	620·2	278·9	203·0	126·5	117·9
Peace Establishments	160·0	160·0	155·0	120·0	112·9
	460·2	118·9	48·0	6·5	5·0
Munitions	..	16·1	6·3	2·2	·8
Railway and Canals	56·5	42·7	73·3	32·7	·9
Shipping	..	·9	..	7·0	1·9
Ministry of Food	2·7	1·6	..	..	..
Loans to Allies, etc.	137·9	24·5	3·4	..	..
Training and Resettlement of ex-soldiers	41·4	25·2	9·9	5·4	3·0
Coal Mines	26·1	15·0	2·0	1·2	·8
Other Expenditure	16·3	12·8	6·5	4·6	3·2
Total Expenditure	741·1	257·7	149·4	59·6	15·6
Receipts[1]	254·4	265·7	110·8	43·4	29·7
	486·7	(8·0)[2]	38·6	16·2	(14·1)[2]

[1] Mainly sales of war stocks, ships, etc., but exclusive of reparations.
[2] Excess of receipts over expenditure.

A further net sum of £22,250,000 was provided through the civil contingencies fund (advances, 1919–20, £64,500,000; repayments 1919–20 to 1921–2 £42,250,000). The total net war expenditure is thus (in £ millions):—

Total War Expenditure

	British Expenditure	Loans to Allies, etc.	Total
Votes of Credit	6,084	1,665	7,749
Subsequent Years	376	166	542
	6,460	1,831	8,291

Advances *from* Allies were:—		
United States	865	
Canada	184	
France, Russia and Italy (gold)	136	
	1,185	
Voluntary contributions from India and Colonies (principal only) up to 1923	90	
		1,275

This may be regarded as reducing the net "immediate burden" of advances to Allies to £556,000,000. The burden of War pensions, actuarially capitalised at some date in the midst of the War, may be put at £1,000,000,000.

Finance After the War

In 1919 the tremendous overstrain of the War period was still making itself felt in the direction of inflation. The most obvious symptoms of weakness were in the floating debt and the external debt (see above). The shortage of tax-revenue and genuine savings, as compared with the expenditure to be met, was made good partly by drawing on foreign resources, partly by bank credits. Practically, with the cessation of advances from the American Govt., foreign resources ceased to be available. Bank credits meant the creation of the means of payment out of nothing—pure inflation. Excessive Government borrowing seemed so entirely adequate an explanation of the growing inflation that a more insidious cause was hardly taken into account. Bank rate had remained at 5%, but had not been made effective. The Treasury bill rate, which governed the market, had been reduced since Feb. 1918 to 3½%. Under war conditions the effect of cheap commercial borrowing in stimulating business was undoubtedly much diminished though not entirely avoided. With the return of peace its full effect would be felt.

The committee on currency and foreign exchanges after the War, presided over by Lord Cunliffe, had presented a grave and authoritative report in Aug. 1918. The report urged the cessation of Government borrowing, but also the use of a high Bank rate to protect the gold reserves. The foundation of all their recommendations was that "under an effective gold standard all export demands for gold must be freely met." "The conditions necessary to the maintenance of an effective gold standard in this country no longer exist, and it is imperative that they should be restored without delay." Unless the remedies approved by experience were applied, "there will be very grave danger of a credit expansion in this country and a foreign drain of gold, which might jeopardise the convertibility of our note issue." The Committee condemned proposals for "a liberal supply of money at low rates," based on a further growth of the note issue, because "in the result the gold standard will be threatened with destruction through the loss of all our gold."

In spite of these wise and emphatic recommendations, the gold standard was abandoned without an effort, as soon as the arrangement for supporting the New York exchange with American credits was brought to an end. A regulation under the Defence of the Realm Act, replaced in 1920 by the Gold and Silver (Export Control) Act, prohibited the export of gold (March 1919). The régime of cheap money continued. Burdened with heavy war commitments the Budget for 1919–20 brought the prospect of a heavy deficit. In June a new 4% loan was offered for subscription in two forms, the funding Loan, at 80, redeemable 1960–90; and the Victory Bonds, at 85, repayable by annual drawings at 100.

During the War the issue of loans at a considerable discount had been avoided, the lowest price of issue being 95. This was a favourable contrast to the policy during the Napoleonic wars, which swelled the nominal amount of the debt and diminished the effectiveness of the big conversion operations of the 19th century. The Funding Loan represented a change in that respect. It secured the investor against the reduction of his interest after 1960 unless the market rate of interest had fallen by then below 4%. That is a very slight advantage to the investor, and any difference that it made in the price of the loan would not go far to compensate the Government for the loss of what might be a valuable option in the future.

The twin loans yielded £475,000,000, but £92,000,000 had been subscribed by banks, so that the real contribution towards sound finance was only £383,000,000. Moreover, the well estab-

lished but deceptive city tradition of fertilising a loan with cheap money had been followed. The sale of Treasury bills had been absolutely suspended, and the Government had borrowed at a low rate from the money market and so far as necessary from the Bank of England. The inflationary tendency, already serious, was accentuated. The sale of Treasury bills was resumed on July 14. In Oct. came a change; the rate for three months bills was raised from 3½% to 4½%—the first step towards a restriction of credit. In Nov. the rate was raised to 5½% and Bank Rate to 6%. In Dec., pursuant to a recommendation of the Cunliffe Committee, a limit was imposed upon the currency note issue. A Treasury Minute of Dec. 15 1919 (a purely administrative instrument without statutory validity) prescribed that the fiduciary issue of currency notes (those uncovered by gold or Bank of England notes) in any year should not exceed the maximum fiduciary issue recorded in the preceding year. The actual maximum recorded for 1919 was £320,600,000, and accordingly this became the prescribed maximum for 1920. Under this rule the limit can decrease but cannot increase. The limit for 1926 was £247,900,000.

Inflation in Great Britain works through bank credits, but a limit on the supply of legal tender money, if really meant to be effective, was bound to react on the creation of credit. Nevertheless in the opening months of 1920 inflation continued unabated. The price level (*Statist* index, 1913 being 100) rose from 217 in April 1919 to 313 in April 1920. The American exchange fell one-third below par. In April 1920 the sales of Treasury bills at the fixed rate of 5½% fell off, and £55,000,000 had to be borrowed from the Bank of England on Ways and Means. An abyss of inflation seemed to be opening. The Treasury bill rate was thereupon put up to 6½%, and Bank Rate to 7% (April 15).

The next week Mr. Austen Chamberlain introduced the Budget for 1920–1. Inflation was swelling the revenue from the heavy taxes already in existence, but fresh taxation was nevertheless imposed. A tax revenue exceeding £1,000,000,000, in addition to enormous receipts from liquidation, was budgeted for, and the estimated surplus was £234,000,000. The severe régime of high discount rates and no Government borrowing, recommended by the Cunliffe Committee, was being applied. But after a year of unconscionable inflation, a stronger dose was needed than they ever contemplated, and produced results which they never thought of. A year of 7% Bank Rate caused a tremendous collapse of prices, while the exchange was little improved (*see* CURRENCY), and the gold standard was not restored.

The peril of inflation had vanished. It was excessive deflation that was now the trouble. But a contraction of credit, while it brings depression, bankruptcy and unemployment, nevertheless, after the first passing phase of stringency, causes a rise in the prices of fixed-interest securities and favours funding operations, just because it diminishes the profits of production and trade.

When the budget for 1921–2 was introduced in April 1921, little progress had been made with the floating debt, which still amounted to £1,243,000,000. The loan issues of 1919, together with an issue of 5¾% Exchequer bonds in Feb. 1920, had been mostly used up in meeting a deficit of £326,000,000 for 1919–20 and a large amount of maturing bonds. The surplus of £230,000,000 for 1920–1 had been needed partly to pay off external debt (including $250,000,000 of the Anglo-French loan of 1915 maturing in Oct. 1920), and partly to pay off bonds. Further heavy maturities were in prospect. By April 1922, £138,000,000 of Exchequer bonds would have to be met, and between Oct. 1922 and Feb. 1924 the 5-year National War Bonds, amounting to £574,000,000. Certain securities also had the privilege of being used in payment of Death Duties and Excess Profits Duty. The total amount so used had been averaging £70,000,000 a year. The Depreciation Fund on the War Loan of 1917 required over £30,000,000. All these obligations had to be met if the floating debt was to be prevented from increasing.

In the Budget statement in April 1921 was announced the issue of a new 3½% Conversion Loan. It was to be a funded stock like Consols, being redeemable only at the option of the Government (after 1961), and not at any fixed due date. A sinking fund of 2% per annum on the amount outstanding was to be applied so long as the price was below 90. Cash subscriptions were not asked for, the loan being destined only to be exchanged for the 5-year and 7-year National War Bonds. At that time gilt-edged stocks had not recovered far from the lowest levels of 1920. The 4% funding loan which had fallen to 66 in Dec. 1920, stood at 71. The 5% War Loan had risen from 81½ to 88. The National War Bonds (carrying a premium on redemption) were slightly below par. From £160 to £163 of 3½% Conversion Loan was offered to the holder of £100 of National War Bonds. The stockholder was secured a return of about 5⅔% on his money, and the interest could not be reduced before 1961, and even then only if the Government was able to borrow at less than 3½%. By good fortune the loan was a failure. Only £164,000,000 of National War Bonds were converted, out of £630,000,000 to which the offer applied, but even so the increase in the nominal amount of the debt was about £100,000,000.

A year later, still months before the earliest maturities of National War Bonds, the situation had been transformed by the trade depression. The 4% Funding Loan at 88½, and the 5% War Loan at 99 were well above their issue prices. The Conversion Loan, which had been offered in April 1921 on terms corresponding to a price of 62, had risen to 77¾. Treasury Bonds to yield 5½%, and then, as the market improved, 5% had been sold to an amount exceeding £400,000,000. In 1922 a further batch of £70,500,000 of National War Bonds were converted into 3½% Conversion Loan on the basis of a price of about 75. When the bonds were above par it ceased to be profitable to use them in payment of duties. And now that the 5% War Loan was well above the issue price, the option attaching to National War Bonds of converting into it at the issue price became profitable, and in the three years 1922–5, £251,000,000 were so converted. No difficulty was found in raising the money to pay off £100,000,000 in cash in the same period, and in addition the floating debt was reduced from £1,243,000,000 in March 1921 to £742,000,000 in March 1925 (inclusive of £166,500,000 of advances from Public Departments).

In April 1921 the pre-War system of selling Treasury bills by public tender was reverted to. The change was an important one, because it meant that in respect of the discount rate the Treasury followed the market instead of leading it. So long as the Treasury sold all the bills that the market would buy at a prescribed rate and no more, the Bank of England was bound to lend to the Treasury if the sales of the bills did not produce enough. A Bank Rate appreciably above the Treasury bill rate could not be made effective. A Bank Rate below the Treasury bill rate would be equally unworkable. In fact the Treasury had usurped the place of the Bank as regulator of credit. So long as bills are issued by tender in just sufficient amounts to meet the needs of the Treasury, the Bank of England can discharge its responsibilities undisturbed.

In 1924 a new form of Conversion Loan was created, a 4½% security redeemable in 1940–4, in order to make a beginning with the conversion of the great 5% War Loan. The Government has the option of repaying that loan at par at any date after 1929. The amount involved is enormous. Conversions of National War Bonds had raised the total in April 1924 to £2,100,000,000. Difficulty might be experienced, even in a favourable market, in dealing with so great a mass of stock, if notice were given in respect of the whole in or after 1929, and there may therefore be advantages in converting moderate portions at a time by offering suitable terms to the holders. The amount converted into 4½% was £148,000,000.

American Debt.—The net external debt had been reduced from £1,179,000,000 in March 1919 to £948,000,000 in March 1922, of which £856,000,000 represented the debt to the American Government. But these figures exclude the interest on the American debt which the American Government had spontaneously suspended in 1919 and which had been accumulating ever since. Towards the end of 1922 it was decided to negotiate with the American Govt. for the settlement of the arrangements for paying off the debt. A sum of $100,000,000 was paid on account and in March 1923 an agreement was negotiated by Mr. Baldwin, the Chancellor of the Exchequer, who with Mr. Norman, Governor of the Bank of England, visited the United States for the purpose.

The loan had been till then in the form of an obligation payable "on demand" and yielding interest at 5%. The agreement reduced the suspended interest to 4¼%, and fixed the future interest at 3% for 10 years and thereafter at 3½. The capital of the debt (including past interest) was rounded down by a small cash payment to $4,600,000,000, and was to be paid off by instalments in 62 years, starting at ½% ($23,000,000) and rising gradually so as to keep the annual obligation for interest and principal together approximately fixed at about $161,000,000 for 10 years and $184,000,000 thereafter. Great Britain has the option of paying the debt either in "U.S. gold coin of the present standard of weight and fineness" or in gold bullion or in bonds of the U.S., and may postpone the

payment of half of any instalment of interest. There was in addition a debt of $61,000,000, being the balance of the advances of silver made for the benefit of India under the Pittman Act of 1918. This sum was paid off in 1923 in cash. (*See* DEBTS, INTER-ALLIED.)

Sinking Fund.—The sinking fund in operation at the beginning of the War (a fixed debt charge of £23,500,000 inclusive of interest) had become obsolete. Surpluses of revenue over expenditure were legally applicable to the redemption of debt (the "old sinking fund"), and under the Finance Act of 1920 a surplus could be so applied as it accrued, instead of being accumulated in Exchequer balances till the end of the year. The accumulation of a surplus of £200,000,000 like that of 1920–1 would have been an absurdity. The Finance Act of 1923 repealed the fixed debt charge arrangement, and established a new sinking fund. A sum of £40,000,000 was to be included in the expenditure of the year for the redemption of debt in 1923–4, £45,000,000 in 1924–5 and £50,000,000 in 1925–6 and subsequent years. With the fixed debt charge the saving of interest went to increase gradually the amount applicable to debt redemption. Under the sinking fund of 1923 it goes in diminution of expenditure, the sum applicable to debt redemption remaining at £50,000,000. Surpluses, however, remain, as before, applicable to debt redemption. Realised surpluses have been as follows (in £ millions):—

1920–1	1921–2	1922–3	1923–4	1924–5
230·6	45·7	101·5	48·3	3·6

Repayments of principal of War advances to Dominions and of relief loans are paid to the National Debt Commissioners for debt redemption, without appearing in the Exchequer account.

Post-War Taxation.—The year 1919–20 was financially a War year, with a heavy deficit. The Excess Profits duty was reduced from 80 to 40 %, but at the same time heavy additional duties were placed on beer and spirits, calculated to produce an additional revenue exceeding £50,000,000, in a full year. The budget of that year (Mr. Chamberlain's) is noteworthy for the introduction of preferences in favour of products of the British Empire. Protective duties were not introduced for the purpose, but the preference was grafted on the revenue duties already in existence (sugar, tobacco, tea, etc.) The year 1920–1 saw the end of War deficits. Nevertheless big additions were made to taxation, further increases on beer and spirits, an increased super-tax, a new tax on the profits of limited companies, a rise in Excess Profits duty to 60 per cent. On the other hand an important simplification of the system of Income Tax abatements involved a loss of revenue in a full year of about £30,000,000 (at 6s. in the pound). This year saw tax revenue at its maximum, £1,031,700,000.

The years 1921–2 to 1924–5 were years of steady remissions of taxation. Excess Profits duty was repealed (1921). Corporation Profits Tax was first halved (1923), then repealed (1924). Income tax was reduced from 6s. to 5s. (1922), to 4s. 6d. (1923) and to 4s. (1925). The duties on beer (1923), sugar (1924) and tea (1924) were reduced. The "McKenna" duties were repealed by Mr. Snowden in 1924, but reimposed by Mr. Churchill in 1925. The Safeguarding of Industries Act, 1925, imposed a number of protective duties.

Analysis of Expenditure

	(£ millions)					
	1919–20	1920–1	1921–2	1922–3	1923–4	1924–5
I. Ordinary						
Debt	332	350	332	324	347	357
Defence	160	160	155	120	113	111
War pensions	99	106	96	81	73	70
Education	41	56	61	49	48	49
Old age pensions	19	25	26	22	23	25
Health and labour ministries	19	28	38	31	32	34
Other	123	157	196	135	148	146
Total ordinary	793	882	904	762	784	792
II. Exceptional						
Bread subsidy	50	40	..	..	..	..
War expenditure	741	258	149	60	16	4
	1,584	1,180	1,053	822	800	796

Expenditures.—These liberal reductions of taxation could not be effected without substantial economies in expenditure. In 1921 a Committee with Sir Eric Geddes as Chairman made a searching investigation of the expenditure of public departments and recommended extensive savings. The foregoing table analyses public expenditure up to 1924–5 (appropriation accounts) and distinguishes ordinary from War expenditure.

The diminution of £142,000,000 in ordinary expenditure in 1922–3 is not wholly due to economy. The exclusion of Irish services relieved civil votes of about £20,000,000. The heavy fall of prices relieved expenditures not only directly, but also through the consequent reduction of the bonus dependent on cost-of-living, which is added to civil service salaries. The increase in ordinary expenditure in 1922-3 was due to the rise of £23,000,000 in debt charges, consequent on the establishment of the new sinking fund and the beginning of the payment of the American debt.

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(R. G. H.)

BANKING

During the post-War period, and especially in the period 1918–20, the British banking system underwent a process of change which, although from the historical standpoint only a continuation of tendencies which had been in operation for many years, in fact altered the whole balance of power within the sphere of domestic banking, and altered considerably the relations which used to obtain between the sphere of the domestic banks and those operating predominantly overseas. As a consequence there arose a series of problems which were still unsolved at the end of 1925. These were the adjustment of the internal economy of the banks to the new scale of business which they were undertaking; the relations of the banks with the central bank and the money market in the technical sense; and the relations of the banks with their customers and to the national economic life as a whole.

The Amalgamation Movement.—This consisted in the process of reducing the total number of independent banks. In contradistinction to the developments in Germany, the technical form assumed by the process of concentration was exceedingly simple. Whereas in Germany a whole series of intermediate forms existed between complete fusion of banking establishments and completely independent institutions, such as the exchange of shares, pooling of resources, agreements not to invade territory, interlocking directorates and stock-ownership without the extinction of the legal existence of the firm whose shares had been acquired, the founding of subsidiary enterprises by joint action, etc.; but in Great Britain, when two banks amalgamated, the separate legal and economic existence of the amalgamating establishments ceased. Moreover, the field of operation of the British joint-stock banks was confined to England and Wales: Scottish and Irish banking being conducted under different legal codes, it was thought impossible to amalgamate such institutions with English banks: and no attempt was made, except shortly before the War, to invade the sphere of the foreign and colonial banks. It was only in 1905 that the first attempt was made by an English joint stock bank (the Midland) to open a separate branch in the City of London for the conduct of foreign operations, an example which was very soon followed; whilst in 1911 the first overseas venture of an English joint-stock bank was made when Lloyds Bank acquired the business of Armstrong and Co. in Paris.

Simple as the nature of the British amalgamation movement was, both as regards form and aim, it had sufficed to reduce very materially, even in pre-War years, the total number of separate banks. By 1910 the total number of separate joint-stock banks

in England and Wales had been cut down to 45, the number having been 104 in 1890 and 77 in 1900. At the same date there were only nine private partnerships conducting a banking business—a sufficient proof of the extent to which the process of absorption by joint-stock banks had affected a transformation of banking conditions since joint-stock banking was first permitted under the Act of 1826. These 45 banks possessed between them 5,102 branches, paid-up capitals and reserves of £81,000,000, deposits amounting to £721,000,000 and outstanding acceptances to the amount of £52,000,000. At the same date the deposits of the remaining private bankers were only some £27,000,000. By 1914, the number of joint-stock banks had fallen to 38, their branches had risen to 5,869, their capitals and reserves stood at £82,000,000 and their deposits at £896,000,000, whilst the number of private banks had decreased to eight, and their deposits stood at £33,000,000. The leadership among English joint-stock banks at that date already belonged to the five banks which have since become known as the "Big Five." At the end of 1914, the deposits and numbers of offices of these banks stood as follows:—

	Deposits £	Offices
London, City and Midland	125,700,000	1,027
Lloyds	117,700,000	1,085
London County and Westminster	101,000,000	363
National Provincial	74,900,000	447
Barclays	167,400,000	606

Behind these leading banks ranged four large banks with deposits of over £40,000,000 each, viz.: Parrs, the Union of London and Smiths, the London Joint Stock, and the Capital and Counties, whilst five banks possessed deposits of between £20,000,000 and £30,000,000.

Home Absorptions.—The history of the amalgamation movement after 1918 is but a description of how the leading five banks completely absorbed their powerful but somewhat smaller rivals, by a process of competition among themselves. The critical years were 1918 and 1919. In those two years, to mention only the more important events, the National Provincial absorbed the Union of London and Smiths, the Sheffield Banking Co. and the Bradford District Bank: Barclays (having absorbed the important United Counties Bank in 1916) took over the just amalgamated London, Provincial and South Western Bank; the Westminster absorbed Parrs Bank and the Nottingham and Nottinghamshire Banking Co.; Lloyds Bank took over the Capital and Counties and the West Yorkshire Bank; finally, the Midland absorbed the London Joint Stock Bank. In the same years the Bank of Liverpool amalgamated with Martins Bank, and absorbed the Halifax Commercial Bank, the Palatine Bank and Cocks, Biddulph and Co., thus forming a new and powerful group, better able to stand centripetal pressure from the older and more powerful combinations. The competition to absorb did not relax in later years, and affected particularly the remaining private bankers. In 1920 the Westminster took over Beckett & Co. of Leeds; in 1923 Cox and Co., and H. S. King and Co. were absorbed by Lloyds, and Holt and Co. by Glyn Mills and Co. In the following year the old firm of Child and Co. was acquired by Glyns, and Grindlay and Co. by the National Provincial, while the Royal Bank of Scotland absorbed Drummond and Company. In the same year also the National Provincial absorbed the Guernsey Banking Co. and the Westminster took over the Guernsey Commercial Banking Co.

Affiliations and Extensions Oversea.—Even more significantly, the amalgamation movement no longer confined itself to traditional forms and areas. During and after the War, the "Big Five" converted their undertakings from unified structures to banking groups with a main stem representing the amalgamations, with branches from the main stem in the shape of affiliated and subsidiary undertakings, and with undertakings owned in common. Thus the Midland affiliated the Belfast Banking Co. in 1917, the Clydesdale Bank in 1920 and the North of Scotland Bank four years later: Barclays control two affiliated institutions, the British Linen Bank (1919) and the Union Bank of Manchester (1919), and possesses subsidiaries in the shape of Barclays Bank (Overseas) Ltd., Barclays Bank S.A.I. at Rome, and Barclays (Dominion, Colonial and Overseas) Bank. Barclays' holding of shares in the Colonial Bank and the Anglo-Egyptian Bank were turned over to the last named, formerly the Colonial Bank, with which the Anglo-Egyptian Bank and the National Bank of South Africa are amalgamated. Lloyds Bank has a footing in India through the acquisition of Cox and Co. and H. S. King and Co., is affiliated with the National Bank of Scotland and the Bank of London and South America (an amalgamation of the London and River Plate Bank and the London and Brazilian Bank), is joint owner with the National Provincial Bank of Lloyds and National Provincial Foreign Bank Ltd., and is a shareholder (as are also the Westminster, the National Provincial and the Standard Bank of South Africa) in the Bank of British West Africa.

The Westminster Bank has affiliated the Ulster Bank, is a shareholder in the Royal Bank of Canada as well as in the British Italian Banking Corporation (as are also its leading competitors, Lloyds and the National Provincial), and owns the Westminster Foreign Bank Ltd. The National Provincial has affiliated Coutts and Co. (1920), is a shareholder in the P. and O. Banking Corporation, and is half owner of Lloyds and National Provincial Foreign Bank. Thus with the exception of the Midland Bank, all the leading institutions are interested directly in overseas banks. The tendency to be interested in such concerns has affected even the smaller joint-stock banks: thus Williams Deacons Bank and the Union Bank of Scotland are both shareholders in the British Overseas Bank, and a very large number of concerns other than those already mentioned are included among the shareholders of the British-Italian Banking Corporation.

Effect of Amalgamations.—So vast a development as this was well calculated to attract public attention and to cause alarm. But, in the main, public attention and criticism have been confined to the absorption and extinction of competing banks within the confines of the country and have concerned themselves little with the other features of the situation, which, as a matter of fact, represented a more significant breach with tradition. On March 11 1918, when the competitive amalgamation movement was at its height, the Treasury appointed a committee on bank amalgamations to investigate the whole position. The committee reported on May 1 of the same year, but the evidence laid before it was not made public. The committee was clearly not very impressed by the argument that the growth in the scale of business undertakings justified the latest amalgamations, and was influenced by the view that when two banks of national scope join together, the effect is a net reduction of competition.

It thought the tendency for amalgations to reduce the ratio of capital and reserves to deposits undesirable, and gave cautious assent to the view that circumstances might produce something approaching a money trust at a comparatively early date. The committee therefore recommended legislation requiring that the prior approval of the Government must be obtained before any amalgamations are announced or carried into effect, "including under this term proposals for interlocking directorates, affiliations, and in fact, any arrangements which in effect would alter the status of a bank as regards its separate entity and control." Though no such legislation was carried, the prior consent of the Treasury is obtained before amalgamations are carried into effect, and Lloyds' Bank was refused permission to acquire the shares of the National Bank of India in 1919. So far as the domestic situation is concerned, Treasury control does not appear to have affected the course of events very much.

The alarm which the movement has created is in the main due to the feeling that the absence of effective competition would mean less ample facilities and higher charges for the public, as well as greater rigidity in the business intercourse with banks. It is almost impossible to gauge how far the latter fear may have been subsequently justified: it is perhaps also significant of the greater power of the banks that they had not, by the end of 1925, raised the rate on time-deposits to the pre-War level of 1½% below bank rate. What is undoubtedly true is that the amalgamation movement has not in any way checked competition among the banks in the creation of new offices. These continue to increase in a ratio for which there would seem to be very little real justification.

The amalgamations of 1918–9 were undoubtedly in part competitive: the leading banks absorbed others lest some competing bank should do so. The cost of acquisition was thus in some cases unnecessarily high, but the relative smallness of British banking capitals—a disadvantage from other standpoints—prevented these high acquisition costs from being a very serious permanent burden. A more legitimate reason for expansion was undoubtedly the feeling that the end of the War would see intensified competition between Great Britain and Germany, for which strong and powerful banks were needed: but whilst this was hardly a justification for the internal absorptions (in view of the already large size of the then existing banks) it was a legitimate argument as regards overseas expansion. On the other hand, the later and lesser amalgamations which accompanied the trade depression of 1921 and subsequent years

were no doubt forced upon the absorbing banks by the position of the weaker banks, and by the fear that a general distrust of the banking system would arise if a series of failures were allowed to take place.

Occurring at a time when all economic phenomena were affected and distorted by the War (in particular, in the case of banking figures, by inflation) it is impossible to say to what extent the actual movements of deposits, loans, investments and advances would have been different, had amalgamations been less frequent.

The most significant changes are the decline in deposits since the maximum of 1921 and the fall in investments accompanied by a rise in advances and discounts. This would indicate that the banks are responding to the needs of trade by reducing their holdings of fixed interest-bearing securities and of Treasury bills. Substantially the same results are revealed by taking the total banking figures of Great Britain, as under:—

Statistics of the "Big Five" Joint Stock Bank

	At June 30							(At Dec. 31)
	1914	1920	1921	1922	1923	1924	1925	1925
Capital and Reserves	56·7	101·4	106·1	106·3	106·2	109·2	109·3	111·6
Acceptances	32·7	74·8	47·4	45·5	64·5	73·0	79·8	97·2
Deposits	642·4	1,585·1	1,620·1	1,600·2	1,504·2	1,518·7	1,509·0	1,522·1
Cash in Hand and at Bank	100·3	263·2	253·6	242·5	230·0	246·2	252·4	258·1
Investments	97·2	330·0	303·2	377·0	324·8	319·0	264·7	259·2
Discounts, Loans, Advances and Money at Call	488·8	1,077·9	1,147·5	1,064·3	1,031·4	1,037·9	1,075·8	1,090·4
Cover for Acceptances, Premises, Sundries	46·5	90·2	69·3	68·2	88·7	97·8	105·2	123·2
Total Assets or Liabilities	731·8	1,761·3	1,773·6	1,752·0	1,674·9	1,700·9	1,698·1	1,730·9

Banking Liabilities and Assets

	Liabilities In £, millions of		
	1922	1923	1924
Capital and reserves	156·2	156·1	161·4
Undivided profits	8·2	8·5	8·7
Deposits	2,209·4	2,154·7	2,136·3
Acceptances	91·9	118·6	142·4
Notes, etc.	33·8	31·5	31·8
Total	2,499·5	2,469·4	2,480·6

	Assets In £, millions of		
	1922	1923	1924
Cash in hand, at bank, and at call and short notice	503·6	487·6	508·5
Investments	585·2	542·9	492·9
Discounts and advances	1,291·9	1,291·3	1,309·7
Premises and cover	118·8	147·5	169·4
Total	2,499·5	2,469·3	2,480·5

(T. E. G.)

V. POPULATION

The decennial census due in 1921 was planned for April 24 of that year. Owing to the coal dispute then in progress the enumeration was postponed to June 19. The total population found at this latter date may be compared with that found in 1911 as follows:—

Before 1921 the decennial increase per cent had never been less than 10% for England and Wales. The number of females to 1,000 males in England and Wales, had, since the date of the first census in 1801, never been less than 1,036 (in 1821) and never, until 1921, been more than 1,068 (in 1901 and 1911). For the large excess of women in 1921 and for the unusually small increase per cent that occurred during that period, the War is in part responsible. The effect of the War can be more clearly seen when the crude birth rates and crude death rates since 1911 are considered. The crude rates are the numbers born and the numbers dying per 1,000 of the population during the year to which they refer. Deaths due to the War occurring abroad are excluded.

TABLE I. *Total Population of Great Britain*

Area	Date of Census	Persons	Population	Increase of Population since the preceding Census	Decennial increase per cent of Population	No. of Females to 1,000 Males
England and Wales	1911	36,070,492	M 17,445,608 F 18,624,884	3,542,649	10·89	1,068
England and Wales	1921	37,886,699	M 18,075,239 F 19,811,460	1,816,207	4·93	1,096
Scotland	1911	4,760,904	M 2,308,839 F 2,452,065	288,801	6·5	1,062
Scotland	1921	4,882,497	M 2,347,642 F 2,534,855	121,593	2·6	1,080

The effect of the War upon the death rate was to check the decline which had been in evidence previously. The influenza epidemic of 1918, which may be traced to the War, caused a high death rate that year. Since the War the death rate has declined to a lower figure than was ever shown before 1914. When the infant mortality rates for these years are considered (that is the number of children dying under one year of age per 1,000 born) it appears that the greatest improvement has been effected in the case of infants. The infant mortality rate, for instance, which in England and Wales was 128 for the period 1901–1910 and 100 for the period 1911–1920, declined to 83 in 1921, to 77 in 1922, and to 69 in 1923.

The effect of the War upon the birth rate was to cause during the progress of hostilities a more rapid decline than had been in evidence before and to cause after the end of hostilities a sudden rise to a higher figure in 1920, since when it has declined to a lower figure than was ever reached before. The decline in the crude birth rate which had been taking place for more than 50 years is mainly to be accounted for by decline in the number of children born to wives of reproductive age, but partly also by a change in the age distribution of the population. Owing to this change in age distribution there is now a smaller percentage of wives of the most reproductive ages than formerly.

These two facts may be illustrated as follows. In the period 1911 to 1915 there were 189·7 births per 1,000 wives aged 15 to 45; whereas there were in 1921, 176·5; in 1922, 161·6; and in 1923, 156·3. During the same period, however, of 100 wives

TABLE II. *Birth Rates and Death Rates: 1911-1924*

Date	Birth Rate per 1,000 of the Population		Death Rate per 1,000 of the Population	
	England and Wales	Scotland	England and Wales	Scotland
1911	24·3	25·6	14·6	15·1
1912	23·9	25·9	13·3	15·3
1913	24·1	25·5	13·8	15·5
1914	23·8	26·1	14·0	15·5
1915	21·9	23·9	15·7	17·1
1916	20·9	22·8	14·4	14·3
1917	17·8	20·1	14·4	14·3
1918	17·7	20·2	17·6	16·0
1919	18·5	21·7	13·7	15·4
1920	25·5	28·1	12·4	14·0
1921	22·4	25·2	12·1	13·6
1922	20·4	23·5	12·8	14·9
1923	19·7	22·8	11·6	12·9
1924	18·8	21·9	12·2	14·4

under 45 the proportion of wives under 35 has decreased, and this partly accounts for the decline in the number of children per wife. Thus in 1901 there were 593 wives under 35 years of age out of every 1,000 wives under 45; in 1911, 559; and in 1921, 535.

The changes in age distribution revealed by the census indicate that the proportion of young persons in the population is declining while that of old persons is increasing. There were, for example, out of every 10,000 of the population in England and Wales, 2,094 persons under 10 years of age in 1911 and 1,806 in 1921, whereas there were 297 persons of age and over in 1911 and 344 in 1921. The fact that the average of both sexes in Scotland was 28·0 in 1911 and 29·6 in 1921 illustrates a similar change in that country.

Distribution in Urban and Rural Areas.—The density of the population in England and Wales was 649 per sq. m. in 1921 and 164 per sq. m. in Scotland. The population was distributed as between urban and rural areas in the following proportions: England and Wales 79·3% urban and 20·7% rural in 1921, as compared with 78·1% and 21·9% in 1911; Scotland 77·3% urban and 22·7% rural in 1921 as compared with 75·4% urban and 24·6% rural in 1911. When making comparisons between England and Wales on the one hand and Scotland on the other in this respect, it must be remembered that owing to differences in local government between the two areas the terms "urban" and "rural" are used in somewhat different senses.

Two further points should be borne in mind when considering figures for urban and rural areas. These areas do not remain constant from census to census. Areas, formerly classed as rural, are from time to time added to the total urban area owing to changes in the organisation of local government. The population classed as urban therefore occupies a somewhat larger area at each succeeding census. Again the urban area includes many small towns and therefore not all those classed with the urban population are living under strictly urban conditions. A better picture of the urbanisation of the country is provided by the fact that 33·8% of the population of England and Wales were in 1921 living in towns of over 200,000 inhabitants each. The concentration of population in certain areas may also be illustrated by the fact that out of the 53 counties in England and Wales the 12 most populous counties contain 67·1% of the population while the 7 most populous of the 33 counties of Scotland contain 71·9% of the population.

Another method of illustrating the same point is to calculate the proportion which each county respectively contributed to every 100,000 of the population in 1921. It is then found that Lancashire contributed 13,007, London 11,838, Yorkshire 11,041, Durham 3,905, Essex 3,881, Warwickshire 3,669, Staffordshire 3,560, Middlesex 3,307 and Glamorganshire 3,305. Eight counties in England and Wales show an actual decrease in total population between 1911 and 1921. They are Cornwall, Herefordshire, Montgomeryshire, London, Rutlandshire, Westmoreland, Cardiganshire and Merionethshire. London as a whole, it may be noticed, has increased, the increase having taken place outside the county administrative area. In Scotland 17 of the 33 counties show decreases within the same period. Every county in England and Wales shows an increase in total population between 1801 and 1921, but in Scotland five counties, Argyll, Berwick, Orkney, Perth and Sutherland, had in 1921 fewer inhabitants than in 1801.

The most populous towns of England and Wales in 1921 were as follows:—

London (administrative county)	4,484,523	Sheffield	480,639
Birmingham	919,444	Leeds	458,232
Liverpool	802,940	Bristol	376,975
Manchester	730,307	West Ham	300,860

In Scotland the most populous towns in 1921 were:—

Glasgow	1,034,174
Edinburgh	420,264
Dundee	168,315
Aberdeen	158,963

In England and Wales there were 46, and in Scotland four towns each with more than 100,000 inhabitants.

Distribution by Occupation.—The first use which can be made of the information collected at the census regarding occupation is to classify the population according to industrial status. Table III. illustrates the result.

The number of women recorded in Table III. as "gainfully" occupied is relatively small because most women not "gainfully" occupied are married and household duties are not included in in the term "gainful" occupations. Of the 10,542,599 women in England and Wales for instance, in 1921 over 12 years of age, who were not "gainfully" occupied, 6,886,931 were married.

TABLE III. *Industrial Status of Persons Gainfully Occupied, 1921*
12 Years of age and over

Industrial Status	England and Wales		Scotland	
	Males	Females	Males	Females
Employers	563,203	73,708	88,745	9,445
Employees	10,800,276	4,664,603	1,354,078	584,096
Working on own account	749,239	327,021	91,996	39,244
	12,112,718	5,065,332	1,534,819	632,785

The population may next be classified according to the occupations followed. The chief occupations in England and Wales and in Scotland respectively were as follows:—

TABLE IV. *Chief Occupations by Sex, 1921*

Occupations of Males	Total in each Occupation	Occupations of Females	Total in each Occupation
England and Wales			
Metal working	1,540,235	Personal service	1,676,425
Transport and communication	1,420,593	Textile workers	608,964
Agriculture	1,171,298	Makers of textile goods and dress	548,013
Commerce and finance	1,063,120	Commerce and finance	496,056
Mining and quarrying	1,061,749	Clerks and typists	429,695
Clerks and typists	568,034	Professional	359,982
Scotland			
Metal working	280,210	Personal service	168,149
Agriculture	169,984	Textile workers	92,407
Transport and communication	169,912	Commerce and finance	83,111
Mining and quarrying	151,884	Makers of textile goods and dress	53,967
Commerce and finance	116,460	Clerks and typists	67,966
Workers in wood and furniture	80,860	Professional	44,970

Since a new classification by occupation was used in 1921, comparisons with former censuses cannot easily be made. It should be remembered that this classification is by occupation and not by industry. It might with care make possible a rough estimate of the numbers engaged in sedentary and non-sedentary occupation, in skilled and unskilled occupations and similar comparisons. It does not show the numbers engaged in different industries. Thus clerical workers are placed in a separate group. If all such workers are allocated to the industries with which they are usually associated, it is possible to classify the population by industry. This is done in the following table.

TABLE V. *Chief Industries, 1921*

England and Wales		Scotland	
Industry	Total in each Industry: Both Sexes	Industry	Total in each Industry: Both Sexes
Commerce and finance	2,275,148	Commerce and finance	289,369
Manufacture of metals	2,196,014	Manufacture of metals	368,610
Personal service	2,046,825	Personal service	199,648
Public administration and defence	1,335,879	Agriculture	183,086
Mining and quarrying	1,283,728	Mining and quarrying	179,952
Transport and communication	1,203,566	Transport and communication	155,564
Manufacture of textiles	1,153,829	Manufacture of textiles	151,166
Agriculture	1,123,962	Public administration and defence	143,191

The precise scope of the industries included in the above table requires careful examination if the figures are to be properly appreciated. Thus commerce and finance includes persons engaged in all

forms of wholesale and retail dealing, in auctioneering and valuing as well as in banking and insurance. Shop assistants therefore form a large part of the total in this group. The manufacture of metals includes also the manufacture of machines, implements, conveyances, jewellery and watches. Personal service includes not only domestic service but also service in lodging houses, hotels, clubs, laundries and restaurants. Public administration and defence includes, in addition to the fighting services, those employed both by local and central government authorities. Transport and communication includes those employed in connection with storage. The manufacture of textiles includes not only those engaged in the manufacture of cotton, wool and silk goods but also those engaged in the manufacture of various miscellaneous products such as lace, carpets, rope, asbestos, tents and tarpaulins, as well as those engaged in dyeing, printing, bleaching and calendering.

When the population is thus classified, it is seen that those engaged in certain industries are less in number than those engaged in the corresponding occupations. Those engaged in the transport industry, for example, are fewer in number than those engaged in the occupation of transport and this is so because some of those who follow transport as an occupation appear in the industry table as belonging to another industry. Thus while a railway man would appear among those engaged in transport both as an industry and as an occupation, a carter employed by a mining company would be classed as following the occupation of transport but belonging to the industry of mining. Those who follow the occupations of mining and agriculture comprise nearly all those who are engaged in the corresponding industries, whereas those engaged in commerce and finance as an occupation only form about half of those engaged in the corresponding industry owing to the fact that numerous clerical workers who follow the clerical occupation belong to the industry of commerce and finance. Four of the eight chief industries are not industries in the everyday meaning of the term, namely, commerce and finance, personal service, public administration and defence, and transport and communication. If they are omitted from consideration, the industry of the manufacture of metals takes the first place in Great Britain.

The low place of agriculture is noteworthy. It was once considered remarkable when those engaged in agriculture were less numerous than those engaged in all other industries taken together. Agriculture is now not even the most important industry from the point of view of numbers, having fallen to the fourth place in England and Wales and to the second place in Scotland. It is possible to classify industries broadly into those which are extractive, manufacturing, distributive and certain miscellaneous groups. If agriculture, mining and fishing are regarded as extractive and commerce and finance and transport and communication as distributive, then the following result is obtained. In England and Wales of all those engaged in industry, those engaged in manufacture comprise 43·6%, in distribution 20·3%, in extraction 14·0%, in personal service 11·8%, in public administration and defence 7·7%, in professions 2·9%, in sport and entertainment ·7%. In making this calculation the 162,767 persons engaged in the gas, water, electricity industrial group have been included among those engaged in manufacture. It should be noticed that about 60,000 of them are employed by local authorities and that a certain percentage of all those in this group should more properly be included among those who are engaged in the work of distribution.

Housing.—For the purpose of the census a structurally separate dwelling is defined as any room or set of rooms having separate access to the street or staircase. Thus a flat is such a dwelling. In counting the number of rooms, sculleries, bath rooms, shop or office rooms are excluded. The total number of dwellings was found to be 7,759,821, having a total number of 39,894,618 rooms. There were thus an average of 5·14 rooms per dwelling in England and Wales, but as some dwellings were occupied by more than one family there were only on the average 4·55 rooms per family. As the average number in a family was 4·14 the average number of rooms per person was 1·1. But these averages by themselves give little or no idea of the actual housing conditions of the population. Thus there were no fewer than 3,480,273 private families with less than ·5 rooms per person, while there were 17,429,709 persons belonging to families with less than one room per person. Again 9·6% of the total private family population was living with more than two persons per room in England and Wales. Judged according to this standard the counties vary greatly. London has 16·1% of the population living with more than two persons per room while Cornwall has only 2·8. These figures, however, take no account of the size of the rooms. Housing statistics tend to show a progressive improvement when the returns of one census are compared with those of preceding censuses, though the figures for 1921 exhibit a check to the rate of improvement. The following figures for Scotland show the number of occupied houses per 100 of the population: 1881, 19·8; 1911, 21·3; and 1921, 21·7.

Marital Conditions.—Of the male population in England and Wales in 1921 55% was single, 41·4% married and 3·6% widowed. Of the female population 53% was single, 38·3% married and 8·2% widowed. The large number of widows, 1,621,658, is noticeable, amounting to nearly three times the number of widowers. There were at this date 8,464 men and 8,218 women divorced.

Language.—The census returns show that the use of Welsh and Gaelic is declining. The proportion of persons three years of age and over in Wales and Monmouthshire speaking Welsh only was 85 per 1,000 in 1911 and 63 per 1,000 in 1921, while in Scotland the proportion of those speaking Gaelic only was 4·56 in 1911 and 3·47 in 1921. The proportion of those speaking both English and Welsh and English and Gaelic has also declined.

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England and Wales: Registrar-General, *Weekly returns of births and deaths; Quarterly returns of marriages, births and deaths.*

Scotland: *Weekly returns of births, marriages and deaths in sixteen towns of Scotland; Monthly returns of births, marriages and deaths in sixteen towns of Scotland; Quarterly returns of births, deaths and marriages of Scotland.* (A. M. C.-S.)

VI. INDUSTRY AND TRADE

The period of 1910–3 was one of steadily improving trade, but during the first seven months of 1914 there was a perceptible decline of prices and employment.

The War Period.—The principal effects of the World War were the alteration of the normal directions of foreign trade, owing to the interruption of commerce between the belligerent nations and the influence of blockage policies on the commerce of neutral countries; the gradual assumption of control by the Government over both production and distribution; the diversion of production and distribution; the diversion of production into new channels for the supply of War requirements and to make good the loss of imports due to the interruption of commerce; and great changes in labour conditions.

Government Control.—The progress of control by the Government is thus described in the Report of the War Cabinet for the year 1917 (Cmd. 9005, p. 130).

As the military struggle developed in scope and intensity, and the necessity of concentrating national efforts on the War became more pressing, section after section of industry was taken over, and wages, prices and profits, from raw material to finished product, were placed under Government control. The process of extending State control, taking over more works and applying it to an always widening range of products, continued unbroken right up to the end of 1916. Whilst no exact demarcation line can be fixed, if a broad definition of the character of the movement to that period were attempted it would be that industries essential to War needs had been taken under Government control whilst industries serving the civil population were still left in private hands. In the same way 1917 may be described as the year in which State control was extended until it covered not only national activities directly affecting the military effort but every section of industry—production, transport and manufacture.

Towards the end of June 1917 the country was faced by a serious crisis in the cotton industry, owing to the difficulty of securing supplies of raw cotton. With the co-operation of the industry, a cotton control board was set up. The production of the cotton mills was cut down to 60%, extensions only being allowed on payment of levies, and the sum thus raised utilised for the benefit of the work-people in the less employed mills. The control board thus established contained representatives of the employers and the employed and also of the Government.

A board of control on somewhat similar lines was set up for the wool textile industry, to deal with the difficult problems which arose from the fact that, after Government requirements had been met, rather less than 20% of the output of the trade was left for civil needs. According to the War Cabinet Report for 1918 (p. 210), there was no question raised in connection with the wool textile industries to the solution of which the board did not contribute a most valuable part. Somewhat similar arrangements were made for the jute, flax and hemp industries.

One important effect of the Government control and of the strain put upon various industries by War conditions was the attempt made to extend the standardisation of production even into the clothing industries. By the end of 1918 there had been put on the market £15,000,000 worth of standard suits, over 2,000,000 lb. weight of hosiery, 1,000,000 blankets and 8,000,000 pairs of standard boots. These schemes of standard-

isation did not long survive the end of the War, though they may have led in some degree to simplification and the reduction of patterns. Of more lasting effect was the great alteration brought about in the productive capacity of various industries.

The manufacture of explosives and propellants was chiefly carried out in special Government factories, but shell cases, rifles, guns, trench weapons, aircraft, tanks, etc., could be produced in different classes of engineering works, and the engineering industry of the country was by degrees almost entirely absorbed in this work, which led to a very considerable expansion of engineering capacity. The same cause brought about a 50% expansion of capacity in the iron and steel industry, and varying increases in many smaller industries.

Various new industries had to be created to supply essential products which were formerly imported from sources rendered unavailable by the War. Amongst these may be mentioned dyestuffs, a large range of fine chemicals, optical and scientific instruments and their components, and various special products such as magnetos. A special Act (The Dyestuffs [Import Regulation] Act 1920 [10 and 11 Geo. V., Ch. 77]). was passed in 1920 prohibiting the importation of dyestuffs except under licence, the idea being gradually to build up by these means British production of essential dyestuffs. In 1921, the Safeguarding of Industries Act (11 and 12 Geo. V., Ch. 47), subjected to an import duty of 33⅓% a wide range of the other articles mentioned above.

War conditions brought about:—

(*a*) Changes in wages, (*b*) new methods of negotiation and relations between employers and employed, (*c*) the introduction of new processes and spread of repetition work, (*d*) improvement in the position of unskilled relatively to skilled labour, (*e*) an enormous increase in the industrial employment of women and (*f*) an increased interest in the improvement of methods of production and the welfare of workers.

Prices and Wages.—The complete control assumed over various industries fixed on the State the responsibility for the control of wages. The cost of living rose steadily during the War (from 100 in July 1914 to 205 in July 1918), and as the demand for War material was practically unlimited the adoption of the cost of living as a standard in the fixation of wages was almost inevitable. This principle was, however, not universally adopted, nor was there any generally accepted decision as to whether the increase should be a flat rate for all workers (on the ground that all need approximately the same minimum amount of food, clothing, etc.), or a rate proportional to earnings or varying inversely with earnings. The method generally adopted by the Government in the controlled industries was, however, to give a flat rate War wage.

This principle had the very important effect of introducing a change in the relation between skilled and unskilled labour, the position of the unskilled being very greatly improved. The following summary by Professor Bowley of the progress made from 1914–20 may here be quoted:—

After a few months of unsettlement the demand for War materials and the withdrawal of men to the Army resulted in very plentiful employment. The opportunity of increased family earnings at former rates of pay together with an active patriotic spirit prevented for some time demands for increased wages. As food became scarce and prices rose, however, earnings became insufficient in some cases to meet the reasonable needs of efficient subsistence, and bonuses and War wages were given, while the great demand for labour had its natural effect in raising rates of wages. So far as generalisation is possible, we may state that the growth of rates of wages generally lagged behind that of prices, but earnings, in those very numerous cases where piece rates or overtime gave facilities for additional work and pay, increased more rapidly than prices from the outbreak of the War to the Armistice. In the early part of 1919 the War rates continued, though earnings probably tended to fall; and the working classes, fairly content with existing rates in view of the slight fall in prices, devoted their attention to reduction of hours, so that in fact the normal working week was generally reduced by some 10%, while the same money was received for the shorter week as formerly for the longer. When the rise of prices set in again there were continued further upward movements of wages, and at the same time several of the more powerful trade unions made definite efforts to secure a higher standard of living than before the War, while the principle of a minimum wage, intended to be sufficient to allow a livelihood more liberal than had been customary, was widely applied. The result was that during 1919 and 1920 there was a race between wages and prices.

With regard to the employment of women, the following figures sufficiently illustrate the position:—

Average figures for men and women in industrial employment (manufacturing)

	July 1913	July 1918	July 1924
Men	6,301,000	5,058,000	6,016,900
Women . . .	2,178,600	2,970,600	1,987,990

The end of the year 1920 marked the peak of prices, and the slump of 1921 came upon a chaotic wage position. In some classes of work real wages were higher than pre-War, but in others they were lower. Railway workers, coal-miners, dockers and others had definitely obtained improvements in their standard of living. The effects of War tendencies continued in varying degrees in different industries, sometimes without due consideration for what the commercial conditions enabled the industry to sustain. Moreover, the operation of foreign competition upon certain industries created a great disparity between wages in these industries and those in the non-competitive or sheltered industries (covering about one-half of the total persons employed), and it is the general view of industrialists that the high level of these latter wages added a very considerable burden of cost to the less fortunate industries and seriously hindered their revival. (*See* PRICES; WAGES.)

Industrial Relations.—The experience of such bodies as the cotton and wool control boards, the spirit of comradeship engendered by the War, and the strengthening through War experience of the nation's realisation of the dangers of industrial strife, created a new attitude towards the relations between employers and employees. This found expression in individual works in the growth of works committees and other co-operative methods, and nationally in the establishment of the scheme for joint industrial councils, recommended by what is known as the Whitley Committee's Report. Of these there were by the end of the year 1921 between 50 and 60 in operation, covering such important industries as wool and allied textile, heavy chemical, printing, pottery, flour milling and gas and electricity supply.

The fact that the scheme was not adopted in coal-mining, cotton, engineering, railways, iron and steel, and certain other industries was largely due to the existence in those industries of well-tried conciliation schemes, which neither party desired to change. The intention of the scheme was that the councils should include in their scope not only conciliation but a wide range of subjects of general interest to the industry, such as technical education, etc. This intention has only been very partially carried out. Another evidence of the new spirit was the foundation of such bodies as the National Alliance of Employers and Employed (now called the National Industrial Alliance); the Industrial Welfare Society; the Institute of Industrial Psychology; the Industrial Fatigue Research Board, bodies which still survive to carry on the useful work indicated by their titles. (*See* INDUSTRIAL RELATIONS.)

Scientific Research.—The War strongly stimulated a most beneficial movement for scientific research. In 1917 Parliament voted a sum of £1,000,000 to be administered by a special committee of the privy council in grants to trades willing to form research associations. In 1924, 23 industrial research associations were in actual operation, and the privy council committee was able in its report for 1923–4 to record the opinion that the scheme promised to be a marked success. There has also been a substantial extension of research work by individual firms. (*See* INDUSTRIAL RESEARCH.)

Trade Organisation.—Shortage of raw materials and other factors made it absolutely necessary for the Government, when handling industrial questions, to be able to deal with trades as a whole. This led to the formation of voluntary representative associations in a considerable number of industries, while the increased realisation on the part of industrialists of the importance of mutual consultation and co-operation for commercial

purposes led to the foundation in 1916 of the Federation of British Industries, a strictly non-political body dealing solely with commercial questions.

The tendency towards amalgamation of individual firms was also much stimulated by War experience and by the recommendations of Government committees, which brought home to industrial leaders the necessity of safeguarding supplies of raw material, enlarging the scale of production, etc. The armament firms, faced with large extensions of plant, sought to facilitate the employment of these after the War by the acquisition of subsidiary businesses, capable of acting in the capacity of suppliers of material or buyers of partly finished products. There were also considerable amalgamations in the iron and steel, electrical engineering, in cocoa, chocolate, biscuit and glass industries. The formation of a large combine in the jute trade in 1920 may also be mentioned, but there was not any very general enlargement of units in the textile industries. These various amalgamations have not all been equally successful.

Trade Development.—Owing to changes in values and methods of recording it is difficult to compare post-War trade with that of 1913. The following chart and tables show the course of trade of the United Kingdom and in certain specified industries. Figures are for the whole of the British Isles up to April 1 1923, and for Great Britain and Northern Ireland after that date. The quantity index has been compiled to compare the post-War overseas trade with that for 1913.

Overseas Trade of the United Kingdom in value and volume, 1913, and 1919 to 1925

1. IMPORTS

Year	Food, Drink and Tobacco		Raw Materials and Articles mainly unmanufactured		Manufactured Articles		Total	
	Mill. £	Index of vol.	Mill. £	Index of vol.	Mill. £	Index of vol.	Mill. £	Index of vol.
1913	295	100	270	100	201	100	769	100
1919	719	93·9	607	96·1	296	63·2	1,626	88·4
1920	766	90·1	710	91·8	453	81·8	1,932	88·4
1921	567	93·3	271	64·9	244	59·0	1,085	74·3
1922	472	99·5	298	80·8	230	72·4	1,003	85·8
1923	509	114·0	325	80·7	257	86·3	1,096	93·3
1924	571	125·4	400	90·5	300	98·0	1,277	104·0
1925	572	123·9	425	95·3	320	107·8	1,322	108·2

The Slump of 1921.—It will be observed that in the year 1920, in almost every industry, the total value of exports had enormously increased, although the actual quantities exported were

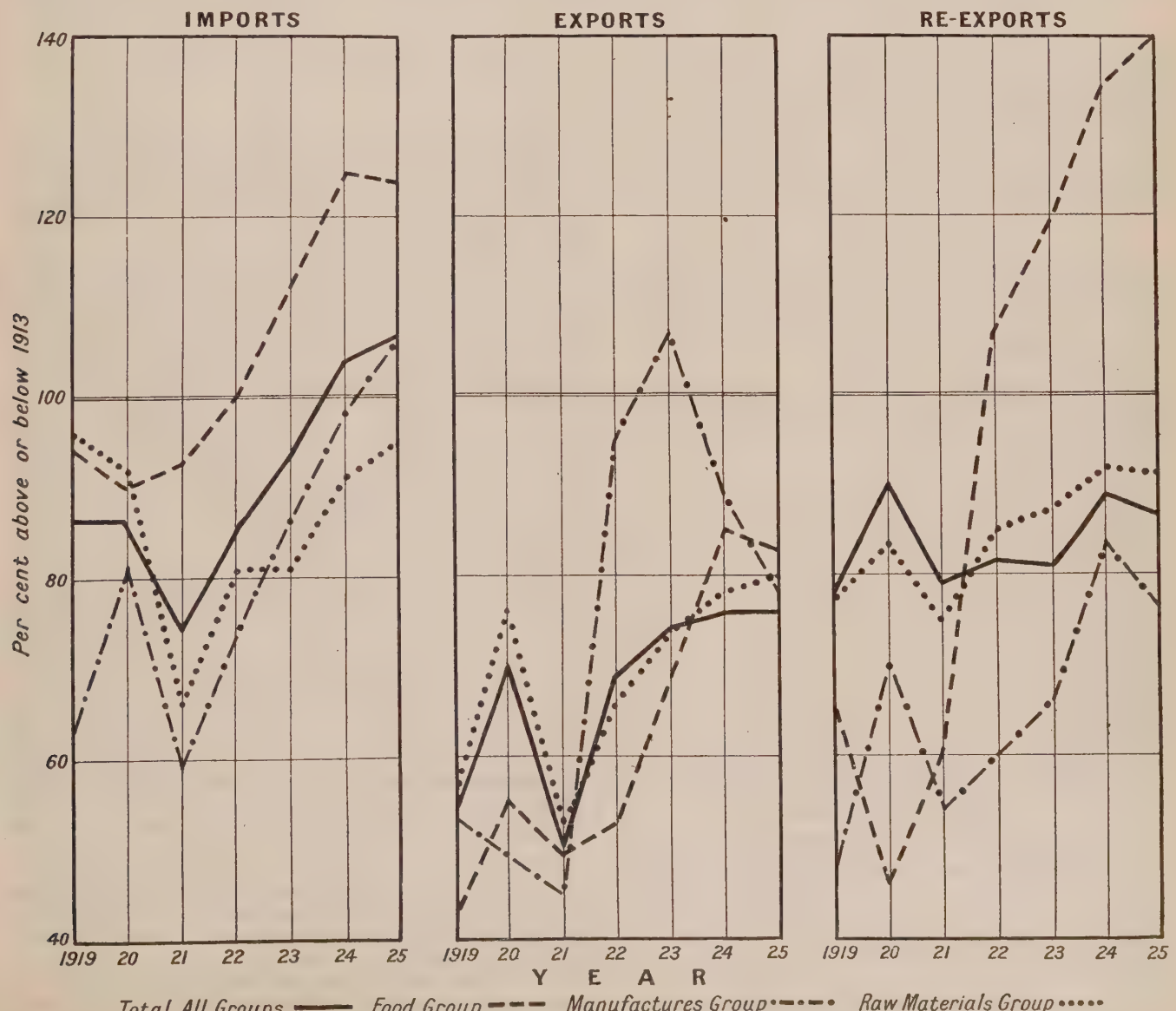

FIG. 1.—Graphs showing the trend of overseas trade (volume) of the United Kingdom from 1919 to 1925. The volume in 1913 is taken as equal to 100, the volumes for the years 1919 to 1925 being shown as percentages above or below that of 1913.

2. Domestic Exports

Year	Food Drink and Tobacco		Raw Materials and Articles mainly unmanufactured		Manufactured Articles		Total[1]	
	Mill. £	Index of vol.	Mill. £	Index of vol.	Mill. £	Index of vol.	Mill. £	Index of vol.
1913	34	100	66	100	414	100	514	100
1919	34	43·7	111	53·6	641	56·4	786	54·9
1920	51	55·3	145	48·9	1,120	76·5	1,316	70·9
1921	37	48·9	64	45·1	589	50·8	690	49·8
1922	36	52·7	102	94·7	569	66·5	615	68·9
1923	44	68·9	131	107·5	580	73·5	755	74·6
1924	57	85·6	107	89·3	619	78·7	783	76·1
1925	55	82·4	84	78·9	616	79·8	755	76·0

3. Re-exports

Year	Food, Drink and Tobacco		Raw Materials and Articles mainly unmanufactured		Manufactured Articles		Total	
	Mill. £	Vol. index	Mill. £	Vol. index	Mill. £	Vol. index	Mill. £	Vol. index
1913	16	100	64	100	30	100	110	100
1919	43	65·1	83	77·8	38	48·7	164	78·2
1920	46	45·3	123	83·2	54	70·7	223	90·3
1921	30	60·2	50	74·6	27	53·4	107	78·6
1922	22	106·6	55	85·2	27	59·8	104	81·5
1923	25	118·1	67	87·5	27	65·9	119	80·7
1924	30	134·3	76	91·8	34	83·4	140	88·4
1925	32	139·4	91	91·2	31	76·6	154	87·3

Exports of Metals and Metal Products
(In millions of £)
(Reproduced by the Courtesy of the British Engineers' Association)

	1913	1920	1921	1922	1923	1924
Iron and steel and manufactures thereof:						
Declared value	55·4	128·9	63·6	60·9	76·2	74·5
Corrected value (on basis of 1913 average values)	55·4	40·3	22·2	38·4	49·7	47·9
Non-Ferrous metals and manufactures thereof:						
Declared value	12·0	25·8	11·7	11·5	14·5	15·6
Corrected value	12·0	14·7	8·8	11·2	12·7	12·9
Cutlery, hardware, implements and instruments:						
Declared value	7·1	13·6	9·0	6·4	7·4	8·5
Corrected value	7·1	5·2	3·2	3·3	4·4	5·5
Electrical goods and apparatus:						
Declared value	5·4	11·6	13·0	7·3	10·2	10·1
Corrected value	5·4	4·3	4·4	2·9	4·3	4·3
Machinery:						
Declared value	33·6	63·4	74·6	51·5	44·5	44·7
Corrected value	33·6	23·3	24·2	19·3	20·9	22·3

Exports of Coal and Coke
(Quantities in millions of tons. Values in millions of £)

	1913	1919	1920	1921	1922	1923	1924	1925
Coal								
Quantity	73·4	35·2	24·9	24·7	64·2	79·5	61·7	50·8
Value	50·7	83·2	99·6	43·0	72·5	99·8	72·1	50·5
Coke								
Quantity	3·3	3·2	3·9	1·6	3·7	5·0	3·9	3·3
Value	2·9	9·1	20·7	3·4	5·2	10·1	6·2	3·8

[1]With minor items included.

Motorcars and Chassis
(Values in millions of £)

Year	Imports				British Exports			
	Cars		Chassis		Cars		Chassis	
	No.	£	No.	£	No.	£	No.	£
1913	6,820	1·7	7,958	1·9	7,595	2·4	1,234	0·5
1919	4,365	1·3	2,240	0·7	1,514	1·0	678	0·5
1920	33,332	10·5	12,106	4·3	5,309	3·9	3,124	2·5
1921	7,397	1·8	4,069	1·1	2,721	2·3	1,041	1·0
1922	14,315	2·5	8,517	1·5	1,934	1·3	1,107	0·7
1923	17,199	2·9	12,627	1·7	4,232	1·9	2,022	1·0
1924	14,717	3·0	12,459	1·8	12,754	3·7	2,905	1·2
1925	34,722	6·3	15,617	2·2	19,316	5·1	2,620	1·3

Artificial Silk
(Including yarn and manufactures thereof other than apparel)

Imports (in millions of £)					
1920	1921	1922	1923	1924	1925
0·6	1·2	2·6	4·4	5·5	6·9
Exports (in millions of £)					
3·0	1·7	2·6	3·5	4·3	5·4

less than in 1913 by varying degrees, and that this position was suddenly changed in 1921, when the volume of exports fell to a fraction of the volume in 1913, though the values continued to be substantially higher. Thereafter quantities gradually rose and values fell. The causes of the slump were described as follows in a report issued by the Federation of British Industries in the year 1922:—

Although there was, for various reasons, considerable delay in the resumption of the normal flow of orders for manufactured goods after the War, and the intake by the countries normally buying large quantities of such goods was during 1919 and 1920 far below the normal, the demand was more than the capacity of the manufacturing countries, hampered and reduced as it was by the effects of the War, could supply.

At the end of 1918 a boom in manufactured goods was experienced in Japan, which passed to the United States, and later in turn to Great Britain, to France and Belgium and finally to Germany. In these circumstances, and with Central Europe very largely unable to import at all, Great Britain was in a relatively fortunate position for obtaining supplies of food and raw materials. In 1919 the necessary foreign credit was secured in the first few months by a continuance of borrowing, and subsequently to a large extent by the very high earnings of our shipping and the abnormal prices we were able to secure for our coal exports. To the goods we were able to buy in this way have to be added the considerable imports on government account ordered during the War, but not shipped till after the Armistice. In 1920 the demand for our manufactured goods was so intense, that though the tonnage exported was small compared with 1913, the total value was very much larger, the average price being nearly four times the average pre-War price.

These developments were accentuated by the fact that many countries had heavy accumulated stocks of raw materials which they were unable to realise, as these accumulations were largely of materials normally taken by the Central Empires and other countries which were still out of the market. Unable to realise their products, these countries in turn were unable to buy the manufactured goods they required, and the normal circle of commerce was interrupted. The effect was immediately to prick the bubble of prices. Purchasers all over the world ceased to buy our goods, and, as prices fell, tended to defer purchasing altogether until they could see some sign that prices had touched bottom. On the one hand, therefore, manufacturers were left with high-priced goods for which the demand had suddenly ceased, while, on the other hand, there were heavy accumulations of unsold agricultural products and raw materials in the hands of potential buyers in distant parts of the world. This has had the result of checking production throughout the world both of agricultural products and manufactured goods.

Another factor which acted as a depressing influence immediately the slump commenced (and had, indeed, prevented some industries from profiting by the boom) was the liquidation by the Government of the enormous stocks of War material held by them at the conclusion of hostilities.

The table on page 273 gives the production of various industries, together with the trend of population in Great Britain and the outward passenger movement for the periods 1911 to 1913 and 1919 to 1925.

Statistics (Production and Population) for the United Kingdom

Year	(1) Cotton Spindles (000's omitted)	(2) Cotton Consumption (in thousands of bales, 000's omitted)	(3) Raw Wool Imports retained in the U.K. (in millions of lb.)	(4) Pig Iron production (in thousands of tons)	(5) Steel production (in thousands of tons)	(6) Gross merchant tonnage launched in Great Britain and Ireland (in thousands of tons)	(7) Coal Raised (in thousands of tons)	(8) Iron Ore produced (in thousands of tons)	(9) Imports of Wheat retained for home consumption (in millions of cwt.)	(10) Estimated Population of Great Britain (in millions)	(11) Net Passenger Movement outwards to places out of Europe (number)
1911	54,522	3,240	529	9,526	6,461	1,804	271,892	15,519	97·7	40·9	272,996
1912	55,317	3,734	517	8,751	6,796	1,739	260,416	13,790	108·9	41·1	316,139
1913	55,652	3,667	539	10,260	7,663	1,932	287,430	15,997	105·4	41·3	329,073
1919	..	..	911	7,398	7,894	1,620	229,037	12,240	71·4	41·7	7,903
1920	58,692	3,074	672	8,034	9,067	2,056	229,295	12,678	109·3	42·5	154,174
1921	56,140	1,678	449	2,616	3,703	1,538	164,344	3,471	79·8	42·8	149,924
1922	56,605	2,275	699	4,902	5,880	1,031	250,808	6,836	96·2	43·1	119,162
1923	56,583	1,919	361	7,440	8,481	646	278,141	10,875	99·9	43·4	252,776
1924	56,750	1,695	435	7,307	8,201	1,440	269,134	11,051	116·7	43·6	117,874
1925	57,116	2,344	414	6,236	7,397	1,079	246,671	..	96·4	..	..

(1) Raw cotton spinning spindles based on the July issues of the International Cotton Federation statistics, not including doubling and waste spindles. (2) Consumption of American cotton lint based on the International Federation's spinners' returns for years ending July 31. (3) Total raw wool retained in the United Kingdom compiled from the trade returns for the U.K. (4) and (5) Production of pig iron and steel according to statistics compiled by the National Federation of Iron and Steel Manufacturers. (6) Lloyd's Annual Summary of shipbuilding. (7) Production excluding Ireland from 1922. Prepared from the Board of Trade Returns. (8) Output according to the annual report of the Secretary for Mines. Production excluding Ireland from 1922. (9) Total wheat retained for home consumption compiled from the U.K. trade returns. (10) Estimated population compiled from the annual reports of the Registrar-General. (11) Board of Trade Returns.

The Various Industries

Coal.—The story of the coal industry was a particularly unhappy one. In 1914, 1,133,746 men were engaged in the coal mines of Great Britain, of whom 150,000 approximately joined up for war services. At the end of the War there were 1,008,867 and in 1924 1,230,248 men in the industry. Immediately after the War huge demands for coal arose. During this time due attention could not be given to maintenance problems, and this, coupled with the return of the miners from the armies, created acute difficulties in organisation, leading to increased costs with reduced outputs. The market showed considerable inequalities, export prices being extremely high as against home prices. During 1920–1 exports steadily fell, but in 1922–3 there was a sudden and sustained improvement, due to the disturbance of continental production through the occupation of the Ruhr. As this factor gradually ceased to operate the depression set in again. In 1925 the Government appointed a Commission to inquire into and report upon the economic position of the industry. Their report was published on March 10 1926 (*see* Coal).

Iron and Steel.—The export figures increased very largely in 1922, the reason in this case also being the French occupation of the Ruhr. When this artificial stimulus was withdrawn the prosperity of the industry immediately declined. This decline continued through 1924 until the last quarter of 1925. The following statement by the National Federation of Iron and Steel Manufacturers summarises the position at the commencement of the last quarter of 1925.

Blast Furnaces in Operation.—There are in the United Kingdom some 480 blast furnaces for the production of pig iron, which is the basic material for the manufacture of iron and steel. If the demand for pig iron required it, some 360 of these furnaces could be blowing at one time. In 1913 there was an average of 338 furnaces blowing throughout the year; the maximum number blowing at any one time since the War was 303 in Sept. 1920. At the present time there are only 129 furnaces in blast, the number having steadily fallen since May 1923.

Pig Iron.—The decrease in the number of furnaces in operation is naturally reflected in the production of pig iron. Pig iron reached its maximum production in the year 1913, when 10,260,300 tons were produced. In 1920 the output amounted to 8,034,700 tons, but in 1924 this had fallen to 7,307,400 tons or an average of 609,000 tons monthly, and this has still further fallen in the present year, so that the average monthly output for the first nine months amounted to only 529,400 tons, the output for Sept. amounting to 448,700 tons.

Steel.—The output of steel ingots and castings in 1913 amounted to 7,664,000 tons, but owing to war needs the steel-making capacity of the country was expanded by approximately 4,000,000 tons per annum, and the country has now the capacity to produce at least 12,000,000 tons annually. In 1920 the output of steel ingots and castings amounted to 9,067,300 tons. In 1924 the output had fallen to 8,201,100 tons, or an average of 683,400 tons monthly, and in the first nine months of 1925 the average was 609,400 tons.

Exports.—The prosperity of the iron and steel industry depends very largely upon the extent of its export trade. In 1913 the total exports of iron and steel amounted to 4,969,200 tons; in 1924 exports were 3,853,100 tons, or an average of 321,100 tons a month, while the average in the first nine months of 1925 was no higher than 300,000 tons a month. In Sept. exports touched their lowest point for 1925 and amounted to 273,200 tons.

Imports.—Imports, on the other hand, have increased in spite of the fact that the increased capacity during the War was sufficient to make it unnecessary for any steel to be imported. Imports of iron and steel in 1913 averaged 186,000 tons a month; in 1924 they had increased to 202,400 tons a month, and in the first nine months of 1925 amounted to 227,000 tons a month.

The decline in this trade has been due to causes which have affected other industries, *i.e.*, depreciated exchanges abroad, lower taxation, lower wages, longer hours in other countries and high foreign tariffs, the difficulties of the steel trade being accentuated by the increase in productive capacity both here and abroad.

Engineering.—In regard to the engineering industry, the same causes were in operation. The year 1925, on the whole, saw an improvement. An unfavourable feature, however, was a rise in the average value of machinery imported in comparison with the average value of machinery exported, showing that the imported goods are of a more highly developed and costly character than those exported. The position of the electrical side of the industry was more satisfactory than that of the other branches, no doubt because of the great increase throughout the world in the consumption of power.

Shipbuilding.—Particularly unfortunate was the experience of the shipbuilding industry. The productive capacity of the world has, since the slump of 1921, been greatly in excess of demand, due to the extension of plant throughout the world necessitated by the rapid wastage of tonnage during the War, and also to the continued depression of international trade which reduced the demand for freight.

Exports of Cotton Products

(Quantities in millions of lb. Values in millions of £)

	1913	1919	1920	1921	1922	1923	1924	1925
Yarn:								
Quantity	210·1	162·6	147·4	145·9	202·0	145·0	163·1	189·5
Value	15·0	33·9	47·6	23·9	26·5	21·0	27·8	30·5
Piece Goods:								
Quantity	6,580·0	[1]	4,435·4	2,902·3	4,183·7	4,140·2	4,444·0	4,433·7
Value	97·8	..	315·7	317·1	142·4	138·3	153·4	150·5

[1] Not available.

Exports of Woollen and Worsted Products

Reproduced by the courtesy of the Wool Textile Delegation, 1925 figures being added

(Quantities in millions of lb. Values in millions of £)

	1913	1919	1920	1921	1922	1923	1924	1925
Tops:								
Quantity	43·6	14·9	23·8	34·7	41·6	38·9	41·2	32·0
Value	3·7	3·2	5·0	4·4	4·4	5·3	6·5	5·3
Worsted Yarns:								
Quantity	49·9	24·6	24·6	23·5	42·9	34·9	45·6	38·9
Value	5·0	10·6	11·5	5·2	7·6	6·2	9·1	7·9
Woollen Yarns:								
Quantity	4·8	4·0	6·4	6·0	9·7	9·2	8·3	6·0
Value	0·5	1·3	3·2	1·9	2·3	1·9	1·9	1·5
Alpaca and Mohair Yarns:								
Quantity	17·2	1·5	4·3	4·1	6·8	9·6	8·4	8·0
Value	2·2	0·6	1·9	1·3	1·5	2·3	2·0	1·9
Other Yarns:								
Quantity	8·5	2·0	3·3	..	2·8	2·8	3·6	4·6
Value	0·4	0·4	0·2	0·1	0·3	0·3	0·4	0·6
Woollen Tissues:[1]								
Quantity	105·9	130·9	187·2	76·6	121·6	148·6	164·7	132·3
Value	14·5	60·4	75·2	24·6	25·1	28·3	30·1	26·3
Worsted Tissues:								
Quantity	62·5	33·2	77·3	40·8	62·3	62·9	56·8	47·3
Value	6·2	11·7	26·7	11·2	11·8	11·4	10·0	9·0

[1] Returns in sq. yd. from 1920 onwards.

Exports of Heavy Chemicals

(Quantities in millions of cwt. Values in millions of £)

	1913		1919		1920		1921		1922		1923		1924		1925	
	cwt.	£	cwt.	£	cwt.	£	cwt.	£	cwt.	£	cwt.	£	cwt.	£	cwt.	£
Sodium Carbonate, including Soda Crystals, etc.	3·9	0·7	4·1	1·5	4·5	2·0	3·0	1·2	5·0	1·6	6·0	1·7	6·1	1·6	5·5	1·5
Caustic Soda	1·5	0·7	1·0	1·3	1·0	1·4	0·6	0·7	1·5	1·6	1·6	1·3	1·8	1·4	1·7	1·3
Sulphate of Soda	1·3	0·1	0·5	0·7	2·0	1·2	0·4	0·4	1·4	0·3	1·5	0·4	1·5	0·3	1·5	0·2
Bleaching Powder (Chloride of Lime)	0·7	0·2	0·3	0·3	0·4	0·5	0·2	0·2	0·2	0·2	0·3	0·1	0·3	0·2	0·4	0·2
	mill. gal.		mill. gal.		mill. gal.		mill. gal.		mill. gal.		mill. gal.		mill. gal.		mill. gal.	
Heavy Coal Tar Oils	36·8	0·6	13·7	0·4	24·7	1·3	14·0	0·7	25·6	0·7	47·9	1·8	45·3	1·7	37·1	1·1

Exports of Fertilisers

(Quantities in thousands of tons. Values in millions of £)

	1913		1919		1920		1921		1922		1923		1924		1925	
	tons	£	tons	£	tons	£	tons	£	tons	£	tons	£	tons	£	tons	£
Basic Slag, Super-phosphates, Guano, etc.	381·0	1·4	58·5	0·7	73·6	1·1	28·6	0·3	54·2	0·4	86·9	0·5	116·7	0·7	128·9	0·8
Ammonia Sulphate	323·1	4·4	92·9	2·2	109·6	3·7	128·5	2·7	144·3	2·4	253·3	4·0	277·7	3·7	262·3	3·3

Cotton.—The position of the American section of the cotton trade was continually unsatisfactory. Owing to short cotton crops the price of material was so high that the relatively poor markets, in which the great majority of sales are made, were unwilling to pay the prices which manufacturers were compelled to ask. Here again the year 1925 gave promise of an improvement. In regard to the finer side of the trade, that using Egyptian cotton, the raw material supply was more satisfactory, and trade was consequently better. Moreover, this side of the industry suffered less than the American section from the tendency of cotton-growing countries to install spinning machinery. Finally, reference should be made to the policy of recapitalisation at higher values during the boom period, the subsequent effects of which seriously embarrassed a number of firms (*see* COTTON).

Wool.—In regard to the woollen and worsted industry, there was very rapid recovery of trade in the second half of 1921, which continued, subject to a slight setback at the end of that year, through 1922 and 1923, the demand generally being for the finer class of goods at the expense of lower grade. During 1923 there was a further setback largely due to the disturbance in continental trade through the Ruhr occupation, which had so substantially benefited the iron and steel and coal industries. During the first half of 1924 there was a gradual recovery, which, however, affected the heavy more than the finer goods; but in the second half of that year the depression returned, and continued during the opening of the year 1925. In the latter part of 1925 there were signs of recovery. In this industry, as well as in cotton, there was a world shortage of material which maintained prices at a relatively high level, and was detrimental to consumption in the impoverished state of most markets. In neither wool nor cotton had the policy of central control, initiated during the War, maintained its power (*see* WOOL).

Chemicals.—The chemical industry includes heavy chemicals, dyestuffs and intermediates, fine chemicals and fertilisers. The progress of the heavy chemical trades since the War was extremely variable, as is shown by the export figures in the above tables. These have been chosen as samples, the great variety of products in the industry making any general statistical statement impossible.

Dyestuffs and Intermediates.—At the outbreak of War less than 20% of the colours used here were actually made in Great Britain, the market being dominated by the German industry. The cessation of imports soon created a dye famine, and prices rose to unprecedented heights, to the great injury of the textile and other dye-using industries. By the end of the War, however, British makers were able to supply not only their own essential requirements, but also some of the needs of our Allies. Government assistance and finance were necessary to enable this result to be attained. In addition the Government assisted the formation of a new company called the British Dyestuffs Corporation, Ltd., an amalgamation of various existing concerns, and itself invested a large sum in the corporation. In 1925 it was claimed that the British industry was meeting 80% of the needs of British colour users, and that an average reduction of 50% in prices had been effected since 1921. The working of this system of protection and partial Government control had not, however, been altogether happy, and during 1925 a reorganisation was carried through, the Government giving up its shareholding in the corporation.

Fine Chemicals.—The following summary is taken from the volume *Chemicals* by Ashe and Boorman (Ernest Benn, Ltd. 1924) in the series, on *The Resources of the British Empire:*—

Prior to 1914 the fine chemical industry was practically a monopoly of Germany, although several British firms possessed an international reputation for some of their products. The War cut off entirely our normal supplies of all kinds of fine chemicals, and beyond the stocks in the country we had no means of obtaining supplies of drugs such as aspirin; of anaesthetics such as novocaine; of remedies such as salvarsan; of synthetic photographic chemicals which were vital to aerial photography and for X-ray work in the hospitals; of synthetic tannins required in the leather industry; of analytical reagents for chemical analysis in the great steel works and in practically every other industry; and of a variety of other fine chemicals necessary for research work and in industry. Fine chemical manufacture was hurriedly undertaken in Great Britain, under most adverse conditions in respect of buildings, plant and processes, and very substantial progress was made. In a few months British salvarsan and salicylic acid were on the market; other drugs soon followed, and before hostilities ceased there was scarcely a synthetic drug of real importance that was not made in this country in sufficient quantities, and in many cases with a margin for export. The same was true of the synthetic photographic chemicals, amidol, metol, paramidol and glycin, and at the present time British photographic chemicals are second to none in quality. Of the synthetic perfumes and flavourings a certain number were made here before the War, but since the production has been largely developed. At the end of 1925 it was estimated that the British production was thrice as great and the volume of exports double what it had been before the War.

Fertilisers.—The fertiliser industries, producing basic slag, sulphate of ammonia and superphosphate of lime suffered much from the agricultural depression, due to bad harvests throughout the world, and from the fact that many of the products are the by-products of other industries. Before leaving the chemical industry mention must be made of the successful establishment since the War of a large scale plant for the fixation of nitrogen by synthetic process; this is a matter of great importance as Great Britain was previously entirely dependent on imports of nitrate of soda.

Motorcars.—The progress of this industry is well illustrated by the tables given above. Satisfactory features were the increased exports in 1923–4 and reduction of imports in 1924. It may be noted that a 33⅓% *ad valorem* duty on imported motor cars, components and accessories was imposed in 1917, removed in July 1924 and reimposed in July 1925.

Artificial Silk.—Before the War artificial silk was not regarded as of sufficient importance to be allowed a special heading in official statistics. The figures given above show how prominent a place the trade held in Great Britain in 1925. It must be remembered that the figures represent values only, and that prices fell during the period 1921–5 (*see* ARTIFICIAL SILK).

Sugar Beet.—The development of the sugar-beet industry in Great Britain is in too early a stage to make any statistical record possible. The Government pledged itself to a generous scheme of subsidy, and the new industry started under favourable auspices. At the end of 1925 there were 10 factories actually in operation.

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(C. T.)

VII. AGRICULTURE

The period 1911–25 witnessed great changes in the cultivation of the soil, in the prices of agricultural produce, in the ownership of land, and still more in the relation of the State to the industry. Indeed, the period witnessed the popular acceptation of the idea that agriculture stood on a different footing from other industries and as such demanded that the State should have a "policy" calculated in one way or another to encourage the full cultivation of the soil.

Before the World War, Government action was of a very limited character. Its most important function was the eradication of contagious diseases of animals in continuation of the policy begun in the '60s for the prevention of the spread of foot-and-mouth disease, cattle pleuro-pneumonia, swine fever and rabies. A beginning had, it is true, been made in promoting agricultural education and research, in the extension of small holdings, and in the improvement of light horse breeding, but generally in this period the policy of the Government, apart

from the suppression of animal diseases, was one of non-interference with the industry, combined with some tentative efforts towards education and the spread of information.

The War Period.—With the outbreak of war, agriculture assumed a new significance. It ceased, at least for the time being, to be an industry pursued, like other occupations, entirely for the benefit of those engaged in it. The production of food became a national question. For a time it seemed as though the increased prices would in themselves provide sufficient stimulus, and it was not immediately obvious in what direction the State could usefully intervene. Gradually, both the food and labour supply became increasingly difficult, and in Jan. 1917 the Food Production Department was established under the Board of Agriculture with a view to more active steps being taken through county war agricultural committees and otherwise to stimulate the cultivation of the soil.

The Corn Production Act.—In the following March the Government announced an entirely new policy, which was afterwards incorporated in the Corn Production Act, 1917. This new policy was based on the view that in order to get farmers to plough up grass land and grow more cereals it was necessary to give them confidence in the future course of prices by providing a Government guarantee that the prices of wheat and oats should not fall below a certain figure during the next few years. The Act, as ultimately passed in Aug. 1917, fixed the prices as follows:—for 1917, wheat 60s. and oats 38s. 6d. per imperial quarter; for 1918–9, 55s. and 32s.; and for 1920–1–2, 45s. and 24s. respectively. Provision was made for the payment to the grower of the average difference between these prices and the average price ruling in the seven months following the harvest in each year. These guarantees, however, never became operative, as the actual price throughout the period was above the guaranteed price. Apart from the guarantees, the Act embodied another new and important departure in policy by providing for the establishment of an agricultural wages board, whose duty it was to fix minimum wages for workmen in agriculture and to see that not less than these wages were paid. This was combined with restrictions on the raising by land-owners of agricultural rents, and with power to enforce the proper cultivation of the land by farmers. Thus the policy contained in this Act was of a dual character: on the one hand it ensured to farmers for a period of six years certain minimum prices for their two principal cereal crops and protected them against any undue raising of rents; on the other hand it required them to pay adequate minimum wages to their workers and to cultivate their land in accordance with the rules of good husbandry.

As a policy of a less permanent character, very active steps were taken by the Food Production Department (under Lord Lee) during 1917–9 in the direction of increasing the area under the plough and generally in promoting the output of food. The increase in the area of the corn and potato crops between 1916 and 1918 was over 1,500,000 acres in England and Wales alone, while the total increase in the United Kingdom was just on 3,000,000 acres.

The Selborne Committee.—In the meantime, the question of the policy to be adopted in regard to agriculture after the War had been considered by the Agricultural Policy Sub-Committee, of which Lord Selborne was chairman. The reference to this committee was " to consider the methods of effecting an increase in the home-grown food supplies, having regard to the need of such increase in the interests of national security," and their report was issued in July 1918. It contains a full exposition of the position of agriculture in this country and deals in detail with the various problems presented, the object being " to formulate a scheme of agricultural policy which may be generally accepted by the nation and adhered to through a long course of years." Briefly, the committee took the view that the security and welfare of the State demanded that agricultural land should be made to yield its maximum production of foodstuffs, and that if this object was to be attained it was necessary to provide a basis of security and stability in the conditions under which agriculture is carried on. The method they recommended was the permanent adoption of the principles underlying the Corn Production Act, viz.: a minimum wage for the agricultural labourer, a guaranteed minimum price for wheat and oats for the farmer, and a control of cultivation sufficient to ensure to the State a permanent development of agriculture and the proper utilisation of the land.

These principles were incorporated in the Agriculture Act which, after prolonged discussion, was passed on Dec. 23 1920. The minimum prices guaranteed under this Act were to be ascertained annually on the basis of the estimated cost of production in any year as compared with 1919. Within a few months of the passing of the Act, however, it became apparent that a serious slump in agricultural prices was taking place and that the burden on the State involved in the guaranteed prices would be very large. This was combined with a general financial stringency which demanded a reduction in all Government expenditure.

A Reversal of Policy.—The result was that the main operative clauses of the Agriculture Act, 1920, were repealed by the Corn Production (Repeal) Act, 1921, and the whole policy of the the intervention of the State in agricultural wages, prices and in the control of cultivation was abandoned. Some temporary compensation was given to farmers by the payment of a subsidy on wheat and oats grown in 1921, which amounted to the sum of £18,000,000, and the sum of £1,000,000 was added to the development fund, mainly for the purpose of promoting agricultural education and research. The Agricultural Wages Board was abolished, and in its place conciliation committees representing both employers and workers were established to fix wages by voluntary agreement.

Between 1921 and the end of 1925, a great deal of discussion took place as to the adoption of some national policy in regard to agriculture, and a large number of proposals were put forward. A conference representative of the various interests was proposed with the object of arriving at some agreed method which would be acceptable to all parties and shades of political opinion, but owing to preliminary differences this conference was never held. The Council of Agriculture, which is a statutory but unofficial body, proposed a scheme which, among other matters, involved a subsidy amounting to some £5,000,000 or £6,000,000 for the encouragement of arable cultivation in England and Wales, but public opinion appeared generally to be opposed to subsidies of any kind.

Thus, at the end of 1925 there was no broad national policy recognised by the State in regard to agriculture of a character comparable with what was attempted by the Corn Production Acts. On the other hand, between 1921 and 1925 a great many agricultural questions were dealt with separately, and very extensive action was taken by the State in the direction of fostering and promoting agriculture. Very considerable sums are voted annually by Parliament with this object, and the position may be summed up by saying that policy is in the direction of helping the farmer to help himself without the intervention of the Government either in regard to prices or cultivation.

Agricultural Wages.—In regard to agricultural wages, the State again intervened and by the Agricultural Wages Regulation Act, 1924, provided machinery whereby minimum wages for workers in agriculture must be fixed in England and Wales. It was not thought necessary to include Scotland in its provisions because Scottish workers appeared able to arrive at satisfactory agreements with their employers without any assistance. The English Act provides for wages to be fixed locally by 47 committees covering the whole country, each committee being composed of an equal number of employers and workers (usually six to eight on each side), two impartial members appointed by the Minister of Agriculture and a chairman. In the event of failure to agree, an agricultural wages board similarly constituted has power to act in default.

Apart from this action in regard to labour, the newer features of the agricultural policy are the action taken in regard to land settlement, education and research, and sugar beet, to which may be added the enquiries and investigations carried out in the first instance by the Linlithgow committee and subsequently

by the Ministry of Agriculture in regard to the marketing of agricultural produce. Combined with these developments is a continuance of the older policy in regard to the control of contagious animal diseases, more especially foot-and-mouth disease, which of late years has presented a more formidable problem than it did for a long period prior to the World War.

Land Settlement, Education and Research.—A forward movement was begun after the Armistice in the direction of settling ex-service men on the land, and under the Land Settlement (Facilities) Act the area of land in England and Wales held by public authorities for letting as small holdings was more than doubled, viz.: from 201,000 ac. at the end of 1918 to 447,000 ac. at the end of 1924, while the number of occupiers increased from 13,874 to 30,177. As regards research and education enormous progress has been made, research institutes (connected in most cases with universities) being now provided for the study of all the scientific sides of agriculture, while instruction of a practical character is undertaken under the direction of the local authorities in every county in the country. This work is maintained or aided by grants from the Ministry of Agriculture, the expenditure from Parliamentary funds in England and Wales alone in 1925–6 amounting approximately to £647,000.

Another direction in which Parliament is providing large funds for the assistance of agriculture is by encouraging the establishment of the sugar beet industry by subsidising the manufacture of sugar from home-grown beet for a period of 10 years under the British Sugar (Subsidy) Act, 1925. The acreage under this crop rose to 55,000 ac. in 1925, and it was expected that this figure would be doubled in 1926. Considerable expenditure is also incurred in the direction of the improvement of livestock. An attempt was made under the Agricultural Credits Act, 1923, to establish a scheme of co-operative credit societies aided by loans from the State, but the number of societies actually established is very small (*see* CO-OPERATION).

The change in the attitude of Parliament towards agriculture may to some extent be measured by the change in expenditure. Thus in 1911–2, the total expenditure of the Board of Agriculture and Fisheries was £251,000, of which possibly 10% represented expenditure on fisheries. This covered England and Wales and Scotland. In 1925–6, the gross estimate for the Ministry of Agriculture (excluding expenditure on fisheries) was £3,277,000 for England and Wales alone, while the estimate for the Board of Agriculture for Scotland amounted to £452,000. The bulk of this expenditure took the form of grants for the purposes mentioned above and involved in most cases considerable additional expenditure on the part of local authorities and others.

A factor which has vitally affected both agriculture itself and the policy of the State has been the change in the price of agricultural produce since the War. During the War, prices naturally rose very considerably, and the rise continued till towards the end of 1920. In the middle of 1921 a severe and continuous slump set in, with the result that the prices of agricultural produce generally, which were 202% above pre-War prices in Sept. 1920, fell to 57% above in Sept. 1922, and with some fluctuations remained more or less at this level for the next three years, the figure for Nov. 1925 being 53%. The sudden fall in prices resulted in severe capital losses, and made agriculture, at any rate for a time, a very precarious undertaking (*see* AGRICULTURE).

In this connection, reference may also be made to another factor connected with the change in the value of money. The prevailing system of tenure in Great Britain is that of landlord and tenant, whereby the land and buildings are provided and maintained by the landlord at a rent which is generally admitted to give only a very small return by way of interest on the capital represented. The much higher rate of interest obtainable during the post-War period on first class securities led to extensive sales of estates, and is said to be resulting in a gradual change in the older system in the direction of a greater tendency towards occupying ownership. Such statistics as are available suggest that the percentage of land occupied and farmed by the owner increased from about 15% in 1920 to 25% in 1924.

Changes in Cultivation.—The changes in cultivation in Great Britain in the 14 years 1911 to 1925 reflect the policy of the period. Up to 1916 there was little development; in 1917 the pressure for increased food production began to make itself felt and reached its maximum intensity in the following year. With the close of the War the impetus was lost, and the proportion of land under the plough gradually decreased and fell below the pre-War level. The following figures, in thousands of acres, show the changes in Great Britain from 1911 to 1925:—

Acreage under Crops and Grass (000's omitted)

	Corn Crops	Arable Land	Permanent Grass	Total Acreage under Crops and Grass
1911	7,041	14,648	17,447	32,095
1917	7,308	14,606	17,251	31,858
1918	8,974	15,852	15,896	31,749
1925	6,321	13,912	16,549	30,461

The decline in the total acreage under crops and grass is to some extent compensated by an increase in mountain and heath land and rough grazings not included under that heading. The area under wheat (included in the above table under corn crops) which was 1,906,000 in 1911, reached a maximum of 2,636,000 ac. in 1918, and declined to 1,547,000 ac. in 1925. In regard to livestock, a very striking feature was the way in which on the whole the flocks and herds were maintained during the War, notwithstanding the shortage of feeding-stuffs. From 1916 to 1920, however, there was a quite noticeable decline in the number of sheep, part of which has since been recovered. As compared with pre-War years cattle are somewhat more numerous, while the pig population, always a fluctuating factor, reached a maximum in 1924. As a broad indication of the magnitude of the industry it may be mentioned that the total value of the "output" of agricultural land in Great Britain represented by the produce sold off farms for consumption elsewhere was estimated in 1923 at £259,000,000.

Agricultural Policy in 1926.—In Feb. 1926 the Government issued a considered statement on agricultural policy, which declared that the Government was not prepared to recommend subsidies for the increase of corn growing or arable cultivation and that it was definitely opposed to compulsory control of cultivation. "The right course in the best interests of the industry itself and of the nation as a whole is to proceed on the lines of education and encouragement rather than of coercion, to endeavour to create that confidence which is essential for progress, to stimulate the private enterprise of those engaged in the industry, and to assist them to organise themselves on an economic basis." It then went on to indicate the lines on which the Government would proceed, such as the development of agricultural credit, small holdings, afforestation, land drainage, marketing of agricultural produce, housing in rural areas, protection against disease and the development of sugar beet cultivation.

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(R. J. T.)

VIII. COMMUNICATIONS AND TRANSPORT

At the outbreak of the War the Government took complete control of the railways under an agreement whereby the companies were guaranteed their pre-War revenues. The fact that the War lasted for more than four years, and involved a far-reaching rearrangement and redistribution of the trade and traffic of the country, made the strict terms of the agreement practically inapplicable. A huge sum of money was required to put the companies back into their pre-War condition of repair and efficiency. Rolling stock had been removed to other countries, stations closed, permanent way and other plant allowed to fall into comparative disrepair, staff seriously depleted, and the arrangements for the routing of traffic widely altered. The costs of operation had also risen enormously.

The Ministry of Transport.—The Government, foreseeing the difficulties which would arise if control were suddenly removed, passed in 1919 the Ministry of Transport Act, which gave the Minister powers to control the operation of all existing means of internal transport. One provision in the Act has proved of permanent importance. This was section 21, which provided for the setting up of the Rates Advisory Committee composed of five members: one person of legal experience (to be chairman), two representatives of trading and agricultural interests, one representative of transport interests, and one representative of labour. It was laid down that before directing any revision of charges, etc., the Minister should consult this committee.

The Act was immediately followed by a reference from the Minister to the committee to report upon an interim revision of railway rates for merchandise and minerals. The committee reported in favour of a general increase varying according to class from 25 to 60%, with flat rate additions, and increased charges for collection and delivery. This was brought into operation on Jan. 15 1920. On May 11 the Minister announced his determination to undertake to complete revision of railway charges and invited the committee to report on the general principles which should govern the revision, including the classification of merchandise traffic. Meanwhile he directed the increase of rates up to 100% above pre-War as from Sept. 1 1920.

As a result of the committee's general report, there was finally passed the Railways Act 1921, which had the effect of entirely reorganising the railway system of the country. The Act's most important provisions may be summarised as follows:—

1. The railways of Great Britain were amalgamated into four large groups, the Southern, the Great Western, the London, Midland and Scottish and the London and North Eastern.
2. A new tribunal called the "Railway Rates Tribunal" was set up to which almost all the powers of the Railway and Canal Commission and many new powers were entrusted, its most important function being the settlement of the schedules and charges of the amalgamated companies. The tribunal consists of one person of legal experience, who is chairman, one person of railway experience and one of commercial experience, and is obviously the successor of the Rates Advisory Committee.

The first of these provisions was intended to facilitate working economies by eliminating costly competition, and the second to provide a cheap and business-like tribunal for exercising the necessary control over the new system

Charges and Wages.—The Act laid down an entirely novel principle in regard to the basis of charge. Section 58 provides that the charges be fixed on a basis estimated to yield an annual net revenue ("the standard revenue") equivalent to the aggregate net revenues in the year 1913 of the various companies absorbed by the amalgamated company together with allowances for interest on capital expended or raised since Jan. 1 1913, or capital which had not at that date become fully remunerative. Section 59 provides for periodical revisions of the charges and also lays down that if on any such review the tribunal finds that the net revenue of the company is substantially in excess of the standard revenue, such excess shall be divided between the public and the railway companies, 80% being allocated to reduction of charges and 20% being retained by the company as profits. This increased standard (the old standard plus 20% of the excess) is then to become the standard revenue of the company.

The tribunal was also given power to revise the classification of goods, and some control was vested in it of exceptional rates. There is no doubt that the framers of the Bill intended, by extending the number of classes and instituting a strict revision of exceptional rates, to reduce the complexity of the rate books, which were said to include more than 80,000,000 exceptional rates, many of them obsolete. The powers which the Bill proposed to vest in the tribunal for this purpose were however strenuously opposed by both traders and railway companies, and, although the tribunal has increased the number of classes from 8 to 21, it is improbable that the new provisions will succeed in substantially reducing the number of effective exceptional rates. In regard to wages and provisions of service, the Act provides that all disputes in regard to these shall be referred to two bodies, the Central Wages Board and the National Wages Board, the latter acting as a court of appeal from the former. Both these bodies are in the nature of conciliation committees including representatives of the companies and their employees; the National Wages Board also includes representatives of railway users.

Between the passing of the Act and the end of 1925, the Railway Rates Tribunal was more or less continually involved in the carrying out of the reorganisation of the railway system entrusted to it by the Act. The ascertainment of the standard revenue proved a very great difficulty, and might indeed have proved impossible but for the formation of a committee known as the traders' co-ordinating committee, representative of all trades substantially interested in railway traffic, and of such great organisations as the Federation of British Industries, the Association of British Chambers of Commerce, etc. This committee has been legally represented before the Tribunal and has been able to negotiate settlements with the railway companies. It appears likely that the almost insuperable difficulties involved in the application of the Act will be surmounted in this way. Reverting to the question of charges, these have been reduced by successive concessions in 1922 and 1923, till at the beginning of 1925 they were 50% above pre-War, with certain flat rate additions, some of the heavy traffic standing at 40%.

In July 1914 the railway trades unions were preparing a claim for improvement of conditions and increase of wages, to be presented in Nov. 1914, when an existing agreement was due to run out. On the outbreak of War it was agreed between the unions and the companies that the existing agreement should continue, but should be terminable by six weeks' notice on either side. The government during the War granted various increases of wages, and in Nov. 1918 the unions gave notice to terminate the agreement. There followed a prolonged negotiation in which the unions, the companies and the government were all involved, and on Sept. 26 1919 500,000 railway workers came out on strike. Work and negotiations were resumed on Oct. 5, and an agreement reached on March 20 1920. Under this rates were divided into two classes, "A" rates and "B" rates. The "A" rates represented the pre-War rates plus certain flat rate additions. These latter were to be subject to adjustment according to the cost of living. The "B" rates represented practically the pre-War wages plus 100%, and it was agreed that, whatever the change in the cost of living, wages should not fall below this level. In 1925 the railway unions put forward claims for a general increase of wages, and the companies counter-claimed for a general reduction. The National Wages Board rejected both claims, but provided that new entrants into the railway service should no longer be entitled to the benefit of the "A" rates. The Board also stated that they did not regard the "B" rates as an "irreducible minimum."

The Removal of Control.—The position of the companies after the removal of Government control in 1921 was an unfavourable one. The economies promised through amalgamation were slow in materialising, and the trade depression resulted in a decline of traffic which was only temporarily alleviated by the great increase in the iron and steel and coal traffic caused by the French occupation of the Ruhr. At the same time the rapid increase of road transport has diverted from the rail a considerable and increasing volume of the high grade traffics which were the most lucrative to the railways, whose position has been further complicated by the great increase in working costs. Expenditure in 1924 exceeded that of 1913 by £96,000,000 or 117%, whereas to meet this additional burden receipts had only increased by £88,000,000 or 70%. Coal was 142% higher than in 1911 and 89% over 1913; other materials were 67·9% and wages 153% above 1913. There was an increase in staff due to the operation of the eight hours' day, the staff in the four amalgamated companies having increased by 76,000 or 13%.

The companies' financial position was, however, relieved by the fact that in 1922 the Government, in order to clear up claims for compensation under the control scheme, handed over to them sums amounting in all to £62,000,000, making over £100,000,000 so distributed since the beginning of control. The companies were able in the years 1923 and 1924 to maintain their dividends by drawing money (over £5,000,000 in 1924–5) from their reserve funds, which had been enormously augmented by these grants. It should be mentioned that the companies have made efforts to secure legislation enabling them to carry by road, but hitherto without success. Meanwhile, they are no doubt endeavouring to effect economies in their operating expenditure. Electrification schemes are being put in hand, notably by the Southern Company. The L.&N.E.R. and the G.W.R. have taken steps to increase the size of the mineral trucks on their systems, the ideal apparently being a 20 ton standard; and passenger services are being co-ordinated, etc. Attempts are also being made to obtain relief from the burden of local rates.

Canals.—During the War the Government took over the great bulk of the canals, the object being to relieve the railways as far as possible of traffic which could equally well go by water. The arrangements for compensation were similar to those made with the railway companies. The great value of the canals during the War caused a revival of interest in their potentialities, especially as the railway system was very congested during the early post-War period. The

government instituted inquiries into the possibility of reviving the canals which had largely fallen into disuse prior to the War, but no government felt justified in undertaking the somewhat ambitious schemes of reorganisation which have been recommended at various times. Local schemes, have, however, been under consideration in various districts, and with government and municipal assistance important improvements are being made on the waterways between Nottingham and the Humber. It is possible that further developments may be undertaken, notably between Birmingham and the Mersey, and Birmingham and the Severn.

Roads.—The development of road transport during the first decade of the 20th century directed attention to the condition of the roads in the country, and as a result the Development and Road Improvement Funds Act was passed in 1909. Under this Act a Road Board was constituted with powers:—

(*a*) To make advances to county councils and other highway authorities in respect of the construction of new roads or the improvement of existing roads;

(*b*) To construct and maintain any new roads.

The income of the Road Improvement Fund was to be derived from motor spirit and carriage licence duties. During the World War the income was absorbed into the general revenue of the country and road development was arrested. By an order in council dated Sept. 22 1919 the powers and duties of the Road Board were transferred to the Ministry of Transport. In 1919–20 a special fund of £10,536,000 was set aside for the road and bridge programme, and arterial road construction actively proceeded with, particularly in the London area. Under the Finance Act 1920 a new system of taxation, registration and licensing of mechanically propelled vehicles was introduced and came into force on Jan. 1 1921. Special schemes were put in hand for the relief of unemployment, for which £4,000,000 was provided from the Road Fund in 1920–1. The income of the Road Fund in 1922–3, derived from motor spirit duties, carriage licenses, Exchequer grants and motor taxation, was £12,802,754: these receipts had increased in 1924–5 to £15,234,225. During the period 1919–25 arterial roads were constructed in the London area, Scotland, etc.; the total length of new construction was 169 miles, and 48 miles of existing roads were widened. On March 31 1925 the total commitments of the Road Fund amounted to £36,087,000. Expenditure by local authorities on the maintenance, improvement, etc., of roads increased from £18,903,840 in 1913–4 to £28,413,674 in 1919–20 and to £45,431,036 in 1921–2. The great increase during the post-War period was due partly to the practical cessation of work during the war period and partly to local unemployment relief schemes. After 1921–2 expenditure by local authorities was considerably reduced.

Postal Service.—Telephone tariffs varied widely in different areas in 1910, but by 1921 a system of uniform charges had been instituted as far as possible. The National Telephone Company's system was transferred to the Post Office on Jan. 1 1912. The number of exchanges increased from 1,566 in 1910 to 3,971 on Dec. 31 1925, and the number of telephone stations from 619,399 in 1910 to 1,357,908 on Dec. 31 1925. The acceptance of telegrams from subscribers by telephone, and delivery to them by the same means increased greatly between 1910 and 1925. Rates for inland telegrams on Sept. 1 1920 were double those of 1910.

The following table shows the more important alterations in postage rates between 1910 and 1925:—

Changes in Postal Rates

	1910	June 1918	June 1920	June 1921	May 1922
Initial letter rate (inland and imperial) .	1d.	1½d.	2d.	2d.	1½d.
Initial letter rate (foreign)	2½d.	2½d.	2½d.	3d.	2½d. (May 1923)
Postcard rate (inland)	½d.	1d.	1d.	1½d.	1d.
Initial printed paper rate	½d.	½d.	½d.	1d.	½d.
Inland parcel rate (up to 2 lb.) . . .	4d.	6d.	9d.	9d.	6d. (May 1923)
Inland parcel rate (up to 11 lb.) . . .	11d.	1s.	1s. 6d.	1s. 6d.	1s. 3d. (May 1923)

Air Mails.—The post-War period was marked by the development of commercial aviation. The Post Office inaugurated air mail and parcel services between London and the Continent. Mails are accepted by the air mail for Belgium, France, Morocco, Algeria, Germany, Denmark, Norway, Sweden, etc.; air services established in Continental countries are used to supplement this service. The total weight of letter mail despatched by air in 1925 was 15,520 pounds. The air parcel service carried during that year 50,000 lb. of parcel air mails to Paris, Holland and Germany including the Rhine Army.

Wireless and Cables.—Wireless services considerably increased between 1910 and 1926. A new wireless station was built at Hillmorton, near Rugby, and was opened for service from Jan. 30 1926. This station was able to send messages which could be picked up by ships at sea and by every efficient receiving station in the world. In 1925 the British Govt. owned and worked two cables between Great Britain and Halifax, Nova Scotia. One, in German ownership before the War, is worked directly between London and Halifax. The other, purchased from the Direct United States Co., and taken over by the British Post Office in 1922, is worked from London to Newfoundland and Halifax. The two cables are called the imperial cables.

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GREAT LAKES AND ST. LAWRENCE (*see* 12.399 and 24.21).—The Great Lakes and the St. Lawrence form one of the greatest and most important transportation routes in the world, rivalling in tonnage and economy of operation any other existing water transportation route. To July 1 1924 the United States Federal Govt. had expended about $150,000,000 for improvements in the Great Lakes-St. Lawrence system, exclusive of expenditures by Canada, by States or Provinces and by municipalities.

Traffic.—During the 30 years 1895–1925 over 1,500 million tons of freight moved through the locks at Sault Ste. Marie alone. The 72,000,000 tons which passed through these locks in 1924 included 13,500,000 tons of flour and grain and 42,500,000 of ore, moving east, and 13,500,000 tons of coal moving west. Except for the construction of several experimental Diesel engine-driven vessels, no great developments were made in the type of the large bulk freighter in the 15-year period ending in 1925. The highly specialised freight-handling equipment at the terminals, which has in large measure accounted for the economic system of transfer, has developed only in size during the same period. The record for handling cargo between shore and ship is 16½ min. for loading 12,508 gross tons of ore and 3 hr. 5 min. for unloading.

During the 20 years 1905–25 a considerable tonnage in limestone and sulphur grew up. The stone, used as a flux in ore furnaces, is transported on self-unloading vessels between harbours on Lake Huron and the great iron and steel centres in the vicinity of Lakes Michigan and Erie. Sulphur is carried by water from the wells in Texas and Louisiana to New York, and thence in barges through the New York State barge canal to Buffalo, Cleveland and other points on the Great Lakes. Package freight on the Great Lakes has not kept pace with bulk freight, though still amounting to over 1,000,000 tons. Over 90% of the commerce has been confined to the upper lakes, a small portion only passing into Lake Ontario and the St. Lawrence. Traffic on the upper lakes has increased to such an extent that the locks at Sault Ste. Marie in existence in 1910 (two American and one Canadian) were not sufficient to cope with the traffic, and two new locks (numbered 3 and 4) were constructed on the American side and put in operation in 1918. Each of the new locks is 1,350 ft. long and 80 ft. wide, with 24½ ft. of water over the sill. The old Weitzel lock has not been in operation since 1918.

Harbours.—Originally the mouths of rivers were used as harbours on the lakes. It was necessary to dig out the bars which usually formed at the lake entrance, and later piers were constructed at river mouths which contracted the area of flow and tended to keep the channels scoured out. Still later, breakwaters were built in the lakes to protect pier entrances from wave action. As conditions became more congested in the rivers, these breakwaters were extended to form large outer harbours. These structures were originally stone-filled timber cribs, the tops of which, after the timber decayed, were replaced by concrete or stone. The more recently constructed breakwaters are formed of a line of concrete caissons sunk side by side, or of a long rubble mound composed of stones varying from half a ton to 10 and 12 tons in weight, more or less carefully placed. Some of these outer harbours are as much as four and five m. long and afford ample protection to the largest lake vessels.

Maintenance dredging must be carried on at all times in most of the harbours of the Great Lakes. About 65 harbours on the upper lakes (excluding Lake Ontario) have an authorised pro-

ject depth of 19 ft. or more at low water; about 65 others on the Great Lakes-St. Lawrence system have been improved so as to be available for smaller vessels.

Connecting Waterways.—The critical points in the navigation of the lakes are the connecting waterways. These, like the harbours, require continuous dredging to preserve project depths and to remove obstructions. The Lake Carriers' Association, a federation including nearly all the owners of freight-carriers on the lakes, have formed an efficient system of communication and supervision which permits them to take advantage of water conditions and load their vessels to the greatest possible depth. The deepening and widening of the connecting channels authorized some years ago have practically been completed; and at many of the most critical points, such as the Neebish channels below Sault Ste. Marie and the channels between Lakes Huron and Erie, separate upbound and downbound passageways are maintained. On the upper lakes the minimum width of channels used for two-way traffic is 500 ft., whereas 293 ft. is the least width of channel now used for one-way traffic. The controlling depth of water between Lakes Erie and Superior is still 20 ft. at low-water datum. A dike on which sluice gates are installed has been constructed across St. Mary's river near Sault Ste. Marie. The gates are operated under the supervision of an international board of control in order to maintain water-levels in Lake Superior and to compensate for diversions on both the Canadian and the American sides at Sault Ste. Marie for power purposes.

The question of diversion of water from Lake Michigan into the Chicago drainage canal for the purpose of sewage disposal has not been settled. The Supreme Court of the United States decided against Chicago in a suit instituted to enjoin the Chicago sanitary district against withdrawing water. However, in order to permit the Chicago Sanitary Commission to prepare plans and construct works necessary to take the place of the prevailing system of sewage disposal, temporary authority to divert 8,500 cu. ft. of water per sec. from Lake Michigan was granted by the United States War Department for a period of five years under certain conditions, which, when carried out, will permit the reduction and perhaps the eventual discontinuance of the diversion for sewage purposes. The question is of importance because of enormous losses claimed by shipping interests on account of lower water levels. It has been stated by government engineers that the diversion of 8,800 ft. from Lake Michigan affects the level of Lake Erie from ·38 to ·43 ft.; of Lakes Michigan and Huron from ·42 to ·44 ft.; and of the St. Lawrence river at lock No. 25 from ·6 to ·65 of a foot.

Erie–Ontario Routes.—Two navigable routes (1926) connect Lake Erie with Lake Ontario. The Erie branch of the New York State barge canal system, completed in 1918, connects Lake Erie and the Niagara river through the Oswego branch of the barge canal with Lake Ontario at Oswego. The barge canal route continues through the State of New York and connects with the Hudson river at Troy, forming a complete waterway available for vessels of less than 12-ft. draft and requiring not more than 15½ ft. of head room. A new Welland canal between Lake Erie and Lake Ontario is being constructed to replace the existing one. It is estimated the work will be completed in 1930. Seven lift locks will replace the 25 locks in the present canal, and the distance between the two lakes will be shortened to 25 miles. The new canal is being excavated to a depth of from 25 to 26½ ft. below Canadian low-water level. The new locks will be 820 ft. long by 80 ft. wide, and, in order to provide for possible future deepening of the canal, will be constructed so as to accommodate vessels drawing 30 ft. of water. The estimated cost of the completed structure is $110,000,000.

The question of improvement of the St. Lawrence river from Lake Ontario to tidewater in the interest of navigation and power development is being seriously considered by joint action of the United States and Canada. The St. Lawrence river affords opportunity for the development of over 4,000,000 H.P. of hydroelectric energy. On account of the many interests involved on both sides of the border, it had been difficult to effect an agreement on the question of the St. Lawrence improvement.

By treaty stipulation the amount of water that may be diverted from the Niagara river for power purposes has been limited to 36,000 cu. ft. per sec. on the Canadian side and 20,000 cu. ft. per sec. on the United States side. Of the Canadian diversion all but about 10,000 cu. ft. per sec. is used by the Hydroelectric Power Commission of Ontario, in three plants, the largest of which, near Queenstown, has a head of over 300 ft. and develops about 500,000 H.P. from the nine turbo-generators installed. Of the American diversion practically all the water is utilised by one concern with an installation of over 500,000 horsepower.

Boundary Water Treaty.—In 1909 the United States and Great Britain signed a treaty known as the "Boundary Water Treaty," whereby the waters between the United States and Canada were guaranteed free and open to the inhabitants of both countries on equal terms, and principles governing the use of boundary waters were laid down. An international joint commission, consisting of three members from Canada and three members from the United States, was established.

TABLE I.

Lakes	Area of Water Surface	Maximum Recorded Depth	Mean Elevation Approved Low-Water Datum	Ordinary Fluctuations, Water Surface	Average Date of Opening of Navigation	Average Date of Closing of Navigation
	Sq. Miles	Feet	Feet	Feet		
Superior	31,810	1,180	601·6	2·5	April 23	Dec. 9
Michigan	22,400	870	579·6	2·8	April 12	Dec. 15
Huron	23,010	750	579·6	2·6	April 6	Dec. 17
St. Clair	460	26	573·8	. .	March 30	Dec. 18
Erie	9,940	210	570·8	3·0	March 29	Dec. 17
Ontario	7,540	738	244·5	3·3	April 5	Dec. 18

TABLE II.

Rivers	Length	Least Width	Greatest Width	Limiting Depth at Low Water	Current in Navigated Portions	Discharge at Mean Stage
	Miles	Feet	Feet	Feet	Miles per Hour	Cubic Foot-Seconds
St. Marys	63	300	24,000	21	1–3½	[1]
Strait of Mackinac	30	10,900	100,000	110	. .	47,000
St. Clair	40	800	5,100	20	1–5	203,000
Detroit	31	1,900	19,000	22	1–6	208,000
Upper Niagara	20	1,500	8,000	10–23	1–7	207,000
Lower Niagara	15	210	2,600	30	1–2½	207,000
St. Lawrence to Montreal	179	1,200	40,000	14	1–6	240,000

[1] In its original condition the mean stage discharge of the St. Marys river was about 78,000 cu. foot-seconds. The flow of this river is now entirely controlled by regulating works.

TABLE III.

Commerce (in short tons) on the Great Lakes

Year	Total U.S. Commerce on Great Lakes (Adjusted)	Canals at Sault Ste. Marie (Reported)	Detroit River (Estimated)	Welland Canal (Reported)	St. Lawrence Canals (Reported)	N.Y. State Barge Canal (Reported)
1910	92,044,843	62,363,218	73,526,602	2,326,390	2,760,752	3,073,412[1]
1920	111,139,686	79,282,496	80,410,082	2,276,072	3,067,962	1,421,434
1921	71,460,170	48,259,254	63,973,308	3,076,422	3,734,065	1,457,802
1922	94,038,090	66,067,258	68,497,062	3,391,419	4,319,919	2,260,763
1923	125,517,551	91,379,658	92,170,460	3,755,912	4,541,528	2,572,635[2]
1924	109,831,279	72,037,390	80,073,850	5,037,412	5,536,374	2,658,674[2]

[1] Old canal system partly closed down between 1910 and 1918 during construction of a new 12-ft. canal.

[2] Includes 566,351 and 626,357 tons for 1923 and 1924 respectively of local terminal traffic that did not pass through the canals.

(H. T.*)

GRECO-TURKISH WAR: *see* BALKAN WARS.

GREECE (*see* 12.425), a republic of southern Europe and a member of the League of Nations. Its area is 49,200 square miles. The area of Old Greece in 1912 was 24,400 square miles. The Balkan Wars of 1912–3 resulted in the addition of New Greece, consisting of Macedonia, Epirus, Crete and a number of islands in the Aegean, with an area of about 21,600 sq. m., making the total area of the country about 46,000 sq. m. in 1914. After the World War, Greece occupied Thrace and a part of the vilayet of Aidin in Asia Minor, and these occupations were confirmed by the treaties of Neuilly and Sèvres. But, as the result of the Asia Minor campaign, Greece in 1922 evacuated Asia Minor and Eastern Thrace in favour of Turkey, and by the Treaty of Lausanne in 1923 she also retroceded Imbros and Tenedos. The area of Greece after these various changes, is now about 49,200 square miles.

A census taken in 1920 gave the total population of Old and New Greece as 5,536,375, including Thrace. An estimate which allows, on the one hand, for the subsequent loss of territory and for the transfer of the Moslem inhabitants of Greece to Turkey, and, on the other hand, for the influx of some 1,400,000 refugees from Turkey after the war in Asia Minor, would place the population in 1925 in the neighbourhood of 6,200,000.

The various racial migrations which have been brought about by the wars from 1912 onwards, whether voluntary or compulsory, involving the transfers, in either direction, of nearly 2,500,000 Greeks, Bulgarians and Turks, have had the result of introducing homogeneity in the regions affected, where before there was great diversity. Thus the proportion of Greeks in the population of Macedonia and Western Thrace, which stood at 43 and 36% respectively before the Balkan Wars, is, in 1925, 88 and 62%. (L. G. R.)

BULGARIA
YUGOSLAVIA
ALBANIA
GREECE
TURKEY
AEGEAN SEA
IONIAN SEA
MEDITERRANEAN SEA
SEA OF CRETE
Durazzo
Tirana
Elbasan
Berat
Valona
Monastic
Florina
Edessa (Vodena)
Verroia
Kastoria
Argyrokastron
Koritsa
Kozani
Grevena
Olympos
Katerina
Salonika
Khalkidike Pena
Mt Athos
Seres
Drama
Kavalla
Rhodope
Gümüljina
Adrianople
Dimotika
Mesta R.
Rhodope Mts
Dedeagach
Enos
Thasos
Samothrace
Imbros
Lemnos
Mudros
Tenedos
Mytilēnē
Lesbos
Skyros
Sporades
Euboea
Chios
Smyrna
Samos
Nikaria
Andros
Tēnos
Mykonos
Keos
Syros
Hermoupolis
Cyclades
Paros
Naxos
Amorgos
Dodecanese
Mēlos
Ergastēria
Aigina
Piraeus
Athens
Megara
Corinth
Argos
Nauplion
Sparta
Leonidion
Meligala
Kalamata
Messēnē
Laconia
Methone
C. Gallo
C. Matapan
Neapolis
C. Malea
Kythēra
C. Kapela
Antikythēra
Crete
Canea
Retimo
Candia
Sphakia
Lasithion
Kasteli
C. Litinas
C. Sidero
Yannina
Corfu
Prevesa
Parga
Paxos
Arta
Preveza
Trikkala
Larisa
Volos
Meleai
Northern Sporades
Lamia
Phthiotis
Acarnania & Aetolia
Phocis & Boeotia
Attica
Levadeia
Khalkis
Thebes
Aigion
Patras
Kalavryta
Achaea & Elis
Argolis & Corinthia
Amalias
Olympia
Pyrgos
Kyparissia
Arcadia
Messenia
Zante
Cephalonia
Ithaka
Levkas
Agrinion
Amphissa
Mesolongi
Aetolia
Kozani
Servia
Olympos
Salonika
Seres
Drama
Kavalla
Rhodope
Gümüljina
Dedeagach
Enos
Thasos
Samothrace
Imbros
Lemnos
Mudros
Tenedos
Mytilēnē
Skyros
Sporades
Euboea
Chios
Smyrna
Andros
Tēnos
Mykonos
Keos
Syros
Hermoupolis
Paros
Naxos
Amorgos
Mēlos
Ergastēria
Aigina
Piraeus
Athens
Megara
Corinth
Argos
Nauplion
Sparta
Leonidion
Meligala
Kalamata
Messēnē
Laconia
Methone
C. Gallo
C. Matapan
Neapolis
C. Malea
Kythēra
C. Kapela
Antikythēra
Crete
Canea
Retimo
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Sphakia
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Patras
Kalavryta
Achaea & Elis
Argolis & Corinthia
Amalias
Olympia
Pyrgos
Kyparissia
Arcadia
Messenia
Zante
Cephalonia
Ithaka
Levkas
Agrinion
Amphissa
Mesolongi
Aetolia
Florina
Edessa (Vodena)
Verroia
Kastoria
Argyrokastron
Koritsa
Kozani
Grevena
Olympos
Katerina
Salonika
Khalkidike Pena
Mt Athos
Seres
Drama
Kavalla
Rhodope
Gümüljina
Adrianople
Dimotika
Mesta R.
Rhodope Mts
Dedeagach
Enos
Thasos
Samothrace
Imbros
Lemnos
Mudros
Tenedos
Mytilēnē
Lesbos
Skyros
Sporades
Euboea
Chios
Smyrna
Samos
Nikaria
Andros
Tēnos
Mykonos
Keos
Syros
Hermoupolis
Cyclades
Paros
Naxos
Amorgos
Dodecanese
Mēlos
Ergastēria
Aigina
Piraeus
Athens
Megara
Corinth
Argos
Nauplion
Sparta
Leonidion
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Messēnē
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C. Matapan
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C. Malea
Kythēra
C. Kapela
Antikythēra
Crete
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Sphakia
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Kasteli
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C. Sidero
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Paxos
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Preveza
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Mt Athos
Seres
Drama
Kavalla
Rhodope
Gümüljina
Adrianople
Dimotika
Mesta R.
Rhodope Mts
Dedeagach
Enos
Thasos
Samothrace
Imbros
Lemnos
Mudros
Tenedos
Mytilēnē
Lesbos
Skyros
Sporades
Euboea
Chios
Smyrna
Samos
Nikaria
Andros
Tēnos
Mykonos
Keos
Syros
Hermoupolis
Paros
Naxos
Amorgos

I. POLITICAL HISTORY

In Jan. 1910 the Military League had summoned Veniselos from Crete as their political adviser, and he had arranged for the election of a National Assembly. But the obstruction of the party leaders soon obliged him to take the premiership himself and to appeal once more to the electorate. When the second revisionary National Assembly met on Jan. 22 1911, he took office at the head of an overwhelming majority. During the following 18 months the constitution was revised, internal administration was thoroughly overhauled, army and navy were remodelled and trained under French and British missions, and the Macedonian feud was forgotten.

The Balkan Wars.—A treaty was signed with Bulgaria (May 1912) who had already signed a treaty with Serbia for the partition of Macedonia, and in Oct., the first Balkan War broke out. Montenegro declared war on Turkey, Oct. 8; Turkey declared war on Bulgaria and Serbia, Oct. 17, but offered Greece the island of Crete and other concessions to remain neutral. Veniselos however realised the supreme importance of including Greece in the new grouping. The long-excluded Cretan deputies were admitted to the Greek Chamber and Greece declared war on Turkey on Oct. 18 1912.

The Balkan allies gained rapid success. The Greek Army cleared Macedonia and occupied Salonika (Nov. 9); the fleet blockaded the Dardanelles. Greece refused to sign the armistice obtained from the other allies (Dec. 3) but joined the conference which met a fortnight later in London. The allies demanded from Turkey the surrender of all the territory their armies actually held in Europe together with the fortresses invested. The seizure of power by the "Young Turkish" party at Constantinople prevented the acceptance of these terms, and hostilities were re-opened on Feb. 3 1913. But after Adrianople had surrendered to Bulgarians and Serbs, Scutari to the Montenegrins, and Janina to the Greeks under Prince Constantine—who 12 days later (March 18) became King on the assassination of his father George I. at Salonika—Turkey by the Treaty of London (May 30) signed away collectively to the Balkan allies all her territory in Europe west of a line drawn from Midia on the Black Sea to Enos on the Aegean Sea, leaving the Powers to settle the problems of Albania and the Aegean Islands.

Second Balkan War.—The erection of an independent Kingdom of Albania, by excluding Serbia from the Adriatic, rendered inevitable a quarrel between the allies. Greece, alarmed at the menacing attitude of Bulgaria, had in June signed a defensive alliance with Serbia, and when Bulgaria attacked without warning (June 30) she was heavily defeated, and after the intervention of Rumania was compelled to sign the Treaty of Bucharest (Aug. 10 1913) which excluded her from the Aegean port of Kavalla and carried the frontier of Greek Macedonia eastwards to the river Mesta and northwards to Doiran and Florina. The course of events had thus compelled Veniselos to substitute a policy of balance of power for that of a Balkan League.

The Aegean Islands.—The Powers assigned to Greece (Conference of London, Feb. 1914) all the islands of the Aegean actually occupied by the Greek fleet during the war, with the exception of Tenedos and Imbros and of the islands of the Dodecanese which Italy had occupied in 1912 as security for the Turkish fulfilment of the Treaty of Lausanne (Oct. 18 1912) pledging her good faith that her occupation should be conditional and temporary. After the World War, Veniselos negotiated an agreement with Signor Tittoni (July 29 1919) by which all these islands were to revert to Greece unconditionally, the cession of Rhodes alone being made contingent on a plebiscite to be held within five years of England's cession of Cyprus. This agreement was recognised by the Supreme Council, the time limit within which the plebiscite was to be held being extended to 15 years, on the signature of the Treaty of Sèvres (Aug. 10 1920) in accordance with which Tenedos, Imbros and Lemnos, which had been occupied during the War by the British fleet, were handed over to the Greek authorities on June 25 1921. The Tittoni agreement was repudiated by Italy, who remained in occupation of the Dodecanese, after the fall of Veniselos and the non-ratification of the Treaty of Sèvres. Turkey closed the Balkan war with Greece by a provisional agreement (Treaty of Athens, Nov. 13 1913) but refused to accept the decision of the Powers of Feb. 1914; consequently the *de jure* possession of the islands remained in suspense until the Treaty of Lausanne (July 24 1923) whereby Turkey renounced in favour of Italy all rights over the Dodecanese, and recognised Greek sovereignty over the remaining islands as conferred by the Conference of London, subject to certain provisions for their demilitarisation, and with the exception of Imbros and Tenedos, which were retroceded to Turkey on condition that they should enjoy full local autonomy.

The World War.—Greece definitely annexed Crete and thus emerged from the Balkan Wars with a very large acquisition of territory in Epirus, Macedonia, Crete and the Aegean Islands, with a total population of over 1,800,000, or almost as much as that of "Old Greece." Turkey's refusal to recognise the ruling of the London Conference was accompanied by a boycott of Greek shipping and an organised persecution of the Greeks in Asia Minor. But her evident intention of re-opening hostilities with Greece was anticipated by the outbreak of the World War. The attitude of the Greek Govt. as stated by Veniselos was never in doubt. Not only did her interests and tradition bind her to support Great Britain and France; she was bound to Serbia by her defensive alliance, the purpose of which would best be served if Greece stood by to prevent Bulgaria from making any hostile move and to guard Serbian communications with the Aegean. King Constantine on the other hand naturally inclined to Germany for family reasons, and believed in her victory; but he never found the courage to declare openly his intention to remain neutral, preferring to temporise.

In Feb. 1915, when England definitely required Greek help for attacking the Dardanelles, the proposals of Veniselos for specific Greek forces to co-operate with the British fleet were unanimously approved by his own majority in the Chamber, and by a Crown Council of all the political leaders in the kingdom. King Constantine however dismissed Veniselos and dissolved the Chamber (April 10 1915). The new premier Gounaris co-operated with the German propaganda in Athens to represent Veniselos as inspired only by love of war and hatred of the King. King Constantine was thus brought into party politics as a personal opponent of Veniselos and leader of the "pro-German" policy of neutrality. In mid-June the electors nevertheless returned the Liberal (Veniselist) party with a majority. But when Veniselos, after a delay excused by the King's illness, at last returned to office (Aug. 22), his efforts to immobilise Bulgaria by threatening Greek action were useless, because Germany had already been secretly informed that Greek neutrality would be guaranteed by King Constantine even in the event of a Bulgarian attack on Serbia. Bulgaria mobilised on Sept. 19 1915, and King Constantine allowed his Prime Minister to order a counter-mobilisation, and even to suggest to England and France that they might reinforce the Greco-Serbian co-operation with some of their own troops, a suggestion which led to the Allied landing at Salonika. But as soon as Veniselos, on the eve of the Bulgarian attack, explained once more his well-known policy of defending Serbia and received a vote of confidence, he was abruptly dismissed, and M. Zaimes was put up (Oct. 5) to explain that the Greco-Serbian Treaty had "a purely Balkan character." The Chamber was again dissolved and elections held in December. The Liberals abstained from the polls, as a protest against this second and unconstitutional dissolution, and a government was formed under M. Skouloudes (Nov. 6), who declared "very benevolent neutrality" towards the Entente.

From this time forward the King began not only to expect but eagerly to desire a German victory. The violence of his partisans was aggravated when the "Three Protecting Powers," Britain, France and Russia, demanded certain administrative changes which might prevent any connivance between the Govt. and the German espionage (June 21 1916). The Greek Army, which owing to the known sentiments of its general staff threatened, or at least inconvenienced, the Allied base at Salonika, was at last demobilised; whereupon the Bulgarians invaded Macedonia and seized Kavalla. Meanwhile King Constantine would from time to time change his Premier (Zaimes, June 23; Kalogeropoulos, Sept. 16; Lambros, Oct. 9; Zaimes, May 3 1917) and ask the French or British minister to suggest terms on which it might suit him to abandon his "neutrality." When in Aug. Rumania joined the Allies and the King still refused to move, Veniselos seceded to Salonika (Sept. 25 1916) with Gen. Dankles and Adm. Condouriotes, set up a Provisional Government and out of half the kingdom which declared its allegiance to the Triumvirate began to organise a state militant. The Allies refused their official recognition to the Salonika Govt., although Veniselist troops were already fighting for them. At Athens the French admiral suggested that King Constantine might surrender some of his war material. The King was understood to consent; but when French and British marines landed to take delivery they

were shot down by Greek troops from prepared positions (Dec. 1 1916).

The Allies now broke off relations with the King, but, owing to the hesitations of Russia and Italy, did not demand his abdication till June 1917. He retired to Switzerland (June 12) and his second son Alexander was put on the throne. Veniselos returned to Athens as Prime Minister of a nominally united Greece (June 26), recalled the Chamber which had been unconstitutionally dissolved in Nov. 1915 and formally declared war against Germany, Turkey and Bulgaria (June 29). By April 1918, the Greek Army had been mobilised and re-equipped. In July 250,000 Greek troops shared in the Macedonian offensive which culminated in the capitulation of Bulgaria (Sept. 30 1918).

Treaty of Sèvres and Fall of Veniselos.—At the Peace Conference (Paris, Jan. 1919) Veniselos' presentation of the Greek claims was remarkably successful. As affecting Bulgaria these were embodied in the Treaty of Neuilly, to which was annexed a Greco-Bulgarian convention for the protection of racial minorities, etc. (Nov. 27 1919). Bulgaria was cut off from the Aegean, the Allies undertaking to ensure her an "economic outlet." This problem has not hitherto been solved, as it was found impossible at Lausanne (Jan. 1923), even with the guarantee of the League of Nations, to devise any scheme, other than a territorial corridor, acceptable to Bulgaria. The Treaty of Sèvres (Aug. 10 1920) assigned to Greece the greater part of Thrace, and a mandate, based on Greece's interest in the Greek population of Asia Minor. It also assigned to her the basin and hinterland of Smyrna under a strictly controlled régime. Greek troops had landed at Smyrna at the request of the Supreme Council on May 15 1919.

Unfortunately during these negotiations Veniselos had lost touch with his people, and the Govt. at Athens had proven incompetent and corrupted. The resulting discontents were exploited by Constantine's agents. Not the Greek peasants only but many of the urban population were innately averse to Veniselos' 20th-century ideas. In Aug. 1920 Veniselos returned to Athens tired out, and angrily refused any electioneering compromise with the 16 leaders of opposition. Then King Alexander, playing with a pet monkey, was bitten. He died of blood-poisoning (Oct. 25) and his younger brother Prince Paul having refused the Government's offer of the throne, the restoration of King Constantine became the real issue at the general election. On Nov. 14 1920 Veniselos was heavily defeated at the polls. He resigned, and with many of his ministers and officials left the country. A government was formed by the aged Demetrius Ralli which entrusted the Regency to the Dowager Queen Olga.

After the formality of a plebiscite King Constantine returned to Athens (Dec. 19 1920). The Allied Powers refused to recognise him officially, withdrew their financial assistance, and agreed to reconsider the Treaty of Sèvres, which though signed had not been ratified and had already been repudiated by the Turkish Nationalists. The withdrawal of their support was serious. The armistice concluded with Turkey (Oct. 30 1918) had made very incomplete provision for the disarmament of the Turkish forces and it was partly in order to restore order in Asia Minor and protect the Christian populations that Greek forces had been authorised to land at Smyrna. But the Supreme Council, although it had finally (July 1920) asked the Greek troops, in Mr. Lloyd George's words, "to clear up the whole neighbourhood between Smyrna and the Dardanelles," a task successfully accomplished in 10 days, had set very definite limits to the Greek army of occupation: and Mustafa Kemal had had time to organise a formidable force. Greece was isolated; France and Italy both, overtly or covertly, supported Turkey, and Great Britain declined to embark on expensive Eastern adventures.

Greco-Turkish War.—Yet the new premier M. Kalogeropoulos (Feb. 7 1921) and his successor M. Gounaris (April 7) rejected the moderate proposals of a Conference of the Three Powers (Britain, France and Italy) which met in London (Feb. 21) to reconsider the Treaty of Sèvres; and instead actually ordered from London an offensive (March 24) against the Turkish Nationalist positions, which after seizing Afiun Qarahisar and Eskishehr, was disastrously defeated (April 5) with 4,000 killed and wounded. On June 11 (anniversary of the fall of Constantinople in 1453) King Constantine left for Smyrna hailed by the government press as emperor designate of Constantinople and commander of the Anglo-Greek forces in the Near East. On June 19 the Allied Powers again offered "their friendly services to prevent the reopening of hostilties," but the offer was magniloquently rejected. The Greek forces opened their new offensive in July. A month later they were within 60 m. of Angora. But in August they were disastrously defeated on the river Sakkaria with very heavy losses. On Sept. 29 1921 King Constantine returned to Athens. On Oct. 16 Gounaris and his foreign minister Baltazzi, after receiving a vote of confidence in the Chamber, left for London and at last placed the interests of Greece without any reserve in the hands of Lord Curzon. Meanwhile the French "Franklin-Bouillon" agreement with Kemal had been signed at Angora (Oct. 20 1921); and Lord Curzon's ability to make peace was limited by the difficulty of coming to a preliminary agreement with France and Italy. Gounaris thus abandoned all Greek interests vested in the Treaty of Sèvres. He also gave up all claim to the balance of credits guaranteed to Greece by the Allies during the War and received in return permission to raise a loan on the open market if he could (agreement with Sir R. Horne, Dec. 21 1921). At Athens this was represented as a financial triumph, and thus arose considerable outcry in British Press and Parliament to the effect that England was secretly financing the Greek Army. Meanwhile the true situation was hidden from the Greek people; the persecution of Liberal deputies and journalists continued. Nor were the Liberals consulted when Gounaris on returning to Athens (March 10 1922) was compelled to reform his government. When the Near East Conference met in Paris, proposals for an armistice and the evacuation of Asia Minor by the Greek Army were transmitted to Athens and the two Turkish governments of Constantinople and Angora (March 26). The real Turkish power, that of Angora, explained away the apparent acceptance of these terms at Constantinople by making it plain that Turkey would accept only the immediate evacuation of Asia Minor.

A few days before the Conference Gounaris had privately addressed to Lord Curzon a desperate appeal for help and confession of imminent disaster. On May 11, after vainly following Mr. Lloyd George to Genoa, he resigned and joined M. Stratos in a coalition under the premiership of M. Protopapadakes, who had previously as Minister of Finance raised a forced internal loan by cutting in half all the bank notes in circulation. The first act of the new Govt. was to remove the commander-in-chief, Gen. Papoulas, who had privately advocated strengthening the front by the reinstatement of Veniselist officers previously removed, and to appoint in his stead Gen. Hadjanestes. In July the Govt. had the independence of Ionia proclaimed by the high commissioner of Smyrna, M. Sterghiades. They also issued a report that the Allies would shortly allow the Greek Army to occupy Constantinople; while Gen. Hadjanestes, a figure of notorious eccentricity, completed the demoralisation of the front and actually transferred large bodies of troops from Asia Minor to Thrace. The Turks attacked on Aug. 26 and entered Smyrna on Sept. 9 1922; five days later the whole city, with the exception of the Turkish quarter, was burned to the ground.

Revolution of Chios.—The Govt. resigned on Sept. 8, after ordering the demobilisation of the troops who were leaving Smyrna. But the attempt to scatter the remnants of the army as they were evacuated from Asia Minor failed. Many units landed on the island of Chios; and there a revolution headed by Col. Plasteras broke out on Sept. 26. King Constantine left the country and died in the following Jan. at Palermo. Eight of his principal ministers and advisers indicted by a special Commission of Enquiry were tried before an extraordinary court martial of 11 officers. Six of the accused (Gounaris, Stratos, Baltazzi, Theotokes, Protopapadakes and Hadjanestes) were shot immediately after the verdict (Nov. 28 1922). The executions shocked Europe. The British Minister, Mr. Lindley, who had refused to take the responsibility of guaranteeing that the accused, if

reprieved, should never again take part in politics, left Athens. But they had a salutary effect on the Greek Army. Thousands of deserters returned to the colours, and a small but efficient army, reformed on the Thracian frontier under the command of Gen. Pangalos, greatly strengthened the hands of the Greek representative (Veniselos, who had consented to represent his country abroad) and of all the Allies at the second Conference of Lausanne which finally succeeded in signing peace with the Turks on July 24 1923.

Refugees and Minorities.—Meanwhile the Revolutionary Govt., after proclaiming an amnesty for all political offences (Jan. 22 1923), was confronted with the problem of the million destitute refugees expelled from Asia Minor. For some months the settlement of the refugees on a productive basis was organised with the help of American charitable societies; later the Greek authorities had to depend entirely on their own resources until a loan was raised (Dec. 1924) the administration of which was guaranteed by the League of Nations. In 18 months the Refugee Settlement Commission of the League of Nations had settled more than half a million refugees in new villages and urban districts throughout Greece. This settlement increased the homogeneity of population on the Greek frontiers, where the problem of alien minorities had already been reduced by a system of exchanging populations, embodied in the Greco-Bulgarian Convention (1919) for the voluntary emigration of minorities and the Greco-Turkish Convention (Jan. 30 1923) for the compulsory exchange of Moslem and Greek-orthodox minorities. These agreements (together with the Turco-Bulgarian agreement of 1913) completed and regularised a series of migratory movements which had begun with the Balkan Wars and had transformed the populations of Thrace and Macedonia. Thrace east of the Maritsa is now completely Turkish, Western Thrace predominantly Greek; and in Sept. 1925, the League of Nations Refugee Settlement Commission reported that Greek Macedonia was then "crowded with an active and industrious population, of which more than 90% were Greeks by race and sentiment" (*see* REFUGEES).

The Corfu Incident.—On Aug. 27 1923, the murder of the Italian member of the Greco-Albanian Frontier Commission led to the Italian bombardment of Corfu. Greece appealed to the League of Nations through whose agency the dispute was ultimately settled (*see* LEAGUE OF NATIONS). Greece's correct and conciliatory attitude in this unfortunate dispute did her great credit.

Return of Veniselos.—At home the revolutionary Govt., led by Cols. Gonatas and Plasteras with M. Alexandres as Foreign Minister, made genuine attempts to return to constitutional government. They failed however to form a moderate centre party (Sept. 1923); and a month later the extreme Royalists, under Gen. Metaxas, attempted to raise a counter revolution, which was easily suppressed. There was evidence that Gen. Metaxas had been in communication with King George II. The Republicans thus received a tremendous impetus, and though at the elections (Dec. 16 1923), from which the Royalists abstained, they were defeated, they had secured the support of the army and the navy, under the influence of Gen. Pangalos and Capt. Hadjikyriakos, whose pressure was so energetic that the Govt. to avoid disorder requested the King to absent himself during the meeting of the National Assembly which was to decide the future of the Throne. On Dec. 18 1923 the King and Queen left for Rumania. Adm. Condouriotes was appointed Regent and Veniselos was invited to return to Greece. In view of the apparent unanimity of the appeal he found it impossible longer to refuse. He returned (Jan. 4 1924) only, he was careful to announce, temporarily, in order to "put an end to civil war," and proposed to solve the constitutional problem by an immediate plebiscite. The Revolutionary Committee resigned and Col. Plasteras retired into private life.

Establishment of a Republic.—A week after his arrival Veniselos unwillingly accepted the premiership. He proposed (Jan. 23) that a plebiscite should be held in two months' time, under the supervision of committees representing every party, to decide whether a republic was desirable, and if not who should be king. The decision was to be followed by a general election held under a system of proportional representation. He found himself opposed however by the extreme Republicans under M. Papanastasiou who insisted on the immediate expulsion of the dynasty and establishment of a republic by a vote of the Assembly. Veniselos resigned the premiership (Feb. 4) to M. Kafantares who also favoured a plebiscite. He succeeded (Feb. 27) in defeating the Republican motions in the Chamber and was proceeding to negotiate for a joint programme with the Royalists when the Officers League was reformed and demanded from Regent and Premier that a republic should be set up without more ado. M. Kafantares resigned, Veniselos left Greece (March 10) and a government was formed by M. Papanastasiou, who proposed to settle the fate of the throne by a resolution of the Chamber to be ratified by a subsequent plebiscite. After the King had refused a very generous offer if he would abdicate voluntarily, there was no difficulty in getting the necessary vote. The republic was proclaimed on March 25 1924. The plebiscite, the arrangements for which were accepted by the Royalists, was held on April 13 when 758,742 voted for the republic and 325,322 for a monarchy. The republic under the provisional presidency of Adm. Condouriotes was recognised on April 23 by England, who had resumed diplomatic relations on Jan. 16.

The Govt. of M. Papanastasiou was strengthened by the inclusion of Gen. Pangalos, Col. Kondyles and Adm. Hadjikyriakos; but the two last-named officers soon left it again and M. Papanastasiou resigned, and was succeeded by M. Sofoules on July 19, after a violent attack on the Minister for War, Gen. Pangalos, by M. Mihalakopoulos who himself formed a government on Oct. 7.

The Unratified Protocol.—At the end of July 1924, Bulgarian komitadjis captured on Greek territory at Tarlis were shot down by their escort, and a month later a Commission of Inquiry appointed by the League of Nations censured the local authorities though it exonerated the Greek Govt.; a satisfactory feature was that the report was signed by the Greek member of the commission. On Sept. 29 the Bulgarian and Greek delegates (Col. Kalfoff and M. Politis) meeting at Geneva signed a protocol providing that each Power should appoint as its official advisers for carrying out the treaty protecting the interests of minorities Col. Corfe (British) and Major de Roover (Belgian), who were already at work on the frontier as members of the existing mixed commission for the exchange of populations appointed under the Greco-Bulgarian convention of 1919. Their authority would be a protocol embodying provisions contained in the Treaty of Neuilly and repeated in an annexe to the Treaty of Sèvres. Unfortunately this sincere and generous movement was regarded at Belgrade as an arbitrary recognition of the existence of "Bulgar" minorities in Greece which might lead Bulgaria to claim similar privileges for "Bulgar" minorities in Serbia. Serbian annoyance and Greek suspicion were quickened by exaggerated rejoicing in the Bulgarian press. On Nov. 27 Serbia denounced the Alliance with Greece and this undoubtedly determined Greek repudiation of M. Politis. On Feb. 3 1925, the Greek Chamber refused to ratify the protocol and on March 14 it fell to Veniselos to announce and defend this refusal before the Council of the League.

Negotiations with Serbia.—On April 27 1925 negotiations for renewal of the Greco-Serbian alliance were opened at Belgrade and soon broke down over the preliminary demands of Serbia. Serbia demanded the control and exploitation of the railway from Ghevgeli to Salonika; an extension of the Serbian zone on the harbour of Salonika; and a recognition that the Slavs of Macedonia were not "Bulgars" but "Serbs." This last demand was referred by Greece to the League of Nations. With regard to the railway line she offered to rebuild and reorganise the line or to appoint a permanent League of Nations official to arbitrate on all Serbian complaints but objected to any such cession of rights as would be not only a diminution of sovereignty but a continual source of friction. The negotiations were broken off on June 1, and a subsequent proposal that the line should be worked by a French company (Oct. 9) was not more successful. With regard to the larger question of the Alliance, which remained in suspense, there was a possibility that, both Powers having disclaimed any territorial ambitions, negotiations might be re-opened (Jan. 1926) for the conclusion of a Balkan security pact analogous to that of Locarno.

The Patriarchate.—At the Conference of Lausanne the Turks had consented to the maintenance of the Oecumenical Patriarch at the Phanar provided he exercised no civil or administrative powers. But on Jan. 30 1925 the new Oecumenical Patriarch was expelled from Constantinople by the Turks, who contended that he was not an "inhabitant of Constantinople" and that accordingly he was not exempted by the Treaty of Lausanne from the provisions of the Convention for the Exchange of Populations. In any case the Greeks had put themselves in the wrong by ignoring the usual formalities of election and failing to obtain Turkish consent to his candidature. The Council of the League of Nations referred the dispute to the Hague Court (March 14); but meanwhile Greece and Turkey arrived at a settlement, Greece persuading the expelled Patriarch to resign.

Gen. Pangalos Seizes Government.—Meanwhile the National Assembly had not yet succeeded in voting the new constitution

and there were numerous complaints of peculation and administrative inefficiency. On June 16 M. Mihalakopoulos reformed his government but 10 days later, confronted by an ultimatum from Gen. Pangalos and Adml. Hadjikyriakos, he resigned. Gen. Pangalos formed a government (June 26) including Adml. Hadjikyriakos, M. Kofinas and, later, M. Rentes (July 2), an experienced diplomatist, and after receiving a vote of confidence dissolved the Assembly. The new constitution, issued by proclamation on Sept. 30, provides for a president to be elected for a term of five years and a Senate of 150 members, 100 to be elected by the parliamentary franchise, 30 by various guilds and corporations and 20 by Chamber and Senate. Gen. Pangalos promised that it should be submitted for ratification after elections to be held in the new year. A proposal to court martial M. Papanastasiou for issuing a democratic manifesto was cancelled (Oct. 5) but Gen. Plasteras was expelled from Athens (Oct. 24). Two officials were publicly hanged for embezzlement.

On Oct. 19 there occurred a fresh frontier "incident" with Bulgaria, in the course of which the latter appealed to the League of Nations (*see* LEAGUE OF NATIONS: *Work of the First Six Years*). The commission ordered Greece to pay damages and found she had violated the Covenant by occupying Bulgarian territory with her troops. The commission also made various recommendations for avoiding frontier incidents (including a system of frontier guards under neutral officers), and for completing without friction the convention for the Exchange of Populations. The undoubted success of the League was obscured in Athens by an inevitable comparison with the Corfu affair, but the decision of the Council in accordance with the report was accepted by the Greek Govt. on Dec. 15.

Meanwhile Gen. Pangalos was making strenuous efforts to suppress political rancour at home. On Nov. 24 at a conference with the party leaders he received assurances that the constitutional question would not be raised at the elections in March and on this understanding the election of a senate was fixed for Jan. 10, and two Royalists, M. L. Roufos and M. Sehiotes, entered the Government. Apparently however it was too much to expect political leaders not to talk politics. On Jan. 3 1926 and in subsequent proclamations Gen. Pangalos announced that the senatorial and parliamentary elections would be indefinitely postponed and that his Government had decided to concentrate all executive and administrative powers in its own hands; with the declared aims of economy and internal order and the forcible reconciliation of contending factions the Ministries of National Economy and Public Assistance were abolished, the permanence of the civil service was suspended and the Press was forbidden to publish any articles written by MM. Kafantares, Papanastasiou and Mihalakopoulos. Adml. Hadjikyriakos and M. Sehiotes immediately resigned. At the Ministry of Finance M. Tantalides, replacing M. Kofinas who had gone on a debt-funding mission to Washington, issued a forced loan similar to that of 1922 from which foreigners were not to be exempted (Jan. 23). All these measures were received by the people with the fatigue and listlessness which were becoming almost a substitute for political stability. Indeed while the agreeable M. Roufos remained at the Foreign Office to develop the improving relations with Serbia, Italy and Albania there was a prospect that Greece might at last enjoy a period of tranquillity and good government. The dictatorship of Gen. Pangalos had the merits as well as the defects of a fire-eating common sense, and it had the advantage of not being disguised in any pretentious ideology. (J. N. M.*)

THE COUNTRY'S DEFENCE

The normal duration of military service, which is compulsory for all Greek citizens, is two years in the active army, 11 in the reserve and eight in the territorial army. Men are called up at the age of 21, and are liable for service until 51. Territorials are only called up in case of invasion or threat of invasion, and are only called up for training twice in the fourth and eighth year for a fortnight. The peace-time strength of the army is 12 infantry divisions, 1 cavalry division and a certain number of units unattached. The total personnel in 1924–5 was 66,484. The Greek Navy consists of 5 old battleships, 1 armoured and 1 protected cruiser dating from before the World War, 11 destroyers and 36 smaller units, including 2 submarines. (X.)

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II. ECONOMIC AND FINANCIAL HISTORY

Pre-War Position.—The economic situation of Greece during the early years of the present century, up to the outbreak of the Balkan War in 1912, was marked by a steady if moderate progress. Industrial enterprises for local purposes were established in considerable number. Communications by road and railway were extended, and large additions were made to the mercantile marine. The premium on gold gradually declined, and finally disappeared in 1909. By the Valaoritis law of 1910, providing for the automatic issue and withdrawal of notes against gold or foreign exchange, the currency was definitely stabilised at par on the gold exchange system, to the great advantage of the general economy and the credit of the country.

The state of the public finances, though less satisfactory, also showed signs of improvement at the latter end of the period. A series of deficits from 1907 to 1909 had to be met out of a portion of the proceeds of a new foreign loan raised for this and other purposes in 1910. At the same time, a programme of fresh taxation was introduced, including income tax and succession duties, with the result that the accounts up to 1912 showed a substantial surplus of revenue over expenditure. The varying interest on the old gold loans, payable out of surplus revenues in the hands of the International Financial Commission, marked a sensible upward progress.

The Balkan Wars of 1912 and 1913 threw a considerable strain on the resources and the finances of Greece, which was, however, relieved in some measure by the material assistance rendered by Greeks abroad. Immediate war expenses were defrayed chiefly out of the balance of the 1910 loan and the proceeds of various provisional loans, which were liquidated by means of a new consolidated loan issued in 1914, and taken up for the greater part in Paris and London. This loan was secured on the revenues assigned to the International Financial Commission, an institution which, though regarded as an encroachment on the sovereign rights of the country, has been found useful on repeated occasions as a means of providing security for fresh loans. The economic strength of Greece was greatly enhanced by the acquisition of territories of both actual and potential value, including the important port of Salonika, the rich tobacco-growing districts of Drama and Kavalla and extensive areas in Macedonia capable of productive development.

The World War.—After the outbreak of the World War, and during the period of neutrality of Greece, which lasted from 1914 until 1917, there was a considerable accumulation of private wealth in the form of foreign balances, but the country suffered severely from internal conflicts, from the economic blockade of Old Greece in 1916–7 and from the prolonged mobilisation and war preparations. Noteworthy economic events during this period were: the law of 1915 facilitating the formation of co-operative societies; the connection, in 1916, of the railway system of Greece with those of Europe; and the agrarian legislation of 1917, which provided for the expropriation of large estates in favour of the peasants, and at the same time prohibited the alienation or mortgage of the peasants' holdings and their subdivision at death.

The entry of Greece into the War in 1917 involved a large increase in military and naval expenditure. Fresh taxation was imposed, including a tax on War profits, and a certain sum was raised by an internal loan and by the issue of National Defence bills. But the bulk of the funds required was provided by advances in kind from the Allied Powers and by credits opened by the latter for expenditure in Greece, against which payments were effected in notes by the Greek Government. These credits were treated as cover for the note issue. The very considerable expansion in the paper currency which resulted from these arrangements did not cause at first too heavy a

demand for exchange, for the factors which contributed to strengthen the foreign balances during the period of neutrality continued to operate until the end of the War.

With the close of the War, however, and the suppression of restrictions on trade, the accumulated purchasing power of the country made itself felt in a large demand for foreign goods. Large purchases of Greek and other securities were made in foreign markets, and the depreciating currencies of Europe offered an attractive field for the speculator. The resultant pressure on the exchange funds of the note-issue was so great that before the end of 1919 the available reserves were exhausted, the exchanges began to fall away from the gold parity, and the Valaoritis law became a dead letter. In the course of 1920 a portion of the Allied credits was realised, but this was quickly absorbed by purchases of supplies, and the excess of imports reached unprecedented proportions.

Effects of the Greco-Turkish War.—At the same time, the Govt. found itself involved in fresh liabilities in connection with the military operations in Asia Minor. To raise the considerable funds required, recourse was had to a large internal lottery loan, to issues of National Defence bills, to loans from the National Bank and, finally, to inflationary issues of paper money. The fall in the exchanges was accelerated by the withdrawal of financial support and credits by the Allies on the return of King Constantine in 1920. By the end of that year the drachma had lost 60% of its gold value. This depreciation of the currency reacted unfavourably on the budget, while the prosecution of the Asia Minor campaign entailed ever-increasing expenditure. In 1921 and 1922 issues of paper money and National Defence bills were effected on a large scale, without authority from the International Financial Commission taxes were raised and a forced loan was extracted from note-holders by compelling them to surrender one-half of each note in exchange for a government bond. The disaster in Asia Minor in 1922 reduced the finances and credit of the country to the lowest ebb, and by the end of the year its securities were quoted on the international markets at prices yielding 20% to the investor, while the drachma had lost 94% of its gold value. This collapse of the monetary unit, with the concomitant rise in the price-level, profoundly disturbed economic conditions throughout the country, and caused serious losses among particular sections of the community. The bulk of the public debt being on a gold basis, the real charge of its service on the state finances was not greatly reduced by the depreciation.

Refugee Settlement.—The influx from Asia Minor and Thrace of a vast number of destitute refugees threw a fresh burden on the resources of the country, and enlisted the sympathy and assistance of foreign countries, especially of England and America. Under the auspices of the League of Nations an independent refugee settlement commission was set up in 1923, for the establishment of the refugees, and a refugee loan was issued in 1924, in London, New York and Athens, guaranteed by revenues assigned to the International Financial Commission. Meanwhile, the Govt. made strenuous efforts to put its finances in order. Considerable fresh taxation was imposed in 1923, including a capital levy to be spread over five years, which has given very mediocre results. The floating debt was largely increased in 1923 and 1924. A fresh uncovered issue of paper money was made in 1923, and at the same time a law was passed authorising further issues against cover in funds abroad. The exchange, after violent fluctuations, settled down in 1924 to about one-tenth of the gold parity. By 1925 the public finances had so far recovered that the Govt. was able to allocate special revenues to the reduction of the floating debt, and to present a balanced budget. But this equilibrium was afterwards disturbed by fresh expenditure and by a renewed fall in the exchanges, due to an inflationary banking policy and a maladministration of the foreign exchange fund created by the law of 1923. At the end of 1925 the drachma had again fallen back to one-fifteenth of its gold parity.

Notwithstanding the instability of the political régime, of the public finances and of the monetary policy, the country as a whole showed remarkable powers of recuperation after a period of 10 years of war ending in a great national disaster. The refugee population tended to become an asset instead of a burden. The refugees settled in Macedonia, extended the cultivated area and increased the production of crops, while large numbers found employment in industrial and other occupations. The expropriation of agricultural properties for the benefit of refugee and other peasants was accelerated, on terms very unfavourable to the owners, by special legislation in 1923 and 1924. The mercantile marine, which had been reduced by nearly two-thirds during the War by sales and losses through enemy action, was restored to its original strength. Exports expanded slowly, but the growth of imports bore witness (apart from the portion attributable to foreign loans) to the extent of the country's additional resources in the form of shipping and other profits, of remittances from emigrants and of investments that were held abroad.

The greatly increased burden of public debt was mitigated by the fact that the larger part of it was held by her own nationals. Nascent local industries, hampered during the War for lack of fuel, took a fresh upward stride, stimulated in some degree by high tariffs and other protective measures, and by the influx of refugee labour. The extension of building operations and other forms of economic activity afforded evidence of increased prosperity, but an exact measure of real progress could not be ascertained while inflation continued. Railways, roads, ports and urban services generally were still in a backward state. At the end of 1925, however, numerous projects were in contemplation or in course of execution, with the aid of foreign capital, for extensive improvements in these directions and for the further development of local resources.

Statistical Comparisons.—The following statistical table summarises the changes in some of the salient economic and financial features of Greece over an interval of rather more than ten years, *i.e.*, 1914 to 1924.

	1914	Present day	
Area, square miles	46,000	1925	49,200
Population	4,800,000	1925	6,200,000
Production of cereals, tons	847,000	1925	871,000
Production of tobacco, tons	25,000	1925	66,000
Production, currants, tons	158,000	1925	133,000
Production of emery, tons	16,000	1925	20,000
Production of lignite, tons	20,000	1925	111,000
Exports, drachmas	178,500,000	1925	4,320,000,000[1]
Imports, drachmas	318,800,000	1925	9,834,000,000[1]
Joint stock companies	68	1925	325
Companies, capital of, drachmas	363,000,000	1925	2,190,000,000[1]
Co-operative societies	5	1925	3,655
Letters carried	29,810,000	1924	73,403,000
Telegrams despatched	1,968,000	1924	5,502,000
Telegraph lines, miles	5,735	1924	11,225
Railways open, miles	1,366	1925	1,689
Piraeus entries, steamships	3,809	1925	7,915
Piraeus entries, net tonnage	4,067,000	1925	5,044,000
Mercantile marine, steamships	474	1925	467
Mercantile marine, gross tonnage	830,000	1925	912,000
Bank deposits, drachmas	474,000,000	1925	5,755,000,000
Bank deposits, postal savings, drachmas	700,000	1925	93,500,000
Note circulation, drachmas	253,000,000	1925	5,339,000,000
Public debt, gold £	43,900,000	1925	77,800,000
Public debt, currency, drachmas	173,600,000	1925	7,918,000,000
Ordinary revenue, drachmas	207,700,000	1924-5	4,719,000,000
Athens cost of living, index no.	100	1925 Dec.	1,644
Exchange on London, drachmas per £.	25	1925 Dec.	378

[1] These figures must be considered in relation with the exchange.

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(L. G. R.)

GREEK LITERATURE, ANCIENT (*see* 12.507).—Our knowledge of ancient Greek literature has been increased greatly since the beginning of the century. In 1918 Sir Frederick Kenyon knew of 920 literary papyri: Professor Oldfather in 1923 counted 1,167. No entirely new authors have been discovered equal in importance to Bacchylides, Herondas and Timotheus, and no new treatise quite equal to Aristotle's *Constitution of Athens*.

The New Comedy.—Of Menander we have considerable fragments—found in 1907—from seven plays, ranging from 550 lines to 88, and can form some opinion of at least three: *The Epitrepontes* (Appeal to Arbitration), with ten characters; *The Perikeiromenê* (Girl with her Hair Cut), with eleven; and perhaps *The Samian Woman*. Again, we have part of the plot of *The Priestess*. A man's wife has left him (possibly for religious reasons) and become a priestess; he does not know what she did with their son, and the priestess is unapproachable. His slave pretends to be possessed by a demon, and so gets taken in to the priestess to be treated. He finds out that the boy is being reared as their own by certain neighbours, and tells the father, who goes straightway to claim his son. But these neighbours also have a genuine son of their own, and by mistake the old gentleman lights upon him. The boy decides that the old man is mad, and tells his foster brother, who, consequently, when his father approaches him on the same subject, humours him as a lunatic. . . .

An opening like this shows how far we have travelled from the simple μῦθοι of the 5th century. We can see that Menander invented his plots, and invented them with an ingenuity and complexity utterly beyond the conceptions of the great tragedians. We can appreciate his exquisite style; colloquial, yet refined, subtle and witty and capable of much emotional power. It is palely reflected in the *urbanitas* of Terence. Contemporaries who were still under the spell of tragedy and the Old Comedy could ask themselves "whether Menander copied life or life Menander"; but on a modern reader he will not make an impression of realism. Lost or exposed children, recognitions, betrayed maidens, captured cities and heroines sold into slavery, faithful or ingenious slaves, indulgent or cross parents, play a larger part on his stage than they ever did in real life.

Yet the general effect does give a vivid picture of Hellenistic Athens. It is an easy-going and cultivated commercial society, steering as best it can, with much understanding and sympathy and humour, amid the shipwrecks of a tormented world. There are no villains, no cruelty; the women have character, the betrayed maidens have generally been betrayed in the excitement of some wild religious festival, and the betrayer suffers torments of remorse. Except in the exposing of children, a favourite motive of Hellenistic fictions, Menander's moral outlook would compare favourably with that of Molière, not to speak of Congreve.

Callimachus.—Callimachus too has become a reality and we can understand the immense influence he exercised upon the Augustan poets. We possess many fragments from his *Aitia* or *Origins*, one of them 80 lines long. Unfortunately nothing is complete; but the fragments show a mastery of the Greek elegiac couplet unknown before. The diction is rather precious. The style often reminds one of Ovid, romantic with a touch of self-mockery, as though the poet felt the absurdity as well as the loveliness of the archaic legends which he collected with so much zest. The Alexandrian courtier is shown in his "Lament on the Death of Arsinoe," his "Coma Berenices" (which we know in a Latin version by Catullus) and other fragments. His gnomic poems are written in the assumed character of the ancient Hipponax, but have none of that satirist's ferocity. One tells the story of the prize for wisdom, which was offered first to Thales but refused by him because Bias was wiser, and by Bias because someone else was wiser and so on by all the wise men in turn. Another contains a contest for superiority between the laurel and the olive, somewhat flat to modern taste.

Another acquisition is a large fragment of a *Life of Euripides* by Satyrus, a Peripatetic of the 3rd century B.C. It takes the form of a dialogue; one of the characters is a woman; and the tone is that of drawing room *belles lettres* rather than history. There is much gossip and anecdote, given for what it is worth; many quotations, and some good literary criticism, *e.g.*, the observation that Euripides wrote the "things that held the new comedy together, peripatetics, betrayed maidens, supposititious children, recognitions by rings and necklaces, etc." The fragment comes from Satyrus' *Lives* in six books, the last of which dealt with the lives of the tragedians. It is extremely interesting as a specimen of the new subject of study introduced by the disciples of Aristotle, personal biography of writers and *savants*. Satyrus seems to have been the chief authority for the anonymous *Life* which has come down to us with the MSS. of Euripides.

Lyric Poets.—Another new author of great interest is the Boeotian poetess Corinna, a contemporary and compatriot of Pindar, though curiously different from him. She stands right outside the sphere of Homeric influence. Her language is the colloquial Boeotian which she spoke, unaffected by literary tradition. Her themes, to judge from the two poems preserved, "The Contest of Kithaeron and Helicon," and "The Daughters of Asopus," are little more than local folklore. She cannot have been quite uneducated; her metre is too correct; but her work leaves the impression that Boeotian women in the 5th century, though they learnt *Mousikê*, did not know much literature. Unlike Sappho, she was a neither a bluestocking nor a genius.

Sappho herself is now represented by about 100 new fragments, but the papyri have been so crushed and broken that very little is continuous or intelligible. The most beautiful of the new songs is perhaps equal to the best known before and has the same poignancy. It begins: " . . . and simply I long to be dead. She left me sobbing, and said: 'Sappho, we have suffered terrible things. I swear, against my will I leave you.'" The exceptionally careful study of the whole material by Mr. Lobel has shown, first, that the papyri are very exact in reproducing dialect, and secondly that Sappho, except in poems modelled upon epic, wrote almost entirely in her native Lesbian. She stands between the rusticity of Corinna and the literary polish of Alcaeus.

Alcaeus also is represented by more than 100 new fragments, various in subject and metre, but seldom large enough to yield continuous sense. A comparison of Helen and Thetis, a few lines about Sisyphus' attempt to outwit Death, much about *dura navis, dura fugae mala, dura belli* confirm but do not greatly enrich the impression made by the previous fragments. There is style, spirit, vigour, variety and there must have been a mass of minute and intimate history. But we find perhaps more continuous beauty in the new fragment of Ibycus, passing in dreamy memory the great shadows of the Trojan War, or the short burst of lyrical hexameters in the style of Alcman.

Pindar, of whom we had before only *epinikia* (victory songs) is now represented by considerable fragments of paeans, *parthenia* (girl songs) and dithyrambs. The paeans show the same abrupt and tortured magnificence of style as the extant *epinikia;* the *parthenia*, as Dionysius of Halicarnassus (Demosth. 39) had remarked, are simpler, and show Pindar in a new mood. "Maidenly thoughts be mine and maidenly speech upon my tongue," says one fragment.

The Drama.—There is also much beauty in the lyrics of Euripides' *Hypsipyle*, one of which is a nurse's song to a baby, with the accompaniment of a rattle and a new effect in one of the scenes where a mother, raging against the nurse who has inadvertently caused the death of her child, is suddenly reduced to silent tears by the presence of the gentle sage, Amphiaraus. The quiet exit of Amphiaraus to his foreseen death, and the subtle indications of Hypsipyle's life-song devotion to Jason, the brief romance of her youth, are in Euripides' most characteristic style. The fragments of Sophocles' Satyr-Play, the *Ichneutae* (Trackers), have great charm. The infant Hermes has stolen the cattle of Apollo; the Satyrs go as detectives to track the thief, and hear underground the first music known on earth—the child playing on the lyre he has made. The remains of Sophocles' *Eurypylus* are very small, but show the great 5th century style.

Increase of Historical Knowledge.—If we turn from our direct gains in beautiful literature and try to estimate the new light thrown by recent discoveries on the history of Greek literature

as a whole, the results are much larger. The excavations of Minoan Crete, though they have brought us no Greek text, make a difference to our understanding of the Homeric poems and of the whole heroic tradition. We see quite clearly now that the poems do not stand at the beginning of literature. There were ages of literature before them. Even their heroic subjects can in many cases be shown to have been already known in or before the 16th century B.C. Gems and frescoes of that date show us the siege of a city, like Troy; a man under the belly of a ram and clinging to its long wool, like Odysseus escaping from the Cyclops' cave; a scene in a deep glen, where a young man attacks an older man in a chariot, as Oedipus attacked Laius. This means that some of the main romantic motives used in Greek heroic poetry were already traditional then, attached to what names we know not. Again, the celebrated "Ring of Nestor" (*Jour. Hellenic Studies*, 1925) shows scenes of initiation and of the next life, ideas which have generally been considered post-Homeric and even for the most part post-classical. We see now that they were in existence before Homer as well as after; and the characteristic theology of Homer, with its avoidance of these ideas, shows itself to be not a thing of primeval simplicity, but a peculiar product of the "Heroic Age" (*i.e.*, the age of the destruction of Minoan civilisation by the Northern invaders). Again, while the excavations indicate pretty clearly that neither of the Homeric poems as a whole is "history," they also show that both are full of historic memories, in various degrees confused and fragmentary, and transmuted into the "heroic" mould.

Variety in Greek Literature.—But what we chiefly learn from the papyri is to appreciate the immense variety of Greek literature, especially in the Hellenistic Age. We have now specimens of three Satyr-Plays, instead of only the *Cyclops*. We have large masses of the New Comedy. We know something of the Alexandrian elegy and idyll, including bits of Euphorion as well as Callimachus. We discover the prevalence of poems in the style of different ancient writers: compositions in imitation of Hipponax, of Epicharmus, of Anacreon, of Alcman and letters professing to come from Hippocrates. We are reminded of the Delian Hymn with its claim to be by "Homer" himself.

Religious or ritual poetry is represented by several hymns and paeans connected with the temple of Apollo at Delphi or that of Asclepius at Epidaurus. The most curious is a paean to Asclepius, which occurs in four almost identical copies of different dates and places. It seems to have been a stock form, with places left open, so to speak, for the names of the particular city or individual wishing to perform the rite. More primitive worships, though in late form, are expressed in the Cretan Hymn to the Kouretes and the Eretrian Hymn to the Idaean Dactyls. The religious literature connected with Egyptian gods, such as Isis and Serapis, is of course extensive, but is generally in prose.

Peculiarly striking is the great mass of light lyric poetry from Hellenistic or early Roman times. A poignant "Paraclausithyron," or "Weeping outside the Door," by a woman; another, less good, by a man; several love-songs in loose Ionic metres (one starting with the poignant line *κατάκειμαι μεθ' ἑτέρου, σε μέγα φιλοῦσα*); soldiers' songs; sailors' songs; a song to the Rhodian winds; a song of spring in the woods; a lament by a boy who has lost his pet cock; a powerful though roughly written complaint, of Roman date, by a girl whose lover is being sent to fight in the amphitheatre as a *mirmillo*, and who desperately wants to buy him off; a charming quasi-philosophic flute-song, written in a tricky metre with a refrain (*αὔλει μοι*), the first letters of each stanza forming an acrostic.

Novels and Light Verse.—Our own commonest form of light literature, the novel, is also well represented. There are three fragments of the preposterously romantic *Chaireas and Callirhoe* of Chariton, which had evidently great popularity: one of Achilles Tatius. The new evidence shows that these romances are much earlier than was supposed, Chariton about 200 A.D. and Achilles about 300. There are also fragments of several novels hitherto unknown—*Semiramis and Ninus*, *Herpyllis*, *Chionê*, *The Dream of Nectanebo*, etc. The supply of novels is equalled by that of "Mimes," or short realistic dialogues for acting or reading aloud. They are poor stuff, illustrating perhaps the pleasure in sheer coarseness which sometimes marks an over-refined age.

More interesting are the poets who write under the inspiration of the Cynic "diatribê," or popular philosophical appeal to conscience. The confusions and inequalities of Hellenistic society stimulated a contempt for worldly standards and civilised conventions and a tendency to exalt the poor, the untaught, and the oppressed. In poetry this led to a revival of the scazons, or "lame iambics," of old Hipponax, which affected both Callimachus and Herondas in later times, and has left us fragments of a 3rd-century anthology, in which the chief figure is Phoenix of Colophon. Better than these scazons are the "meliambi" of Kerkidas the Cynic (*flor.* 250 B.C.), who is known as a friend of the general Aratus, and is perhaps to be regarded as the author of the anthology itself. They are full of strange words and fantastic compounds which suit the mordant and rather brutal style of his "diatribê." It is instructive to observe that Cleanthes the Stoic, when writing his more ideal exhortations, avoids the deliberately fractious metres and uses the harmonious hexameter or iambic.

In prose philosophy we have some striking specimens of 5th-century sophistic; a fragment of Hippias (?) on Music, deriding the theories which invested it with subtle moral values; and two of Antiphon the Sophist, known previously for his denunciations of slavery, with a highly provocative treatment of the difference between *Phusis* and *Nomos*. There is also a fragment of a dialogue by that strange character, Aeschines Socraticus. And meantime the charred remains of the library of the Epicurean philosopher at Herculaneum are slowly being deciphered; much Philodemus, Polystratus "On Unreasoning Contemptuousness," with fragments of Demetrius Laco, and the Stoic Hierocles. Nor should we forget the uncommonly interesting Epicurean Gospel, inscribed by Diogenes of Oenoanda on a large wall, so that the world may read and be saved (2nd century A.D.). "*Grammatikê*" or philology is represented by Chrestomathies, "Lives" or "Sayings" of eminent writers, by scholia and glossaries and by a valuable fragment of Didymus' Commentary on Demosthenes.

History, etc.—The additions to our historical literature are considerable. Besides the *Constitution of Athens* we have more than 500 complete lines of a 4th century historian, who after much controversy seems likely to be identified with Ephorus, rather than with Theopompus or Cratippus. It deals chiefly with the year 395 B.C. Other fragments attributed to Ephorus treat the history of Sicyon and other subjects. There are small pieces of Timaeus, the Sicilian historian, and of Philochorus, the Attic chronicler. There are bits of what seem to be the authentic despatches of the third and second Ptolemies, and perhaps also of the first (*P. Oxy.*, 679), dealing with their own campaigns; also of Sosylus, who lived in Hannibal's camp, and, according to Polybius, "gossipped like a barber," on the "Deeds of Hannibal." Of Satyrus we have spoken above. There is some history also in the new fragments of the orators Lysias and Hyperides.

But both as history and as literature the largest and most surprising additions to our knowledge are to be found in the non-literary papyri, of which there must be more than 10,000. They may be divided into (*a*) official and (*b*) private, the first consisting of laws, rescripts, edicts, documents about taxes, judicial proceedings and the like, the second of contracts, receipts, wills, manumissions and private letters or memoranda. Their value is increased by the fact that they often fall into large coherent groups, such as the papers about the Serapeum, the correspondence of Cleon, the public architect, or of Zenon, the great estate agent. Combined with the rich mass of Hellenistic inscriptions, these documents have illuminated the life and social history of the Hellenistic age to a degree undreamed of before.

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Archiv für Papyrologie, and the various publications of the British Museum. The following separate publications are convenient (dates refer to first edition): S. Sudhaus, *Menandri reliquiae* (1914); O. Schroeder, *Novae Comoediae Fragmenta* (1915); R. Pfeiffer, *Callimachi Fragments* (1923); E. Diehl, *Supplementum Lyricum* (1910); Hans von Arnim, *Supplementum Euripideum* (1913); E. Diehl, *Supplementum Sophocleum* (1913); F. Bilabel, *Kleinere Historikerfragmente* (1923); F. Blass, *Bacchylidis Carmina* (1912); O. Crusius, *Herondae Mimiambi* (1923); B. Lavagnini, *Eroticorum Graecorum Fragmenta Papyracea* (1922); A. S. Hunt, *Hellenica Oxyrhynchia* with fragments of Theopompus (1909) and *Tragicorum Graecorum Fragmenta Papyracea* (1912). Larger and more important are W. G. Headlam and A. D. Knox, *Herodas* (Cambridge, 1922); E. Lobel, *Sappho* (Oxford, 1925); J. U. Powell, *Collectanea Alexandrina* —smaller fragments of poets of Alexandrine age, epic, elegiac, lyric and ethical (1925). See also the lists in W. Schubart's *Einführung in die Papyruskunde* (1918) and *The Greek Literary Texts from Greco-Roman Egypt*, by C. H. Oldfather, University of Wisconsin (1923); Wilamowitz-Moellendorff, *Menander, Das Schiedsgericht* (1925).

(G. G. A. M.)

GREEK LITERATURE, MODERN (*see* 12.524).—The troubled years from 1910 to 1925 were marked by one event of capital importance to the literature of modern Greece, the all but total conquest of the entire literary field by the spoken language, commonly called the demotic or romaïc, after a century's struggle with the official or scholastic tongue, called the pure or catharévoussa.

In 1910, Costis Palamas published the remarkable narrative lyrical poem *The King's Flute*, in which he celebrates, in the moving atmosphere of Byzantium, the continuity of Greek throughout the ages. In *The Immutable Life* he appears as a bold innovator, inspired by French intellectualism, and definitely establishes his position as a poet of world wide fame. Before losing himself in memories of his childhood, as he does in his next work (*Longings for the Lagoon*, 1912) he shows that he possesses the eternal spirit of ancient Hellas, of Byzantium and of modern Greece. He is a poet of the intellect and of thought, whose work, while showing the influence of Western symbolism, is yet filled with imagery and with glowing verbal music. In works such as *Iambs and Anapaests* and *The Grave* he has given expression to the deepest emotions. He was strongly influenced by the prophetic genius of Joannes Psuchares, a master in every *genre* of prose, who introduced into Greece all the most recent linguistic theories. Without his example it is unlikely that Palamas would have succeeded in realising his powers. So was founded the new School of Athens. Palamas, himself an occasional novelist and critic, became the centre of the popular renaissance.

Among the stylists pure and simple of the school we find John Gryparis, a disciple of Hérédia; Laurence Mavilis, strongly influenced by Italian literature, who was killed in the war of 1912; the Baudelairean Papantoniou Costas Ouranis; Aristos Cambanis, whose work is chaste and, if anything, a little cold; and the delicate genius of Malakassis, who owes much to Moreas and to *The Intermezzo*. Peter Vlastos wanders from sphere to sphere, revelling in subtlety of rhythm and metre. All the storied past of Greece comes to life in his work. Apart from these, the dreamy Lambros Porphyras has written his *Shadows;* Sotiris Skipis has sung of his longings for his own country (*Song of Apollo*) and the sufferings of the fugitives from Anatolia. Myrtiotissa in his moving work has sung of passion, while G. Souris and Pol Arcas have turned to satire, and Drossinis, forerunner of many others, has produced his picturesque idylls.

But apart from simple melodists like these tardy Parnassians, the newer poets venture even further than Palamas into uncharted territory. Among them are Angelos Sikelianos, who rediscovered the secrets of the ancient myths of sea and land, and who hymns the greatness of life; Rigas Golphis, bitter, eloquent and passionate; the fiery Varnalis, Ph. Yophyllis, who embodies in his work the minutest details of modern life, and Kavaphis, who, apart from the others, evokes, in a strange and unadorned style, the Alexandrian decadence which resembles his own depression.

Prose Writings.—Modern Greek prose is unusually rich both in *conte* and in the novel. The scattered but recently collected work of Papadiamandis, who disappeared in 1908, remains unequalled. Carcavitsas and Ephtaliotis painted the sea and the islands, and left models for others, as also did the regretted poet, novelist, critic and translator, C. Hatzopoulos. Costis Passayannis, Vlakhoyannis and the Epirote Ch. Christovassilis are accomplished writers of the heroic and the picturesque. D. Voutyras is more deeply moved by the troubles of the working classes. There are also C. Theotokis of Corfu, who combined criticism of society with the study of character, and showed himself in his novels, *The Slaves in their Chains* and *The Life and Death of Karavelas*, as a cruel and unrelenting realist, also C. Paroritis, the powerful author of *Red He-Goat*, and Madame J. Dendrinos, who excels in depicting the ravages of passion. No one, however, in the novel or the theatre has excelled G. Xenopoulos, the creator of a whole gallery of pictures of Zante and Athens (*Isabel, Woman from Three Aspects*).

But Xenopoulos is not alone among Greek dramatists. Paulos Nirvânas, that fine critic and subtle observer, brought Ibsenism into fashion. Spyros Melas and Pandelis Horn achieved remarkable work with a high social aim, D. Tangopoulos distinguished himself in philosophical drama and N. Poriotis shows in *Rhodopi* that tragedy in verse is still to be found in Greece. Among the younger writers Constantinides in *Photinoula* reveals himself as a coming dramatist, and Valsa wrote a model of philosophic comedy in *The Council of Ministers*.

In other spheres, we may mention the names of J. Dragoumis as a critic, of Philindas and of Triandoephyllides in philology and the study of language, while we must not forget the well-known Psuchares, Lambros in history, Politis in folklore, Andréades in political and social economy, Xenopoulos, Nirvânas and Cambanis in literary criticism, Voutieridis in the history of literature. The influence of the literary reviews is shown by the fact that modern Greek literature is becoming more and more westernised in inspiration and form and ceasing to be Byzantine. (P. Le.)

GREEK RELIGION (*see* 12.527).—Our knowledge of this subject has been put on a new basis by researches into the beliefs of pre-Dorian Greece and Minoan Crete. N. M. P. Nilsson's conclusions, that a Mother-goddess and a divine child, who is born, is suckled by an animal and dies annually are characteristic of Crete and of the mainland, that this pre-Greek goddess survives in the Olympian pantheon as Athena and as Hera, that at Eleusis and many other places a cult was continuously practised from prehistoric times, and that the great cycles of Greek mythology all centre round sites important in the Bronze Age, are of the utmost value.[1]

How far this Minoan religion, which has clear affinities with Asia Minor, Philistia and Cyprus, was part of a general Aegean or even Mediterranean culture, we cannot yet say: Sardinia offers a remarkable point of contact.[2] These researches into prehistoric beliefs have transformed the study of Greek mythology. We recognise in it not a little confused history, even if Forrer's identification of Eteokles and Andreus, mythical kings of Orchomenus, with potentates mentioned in the Hittite tablets from Boghaz-Köi (*see* Archaeology: Asia, West), should be seriously contested; we see in it also the reflex of old sacred traditions or rites (thus the death by burning of Herakles on Mount Oeta reflects a fire-ritual there annually performed), the influence of folklore motives distributed over a wide cultural area, and the effects of the desire to tell a good story for its own sake.[3] This study is in a favourable position, since Wilamowitz, Robert and others have done much to determine the earliest form and later developments of heroic stories,[4] while Nilsson, Eitrem, Farnell and many writers in *Religionsgeschichtliche Versuche und Vorarbeiten* have increased our knowledge of ancient ritual.[5]

Others, again, have investigated, not without exaggerations, the survival of ritual forms in drama and in the great games, and the gain to knowledge is clear, though it must be remembered that the search for a single origin of a human custom may well

[1] Summarised in his *History of Greek Religion* (Oxford, 1925).

[2] *Cf.* T. Ashby, *The Year's Work in Classical Studies*, p. 117 f. (1923–4).

[3] *Cf.* F. Pfister, *Philologische Wochenschrift* (July 1922); L. R. Farnell, *Greek Hero Cults and Ideas of Immortality* (Oxford, 1921), is of great value.

[4] C. Robert, *Die Griechische Heldensage* (1920–) is noteworthy as giving a learned and critical survey.

[5] S. Eitrem's chief work is *Opferritus und Voropfer der Griechen und Römer* (Oslo, 1915). A good survey is F. Pfister's article "*Kultus*" in Pauly-Winowa Real-Encyclopädie.

prove illusory, that a rite can arise independently or by parallel development in two places and that at the same time few rites or beliefs have developed unchanged by external influences. Not all athletic contests started as acts of homage to a dead man, but some did, just as all heroes are not degraded gods, but some (as, for instance, Hyakinthos) are.[1] Ritual origins can be forgotten; so could also the original meaning of certain survivals of primitive culture in historic Greece.[2] At the same time, the value of anthropological parallels appears in W. F. Otto's conclusions, partly based thereon, that in Homer the ψυχή or soul in Hades is not the θυμός or soul of the living man.[3] The study of cult has further shown how moral requirements grow out of ritual requirements, and how important is the group as contrasted with the individual.[4] In the study of cults and in particular of their geographical distribution has lain the chief advance in knowledge of Greek religion of the central period.[5]

Meanwhile we have learned much of the Hellenistic age as the period in which Eastern beliefs made their way into the West, and in which many of the religious phenomena of the Empire have their roots; among these are ruler-worship, astral and other mysticism, as also certain liturgical forms and the type of magic familiar in Roman Egypt.[6] Side by side with newer ideas the old worships lived on; there is no simple formula which expresses the religious attitude of the three centuries following Alexander's death. Survivals of ancient paganism in Christianity[7] and in modern Greek beliefs and folklore have been much discussed; on many important points agreement has not been reached, but much progress in detail has been realised.

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(A. D. N.)

GREELEY, ADOLPHUS WASHINGTON (1844–), American soldier and scientist, was born at Newburyport, Mass., March 27 1844. Enlisting in 1861 as a private, he served in the Civil War, and rose to be brevet major. In 1867 he was appointed second lieutenant in the regular army and became chief signal officer and brigadier general. While commanding at Lady Franklin Bay, one of the 13 international circumpolar stations, 1881–4, he reached, in 1882, 83°24′ N. 42°45′ W., the farthest north at that time. Two relief expeditions failed to reach him, and when the third, under Capt. Schley, rescued him at Cape Sabine, all but seven of his party were dead. From 1887 to 1906 he administered the Weather Bureau and the Signal Corps. Under him were built more than 25,000 m. of cables and telegraph lines in Alaska, China, Cuba, Porto Rico and the Philippine Islands. Promoted major-general in 1906, he conducted relief operations in San Francisco and put down the Ute rebellion. He served with the international conference, London, 1904, at the request of the British Govt. and was dean of the American delegation to the wireless conference at Berlin that year. Retired for age in 1908, in 1910 he was sent by President Taft to represent the United States at the coronation of King George V. He wrote extensively on meteorological, electrical, geographical and other subjects. His best known popular volumes are *Three Years of Arctic Service* (1885); *Handbook of Polar Discoveries* (1909); and *Handbook of Alaska* (1925).

GREENOCK, Scotland (*see* 12.548), had a population of 81,123 in 1921. The area of the borough is 2,945 acres. There are several large shipbuilding yards, and a torpedo factory. The old West Kirk is to be removed and re-erected at Seafield to permit of the extension of Messrs. Harland and Wolff's shipyard. The new works at the harbour include a tidal basin and an "always afloat" dock, the entrances of which are closed by caissons to keep in 32 ft. of water at low tide. In 1921 there were three miles of quays in the port. Lady Alice Park was given to the town in 1910, and Lady Octavia Park in the following year; in 1919 Togo House was presented and opened as a maternity hospital.

GREGORY, ISABELLA AUGUSTA, LADY (1852–), Irish playwright and author, was born March 5 1852, the youngest daughter of Dudley Persse of Roxborough, Co. Galway. In 1881 she married Sir William Gregory, a well-known Irish M.P. She produced many plays, essays, volumes of folklore, versions of ancient sagas and romances concerning early Irish heroes, and did much to popularise the Anglo-Irish dialect of English as spoken in the west. She translated for the Abbey Theatre several of Molière's plays into this dialect under the title of *The Kiltartan Molière* (1910). Her work as playwright and director of the Abbey Theatre, in association with W. B. Yeats, was extremely fruitful. This theatre was opened in 1904 and Lady Gregory told its story in *Our Irish Theatre* (1914). Sir Hugh Lane, whose life she wrote, *Hugh Lane's Life and Achievement* (1920), was her nephew.

Among Lady Gregory's other works are: *Cuchulain of Muirthemne* (1902); *Gods and Fighting Men* (1904); *Seven Short Plays* (1909); *The Kiltartan History Book* (1909); *Irish Folk History Plays* (1912); *The Golden Apple* (1916); *The Kiltartan Poetry Book* (1919); *The Dragon* (1920).

GRENADES (*see* 1.869 and 12.578).—A grenade is a small metal missile, usually filled with high explosive, which may be thrown by hand or projected with the aid of a rifle. Grenades may also be charged with poison gas and incendiary or smoke-producing compositions, but the essential features of the various kinds remain the same. Gunpowder grenades, made of wood, bronze and other materials, were used in the 16th century, to be revived later in a high explosive form at the siege of Port Arthur in 1904 and in the trench fighting of the World War. Grenades are described as percussion or time grenades, according as to whether they explode on impact or after a definite time interval.

Hand Grenades.—At the commencement of the World War, the limited supply of grenades in the British Army was of the percussion type, in which a needle in the head of the grenade is by direct impact caused to fire the detonator, a head-on fall being insured by means of tail streamers. At a later date, an all-ways fuse was suggested which would fire the grenade in whatever position it alighted. The main disadvantage of the percussion type is the danger of it exploding if accidentally dropped after being made "live" prior to throwing by the withdrawal of the safety pin or other safety device. These considerations led to the adoption of time grenades as being safer in action and allowing time in case of accident for the bomber to get clear or

[1] On the drama *cf.* F. M. Cornford, *Origin of Attic Comedy* (1914); Sir W. Ridgeway, *The Dramas and Dramatic Dances of non-European Races* (1915); on the games H. J. Rose, *Aberystwyth Studies*, No. 3, p. 24 (1922); L. Malten, *Römische Mitteilungen*, vol. 38, 39; N. M. P. Nilsson, *Deutsche Litteraturzeitung* (Sept. 1925).

[2] H. J. Rose, *Primitive Culture in Greece* (1925), is very useful for its criticism of the supposition that totemism and tribal initiations were prevalent.

[3] *Die Manen* (Berlin, 1923).

[4] *Cf.* J. E. Harrison, *Themis* (1912), significant rather as one of the first attempts to employ modern psychological theory than for positive addition to knowledge.

[5] E. Ciaceri, *Culti e miti nella storia dell'antica Sicilia* (Catania, 1911); Baege, *De Macedonum sacris* (*Dissertationes philologicae Halenses, 22*) (Halle, 1913); G. Gianelli, *Culti e miti della Magna Grecia* (Florence, 1924); R. M. Peterson, *Cults of Campania, Rome, 1919* (1923).

[6] *Cf.* Franz Cumont, *Astrology and Religion among the Greeks and Romans* (1912); R. Reitzenstein, *Die Hellenistischen Mysterienreligionen*, 2nd ed. (1920); *Das iranische Erlösungsmysterium* (1921); E. Norden, *Agnostos Theos* (1913); S. Eitrem, *Papyri Osloenses* (1925); The Hopfner, *Griechisch-ägyptischer Offenbarungszauber* I., II. (1922–4).

[7] *Cf.* C. Clemen, *Religionsgeschichtliche Erklärung des Neuen Testaments* (1924); the new Leipzig journal, Αγγελος; W. R. Halliday, *Folklore Studies* (1924), *cf.* also his chapter in R. M. Dawkins' *Modern Greek in Asia Minor* (1916); and the journal Λαογραφία (Athens, 1909–).

throw away the grenade. Furthermore, time grenades are more easily improvised than percussion ones, and during the period of severe shortage of munitions in the World War, many such grenades were constructed locally out of any handy receptacle. For this purpose a short projecting length (usually 5 sec.) of safety fuse terminating in a detonator (for high explosive fillings) within the grenade was employed. Various friction or strike and cap combinations were used to ignite the fuse before throwing.

The principle of the time grenade is represented in its greatest perfection in the Mills grenade (see fig. 1), invented during the War, of which enormous quantities were supplied to the British Forces. It consists of a barrel-shaped iron casting, *a*, externally grooved in segments to ensure good fragmentation, and of a size to be conveniently clasped in the hand, weighing 1 lb. 8 oz. and containing $2\frac{1}{2}$ to 3 oz. of high explosive, *b;* amatol or ammonal in powder form is convenient. The essential principle is that the ignition of the time arrangement *c* is caused mechanically, as soon as the grenade leaves the bomber's hand. This is effected by the release of a

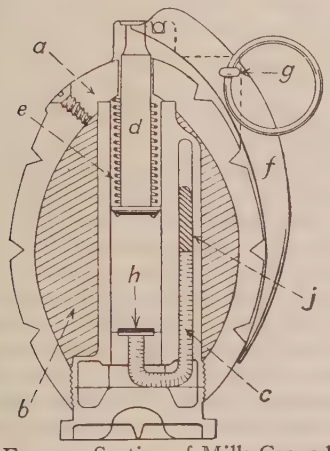

FIG. 1.—Section of Mills Grenade.

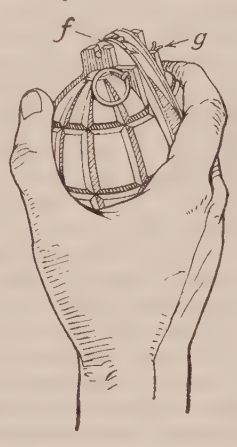

FIG. 2.—Grip for throwing.

striker *d* actuated by a powerful spring *e* which until then is restrained by a lever *f*. On withdrawing the safety pin *g*, this lever is still held to the grenade by the thrower's fingers (see fig. 2), but on the grenade leaving his hand, the loose lever flies off and a cap *h* is struck which ignites the 5 sec. length of safety fuse *c*, which in turn fires the detonator *j* and explodes the grenade.

Rifle Grenades.—Previous to the World War rifle grenades had been designed in order to obtain an increase of range beyond the restricted limits of hand throwing. These grenades were of the percussion type with a steel tail rod, with or without a gas check, which was inserted about 10 in. into the muzzle of the ordinary service rifle and propelled by the gases from a blank cartridge, which impinges on the tail rod. The rodded rifle grenade described above is open to serious objections, being unhandy, and liable to bulge and split the barrel, particularly if the rod is not accurately straight and consequently tends to buckle. In any case, a severe strain is thrown on the rifle, which is eventually bound to damage it. This led to the introduction from the French of the discharger-cup or *tromblon*, which is a short cylindrical cup attached to the muzzle of the rifle, into which the grenade is fitted and from which it is propelled by the gases from a blank cartridge fired in the rifle, acting on the base of the grenade. The Mills grenade can be adapted for firing from a discharger-cup by the addition of a gas check plate, which is screwed into the base; the side of the discharger-cup holds the loose lever in position until the grenade is projected clear, when it flies off and sets the grenade in action. In this way rifle and hand grenades can be made practically interchangeable, thus simplifying both supply and transport in the field.

Future Design.—The tendency of future design is in the direction of percussion grenades, which are considered to be more effective than time ones, chiefly in that no time is given in which to get clear or to throw back the grenade before it explodes, in the event of the time fuse being too long in its burning. The chief difficulty to surmount is so to design the grenade that it is safe if dropped vertically by accident, but is made "live" in the space of a short flight. Other essential conditions are to act in any position of impact or fall after throwing, to be interchangeable with trifling adjustment as a hand or rifle grenade, to be weatherproof and mud proof and to be simple in manufacture and use.

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GRENFELL, WILFRED THOMASON (1865–), British medical missionary, was born Feb. 28 1865 at Parkgate, Cheshire. He was educated at Marlborough and Oxford, where he took the degree of M.D., and studied medicine at the London Hospital under Sir Frederick Treves. At his suggestion Grenfell, in 1889, joined the Royal National Mission for Deep Sea Fishermen and for three years cruised with it in the North Sea as medical missionary. In 1892 he went to Labrador as first medical missionary and there did a great work, building hospitals, establishing homes and missions for the inhabitants, and organising industrial schemes and co-operative stores. In 1906 he received the C.M.G. in recognition of his services. Besides the work he did locally in Labrador and northern Newfoundland, culminating in the opening by King George of the Seamen's Institute at St. John's in 1912, Grenfell lectured in Canada, America and England in order to raise funds, and the mission expanded rapidly until, in 1912, its English, American and Canadian branches were united by the formation in New York of the International Grenfell Association, of which Grenfell became superintendent. During the early part of the World War he was attached as major to the Harvard Surgical Unit in France. In 1920 he became F.R.C.S. and in the same year received the gold medal of the National Academy of Social Sciences of America.

Grenfell's publications include: *Vikings of Today* (1895); *The Harvest of the Sea* (1905); *Labrador: the Country and its People* (1909, re-issued 1913 and 1922 with additional chapters); *Adrift on an Ice-Pan* (1910); *A Labrador Doctor* (1920, abridged 1925); *Northern Neighbours* (1923).

GRETNA, Great Britain, was the scene of a great undertaking during the World War. On a tract of land some 10 m. long and from one to two m. wide, partly in Dumfries, along the north shore of the Solway estuary, and partly in Cumberland, hundreds of stone, brick and steel buildings were erected for the making of munitions and providing for the wants of the workers who flocked there. These buildings included administrative buildings, schools, churches, messrooms, shops, halls, post-offices, fire-stations, etc., as well as factories, glycerine and ether distilleries, electric light and refrigerating plants. The buildings fell largely into two groups, one at Dornock to the west, and one about seven m. to the east at Mossband and Longtown. There were in addition two garden villages, one at Gretna, in the centre, and one four m. to the west at Eastrigg, with some 16 sq. m. of agricultural land, which has since been settled with ex-service men. The whole undertaking, about which great secrecy was preserved during and after the War, cost over £9,000,000 and employed at one time 24,700 people. It was sold in July 1924, although some members of Parliament made efforts to secure its use as a national factory.

GREY, ALBERT HENRY GEORGE, 4TH EARL (1851–1917), British administrator, the son of Gen. Charles Grey, Queen Victoria's private secretary, and grandson of the 2nd earl, the Prime Minister (*see* 12.586), was born Nov. 20 1851; he was educated at Harrow and at Trinity College, Cambridge, where he graduated with a first class in law and history in 1873. As his uncle, the 3rd earl, had no children, Albert Grey was the heir-presumptive to the earldom, and he sat in Parliament as a Liberal, first for South Northumberland, and then for the Tyneside Division, from 1880 to 1886. The Liberalism which he displayed in the House of Commons and developed greatly in a crowded after-life was unlike the conventional Radicalism of the period. He was an enthusiastic social reformer, and a whole-

hearted imperialist. He was one of the 93 dissentient Liberals who by voting against the Liberal Govt. decided the fate of the Home Rule Bill of 1886. He lost his seat in the ensuing General Election and did not reappear in Parliament till he succeeded his uncle in the earldom in 1894. The interval had been largely filled with travel—chiefly along the by-ways of the British Empire. He was in South Africa when his uncle died, and his knowledge of, and interest in, that country led to his appointment in 1895, after the Jameson Raid, as administrator of Rhodesia in succession to Dr. Jameson. There he became a close friend and ardent admirer of Cecil Rhodes, and it was natural that, on returning to England, he should join, in 1899, the board of the Chartered Company. He visited Lord Milner in South Africa after the Boer War, and returned once more in 1912 to unveil the Rhodes memorial on the slope of Table Mountain.

Canada, however, where he went as governor-general in 1904, was the part of the British Empire to hold the first place in his affections. He was no stranger there, but had already visited the Dominion twice, being brother-in-law of his predecessor, Lord Minto. His enthusiasm for the land and the people, his idealistic outlook, his bright and simple manner, his utter lack of conventionality and stiffness, his fondness for travelling and nature and sport captivated the Canadian heart. His term of office was twice prolonged; but Canada was loth to see him go in Oct. 1911, even though his successor was to be the Duke of Connaught. Never much of a party man, he was still less so after his return to public life in England. He devoted himself to the causes which appealed to him. Of these the Federation of the Empire was the first, and he would only contemplate Irish Home Rule as part of a federal scheme. He made a helpful contribution to licensing reform by the institution of the Public House Trust, and he worked hard for proportional representation. He forwarded all promising efforts for the improvement and organisation of agriculture. Lord Grey died at Howick, Northumberland, after a serious operation, on Aug. 29 1917, leaving, by his wife Alice Holford, a son who succeeded him in the earldom.

GREY OF FALLODON, EDWARD GREY, 1ST VISCOUNT (1862–), British statesman (*see* 12.588), became Foreign Secretary in Sir Henry Campbell-Bannerman's Ministry formed in Dec. 1905. Sir Edward Grey (as he then was) had previously announced that the Liberal Govt. would maintain Lord Lansdowne's policy of an *entente* with France and an alliance with Japan, and during the general election of Jan. 1906 he was asked by France, who was being pressed by Germany about Morocco, whether, in case of a Franco-German war, she could reckon on British assistance in arms. He replied that he could promise nothing which would not be fully endorsed by public opinion, but that, if war were forced on France through the *entente* respecting Morocco, he believed British public opinion would rally to her support. The French Govt. then suggested conversations between military experts.

After consulting the Prime Minister, the Chancellor of the Exchequer and the War Minister, he agreed, on the understanding that such conversations should in no way bind the British Government. The Algeciras conference on Morocco followed in the spring of 1906, and the constant support which, on his instructions, the British representatives accorded to the French helped to produce a satisfactory result and to strengthen the Anglo-French entente. In 1907 he came to an understanding with Russia. He concluded a convention with her about Persia, by which the integrity of that country was to be maintained, but Britain recognised that Russia had rights and interests in the northern zone and Russia recognised that Britain had rights and interests in the southern zone. In the same year he forwarded Anglo-American friendship by sending Mr. (afterwards Lord) Bryce to Washington as British Ambassador; and concluded a convention with Spain binding the Powers to maintain the *status quo* in the Straits of Gibraltar and neighbouring waters.

In 1908—the year in which Mr. Asquith, an intimate friend of Sir E. Grey, became Prime Minister—the European situation was considerably modified by the assertion in Oct. by Prince Ferdinand of the independence of Bulgaria and his assumption of the title of King and the simultaneous annexation by Austria-Hungary of Bosnia and Hercegovina, which she had administered under the Treaty of Berlin. These strokes of policy moved the indignation of both the Russian people and the Russian Govt.; but the German Emperor announced that he would stand by his Austrian ally in "shining armour"; and Sir E. Grey, though he protested against the infraction of the public law of Europe, was naturally unable to promise Russia anything more than diplomatic support. The action of the Central Powers confirmed him in the view that it was they who might be the principal danger to European peace; but he was able to keep on friendly terms with them.

The labours of the Foreign Office, coupled with membership of the House of Commons, left him little leisure for forwarding the general policy of the Government. Nevertheless, as occasion arose, he defended all the principal controversial measures. His main preoccupation, however, was British relations with Germany, who gave dramatic notice of her dissatisfaction with the spread of French aims and influence in Morocco by dispatching, at the beginning of July 1911, the gunboat "Panther" to the northwest African coast at Agadir, to protect, it was alleged, German interests. In view of this further attempt to test, and if possible loosen, the entente, he issued a warning, through the mouth of Mr. Lloyd George speaking at the Mansion House, that Britain intended at all hazards to maintain her place among the Powers. The warning sufficed to make Germany lower her tone, and subsequently Sir E. Grey explained to Parliament that the foreign policy of the Government was a continuation of Lord Lansdowne's and had got rid of the constant trouble with France and Russia; that British friendship with these Powers, far from constituting a hostile encirclement of Germany, afforded a guarantee that neither would pursue an aggressive policy towards her; but that, when a nation had the biggest army and was increasing its already big navy, it was natural that other Powers should be apprehensive.

While a section of Radicals and Labour men were suspicious of Sir Edward's policy, public opinion in general (including the Conservative Opposition) supported him and was pleased when in the following year his able services were marked by the very unusual distinction, for a commoner, of the Order of the Garter. In the beginning of 1912 he was a party to sending Lord Haldane on an informal mission to Berlin to reassure the Emperor and his Government as to the pacific intentions of Britain and to probe the intentions of Germany. The Cabinet formally notified the German Govt. that Britain would neither make, nor join in, any unprovoked attack on Germany. But nothing would content the German Govt. but an absolute pledge by Britain of neutrality if Germany were engaged in war —a pledge which Sir E. Grey naturally could not give. Largely in consequence of this ominous rebuff, he exchanged letters on Nov. 22 1912 with the French Ambassador, agreeing that, if either Britain or France had grave reason to expect an attack by a third Power or a menace to the general peace, both Governments would consult whether they should co-operate and what measures they should take in common. Still he found himself able to work in general harmony with the German Govt. in the efforts made by the Powers, in conference in London, to bring a settled peace to the Balkans, which had been distracted in 1912–3 by a series of local but furious and barbarous wars.

In this matter the diplomacy of Germany had appeared so reasonable that he was taken aback by her unyielding attitude in the negotiations arising out of the Austro-Serbian dispute. As soon as he heard of the Austrian ultimatum delivered at Belgrade on July 23 1914, he realised at once that Russia could not allow Serbia to be crushed and exerted himself in the most strenuous fashion to save Europe from the threatened catastrophe. Acting generally in conjunction with France and Russia, one or both, but in face of a lukewarm or hostile Germany, he urged upon Austria the extension of the alarmingly short time-limit of 48 hours; he proposed indefatigably various schemes for conciliation and conference; he pressed upon Serbia the

necessity of going as far as possible to meet Austria. In fact, Serbia accepted almost the whole of the Austrian demands; but Austria would be content with nothing less than complete submission, and on the expiry of the time-limit declared war on Serbia. On July 29 Germany, asserting that war was inevitable if Russia attacked Austria, endeavoured to purchase the neutrality of England by undertaking, if England remained neutral, to make no territorial acquisitions at the expense of France—an undertaking which did not extend to the French colonies—and by promising to respect Belgian integrity, after the War, if Belgium had not sided against Germany. Sir E. Grey next day absolutely refused to make any bargain of the sort at the expense of France and Belgium. In view of the apparent threat to Belgium, he asked France and Germany whether they were prepared to respect Belgian neutrality provided it was not violated, and he asked Belgium whether she would remain neutral. France and Belgium both replied affirmatively, while Germany temporised. Hopeful negotiations which had been begun directly between Russia and Austria were wrecked by a German ultimatum to Russia to countermand her mobilisation; and on Monday Aug. 3 Germany declared war on France.

The moment for decision had come for Great Britain. Russia had asked her to declare herself against Germany and so give the German general staff pause; France had asked her to co-operate as Germany was about to invade French territory. The Cabinet had hitherto been divided, a strong section pressing for the preservation of neutrality, and so Sir Edward had been unable to reply favourably to either Russia or France. But now Germany had declared war on France, and was apparently about to disregard the neutrality of Belgium. The Opposition, through Mr. Bonar Law, tendered support for active measures to aid France and Russia; and Sir Edward, with a Cabinet rallying, with few exceptions, to his view, was able to make an appeal in the House of Commons on Aug. 3 for public and Parliamentary support to a policy of action. The speech finally decided a wavering public opinion; with the exception of some Radicals and extremist Labour men, all parties, including the Irish Nationalists, accepted the necessity of war. Sir Edward demanded next day that Germany should respect the neutrality of Belgium, and, on the German refusal, England went to war.

One of Sir Edward's first tasks was to turn the association of the Powers fighting Germany and Austria into an alliance, which bound its members to fight in common, and make peace in common. In the course of the negotiations for this purpose he did not hesitate to guarantee the support of Great Britain for the attainment of long-cherished national objects, provided that these did not conflict with the aims of liberation and self-development common to the Allies: the most striking case being the promise, after Turkey entered the War on the side of the Central Powers, that Russia should have Constantinople. Much of his time and attention was occupied by difficult questions arising out of the blockade of Germany and the consequent interference with the trade of neutrals. Public opinion in Great Britain constantly complained that the blockade was not enforced with sufficient strictness; while the United States, as the principal neutral, harassed the British Govt. by repeated notes, denouncing the methods of the British Navy as unnecessarily prejudicial to American trade and contrary to international law. He was perhaps more successful in his answers to the Americans than in his justification to the British public; and a large body of opinion in America accepted his explanations as reasonable.

The tenure of the Foreign Office by a statesman so high-minded, sincere and experienced as Sir Edward Grey was everywhere regarded as such a valuable asset for Great Britain that it appeared only natural and fitting for Mr. Asquith, when contemplating the formation of a coalition government in May 1915, to lay down, as one of the essential conditions, that there should be no change in the office of Foreign Secretary. No one could refute with such authority the intermittent assertions of the German Chancellor that it was England and not Germany that was responsible both for the origin and for the continuance of the War. When the pacifists called for negotiations in May 1916, he showed that when the Germans professed a readiness for peace it was only for a peace on the basis that Germany had won and the Allies were beaten; but the Allies were not beaten, and the first step towards peace would be taken when Germany began to recognise the fact. Credit must be given to Sir Edward for facilitating, in the early summer of 1915, the entry of Italy—till May 3 a member of the Triple Alliance—into the War against the Central Powers. It was, however, a bitter disappointment to him that his grave warnings failed to prevent Bulgaria, in the autumn of the same year, from taking the field against the Allies. Allied troops were sent to Salonika, and he offered Cyprus to Greece in order to induce her to carry out her treaty obligations and go to Serbia's aid against Bulgaria. But on this issue King Constantine won the support of his people against M. Veniselos, and Serbia was crushed before help could reach her.

In July 1916 an affection of the eyes, which had been giving him increasing trouble, made it advisable that he should have as much relief from work as possible, and he accepted a peerage. When a few months later, in Dec., his friend and chief Mr. Asquith was succeeded in the premiership by Mr. Lloyd George, failing eyesight and political comradeship both united to determine him to bring his 11 years' tenure of the Foreign Office to a close. He had served for a longer consecutive period than any predecessor, and in his official methods he carried out his own precept—that foreign policy required not striking effects nor bold strokes but careful steering.

After his resignation Lord Grey took little or no part in public life for several years. Happily, though he never regained normal vision, rest and quiet gradually worked a decided improvement in his eyesight. But, with the exception of a three months' mission in 1919 to the United States to deal with questions arising out of the peace, he did not definitely emerge from his retirement till 1922. It was the time of the decadence of the coalition government and Lord Grey urged that it was not trusted and should come to an end, which happened within a few months; he was also anxious to resuscitate the Liberal party, a process which was only partially effected. In foreign affairs he pressed for the re-establishment of good relations with France, and for the arrangement of an inclusive peace pact, beginning with France. When such a pact was concluded at Locarno in 1925 he welcomed it warmly. But the cause to which he devoted most of his energy was that of the League of Nations. He was especially anxious that Germany should be included as a member at the earliest possible date, and maintained that this should be the only business of the spring meeting of the League in 1926, which unfortunately separated without effecting it.

Much of his time in these years was taken up in the compilation of a straightforward narrative and vindication of his course in foreign policy, which was published in 1925 under the title *Twenty-five Years, 1892–1916*. He had published in 1899 another volume on *Fly-Fishing*, his favourite recreation. In 1885 he married Dorothy, daughter of Shallcross F. Widdrington, of Newton Hall, Northumberland. She was killed in a carriage accident in 1906, and in 1922 Lord Grey married, as his second wife, Pamela, sister of George Wyndham, widow of the 1st Lord Glenconner. (G. E. B.)

GRIERSON, SIR JAMES MONCRIEFF (1859–1914), British soldier, was born at Glasgow Jan. 27 1859 and joined the Royal Artillery in 1877. Noted from the outset as an exceptionally keen student of his profession, from 1896 to 1900 he was military attaché at Berlin. As a colonel he was with Lord Roberts during the advance from Bloemfontein into the Transvaal; but he was then transferred to China to act as British military representative on the staff of Count Waldersee, commander-in-chief of the Allied forces against the Boxers. In 1904 he was appointed director of military operations. He commanded the 1st Div. at Aldershot from 1906–10, and was in 1912 put in charge of the Eastern command. On the outbreak of the World War Sir J.

Grierson was selected for the command of the II. Army Corps. He proceeded to France, but died suddenly on Aug. 17 1914 while his troops were still assembling in the area of operations. A good linguist and unusually well acquainted with most of the European armies, Grierson had an understanding of "la grande guerre" and an intimate knowledge of the German Army that made his premature death an incalculable loss to the British cause.

GRIFFITH, ARTHUR (1872–1922), Irish politician, was born in Dublin March 31 1872 and began his working life as a printer. When the Irish party was divided over the Parnell case, Griffith, like Dublin artisans in general, sided with Parnell and against the clergy. But the rancorous quarrels which then disfigured Irish politics disgusted young men and led them to despair of success along constitutional lines.

New organisations came into existence in Dublin, the most important being the Gaelic League for the revival of the Irish language. Griffith joined this movement, but, since it was professedly non-political, his main activities were with the Celtic Literary Society, the leading figure of which was William Rooney. Over and above all these minor groups there existed the Irish Republican Brotherhood or Fenian Society, of which Griffith became a member. He went to South Africa in 1896, owing to lack of employment in Dublin, but home-sickness brought him back to Ireland in 1898. In 1899 *The United Irishman*, a weekly paper, was established, through the columns of which he was destined to influence Ireland.

Early Writings and Aims.—At first Rooney counted for more in the new movement than Griffith, for he possessed that personal magnetism in which Griffith was lacking, yet after his death in 1901, the paper strengthened rather than weakened. No such journalism had appeared in Dublin since the time of Young Ireland. It was savagely political; but its politics had an idealism which was foreign to the agrarian revolution. Griffith cared passionately for the things of the mind; his own writing had the beauty of trenchant steel; and he welcomed contributions from the best writers in Ireland, W. B. Yeats, "A. E." and the rest. No contributor expected to be paid, for all knew that Griffith himself lived on a pittance.

Later, when the power of his pen was recognised, generous offers were made to him, but he rejected them, and steadily pursued his own aim. That aim was both destructive and constructive. He sought first to divert his countrymen from the attempt to win self-government through parliamentary action at Westminster, and secondly to persuade them to work for it in their own country. Physical force was then popularly regarded as an illusion; and Griffith, though all his intimate associates were Fenians, recognised that the majority of Irish Nationalists did not think separation from Britain possible. He therefore resigned membership of the I.R.B., and aimed at winning over the separatists to work for a Parliament in Ireland united to that of England only by the link of the Crown. As a means to this end, he proposed passive resistance and an appeal to moral force. Payment of taxes was to be refused. Members elected to Parliament were to absent themselves from Westminster, and to sit in Ireland as a Council and govern only by the assent of the nation. Tribunals were to be set up to which cases should be brought, and the British courts were to be deserted.

Rise of Sinn Féin.—This policy was first publicly announced at a meeting in Dublin in Oct. 1902. The body which met called itself Cumann nan Gaodheal or "Society of the Gaels." But the name chosen to represent their policy was Sinn Féin "Ourselves"—Irish words which in their proverbial use mean roughly "Stand together." The name was soon transferred from the policy to its adherents. Candidates were put forward at municipal elections and by 1906 there were 14 Sinn Féiners on the Dublin corporation. But Griffith's propaganda was mainly confined to the capital; and in 1907 a member of the Irish party, who resigning his seat, stood for re-election as a Sinn Féiner, was heavily defeated. The attempt to return a Sinn Féiner to Parliament was not renewed for 10 years.

The new policy at first did not make much headway. Resistance to taxation proved difficult because all taxation except income tax was indirect, and a large proportion of income tax payers were Unionists. The only effective forces were the personality and the pen of Arthur Griffith. His paper changed its name in 1906 when damages for libel were awarded against the *United Irishman*. That journal disappeared, and re-emerged as *Sinn Féin*. In 1907, when the Parliamentary party had suffered a reverse, *Sinn Féin* appeared as a daily paper, but this experiment soon had to be abandoned, and after another bankruptcy *Eire* became its name. Griffith wrote no books: but he published in 1905 a pamphlet called *The Resurrection of Hungary* which described how an almost vanished language had been restored to national use, and how the elected deputies of an ancient nation, through a policy of abstention from the Austrian Assembly, gained full freedom under a dual monarchy.

The Volunteer Movement.—Griffith, during these years, taught the rising generation to despise and distrust not only the methods but the character of those who were then leading the main national movement and he was less scrupulous in his modes of attack than a publicist should be. Yet when it became clear in 1911 that a Home Rule Bill was seriously intended, he announced his intention not to hamper Redmond. But the measure proposed was wholly unlike his ideal and he condemned it root and branch, his most furious opposition being directed against that partition of Ireland which he was later constrained to accept. In the shaping of events, neither he nor his paper counted for much till the growth of the Ulster Volunteers revived the hopes of the physical force party.

Griffith supported the counter-organisation of the Irish Volunteers by word and deed. He was one of those who received the rifles landed at Howth in July 1914. The outbreak of the World War revived all his importance. The Volunteers split, nine-tenths of them adhering to Redmond in support of the British cause but the remainder, active and determined, remained in Ireland; and Griffith's paper was their main organ. The censorship attacked it, but instead of *Eire*, there came out *Scissors and Paste*, a journal consisting of extracts from war news arranged to give an impression very unfavourable to the Allies. It was only one of many journals. Griffith had founded a school, a "mosquito press" and had set the example of tenacity and courage.

The Easter Rising.—The Easter Rising of 1916 was a surprise to the majority of Irishmen. Griffith took no part in it, and thereby lost influence with the extremists. But the British authorities remedied this by putting him into Frongoch, the detention camp in Wales, which became a crowded academy of Sinn Féin. Yet when in July 1917 the prisoners were released, Mr. de Valera was chosen as their leader. Griffith proposed this election at the Convention of Sinn Féin, while he himself returned to his desk, re-issuing his paper as *Nationality;* this also was suppressed and re-appeared as *Eire Og*. He was again put in gaol in 1918. At the General Election after the Armistice, Sinn Féin swept the board outside Ulster, and Griffith's policy was put into force. The elected members (such as were not in prison) assembled as Dail Eireann, the Irish Parliament. But, going beyond Griffith's plan, they declared for an Irish Republic, electing Mr. de Valera as President and Griffith as Vice-President. Both these men were then prisoners; but after some months the President escaped and Griffith was liberated.

Griffith as Leader.—During Mr. de Valera's absence in America, from June 1919 to the close of 1920, Griffith acted as head of the "Irish Republic." His policy now was carried out in its entirety. The elected bodies, county councils and municipalities refused to take orders from the British authorities in Dublin Castle; Sinn Féin courts were set up and functioned with notable success; income tax was withheld. But these forms of passive resistance were effective only because active resistance was in progress. Griffith neither launched nor controlled the guerilla war, to the pressure of which England finally yielded.

During that struggle, power rested with Collins and other young men. Yet Griffith had still a great part to play. When the truce was proclaimed and negotiations were opened in July 1921, Mr. de Valera refused to accept the responsibility of abating the full separatist demand. Griffith, thereupon, undertook

the leadership of the delegation which finally secured the inclusion in the treaty of the substance of Sinn Féin's original demand. Defending this settlement in the Dail, he spoke with the conviction of one whose ideal had been accomplished and who knew that it satisfied the desire of Nationalist Ireland in general. Without his authority, prestige and sense of realities, it is unlikely that any settlement of the difficult Irish question would have been reached.

Many of those who supported him would not accept the full consequences of the treaty; and when Mr. de Valera resigned, Griffith was elected President, not of the Free State, but of the Republic and the army continued to be in theory the Republican army. To meet the difficulty, Griffith set up a Provisional Govt. with Michael Collins as Chairman to carry on till a general election should have ratified the treaty. This resulted in an illogical division of authority and as months passed Griffith's public utterances as President were often contradicted by the action or inaction of the Provisional Government. During the final discussions with the British Govt. in June 1922, concerning the treaty, he interviewed the leading Irish Unionists and pledged himself to secure them full representation in the public life of the Free State. His conception of Ireland was less narrowly Gaelic than that of Sinn Féin in general.

After the elections on June 16, when a plain verdict was given for acceptance of the treaty, the Government was at last forced to take action against the mutinous section of the army. Civil war began on June 27. In July the main bodies of the Irregulars were everywhere decisively beaten, and on Aug. 11 a force sent round by sea occupied Cork, the last important town to be regained. On the morning of Aug. 12 Griffith fell dead suddenly on the way to his office in Dublin. The strain had killed him, and the completion of his life work was left to a younger generation. Essentially he must rank as a publicist, an educator, an inspirer of action. Few men in history have accomplished more for their country than he by his unpaid pen. (S. G.)

GRIMSBY, England (*see* 12.603), has an area of 2,868 ac. in the county borough and of 1,798 ac. in the parish, with 117 ac. of water and 248 of foreshore, and a population in 1921 of 82,355. The fishing trade has increased largely since 1910 and has necessitated the provision of a new dock; there are considerable imports of timber and ice, and the town has some ice factories. The tramways were taken over by the corporation in 1925. St. Augustine's Church was built in 1911, St. Luke's in 1912 and St. Peter's (Roman Catholic) in 1919; a new parish, that of St. Stephen's, was made in 1911. A children's home in Brighowgate was opened in 1913, and Queen Mary's hostel, built by the National Mission to Deep Sea Fishermen, in 1925. A War Memorial in Bargate was unveiled in 1921. The Grimsby trawlers and their crews did splendid work in sweeping for mines during the World War (*see* MINELAYING).

GROSSMITH, GEORGE (1847–1912), British comedian (*see* 12.619), died at Folkestone March 1 1912.

His son, GEORGE GROSSMITH (1874–), British comedian, and third of the name, who made his first appearance at the Shaftesbury Theatre in an operetta by his father, became a well-known figure in musical comedy, especially at the Gaiety Theatre, London. He was the author, or part author, of many musical plays, songs and revues, and took a leading part in popularising revue in London. Together with Edward Laurillard he became lessee and manager of several London theatres. During the World War he served as lieutenant in the R.N.V.R.

GRUNDY, SYDNEY (1848–1914), British dramatist (*see* 12.640), died in London July 4 1914. His last play, *A Fearful Joy*, was published in 1908.

GUAM (*see* 12.648).—American naval station in the North Pacific, the largest of the Marianas Islands. The native population, 60% of which lives in the chief town, Agaña, was 14,912 on June 30 1923, and 15,160 on June 30 1924. On the latter date there were also living on the island 550 non-natives, besides the personnel of the naval establishment amounting to 814. With the non-natives are included the families which are the result of marriages with native women.

Production.—Agriculture is the chief occupation, and the Government is making efforts to develop this, so that the island may be more nearly self-supporting and have a larger surplus for export. Copra is the chief crop and about the only export, the normal crop being about 800 tons. In 1923–4 the first coconut-oil mill in the island was erected. Maize and other foodstuffs grow readily. A good grade of coffee is produced, and excellent tobacco can be grown. Fish are plentiful in the waters surrounding the island, but the fishing industry has never been developed to its full capacity, and fish foods are imported.

Education.—Education is compulsory up to the age of 12. In 1923–4 there were 16 primary schools, one intermediate school, one high school and one school for Americans, besides two private schools. Pupils attending the schools were 2,833, of whom 2,676 were in the public schools. The number of American teachers increased from 4 in 1922–3 to 14 in 1923–4. Teaching is in English. Athletics are a recognised part of the curriculum, and baseball is played enthusiastically throughout the island. About 40% of the public receipts are expended on education.

Finance and Trade.—The revenues for the fiscal year 1923–4 amounted to $137,805, and expenditures to $152,781. Revenues for 1923–4 included land taxes, about $42,000; licences, about $15,300; court fees and fines, about $10,650; customs and revenue collections over $9,000 (approximately $6,657 being customs collections); and productive industries, about $27,600. The Government is also collector of customs and revenues. The balance of trade is heavily against Guam. Imports and exports in 1923 were valued at approximately $674,556 and $94,086, respectively, and in 1924 at approximately $632,721 and $66,095 respectively. In 1923 1,432,568 lb. of copra were exported to the United States, and in 1924 2,110,000 pounds. The heaviest import is of food supplies, amounting in 1924 to over $245,000. The only banking institution is the Bank of Guam which was established by the Naval Govt. in 1915, for general banking business and as a depository of the Naval Govt. of Guam. It has a capital stock of $15,000 fully paid up. On June 30 1924 its surplus amounted to $29,000.

Administration.—The administration is directly under the Department of the Navy, and the Governor is a naval officer with the rank of captain who is appointed by the Secretary of the Navy. The Governor has full power and authority to make laws for the government of the island, from which there is no appeal. He is assisted by a native Congress which has only advisory power. The Guam Congress on July 1 1925 resolved that the Congress of the United States be petitioned to enact a law making all native Chamorros of Guam citizens of the United States, or that Congress grant them the privilege of becoming citizens of the United States by naturalisation. The cadastral survey is proceeding rapidly and new roads are being constructed. The Dollar Line has established a regular service to Guam, and there are regular sailings to Manila and Japan. Recent public improvements are a new post-office in Agaña, the capital, school buildings and a number of roads.

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(J. A. Ro.)

GUARANTEES: *see* SANCTIONS AND GUARANTEES.

GUARDIANS, BOARD OF: *see* POOR LAW.

GUATEMALA (*see* 12.661).—A republic of Central America and a member of the League of Nations. Its estimated area is 48,250 square miles. The capital, Guatemala City, was completely destroyed by earthquake between Jan. 25 1917 and Jan. 24 1918.

I. POLITICAL HISTORY

Guatemala was little affected by the World War, but on April 27 1917 she broke off diplomatic relations with the German Govt., and on April 23 1918 adopted "the same belligerent attitude as the United States." Guatemala was one of the signatories to the Treaty of Versailles June 28 1919. In 1915 Manuel Estrada Cabrera, who had been dictator since 1898, was

re-elected for the term 1917–23. In 1920, however, a group of intellectuals known as the Unionist party opened a newspaper campaign against him, which developed into a revolutionary movement and spread to the National Assembly. When the army became infected Cabrera resigned (April 1920) in favour of the vice-president, Carlos Herrera, who was elected President by the National Assembly. His Government was promptly recognised by the Powers. Herrera, who had wide experience of agriculture, banking and commerce, aimed at encouraging foreign capital, stimulating immigration and internal development. He worked energetically to repair the damage caused by the earthquake of 1917–8, and erected many valuable public buildings. On Oct. 10 1921, after prolonged preliminary negotiations, Guatemala, Honduras and Salvador signed a pact of union at San José, agreeing to form a Central American Union. (*See* CENTRAL AMERICAN UNION.)

Each state, for the time, was to conduct its own internal affairs; but the signatory states were to constitute a unit on foreign affairs and for matters of common interest. Costa Rica and Nicaragua failed to enter the Union. On Dec. 7 1921 the Opposition overthrew Herrera, leader of the Unionist party which was favourable to the Union, and Gen. Orellana, leader of a military faction, was elected President in March 1922 for a term of six years. A revolt against him in July was put down with bloodshed. Pres. Orellana repudiated the Pact signed on Aug. 20 1922 by Nicaragua, Honduras and Salvador (*see* CENTRAL AMERICAN UNION) on the ground of avoiding "entangling alliances." His Government was represented, nevertheless, at the Washington Conference of 1922–3 and signed the conventions there agreed upon. In June 1924 it was the first Central American republic to adopt the international commissions of inquiry provided for by the Washington Conference. The National Assembly ratified the general Treaty of Peace and Amity there drawn up.

In Aug. 1924 Guatemala reached an agreement with the United States, according mutual most-favoured-nation treatment in customs, and in Nov. effected a commercial treaty with Germany on the same principle. By a decree of April 28 1925 all foreign companies domiciled in Guatemala must appoint a representative for legal and non-legal transactions. In April 1925, also, women obtained independent legal personality. Under the 1923 general Treaty of Peace and Amity, Guatemala agreed to limit its armed forces for a period of five years to 5,200, and moreover to restrict aircraft to 10 aeroplanes and to maintain no navy.

Education.—Primary education is free and compulsory between the ages of 6 and 14. In 1917 there were 1,942 government schools, with 54,479 pupils in attendance. After the destruction of Guatemala City by earthquake in 1917–8 education suffered a check until 1924, when it received special attention. In 1924 there were 1,477 Government schools, and a number of private secondary, professional, normal and vocational schools, as well as four schools of commerce. There were 94,177 pupils in attendance and 4,284 teachers.

II. SOCIAL AND ECONOMIC CONDITIONS

The census of 1920 gave a population of 2,004,900, and the estimates for 1923 were 2,454,000. About 60% of the population are pure Indians. In Oct. 1924 a contract was authorised for the admission of one hundred Czechoslovak farmer families, for whom were assigned 4,500 hectares of undeveloped lands. Dwellings, medical attendance, schools and hospital service were included in the contract.

Finance.—A new monetary system was introduced in Nov. 1924, with the quetzal (equal to the dollar) of 1·504665 grammes of pure gold as the unit, having a value of sixty pesos. It was to be coined in 5, 10 and 20 quetzal denominations, with subsidiary silver and copper coins. The silver peso in Oct. 1924 was worth $.5376, although only unconvertible paper currency was then in circulation. Provision has been made since Feb. 1925 for a circulation reserve fund, by a tax of an added 50 cents a quintal on coffee and a graded tax of 20 to 30 cents on sugar exports.

The Government budget for the years 1921–4 was (in pesos):—

	Expenditures	Revenues
1921	387,365,234	256,261,970
1922	348,489,894	306,810,074
1923	396,121,964	385,874,260
1924	471,969,841	466,190,332

In 1924 revenue in quetzales was 8,101,686 and expenditure 8,095,573. Current expenditure for 1921 deducting items not requiring cash outlay, such as amortisation of the external debt by transfer securities in London to the Council of Foreign Bondholders, was actually only 324,049,887 pesos. Increase in 1922 revenues was largely due to the high rate of foreign exchange and to collection of the export tax on coffee in gold.

The total debt Dec. 1922 was £1,908,563 constituted as follows:—$1,257,898, 11,923,401 silver pesos and 181,887,314 paper pesos. At the end of 1924 the external debt was considered as £1,875,603 and the internal debt £1,426,961. The total debt was then in dollars 13,239,240.

Industry.—Exports mainly consist of coffee and sugar; cotton and bananas are among the growing exports. The figures of the years 1922–4 for the exports of coffee, sugar and bananas were:—

	Coffee (lb.)	Sugar (lb.)	Bananas (bunches)
1922	94,000,000	24,000,000	3,884,170
1923	96,000,000	27,000,000	4,384,077
1924	89,000,000	18,000,000	5,547,531

The principal imports are cotton goods, flour and other foodstuffs. The average wheat production is 400,000 bu., equivalent to 90,000 barrels of flour. Milling is not commercially developed. During the year preceding May 1 1925 the cotton crop reached 30,000 quintals, a large increase in spite of poor crops in certain parts. Commercial conditions in 1925 were excellent, due to high coffee prices. Importation of automobiles and other luxuries was heavy. Import duties for 1924 amounted to 19,921,316 pesos and $3,009,315, or a total of 3,341,336 quetzales. Exports produced revenues of 56,713 pesos and $1,435,492, or a total of 1,436,437 quetzales. A banking decree stabilising exchange aided merchants in the conduct of business.

A contract for developing petroleum fields by a New York company in the departments of Ezabal and Alta Verapaz was approved in Nov. 1924. Another contract provided for similar development in Alta Verapaz, Quiché and Huehuetenango. Changes in the mining and petroleum development law make the sole tax 10 per cent on the gross product in two zones and eight per cent in two others. Contracts endure 40 years; the geological surveys must begin within six months from the date of the concession.

The foreign commerce for 1913 showed imports worth $10,062,000 and exports worth $14,450,000. For recent years the figures were:—

	1923	1922	1921
All countries			
Imports	$10,840,781	$10,751,660	$13,369,611
Exports	14,725,567	12,065,949	12,130,826
United Kingdom			
Imports	1,665,643	1,599,131	2,289,047
Exports	355,249	306,591	133,618
France			
Imports	307,148	355,678	480,143
Exports	24,694	17,977	11,985
Germany			
Imports	1,302,267	1,199,910	1,240,360
Exports	2,047,320	1,961,395	1,757,306
United States			
Imports	6,519,630	6,644,449	8,177,442
Exports	11,330,986	7,883,386	8,114,117

For 1924 the exports to the United States were $10,089,156, and the imports $8,823,542.

Communications.—British interests in the International Railways Co., incorporated in 1912, and controlling 597 m. of railway, were acquired by American capitalists in 1924. A branch is to be constructed from the Mexican boundary and the Caribbean coast to the Southern end of Salvador. A new line south to Asunción Mita has been approved by the minister of promotion. A private road-building programme, initiated in 1924, provides for the building of new roads from Guatemala City to San Jose; from Antiqua to Panajachel, thence to Quezaltengo; and from Guatemala to Santa Ana in Salvador. The first of these will serve important coffee and sugar export interests. Three wireless stations largely supplant telegraph lines, which are difficult to maintain in the tropical forest. They are at Quezaltenango, a gift from Mexico, Puerto Barrios and at the capital.

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GUCHKOV, ALEXANDER (1862–), Russian politician, was born in Moscow. He studied at the universities of Moscow and Berlin and, after leading an adventurous life of travel, entered politics. He helped to found the Russian "Octobrist" party in the hope that the Tsar's Govt. would work with the moderate Liberals of the Zemstvo, while safeguarding the monarchical principle. In 1910 Guchkov was elected president of the Duma, but as Stolypin became more reactionary, the Octobrists lost their standing ground, and Guchkov eventually resigned the presidentship of the Duma. In the elections to the fourth Duma he failed to secure a seat. During the World War, however, he was in charge of the Red Cross organisation on the German front, and devoted his energies to refitting the army on the technical side. When the March Revolution of 1917 broke out Guchkov became Minister of War, but he was powerless against the mounting flood of desertion and demoralisation in the army, and resigned in despair. Emigrating he found himself without proper place and influence, and later took refuge in Paris, where he pleaded for a reunion of all parties against the Bolsheviks.

GUERRINI, OLINDO (1845–1916), Italian poet (*see* 12.672), died at Bologna Oct. 21 1916.

GUESCHOFF, IVAN EVSTRATIEW (1849–1924), Bulgarian politician, was born at Philippopolis Feb. 1849. He was educated first at Philippopolis, and was then, in 1865, sent to Owens College, Manchester, for four years. He remained at Manchester in business with his father until 1872, when he returned to Bulgaria. In 1877 he was arrested by the Turkish governor and condemned to death for political propaganda against Turkish rule, but was saved by the intervention of the British and American Consuls. He then began to send accounts of the Turkish atrocities to *The Times* and *The Daily News* (London). In 1878 Gueschoff became general manager of the Bulgarian National Bank at Sofia, and was Minister of Finance from 1894 to 1897. He was elected president of the Sobranie (National Assembly) in 1901 and became Prime Minister in 1911. As such, he concluded defensive alliances with Serbia, Greece and Montenegro against Turkey, and so paved the way for the Balkan victories of 1912. After the London peace treaty, May 30 1913, Gueschoff resigned with his Cabinet. During the World War he retired from politics and became president of the Bulgarian Red Cross. He died at Sofia March 11 1924.

GUESDE, JULES BASILE (1845–1922), French socialist (*see* 12.672), died in Paris July 28 1922.

GUIANA, BRITISH (*see* 12.676).—The sole British possession on the continent of South America, has an area of 89,480 sq. miles. The population of the colony at the end of 1924 was 301,204.

Sugar maintains its position as the principal export from British Guiana; of the area under cultivation 57,000 ac. are reaped. The value of the sugar exported in 1924, with its by-products—rum, molasses, molascuit—was approximately £2,000,000. Between 1915 and 1924 machinery to the value of £1,500,000 sterling was imported for the equipment and improvement of the sugar factories. Exports of rice in 1924 were valued at £65,120, an increase on the exports for 1923, which were valued at £57,018. The production of diamonds has increased since 1913; in 1923 214,385 carats were exported, valued at £1,032,585. The output of gold has decreased; in 1924 the exports were valued at £19,600, as against 63,803 ounces exported in 1914 and valued at £232,085. The value of bauxite exported in 1924 was £176,200, and in the same year balata valued at £164,400 was exported. The chief imports are foodstuffs, manufactured textiles and machinery. Under the British preferential tariff imports from the United Kingdom, Canada and other British possessions have increased, while imports from the United States have decreased.

The forest area of 78,000 ac. contains many valuable woods—greenheart, which is produced only in British Guiana, and mora, both of which are suitable for shipbuilding and are resistent to marine borers, purpleheart and crabwood. 168,454 cu. ft. of timber, valued at £26,006, were exported in 1924. Difficulty of access has limited the exploitation of the mineral and timber wealth of the colony to the northern half. The development of the forest lands is being actively pursued by the newly-created Forestry Department, which began its work of locating fresh sources of supply of commercial timbers in Nov. 1925. British Guiana participated in the British Empire Exhibition in London 1924–5, and a resident trade commissioner has been appointed in London.

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GUIANA, DUTCH (*see* 12.680).—The only Dutch possession on the South American mainland, has almost doubled its population since 1910. Statistics obtained in 1925 gave the population as: Europeans, 1,422; natives, comprising Indians and bush negroes, 56,339; Javanese, 18,685; Hindus, 30,974; Chinese, 1,454. The population of the capital, Paramaribo, in 1925 was 44,772. In 1923 there were 35 public schools in the colony with 5,296 pupils in attendance, a Government normal school with 127 students, and 55 private schools attended by 9,481 pupils.

The shortage of labour that followed on the abolition of slavery in 1863, causing the reduction of the plantations from 500 to 5 sugar plantations and 66 for other products, created a labour problem that led to the introduction of Chinese, Javanese and Hindus as contract labourers. The chief products are sugar and coffee; next in importance come bananas, rice and cocoa. Cotton is produced on a small scale, and oranges and coconuts are grown by the crofters, many of whom were originally contract-labourers. The principal articles of export are sugar, coffee, bananas, cocoa, balata. Timber is furnished from the hinterland and gold is mined in many districts. Important deposits of bauxite are known to exist in the colony, but hitherto this mineral has not been worked on any large scale. The balance of trade is usually adverse, and the deficit is adjusted by an annual subvention paid by the Netherlands Government. During the four years 1922–5 the sum required for the state subvention has progressively decreased. Imports in 1924, mostly foodstuffs and manufactured articles, were valued at £624,704. Exports, consisting of agricultural and mineral products, besides timber and balata, were £617,453 during the same year.

See J. M. Brown, *The Dutch East* (1914); A. S. Walcott, *Java and Her Neighbours* (1914); also *Jaarcijfers voor het Koninkrijk der Nederlanden*, annual publication of the Colonial Office, The Hague. (J. C. K.)

GUIANA, FRENCH (*see* 12.681), has an area of about 32,000 sq. m. and a population (1921) of 44,202, including 2,368 Indians (natives). Some Indian tribes may have escaped enumeration, but in any case the colony is very sparsely inhabited. About 10% of the people are whites and another 10% negroes; the remainder are mostly of mixed blood and locally are called Creoles. Cayenne, the capital and chief port, had 10,146 inhabitants; St. Laurent du Maroni, 1,300. The colony is best known as a penal settlement and as including the Iles du Salut, one of these islands being the notorious Devil's Island. The 1921 census figures included 3,775 convicts.

The natural resources of the country remain very little developed. The chief industry is gold mining, the gold produced representing fully half the value of the exports. The mines are near the Dutch and Brazilian frontiers respectively. The forests contain valuable timbers. Rosewood is exported and there are factories for the extraction of rosewood essence. Balata is also obtained from the forests. Small quantities of coffee, cocoa and sugar figure in the exports, but labour is scarce and dear and

only a very small portion of the land is cultivated. The adverse trade balance in 1921 was 25,000,743 francs. The cost of the penal settlement is borne by France. There are few roads and but 15 m. of railway. A seaplane service is maintained between Cayenne and St. Laurent and there is a wireless telegraph station. The colony is represented in the French Parliament by one deputy. See *Le Journal de la Société des Américanistes de Paris*, for articles on the history and explorations of the country.

GUILD SOCIALISM: *see* SOCIALISM.

GUILLAUMAT, MARIE LOUIS ADOLPHE (1863–), French soldier, was born at Bourgneuf, Charente Inférieure, Jan. 4 1863. He left the military school of St. Cyr in 1884, and became a captain in 1893. He served for three years in Tongking with the Foreign Legion, and during the Boxer rising in 1900 was in Tientsin where he received his first wound. In 1903 he was appointed professor of military history at St. Cyr and in 1908 lecturer on infantry tactics. After being director of infantry at the Ministry of War from 1911, he became *chef de cabinet* to the Minister of War, M. Messimy, in 1914. At the outset of the World War, Guillaumat, who had already taken part in 12 campaigns, commanded a division at the battle of the Marne and later in the Argonne. Subsequently, in command of the I. Army Corps, he took a notable part in the battle of Verdun and the Somme. In Dec. 1916 he was given the command of the II. Army in front of Verdun and directed the attack of Aug. 20 1917, which succeeded in freeing the position.

In Dec. 1917 he was sent to Salonika as commander-in-chief of the armies in the East (*see* SALONIKA CAMPAIGNS) but was recalled in July 1918 to take command of the entrenched camp at Paris in face of the enemy advance. He urged the launching of an offensive in Macedonia both at the Inter-Allied War Council at Versailles and before the British War Cabinet; and on Sept. 4 1918, at the London conference, his advice was adopted. In Oct. 1918 Gen. Guillaumat was given the command of the V. Army on the Aisne for the final advance. After the war he was president of the commission of inquiry into the surrender of the frontier fortresses and later was elected a member of the Conseil Supérieur de la Guerre. After being entrusted with a mission to Athens, where he drew up a plan for the reorganisation of the Greek army, he took command of the army of occupation in the Rhineland at the end of 1924.

GUILLAUME, CHARLES EDOUARD (1861–), French physicist, was born at Fleurier, Switzerland, Feb. 15 1861. Educated at Neuchâtel, he became a *docteur-ès-sciences*, and devoted himself to the study of practical physics. He is principally known for his invention of the metal, invar, an alloy of nickel and steel which, having a co-efficient of linear expansion of only ·0000008 for one degree Centigrade, is in general use as a material for standard measures and instruments of precision. In 1920 he was awarded the Nobel Prize for physics and he became director of the international bureau of weights and measures.

Guillaume's works include: *Traité pratique de la thermométrie de précision* (1889); *Les radiations nouvelles; Les rayons X, etc.* (1896); *Les applications des aciers au nickel* (1904); *Détermination du volume du kilogramme d'eau* (1910); *Compensation des horloges et des montres* (1921); *Les récents progrès du système métrique* (1907–21).

GUINEA, FRENCH (*see* 11.102). Revised estimates give the area as 90,000 sq. m. and the population (1925) as 2,000,000. There were 2,000 Europeans, of whom half were French. From the port of Konakri (population 9,000) a railway 411 m. long was completed in 1915 to Kankan, on the Upper Niger. Palm oil and kernels, ground nuts, rubber and hides are the chief exports. Since 1922 cotton has been grown in the Niger regions. Coffee and bananas are other crops.

GUISE, BATTLE OF: *see* FRONTIERS, BATTLES OF THE.

GUITRY, LUCIEN GERMAINE (1860–1925), French actor (*see* 12.705). In 1920 he came to London with his son Sacha, and achieved an immense success in *Pasteur*, when he played the title rôle. He also played in his son's play, *Mon père avait raison*. He died in Paris June 1 1925. Sacha Guitry's play, *Deburand*, had a successful run in New York and London.

GULLSTRAND, ALLVAR (1862–), Swedish physician, was born June 5 1862 at Landskrona. In 1894 he became professor of diseases of the eye at Uppsala and in 1913 was appointed professor of physiological and physical optics at the same university. His investigations concerned the general laws of dioptrics, a new conception of the theory of optical images; the extrication of the optical images in the eye, and the eye's relation to the diffusion of light. In 1911 he was awarded the Nobel Prize for medicine. Among Gullstrand's works are *Allgemeine Theorie der monochromatischen Aberrationen* (1900), *Die optische Abbildung in heterogenen Medien und die Dioptrik der Kristallinse des Menschen* (1908) and *Einführung in die Methoden der Dioptrik des Auges des Menschen* (1911). He received the honorary degree of Sc.D. at Dublin in 1912 and became honorary member of the Ophthalmological Society of the United Kingdom in 1916.

GUN: *see* ARTILLERY; ORDNANCE.

GUNNERY, NAVAL.—It is no easy matter to hit, and keep on hitting a moving target at sea, with a gun mounted upon an unstable platform that is also moving in relation to the target. With a single gun firing, at short ranges, the gunlayer can follow the path of his shot and see it strike the water or target, and can correct his sights so that the next shot will hit. With several guns firing, under battle conditions at even moderate ranges, this becomes a sheer impossibility for anyone stationed at the guns. Hence the necessity for controlling the fire of the guns of a ship from a central position remote from the guns themselves. The control officer is usually stationed high up in the ship where he is in a good position to spot the fall of the shot and has all the available information for estimating the hitting range and for communicating it to the guns. The gunlayers keep their guns continuously laid upon the target and the guns are fired at the command of the control officer.

Let us consider a simple case of a ship firing at a towed target at a range of about 10,000 yards. The range of the target is obtained by the rangefinder and certain corrections, which will be explained later, are applied to the rangefinder range to obtain the estimated " gun range " which is passed to the guns. As the firing ship and the target are both moving, it is obvious that the range must be changing at a certain rate. This rate of change of range is estimated and is applied to the gunsights at set intervals. The deflection is estimated by the control officer and is applied to the sights. The control officer then fires a salvo of two or more guns and watches the fall of the shot. He makes a spotting correction in range and deflection, calculated to get the next salvo to fall, if possible, upon the other side of the target to the first one. If this happens he halves his original spotting correction, applies it in the opposite direction and fires again. This third salvo should fall very close to the target, if it does not hit, and if the rate of change of range has been estimated correctly, subsequent salvoes will, theoretically, continue to hit. This is a very simple case of a bracket system, which is used in one form or another by all control officers.

Corrections.—The corrections which must be applied to the range observed by the rangefinders in order to obtain the hitting or gun range are due to (1) the variations in muzzle velocity caused by the wear of the guns, (2) the change in muzzle velocity due to changes in the temperature of the charges, (3) the direction and force of the wind and (4) the height of the barometer and thermometer. The first two are usually applied as a correction upon the sights of each individual gun and remain more or less constant for any one day. The last two factors are variable from hour to hour and are applied as a direct correction to the rangefinder readings. The rate at which the range is changing is a variable factor since it depends upon the relative bearing between the two ships, which is constantly changing. The same applies, in a lesser degree, to the deflection, and constant corrections are necessary in both rate and deflection to maintain hitting after it is once established.

Increase of Range.—Thus there are many problems to be solved, even in the simple case of firing at a target at 10,000 yards. Battle ranges have now been extended up to 20,000 yd. or more, and as the range is increased the problems with which

the control officer is faced become much more complicated. At ranges which approach the limits of visibility the observation of the fall of shot becomes extremely difficult, and it is practically impossible to tell whether shot are falling over or short, unless they are falling directly in line with the target. As the range increases errors caused by the roll, yaw and pitch of the ship, which at moderate ranges are not so serious, become accentuated and have to be taken into account.

Trial and Error Process.—The trajectory of the shell reaches a very high altitude and the wind and atmospheric conditions in the upper air cannot be known with sufficient accuracy to enable a correct forecast to be made of the effect upon projectiles. The effects of the variations in muzzle velocity, due to the wear of the guns, to changes in the temperature of charges and to other more obscure causes, become more pronounced. Range observation, even with the most perfect instruments and with the best trained observers, becomes unreliable when the visibility is poor and the errors in the rangefinders themselves become greater as the range increases. It thus becomes a matter of great difficulty to make an accurate forecast of the initial gun range and deflection. It has become the practice to obtain the hitting range by a process of "trial and error," employing a large bracket system and using the gun as its own rangefinder, obtaining what assistance is possible, under prevailing conditions, from the instruments of observation. This can be done as long as the fall of shot can be observed, but becomes impossible as soon as this condition ceases to exist. The use of aircraft to assist the spotting officer, or to carry out the whole of the observation of fire at extreme ranges, naturally suggests itself, and it is in this direction, followed by the possible introduction of some form of indirect fire, that future developments may be expected.

The Mechanism of Fire Control

The installation used for the control of fire was intricate in the years before 1914, and War experience has made the addition of further complications necessary. Little can be said of the details of the various instruments used, as the majority of them are confidential, and the functions, and even the existence, of some of them are kept as secret as possible. The main problems are the same for all and may be divided into three parts:—

(1) The communications between the control stations and the guns.

(2) The apparatus for obtaining the hitting range and deflection and for keeping them both correct.

(3) The arrangements for firing the guns and for observing the fall of shot.

Communications.—The positions between which communication must be maintained are the observing positions aloft, the principal control position, usually in the vicinity of the conning tower, the transmitting station and the turrets or other gun positions. Communications must be rapid and sure, as most of the information sent is only of value at the moment of transmission and loses its significance if any delay occurs. Hence several lines usually exist between important stations, any one of which can be used in the event of breakdown of the others. All lines of communication are usually concentrated from outlying stations into the transmitting station. This station is situated in the centre of the ship, well below the armoured deck in the quietest position that can be selected and is the centre of the whole control organisation.

Voice-pipes are used to a great extent between stations that are permanently manned and that are moderately close together. To be efficient a voice-pipe must be as straight as possible, and there are well-defined limits of length for each diameter of pipe beyond which the acoustic properties are lost. Voice-pipes are difficult to make watertight and gastight.

The telephone is used between all stations, often in addition to the voice-pipe. There is usually a telephone exchange, in or near the transmitting station, solely for the use of the fire control organisation and quite independent of the general telephone system of the ship. The telephone transmitters and receivers are of many patterns and are specially designed for use by operators who have other duties to perform, or who have to use the instruments in positions which are exposed to the weather. Electro-mechanical transmitters and receivers are used for passing ranges, deflection, bearing, orders and other information of a standard character between the control positions and the guns. There are several different patterns of these instruments, those most commonly used in all navies being the Barr & Stroud "step-by-step," and the Vickers "counter" types.

Frequently one transmitter is arranged to work a number of receivers in outlying stations. A development of these instruments is found in the "follow the pointer" method, which is commonly used for sending ranges from the transmitting station to the guns. The transmitter takes the form of a sight dial upon which the range is set by moving a pointer to the required setting. The motion of the pointer is transmitted electrically to pointers upon the gunsights. A mechanical pointer, geared to the mechanism which works the gunsight, is kept in line with the electric pointer by the sightsetter, and the sight is thus kept set without the sightsetter having to watch the movements of a separate instrument. The large clock-faced dials and other similar arrangements which are often seen about the upper works of warships are used for communicating the range and deflection in use to consorts who may be firing at the same target. Their place will doubtless be taken in the future by wireless telegraphy or telephony.

Rangefinding and Rangekeeping.—In the transmitting station are situated the majority of the calculating instruments, and to this position are passed the results of all observations of range, bearing, course of enemy, fall of shot, etc. Also all orders from the chief control officer to the guns are passed through the transmitting station. As a rule the control officer is in direct communication with the officer in charge of the transmitting station by means of a large, direct voice-pipe. The functions of the majority of the instruments in the transmitting station and their details are naturally confidential. Broadly they consist of arrangements for deducing the course and speed of the enemy from such data as may be available, and for calculating from this the rate of change of range and deflection that should be applied to the gunsights. In the British service the Dreyer calculating table is in general use, and to this constant improvements are being made to meet the changed conditions brought about by the increasing range at which the guns are used. The details of this calculating table are secret, but there are other patented apparatus, notably the Argo and the Ford, which aim at achieving the same results. Apart from the calculating apparatus, some form of which is in use in all navies, there are a certain number of instruments which are generally employed.

Rangefinders.—The rangefinder most commonly used by all navies, and which forms the equipment of the British fleet is the Barr & Stroud coincidence instrument. In a capital ship there are at least six large rangefinders, mounted in various positions, and the number and size of the instruments are reduced proportionately in smaller ships. The observations of each instrument are transmitted electrically to the transmitting station, where apparatus exists for obtaining rapidly a mean of all the observations, thus giving what is called the "mean rangefinder range." To this are applied corrections for the density of the air, the effect of wind, the temperature of the charges, the nature of the projectile, the change of range during the flight of the projectile and for several other variables. The result is the gun range which is passed to the guns.

Change of Range Calculators.—To obtain the rate at which the range is changing at any moment involves the solution of two triangles, the functions of which are the course and speed of the firing ship, and the bearing, course and speed of the target ship. The first two of these are known, the third is easily observed, but the other two can only be obtained by calculation, or judged approximately by observation. There are several types of calculators for this purpose, but that used in the British service is the Dumaresque in which the elements are set graphically, and the resulting rate of change of range corresponding to the settings is read off in "yards per minute" which is what is required. The speed of the target ship must always be guessed in the first instance, but instruments known as inclinometers are being experimented with, whereby the angle between the course of the target ship and the line of fire can be observed with fair accuracy at any moment. The course of the target ship is thus obtained.

Range Clocks.—Some type of clock, which can be set to run at the rate at which the range is changing is used in all navies. In the British service the Vickers clock is used. This consists of a powerful clockwork escapement, driving a large pointer around a clock face, the perimeter of which is graduated in yards. A method of altering the speed of the pointer is fitted, so that it can be made to move at speeds of 0 to 2,000 yd. per min. in either direction. Arrangements are made for large corrections in range to be put on the perimeter of the clock without interfering with the motion of the pointer, so that the clock can always be run at the gun range that it is desired to transmit to the guns. There are many other uses to which it can be applied.

Deflection Calculators.—It is a difficult matter to obtain the correct deflection for hitting a target at long range. There are many types of deflection calculators, wherewith, by using the data available in the transmitting room, an approximation to the theoretical deflection can be obtained. All these instruments, however, have their limitations, because, although the allowance can be made for the wind at the firing ship, at long range the wind effect at the target may be entirely different. Also the direction of the wind in the upper air, through which the trajectory of the projectile passes, is an unknown factor. The practice is to calculate the proper setting as near as possible and to correct it by observation of fall of shot. Deflection is of the greatest importance in ranging, for at long

ranges, unless the shot fall in line with the target, it is impossible to tell whether they are short or over.

Bearing Indicators.—These instruments are mounted in the control positions, and consist of a bearing plate, mounted with the zero in the fore and aft line of the ship. A telescope or binocular is suitably mounted and the bearing of any object, with reference to the ships fore and aft line, can be readily observed. In the Evershed type used in the British Navy, the bearings are transmitted electrically to the guns and to the transmitting station. This forms a ready method of indicating the correct target to the guns, and from the observations the rate at which the bearing is changing can be obtained.

Observing and Firing the Guns

Before the range at which heavy guns are used at sea became so extended, a single gun was used for ranging, before opening fire with the whole broadside. The differences between the ranging of individual guns, due to wear and a variety of other causes, become accentuated at long ranges, and no two guns can be built that will always shoot precisely the same.

This leads to a " pattern," or spread, resulting when a number of guns of the same size are fired at the same elevation. Apart from this, in practice the errors in laying of the individual gunlayers have to be taken into account. The " spread of the salvo," as it is called, can be reduced by making careful adjustments, but it can never be eliminated entirely, even if there are no errors in laying the guns. The spread can, however, be made an approximately constant quantity, by careful adjustments and training of the personnel, and this quantity is known to the control officer of each individual ship. To base the corrections for the broadside upon the result of the fall of a shot from a single gun is obviously liable to lead to large errors, and at extreme ranges the splash of a single shot is extremely difficult to see.

It is now the general practice to range with a salvo of several guns, usually half the broadside, and to continue firing alternate salvoes of an equal number of guns. The object of the control officer, knowing the approximate spread of his salvoes, is to give such corrections, using some form of bracket system, as will bring the mean point of impact of the salvo on to the target. This is termed a straddle—that is, some shots short and some over, and when this is achieved, the control officer knows that he is obtaining the maximum hitting effect from the armament that he is controlling.

Director Firing.—Practically all navies have now adopted some form of master sight or director, whereby all guns can be fired by a single layer. This system of firing has many advantages, chief amongst which are the elimination of smoke interference between the guns; the reduction in personal errors in laying; and the fact that it is far easier to spot the fall of a salvo that falls " all together " instead of being spread out over an irregular time interval.

In the British Navy the director installation invented by Adml. Sir P. Scott is used. This consists of a director sight mounted aloft, or in a director tower well separated from the guns themselves. The sight is similar to a gunsight and is carried in a mounting which can be trained and elevated in the same way as a gun mounting. The motion of the director mounting is transmitted electrically to training and elevation receivers at the guns. On these receivers are mechanical pointers geared to the training and elevating gear of the turret or gun. The gun is moved in training and elevation so that the mechanical pointers are kept in line with the electric ones worked by the director mounting. The guns thus follow the motions of the director or master sight and are laid at the desired elevation and training. The gun range and deflection are set upon the director sight, and the director telescope is laid upon the target in the same manner as a gunsight. The firing circuits of all guns are brought to a single trigger at the director sight, so that all guns can be fired simultaneously by the director layer.

This brief description indicates the principle upon which the director is worked, but in actual practice there are many complications. Corrections have to be made for the relative positions and levels of the different gun mountings and the director sight and for many other matters. The installation is intricate, but has stood the test of prolonged war service and the results achieved by it have been invaluable. In capital ships there are, as a rule, two director sights, one mounted aloft and one just above the level of the guns, which can be used alternatively for the main armament. A director is also fitted for use with the secondary armament. Light cruisers are fitted with directors for their main armament, and a modified form is used in destroyers.

Squadron Control.—In the foregoing, the control of the fire of the guns of a single ship has been dealt with, but under modern battle conditions, it often happens that one or more ships will engage the same target. When this occurs, unless there is some pre-arranged organisation between the firing ships, confusion will occur owing to the spotting officer taking the fall of another ship's salvoes for his own. Therefore a pair of ships firing at the same target generally fire a salvo or pair of salvoes alternately, each waiting upon the other and correcting the gun range by the fall of the other's salvoes. This necessitates an intimate intercommunication between the two control officers, which is possible by wireless telegraphy.

A squadron of four ships may fire together at the same target, the fire being controlled by the control officer of the leader, who orders the gun range at which each ship shall fire, after receiving the result of observations as to fall of shot from his own and the firing ship's spotting officers, and possibly from the air. In a case such as this, the object of the squadron control officer is the same as that of the control officer of a single ship, that is to bring the mean point of impact of the shell from the armament he is controlling as near the target as possible, for then only can he be sure that he is getting the maximum hitting effect. In view of the extreme ranges at which future actions at sea will be fought, it appears certain that fire tactics will tend to develop in the direction of concentrated fire by pairs of ships or by squadrons, aided by observation from the air. The perfecting of the intricate organisation of the fire control of any ship is the most important item in making her an efficient fighting unit and requires arduous and painstaking exercise lasting over many months. (*See* Ordnance.) (S. H. W.)

GUNPOWDER: *see* Explosives.

GWALIOR, MAHDO RAO SINDHIA, Maharaja of (1876–1925), was born Oct. 20 1876, and succeeded his father, Sir Jayaji Rao Sindhia, in 1886 (*see* 12.748). He threw himself with the utmost keenness into the supervision of every detail of state management, endowing Gwalior with an excellent system of light railways, carrying out irrigation projects, husbanding the revenues and raising the standards of administration by unceasing vigilance. In the World War his two regiments and transport corps fought with distinction in France, East Africa, Egypt, Palestine and Mesopotamia. A boundless and inventive generosity found scope in his constant presentation of munitions of war and princely donations to various relief funds. He took the main part in purchasing, equipping and maintaining the hospital ship " Loyalty," which carried 15,000 war patients; and provided a convalescent home at Nairobi in East Africa—to mention only a few of his gifts. A lieutenant-general in the British Army, he was Hon. A.D.C. to King George V., and the bearer of several Grand Crosses; his permanent dynastic salute was raised to the maximum of 21 guns, and Oxford and Cambridge conferred honorary degrees upon him. King George V. also honoured him by becoming sponsor to his heir, George Jivaji Rao (b. 1916). The Maharaja went to Europe in the spring of 1925, partly to recuperate his impaired health, but died in Paris on June 5.

GYMNASTICS (*see* 12.752).—This form of athletic sports has changed little since 1910. The undoubted influence of the revived Olympic Games upon the modern development of athletic sports and exercises has not greatly affected gymnastics, perhaps because of the already high state of efficiency reached prior to the revival. The International Gymnastic Federation, which has but one affiliated nation outside Europe, *i.e.*, the United States, was founded in 1881, and 20th-century efforts have tended rather to consolidation and perfection than to extension and progress. One important feature was the foundation, in 1923, of an International Federation for the promotion of the educative, instead of the executive, branch of the art. Both federations have their British affiliations, that to the Fédération Internationale de Gymnastique being the Amateur Gymnastic Ass'n and that to the Fédération Internationale de Gymnastique Educative being the Ling Association.

The enormous development of athletic sports throughout most of the European countries has not caused gymnastics to suffer; the great festivals at Nuremberg, Leipzig, Frankfort and in Sweden, France and Switzerland continue to attract thousands of gymnasts. On the continent of Europe the movement is national: in Great Britain, and to a lesser extent in the United States, interest in gymnastics is individual. The repetitive character, the absence of the competitive spirit, perhaps also the collective discipline so necessary, appear to have too little in common with the Anglo-Saxon character for gymnastics ever to arouse the enthusiasm which prevails in the European countries. The inclusion of gymnastic competitions at the Olympic Games has not appreciably affected the situation. (*See* ATHLETICS; OLYMPIC GAMES.) (P. Lo.)

GYNAECOLOGY: *see* WOMEN, DISEASES OF.

GYROSCOPE (*see* 12.769).— This instrument has rapidly become of technical and commercial importance after having been regarded as little more than a toy or means for use in demonstrating the dynamics of solid bodies. The developments in its construction and application, since torpedoes, submarines and aeroplanes came into extensive use, have been numerous. Inventive efforts in connection with it were greatest about the year 1920. From a commercial standpoint, the successful application of the gyroscope in the arts has led to the establishment of important industries turning out gyroscopic appliances with rotors weighing up to about 90 tons.

Improvements in Construction.—Since 1910 many improvements have been made in the construction of the gyroscope and its modification, the gyrostat, independently of accessories for rendering them useful in the arts. Messrs. Gray and Burnside's gyrostat, designed chiefly for experimental purposes, is essentially a direct current electric motor, the rotor of which, in the form of a Gramme ring secured between the peripheral parts of two magnalium disks, serves as the wheel or rotor of the gyrostat. The field magnet and brush gear are within the space between the disks, and the commutator is secured to the inner side of one of the disks. The rotor, made up of the heavy ring, the very light disks and the commutator, is mounted on a stationary shaft and may be driven at a speed of 25,000 revolutions per minute. Enclosed in a magnalium casing, the whole forms a compact, portable apparatus.

In Rutt's gyroscope, the relative arrangements of the parts is reversed, so as to leave the rim of the rotor entirely free, the rotor being mounted adjustably on a central gimbal carried by a rotary shaft.

It is important that the rotor of a gyroscope should be mounted in accurately adjusted bearings, especially when the rotor is spun at a high velocity. In order to satisfy this requirement, when ball bearings are used, Messrs. Griffin and Sons, Ltd., mount the rotor on a tubular spindle encircling a screwed rod secured within the Cardan ring carrying the rotor; the ends of the spindle rotate against ball bearings held in correct position by adjustable sleeves on the rod. The spindle and rod are concentric but do not touch each other. The rotors of many gyros are rotated in a partial vacuum to reduce frictional resistance. In order to minimize the resistance and at the same time keep the interior of the gyro casing cool, Messrs. Anschütz, near Kiel, circulate hydrogen, helium or other light gas through the casing.

Gyrostatic Horizon.—On ships, aeroplanes, etc., where the use of a mercury bath for obtaining an artificial horizon is often impracticable, one of the methods adopted is to employ a gyrostat with its spinning axis vertical and carrying a plane reflector at right angles to that axis. This, the first practical use of the gyro, was introduced by M. Serson in 1774.

Since 1910, several forms of this type of apparatus have been designed. Fig. 1 shows the main features of the gyrostatic horizon of Messrs. Anschütz & Co. A box *a* is mounted on knife edges by a suspension differing from the ordinary Cardan in that the horizontal line joining the knife edges *b*, which directly supports the box, is below that joining the knife edges which support the outer ring, both lines being higher than the centre of gravity of the box and its attachments. Within the box is the rotor *c* supported by ball bearings *d*, *e* and rotated by any suitable motor. A rotary ring *f* carries an adjustable weight *g*, by means of which the centre of gravity of the whole is moved out of the gyroscopic axis so that this axis is constrained to precess in such a way as to compensate for the effects of the earth's rotation; by means of a scale, graduated in degrees of latitude, the weight can be adjusted correctly. An annular vessel *h*, containing mercury or oil, and formed with perforated partitions, is employed for damping precessional movements of the gyro.

Gyro-compass.—This instrument of precision is used in the various navies of the world, and in the mercantile marine; it is used extensively in submarines, for which the magnetic compass is unsuitable. A gyro-wheel, mounted to rotate rapidly about an axis free to turn in any direction, but provided with a form of gravity control, limiting its tilting movement, tends to set itself so that its axis points in the direction of the true north. This represents the working of the principle on which the construction of the gyro-compass depends. The many forms of gyro-compass which have been patented differ mainly in the construction of their gravity control.

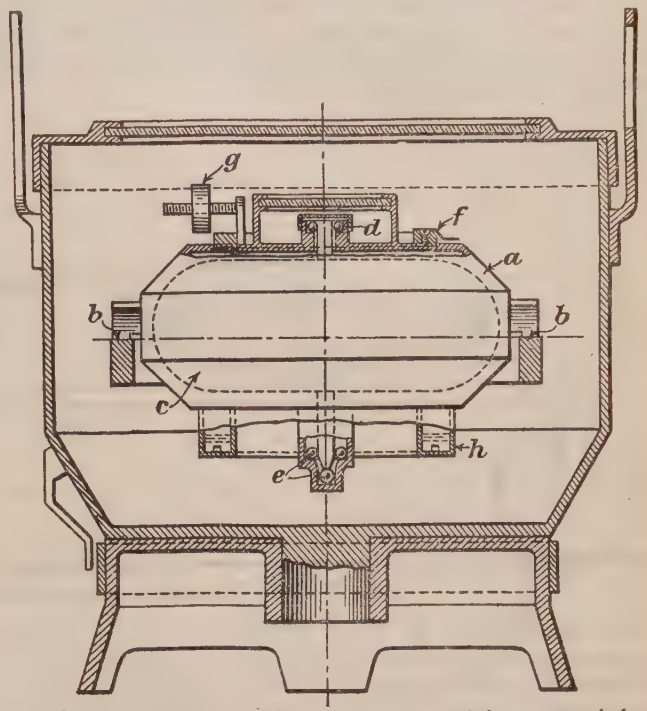

FIG. 1.—Diagram showing the main features of the gyrostatic horizon of Messrs. Anschütz & Co.

In 1852 Foucault used a gyro apparatus to demonstrate the earth's rotation; this was the first practical step towards the production of the gyro-compass. A form of gyro-compass, constructed by Sir W. Thomson (afterwards Lord Kelvin) was exhibited in 1884. In the early part of this century the increasing use of submarines demanded the provision of a compass unaffected by magnetic conditions, and Dr. Anschütz invented a gyro-compass in which the rotor and its casing were mounted in a support floating in mercury, thus limiting movement about a horizontal axis. This compass was unreliable when the ship was rolling, and, to overcome this defect, Messrs. Anschütz & Co. introduced, in 1912, an apparatus comprising three gyros, two of which eliminated errors due to rolling. This apparatus was used in the German navy.

In the gyro-compass of The Sperry Gyroscope Co., of New York (British patent specifications, Nos. 15669 of 1911 and 135500), the gyro-wheel casing is supported by a suspended wire, any twist of which caused during the working of the compass is taken out by a follow-up mechanism of special construction. The Sperry Co.'s compass was adopted for use in the British and Allied navies, and was improved by Messrs. Harrison and Rawlings, who introduced a mercury control attachment (British patent specification, No. 131987).

The suspension of the vertical axis in the Brown gyro-compass (British patent specification, No. 124529) is provided by a pulsating column of oil under great pressure. In Henderson's gyro-compass (British patent specification, No. 166570) the gyroscope has its centre of gravity and that of its gravity-control apparatus at its centre of suspension, and relative motion between the gyro and gravity control is arranged to produce a controlling couple.

Gyro-apparatus for Stabilising Wheeled Vehicles.—About the year 1905, Mr. L. Brennan, of Gillingham, introduced his monorail car, in one form of which he employed two gyrostats rotating in opposite directions and mounted in a horizontally pivoted frame. The gyrostats were geared together so as to rotate in opposite directions; one was provided with means for automatically accelerating the precession when the car swayed to one side, thus effecting stabilisation, in accordance with Lord Kelvin's rule that acceleration of the precession causes the gyro to rise

against gravity. In 1909, Mr. Brennan introduced powerful mechanism to control the precessional movements or to alter the position of the centre of gravity of the car, *e.g.*, by sliding the car body on the under-carriage.

The car was generally unreliable when running rapidly round sharp curves, and its gyro bearings were liable to overheating. Several of the cars were exhibited at different times; a large one was run at the Brennan factory, on Nov. 10 1909. This car had two bogies, each with two double-flanged wheels. The rotors, 15 cwt. each, were rotated at a speed of 3,000 r.p.m.; the gyros were encased and in a partial vacuum. At a speed of about 7 m. an hour, the car travelled satisfactorily on a curved track and could travel on gradients up to 1 in 13.

Gyroscopic Apparatus for Stabilising Ships.—The earliest use of the gyro principle for stabilising ships was made by E. O. Schlick, of Hamburg, in 1903. He mounted a number of gyrostats in the ship and used, for eliminating precessional motions, a braking-mechanism exerting a constant pressure on the gyro mountings. His invention was improved by Messrs. Swan, Hunter and Wigham-Richardson by using spring-controlled or floating bearings for the gyro frames and regulating the braking effect in accordance with the degree of rolling of the ship.

The gyroscopic apparatus of E. A. Sperry and The Sperry Gyroscope Co., of New York, is of an active kind, for its action is not limited by the rolling of the ship but may itself impart to the ship a rolling motion so that the ship may be listed and held

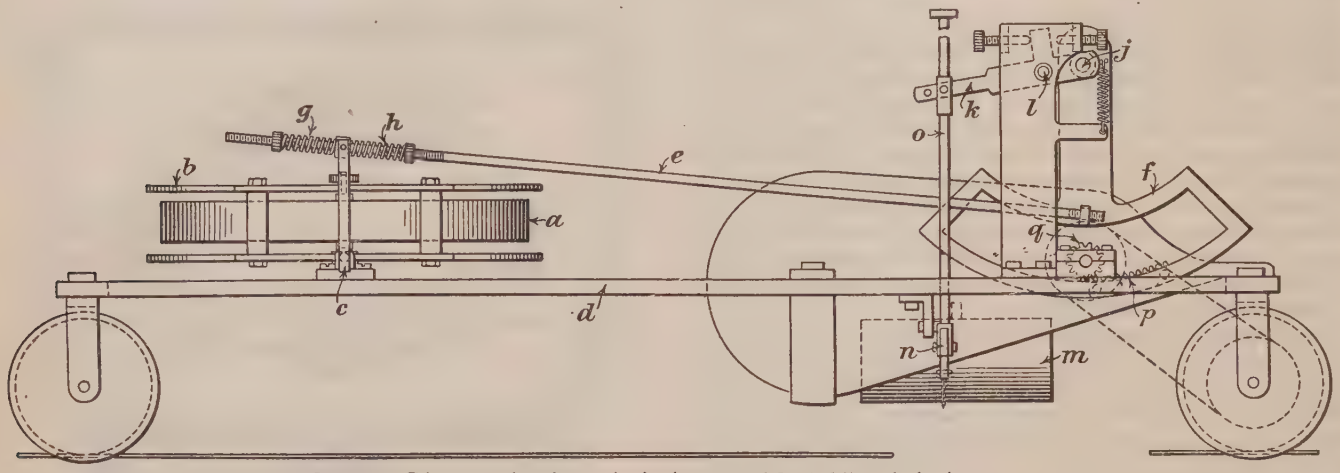

FIG. 2.—Diagram showing principal parts of P. Schilowsky's Auto-car.

The monorail car of R. Scherl, of Dresden, had one or more gyrostats with their rotors on vertical axes and mounted so as to be in unstable equilibrium and positively connected to the car at every moment. Scherl's car was not successful, difficulties having been experienced on inclines and when running round curves to right and left.

In the auto-car of P. Schilowsky, described in British patent specifications, Nos. 12021 of 1909 and 941 of 1914, the gyrostat, like Scherl's, is unstable. Fig. 2 shows diagrammatically the principal parts of the car. The rotor *a* is mounted in a frame *b* supported by pivots c^1, one at each side of the car frame *d*. A rod *e* connects the gyro to a quadrant *f*; this rod is encircled by adjustable springs *g*, h^1, to obtain a yielding connection. The quadrant *f* is suspended at j^2 from a lever *k*, fulcrummed at l^1 and caused to oscillate by the action of a pendulum *m*; the pendulum is pivoted to the car frame and presses against a cord which extends from a fixed part of the frame over a pulley and then beneath the pendulum, on its way to one arm of a bell-crank lever *n*; this is connected to a rod *o*, which rocks the lever *k*.

When the pendulum presses against the cord, as a result of the tilting of the car to one side, the quadrant *f* is lifted and a rack p^1 on the quadrant engages with a rotating pinion q^1; consequently, pressure is applied by the rod *e* to the gyro mounting with the result that its oscillations are annulled and the car brought into an upright position. Although only one pendulum is shown in fig. 2, the auto-car had two pendulums to enable the car to reverse and take curves to right and left. The inventor, in 1914, made trial runs in cars of this type and met with much success. Claiming that a monorail system of transport would be quicker and cheaper than the existing systems, Messrs. Scherl and Schilowsky, at different times, have considered plans for laying down extensive networks of lines, especially in Germany, but nothing seems to have been done.

Dr. J. G. Gray, of Glasgow University, has designed a two-wheel car controlled gyroscopically. This car has a front and a rear compartment, each running on a wheel and connected together by a vertical swivel-joint. The front compartment carries a gyrostat mounted in fixed lateral bearings and the rotor is spun in the vertical plane containing the wheel base. A motor for driving the car is installed in the rear compartment. A car of this kind was shown at a meeting of the Inst. of Civil Engineers, on June 17 1925. The car was driven forwards and the gyro rotor was spinning clockwise as seen from the left-hand side of the car, but when the car swayed to one side the two compartments were thrown out of line. Then, in consequence of the propulsion by the rear compartment, an acceleration of the gyroscopic precession was effected and the car was brought back to the upright position.

up to the full strength of the gyro apparatus installed. Controlled in this way, the ship may be extricated from a difficult position, may be used as an ice-breaker or, as set out in British patent specification, No. 149439, a rolling motion of predetermined magnitude may be maintained in a warship while her guns are being fired.

The important elements of a Sperry stabiliser are the main gyro, the small control gyro, the precession engine and the system of electric circuits. The main gyro may have its spinning axis vertical and is so mounted that a precession can be imparted to it by means of a circular rack which engages with a pinion of the precession engine. The control gyro, spinning on a horizontal axis, is so sensitive that it precesses as soon as the ship begins to roll and effects the closing of an electric contact which, by means of relay switches, operates the precession engine, thus bringing into action a powerful stabilising couple. Next, the control gyro stops the precession engine and is ready to deal with the next wave impulse.

Among the stabilisers built by The Sperry Gyroscope Co. is that for the liner " Huron " of 18,000 tons displacement. A large biconical casing encloses the main gyro in a partial vacuum and the gyro wheel, made by bolting together two disks each 13 ft. diam., weighs about 100,000 pounds.

In the stabilising apparatus of Sir J. B. Henderson, of the Royal Naval College, Greenwich, the velocity of the gyroscopic precession is controlled wholly by means of a single mechanism, which may be a continuously variable speed-gear of the variable-stroke pump type, of the mechanical type or of the viscous resistance type. Fig. 3 shows the mounting of a gyroscope and its hydraulic connections with the ship and fig. 4 a controlling means comprising a variable-stroke pump.

The rotor casing *a* is mounted on trunnions *b* in the Cardan ring *c*, which is carried by trunnions *d* supported by standards *e*, bolted to the deck so that the trunnion axis *d* extends fore and aft. The ring *c* is connected by rods *f* to the buckets *g* of the single acting pumps *h*, *j*, which have suction valves *k* and spring-controlled delivery valves *l*; the suction pipes *m* and delivery pipes *n* may lead to the sea far below the water line. When a wave strikes the ship, the pressure in one of the pumps *h*, *j* increases at once and tends to force the gyro to roll with the ship. The hydraulic cylinders *o*, *p* of the precession-control apparatus are mounted on the ring *c* and their plungers *q*, *r* are connected to a crank *s*, fixed to the trunnion *b* of the gyro case. In order to prevent the ship from rolling, the velocity of the plungers *q*, *r* should be proportional to the difference of pressure in the cylinders *h*, *j* and the ratio between them must have a certain value. To effect this, the cylinders *o*, *p* are respectively connected by pipes *t*, *u* to the cylinder of a variable-stroke pump *v*, the

piston of which is connected to a spring-controlled piston *w*, working in a cylinder *x*; the ends of this cylinder communicate with the pumps *h* and *j* respectively, by means of pipes *y*, *z*.

In a gyro apparatus designed by the Tokio firm, Mitsubishi Zosen Kaisha, the precessional movements of one or more gyrostats effect the closing of electrical circuits controlling an engine which is geared up to rotary retractile fins projecting from the ship's bilge.

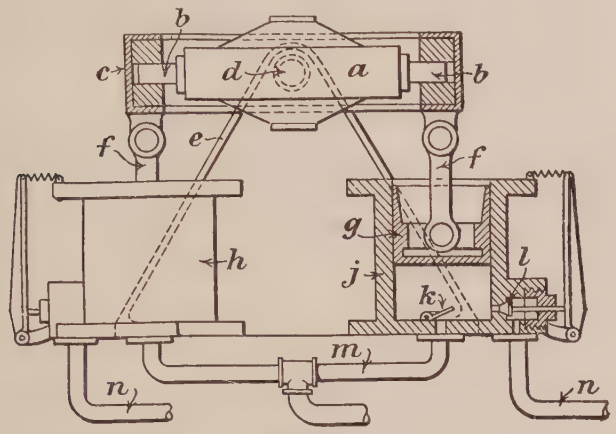

Fig. 3.

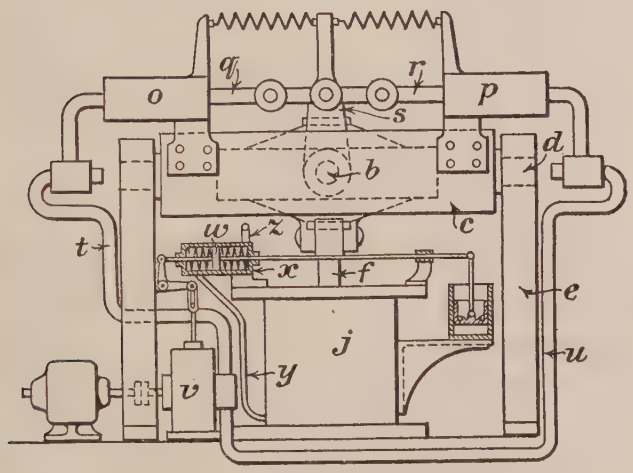

Fig. 4.

FIG. 3.—Diagram showing the mounting of a gyroscope, and its hydraulic connections with the ship; and FIG. 4, a controlling means comprising a variable stroke pump.

Gyro-stabilisers for Aircraft.—One of the more recent of these stabilisers is The Sperry Gyroscope Co.'s, which has two pairs of oppositely rotating gyrostats, with their precession axes vertical, mounted in a Cardan suspension, the outer ring of which has its pivots above the centre of gravity of the gyro-apparatus. The lateral and longitudinal balancing planes of the aeroplane are respectively actuated by relative displacements between the gyro-apparatus and two control arms carried on the aeroplane. These arms control the working of a motor which adjusts the planes. A still more recent stabiliser, that of the Société Anonyme des Établissements Marmonier Fils, comprises two gyros mounted in an elongated frame supported by horizontal pivots, each gyro carrying a pendulum bob. The rotors spin in a horizontal plane and in opposite directions with equal velocities.

Gyro-steering Apparatus for Torpedoes.—Since 1910, improvements have been mainly in details in connection with the driving of the gyro-rotor, its locking and releasing mechanism, or the arrangement of the gyro-apparatus to minimise the effects of rolling of the torpedo.

Gyro Turn-indicators.—In a form developed at Farnborough, the rotor was mounted outside the aeroplane and driven by the wind, the rotation being in a vertical plane at right angles to the direction of flight. The direction and rate of turn was indicated by a precession-actuated pointer. In the Reid control indicator, a compact combination of gyro-turn-indicator, airspeed indicator and clinometer, manufactured by Messrs. Vickers, Ltd., the rotor of the turn-indicator is driven by a jet of air passing through a compound Venturi tube placed in the slip stream of the propeller. The turn is indicated by means of precession-actuated electric contacts, which switch on one, two or more green lamps, if the turn is to the right, or one, two or more red lamps, if the turn is to the left; the number of lamps switched on is directly proportional to the rate of turn (*see* AIR NAVIGATION).

Gyro-apparatus for Indicating Rate of Angular Motion.—This is usually employed for recording the rolling motions of a ship. In the Cunard liner "Laconia," fitted with Frahm's anti-rolling tanks, a gyro pendulum was used for recording the rolling motions. Its rotor was horizontal and driven by an electric motor; the rotor was mounted in a Cardan ring suspended in a stand secured to the deck, the pivots of suspension being fore and aft. The angular motion of the stand relatively to the gyro represents the rolling of the ship and is recorded by a pencil beneath which a paper band travels continuously.

Gyroscopic Transmission Gear.—The gyro principle has been utilised in transmitting power, the gyro serving as a flexible connection between a driving and a driven shaft. (*See* VARIABLE TRANSMISSION GEAR.)

Other Applications.—In apparatus for measuring deviations of bore-holes from the vertical, the gyroscope has been employed to compensate for rotation, in the bore-hole, of the outer casing containing the measuring apparatus. Messrs. Krupp's fire control apparatus for use with naval guns makes use of a gyrostatic apparatus at the observation station and a precisely similar apparatus at the gun station, both apparatuses being connected electrically so as to operate strictly in unison. The gyroscopically controlled photographic camera of Prof. Sir J. B. Henderson comprises a gyro-controlled prism for counteracting the effects of lateral movements and pitching of the support and a gyroscopically rotated sensitive plate to compensate for rolling movements. The camera is intended chiefly for aerial photography and is rigidly secured to an aeroplane.

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(T. E. L.)

HAAG, CARL (1820–1915), British painter (*see* 12.780), died at Rother Thurm, Oberwesel, Germany, Jan. 17 1915.

HAASE, FRIEDRICH (1827–1911), German actor (*see* 12.782), died in Berlin March 17 1911.

HAASE, HUGO (1863–1919), German politician, was born Sept. 29 1863, at Allenstein in East Prussia. At the outbreak of the World War he was parliamentary leader of the Social Democratic party in the Reichstag, but in 1916 he seceded with the Independent Socialists, who refused to vote the estimate and war credits, and became their leader. In this capacity he exercised a moderating influence upon the extreme section of the Independents, who at a later date (1920) joined the Communists. He was one of the commission of six who conducted the Government of the German Reich, in the name of the people, immediately after the revolution of Nov. 1918. Haase died on Nov. 7 1919 from wounds received in an attempt upon his life while he was entering the Reichstag building.

HABER, FRITZ (1868–), German chemist, was born in Breslau Dec. 9 1868. He studied at the universities of Berlin and Heidelberg and at the technical high schools at Charlottenburg and Carlsruhe. He was then appointed staff professor at Berlin University and afterwards became director of the Kaiser Wilhelm Institute for physical chemistry and electrochemistry. He made a special study of thermodynamic technical gas reactions, and also made experiments in connection with the equilibrium of ammonia and the influence of very high pressures and high temperatures. During the World War he studied the gases used in warfare and their effective frustration by gas masks and chemical means. He conducted particularly important researches in collaboration with Bosch, which led to the establishment of the Haber-Bosch process for the production of nitrogen manure. After the War the large works at Leuna, near Halle, produced more nitrogenous manure, according to this process, than was imported previously in the form of nitrate of soda. The chief characteristic of the process is the continuous reaction under a pressure of 200 atmospheres, and the most important raw material used is water gas, produced from coke and gypsum (*see* NITROGEN, FIXATION OF). His recent works include *Beitrag zur Kenntnis der Metalle* (1919); *Über die Synthese des Ammoniaks: Die Chemie im Kriege* (1922); *Fünf Vorträge aus den Jahren 1920–3: Über die Herstellung des Ammoniaks aus Stickstoff und Wasserstoff* (1924).

HABITUAL OFFENDERS.—In the law, as in common parlance, a habitual offender is one who is repeatedly guilty of criminal offences, who makes a business of crime. In this broad sense the term is identical in meaning with recidivist, a constant backslider. In a more restricted and accurate sense, however, habitual offender denotes one who has become a recidivist by force of habit, and this opens up a wide and interesting divergence of opinion among psychologists as to the mainsprings of conduct. One school of students of this science stresses the hereditary element in human nature—instinct, impulse, the innate characteristics—and to the most extreme of these every "true" criminal is by propensity if not in act, a recidivist. The criminal is born, not made. The other school, believing that our original endowment differs only in degree and not in kind, lays the emphasis on environment, the individual's experience of life. The criminal is the product of circumstances.

The Schools of Thought.—Without drawing too fine a line between the adherents of these two schools of thought, it may safely be asserted that the medical criminologists tend to align themselves with the former and the sociological criminologists with the latter. Many psychiatrists have committed themselves to the view that all recidivists, if not all criminals, are either insane or psychopathic personalities. There is, on the other hand, a strong current of psychological thought in evidence at the present time, which strongly supports the view expressed in the popular maxim, "man is a creature of habit." Habit is not only a manner of acting but of thinking and feeling as well. Will, conscience, impulse, are all the fruits of habit. Indeed they *are* the habit of which the external act or conduct is only the expression. The habitual offender is what he is because his experience of life has been such as to cultivate criminalistic ways of thinking, feeling and acting.

Probably no one would deny that the development of these anti-social tendencies comes easier to some than to others, but the clear implication of this doctrine is that, given a sufficiently evil environment, no man that is born of woman is so endowed by nature as to resist its moulding influence. On the other hand it is conceded that some, probably a very small proportion of the whole, are born into the world with such a defective equipment as to render them very unlikely subjects for the development of a socially useful character. Such are the neurotic individuals who early in life develop into insane or psychopathic personalities. The notion, current a few years ago, that the feeble-minded are of this sort, has now been generally abandoned. Mental defect is a handicap in leading any kind of life, good or bad, but it involves no predisposition towards the latter. The net result is that the good life is not an individual endowment but a social achievement, and the same is true of the evil life.

That the habitual offender is not irredeemable appears to have been demonstrated by the experience of Camp Hill in England and by fortunate periods in the recent history of Sing Sing and Auburn prisons in the United States. "Habit is second nature," but like the original nature, it is still plastic and susceptible to new and more wholesome influences.

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John Dewey, *Human Nature and Conduct* (New York, 1922); S. Hobhouse and F. Brockway, *English Prisons To-day* (London, 1922); B. Glueck, "A Study of 608 Admissions to Sing Sing Prison," in *Mental Hygiene*, 2 (1918); "Jack" Black, "Breaking the Shackles," *The Call* (San Francisco, 1918, 1926). (G. W. K.*)

HABSBURG (*see* 12.787), the former ruling dynasty of the Austro-Hungarian Empire. The Habsburgs' relations with their subjects were defined in the 18th century, when Charles VI., last of the Habsburgs proper, issued the pragmatic sanction, which was accepted by the estates of his peoples. The family dominions were hereby declared indivisible, and the descendants of Charles were accepted as their hereditary rulers in perpetuity, so long as a male or female member of them remained. The dynasty of Habsburg-Lorraine, founded by Charles's daughter, Maria Theresa, and her husband Francis I., ruled in virtue of this contract. In 1918 there were over 120 archdukes or archduchesses, descendants of Maria Theresa, who could thus succeed to the throne.

Results of the War.—Charles I. (*q.v.*), the last ruling Emperor of Austria and King of Hungary, succeeded his great-uncle on Nov. 21 1916. At this time his subjects still protested loyalty to the dynasty; but during the collapse of Oct. 1918 one nation after another repudiated its rule. The Poles of Galicia, who had long been practically independent, formed a national council at Cracow on Oct. 28 1918 and soon after adhered to the republic of Poland. The Ruthenians of East Galicia decided on Oct. 19 to form a separate state. The Czechoslovaks on Oct. 21, in a manifesto dated the 18th, declared themselves independent and expressly repudiated Habsburg rule. The Yugoslavs made very similar proclamations during the last days of October. On Oct. 27 Count Andrássy, the Austro-Hungarian Foreign Minister, accepted President Wilson's demands "regarding the rights of the peoples of Austria-Hungary, particularly those of the Czechoslovaks and Yugoslavs." The states of Poland, Yugoslavia and Czechoslovakia soon after came formally into being, and although Charles never renounced his sovereign rights in these territories, the Habsburg family has made no serious claim to reassert them; although a small monarchist party in Croatia

has since toyed with the idea of reuniting with Hungary under Habsburg rule. The treaties of Saint Germain and Trianon perpetuated the boundaries of these States, and confirmed Italy and Rumania in the possession of their parts of the former Habsburg monarchy. Most of the treaties of the "Little Entente" (*q.v.*) are expressly directed towards the maintenance of these frontiers, especially those of Hungary, and thus implicitly (the forms of those states being what they are) to the exclusion of the Habsburgs from these territories.

Position of the Emperor Charles.—There remained only German-Austria and Hungary. On Nov. 11 1918 Charles issued a proclamation in which he stated:

> Still, as ever, filled with unchanging love towards all my peoples, I will not oppose my person as an obstacle to their free development. I recognise in advance the decision which German-Austria will take on its future form of State. The people has assumed the government through its representatives. I renounce any share in the affairs of State. At the same time I remove my Austrian Govt. from its office.

The Provisional Govt. of German-Austria proclaimed a republic on the following day. On March 12 1919, following the elections, the first national assembly repeated this declaration. Charles, however, refused to abdicate in his own name and that of his dynasty. Thereupon the national assembly, by decree of April 2 1919, banished all Habsburgs from Austria and confiscated the family property for the benefit of the War invalids. Habsburgs who renounced all rights other than those of private citizens were, however, allowed to live unmolested in Austria, and several of them did so. The legitimist movement in Austria has been very weak since these events. Vienna is almost fanatically republican, and even in the provinces, the monarchist movement in favour of the Wittelsbach dynasty has been quite as strong as the legitimist Habsburg movement. Austrian republicans claim that Charles's acceptance in advance of the republic was equivalent to a renunciation of the throne.

Charles and Hungary.—Charles issued a similar proclamation to Hungary on Nov. 13 which Karolyi answered by proclaiming the Hungarian Republic on Nov. 16. When, however, the Right regained power in Hungary after Karolyi's and Kun's régimes, it proceeded by Act I. of 1920 to abolish all legislation passed by these two Governments. Hungary, therefore, reverted to the status of a kingdom, and controversy arose whether or not Charles's action has annulled the pragmatic sanction, in which case the monarchy in Hungary, under her old constitution, was elective or not. "Legitimists" and "free electors" disagreed violently, the latter usually demanding the election of a Habsburg but one whose person and wife should be more popular than those of Charles.

On Feb. 2 1920, during the discussions on the draft treaty of Trianon, the Allied and Associated Powers declared that a Habsburg restoration in Hungary would be a matter of international concern and that they would neither recognise nor tolerate such a restoration. They attempted to insist on Hungary's styling herself a republic, but finally, in view of the objections raised by the Hungarian delegation, compromised on the word "Hungary."

Charles returned to Hungary and attempted to assert his claim on March 27 and Oct. 20 1921 (*see* HUNGARY). On April 4 the Conference of Ambassadors insisted that Charles should leave Hungary. After the second coup, under pressure from the Powers and the Little Entente, the Hungarian Parliament passed a decree (Nov. 3 1921) whereby the sovereign rights of Charles and the pragmatic sanction were declared forever abrogated and the right of the Hungarian nation to elect its king by free choice restored. On Nov. 10 Hungary addressed a note to the Powers consenting only to elect its king in agreement with the Powers and accepting the notes of Feb. 2 and April 3 1921. The Legitimist party, however, still looks on Otto as the legitimate king since Charles's death on April 1 1922. Otto and his mother share this view.

Habsburgs are scattered over Europe. Most reside in Hungary, Austria and at the Spanish Court. Their financial position is various. They have lost all valuables and estates owned in virtue of their rank. Great controversy was aroused by the fact that Charles took with him, and sold, the crown jewels. Many of the family, however, as the Modena and d'Este branch, own vast private fortunes and great estates. The Hungarian branch was fortunate in this respect, as their wealth was not touched by the non-socialist Government. The Polish Govt. at first sequestrated Habsburg estates, but afterwards released them. Austria confiscated all estates, etc., that were not purely private property. The income of the senior branch of the family is small.

The Archdukes.—The remaining Habsburgs have not been prominent outside the realms of politics. The Archduke Frederick (b. 1856) became inspector-general to the Austro-Hungarian army after the murder of the Archduke Francis Ferdinand (*q.v.*) in June 1914. His command was only nominal, his chief of staff, Conrad von Hötzendorf, performing the real duties. In 1917 the Emperor Charles took his place. The Archduke Eugen (b. 1863) also held a high command, assisted by Gen. Krauss. The Archduke Joseph (b. 1872) resided in Hungary, where he enjoyed great popularity. During the World War he commanded a division, and later an Army Corps. At the debâcle he assumed a nationalist Hungarian attitude, recalled the Hungarian troops under his command from the front and acted as intermediary between the King and Karolyi's Government. While Karolyi still took the oath of loyalty to King Charles, Joseph had already repudiated the monarchy and his own title. He lived quietly on his own estate as "Joseph Habsburg" throughout the Commune; but after its fall, he assumed power on Aug. 6 1919 as administrator of Hungary. He was forced to retire on Aug. 22, as the Entente declared that they would not negotiate with Hungary under a Habsburg and were "obliged to insist upon the present pretender to supreme power in the Hungarian State resigning." After this time Joseph took little part in public life.

The Archduke Albert (b.1897), son of Archduke Frederick supported by his wife, Isabella, became the chief candidate of the "free Electoral party" in Hungary, with whom he had close relations. The Archduke Stephen (b. 1860), whose estates were in Galicia, was put forward as a candidate by the Polish monarchist party. His son, the Archduke William (b. 1895), at one time aspired to the throne of the Ukraine. Although many archdukes, including Frederick and Francis Ferdinand, were known as collectors, the Habsburgs have not been prominent as creative artists. Archduke Leopold Wölfling wrote a book entitled *Habsburger unter sich.* (*See* AUSTRIA.) (C. A. M.)

HADFIELD, SIR ROBERT ABBOTT, (1859–), British metallurgist, was born in Sheffield Nov. 29 1859. Educated at Sheffield Collegiate School, at an early age he interested himself in metallurgy, subsequently becoming chairman of Hadfields, Ltd., Hecla and East Hecla Works, Sheffield, and director of other important companies. In 1883 he patented his process for the production of manganese steel (*see* 14.809) and became famous as the inventor and improver of various metallurgical processes, including low hysteresis steel and many other special ferrous alloys. He became a member of many scientific committees, and was president of the Iron and Steel Institute (1905–7), of the Faraday Society (1914–20), and of the Society of British Gas Industries (1917–8), besides being master cutler of Sheffield 1899–1900. In 1908 he was knighted; the following year became F.R.S., and was created a baronet in 1917. Sir Robert received many honours, including 10 gold medals, from scientific and learned societies; and became corresponding member of the French Academy of Sciences; hon. member of the Royal Swedish Academy of Sciences; and officer of the Legion of Honour. He published over 160 scientific and technical papers of considerable importance. His book *Metallurgy and Its Influence on Modern Progress* is a standard work of reference.

HADLEY, ARTHUR TWINING (1856–), American economist and educationalist (*see* 12.798), was elected a director of the New York, New Haven and Hartford Railway in 1913. In 1914 he lectured at the University of Oxford on "Institutions of the United States." In 1915 he endorsed college military camps and advocated the counting of military training for a degree.

In 1920 he resigned as president of Yale University and the same year was elected a director of the Atchison, Topeka and Santa Fé Railway. He wrote *The Moral Basis of Democracy* (1919) and *Economic Problems of Democracy* (1923).

HADLEY, HENRY KIMBALL (1871–), American composer, was born at Somerville, Mass., Dec. 20 1871. He studied theory and composition under Emory and Chadwick in Boston, completing his studies in Vienna. In 1904 he went to Germany, where he was Kapellmeister in Mainz Opera House for two seasons, and produced his opera *Sofie* in 1909. Returning to the United States in the same year, he was conductor of the Seattle Symphony Orchestra until 1911, and of the San Francisco Symphony Orchestra 1911–5. In 1921 he became associate conductor of the N. Y. Philharmonic Orchestra. He produced three grand operas: *Azora* (Chicago Opera Co.), *Bianca* (Society of American Singers) and *Cleopatra's Night* (Metropolitan Opera House). He composed also ode-music for the Worcester (Mass.) Festival (60th Anniversary) and *Resurgam* for the Cincinnati Festival, 1923, in addition to four symphonies, overtures and cantatas, three tone poems, ballet suites and over 150 songs. He was elected a member of the American Academy of Arts and Letters in 1924.

HADOW, SIR WILLIAM HENRY (1859–), British scholar and musician, was born at Ebrington, Glos., Dec. 27 1859. He was educated at Malvern and Worcester College, Oxford, and after taking his degree remained at Oxford as a tutor and fellow of his college. In 1909 he became principal of Armstrong College, Newcastle, retaining this post until 1919, when he became vice-chancellor of Sheffield University. He was in 1918 appointed assistant director of education for the troops by the War Office and also worked for the Y.M.C.A. He was knighted in 1918 and was made a C.B.E. in 1920. In 1922 he became Stevenson Lecturer to the University of Glasgow. Well known as a great authority on the history of music, Sir Henry Hadow also composed many songs and pianoforte pieces besides the incidental music to Robert Bridges' *Demeter* (1905).

He published *Studies in Modern Music* (1894 and 1895); *Sonata Form* (1896); *A Croatian Composer*, a valuable tract on Haydn (1897); the section "The Viennese Period" (1904) in *The Oxford History of Music*, of which he was the editor; *Citizenship* (1923); and *Music* (1924) in the Home University Library.

HAECKEL, ERNST HEINRICH (1834–1919), German biologist (*see* 12.803), died at Jena Aug. 8 1919.

HAFSTEIN, HANNES THÓRDUR (1861–1922), Icelandic statesman and poet, was born Dec. 4 1861. As a young man he became known as a lyrical poet. In 1901 he was elected a member of the Althing, and soon became a leader of the Home Rule party. It was chiefly owing to his influence that Denmark consented, in 1903, to the transfer of the residency of the Minister for Iceland from Copenhagen to Reykjavik. On Jan. 31 1904 Hafstein was appointed to this office and inaugurated a new era of practical reform. His first work was to arrange a telegraphic cable to Great Britain and a net of telegraphs and telephones all over the island. His efforts, however, were hampered by the extremists, who demanded greater political independence from Denmark. Their obduracy led to his resignation in 1908. On the victory of the Home Rulers in 1911, Hafstein again became Minister in 1912, but had to resign in 1914 after new and fruitless efforts to effect reconciliation. He lived, however, to see the full reconciliation between the two countries in 1918, and the recognition of Iceland as an independent state in union with Denmark. He died Dec. 13 1922.

HAGENBECK, CARL (1844–1913), German collector of wild animals (*see* 12.814), died at Hamburg April 14 1913.

HAGGARD, SIR HENRY RIDER (1856–1925), British novelist (*see* 12.816), was knighted in 1912. Among his later novels are *Child of Storm* (1913); *The Ivory Child* (1916); *Love Eternal* (1918); *The Ancient Allan* (1920); and *Heu-Heu: or the Monster* (1924). Much of his time, however, in his later years was devoted to matters affecting the welfare of the Empire. As a member of the Dominions Royal Commission he travelled round the world and, to further schemes for settling ex-service men on the land, he visited various parts of the Empire, writing a *Report* to the Royal Colonial Institute. He also wrote *Rural Denmark and its Lessons*, 1911. He died in London May 14 1925.

HAGUE, THE (*see* 12.817), with a population in 1923 of 328,581, continues to be a centre of diplomatic and international movements. In 1910 the tribunal of arbitration of the North Atlantic Fisheries met in the city, and in 1915 the International Congress of Women. In 1917 an agreement was reached here by British and German representatives as to repatriation of disabled prisoners, etc., and in 1920 a committee of the League of Nations Council met here to frame a scheme for the Permanent Court of International Justice. (*q.v.*) In 1913 the Palace of Peace, to which most countries of the world contributed gifts, was dedicated. In 1922 the house, lent to the town, with his pictures and furniture, by Dr. Bredius, the art historian, was opened to the public; in 1924 a museum, chiefly for educational purposes, with large Greek, Asiatic and Egyptian collections, was established.

HAIG, DOUGLAS HAIG, 1ST EARL (1861–), British soldier, was born in Edinburgh June 19 1861, son of John Haig, of Cameronbridge, Fife. He was educated at Clifton and Brasenose College, Oxford, and in 1885 joined the 7th Hussars. He was promoted captain in 1891, afterwards passed through the staff college and was employed with the Egyptian Army in 1898 during the Nile campaign, for which he was given a brevet majority. On the outbreak of hostilities in South Africa in 1899, he went out to Natal on the staff, and was present during the opening engagements near Ladysmith. He was afterwards chief staff officer of the cavalry division during Lord Roberts' victorious advance from Cape Colony through the Orange Free State into the Transvaal, and was promoted brevet lieutenant-colonel for his services.

In the later phases of the struggle he was in command of a column and later was controlling groups of columns; at the close of the war he was appointed A.D.C. to the King, promoted brevet-colonel, and given the C.B. Col. Haig subsequently commanded the 17th Lancers for a year, after which he went out to India as inspector-general of cavalry; this appointment he held until 1906, having been promoted major-general in 1905, in which year he married the Hon. Dorothy Vivian, daughter of the 3rd Lord Vivian. From 1906–9 he was a director in the War Office, and during this time he was intimately concerned in the development of the general staff and the improvements effected in the organisation of the army, which were set on foot while Lord Haldane was Secretary of State. In 1907 he published a volume of *Cavalry Studies*. His next appointment was that of chief of the general staff in India, which he held for three years, being promoted lieutenant-general in 1910. In 1912 he was brought home to take the command in Aldershot, and in 1913 he was made a K.C.B.

On the mobilisation of the Expeditionary Force in 1914, Sir Douglas Haig took the field as commander of the I. Army Corps, which he led during the Mons, Marne and Aisne operations, and the first battle of Ypres; he was promoted full general in Nov. for his services. On the division of the British Expeditionary Force into two armies at the beginning of 1915, he was placed at the head of the first. On the front of his army during 1915 there took place the battles of Neuve Chapelle, Festubert and Loos, and at the end of the year he succeeded Sir John French in the chief command. He had been made a G.C.B. in the autumn.

At this time the armies were passing through a period of transition. The regular army with the exception of its cavalry, had almost ceased to exist and the first need was to weld its remnants, the new armies created by Lord Kitchener and the Territorial Army, into a whole capable of combined action both in attack and in defence. This involved the creation behind the lines of a large number of schools of instruction in the use of the new weapons, which the requirements of trench warfare had created, and of the old ones which had been brought back with the service of war. Beyond and above this technical instruction came the training of the larger formations of all armies and for this it was necessary that a certain number of divisions should

be placed sufficiently far behind the line to allow them the ground and the opportunities for gaining experience.

This remained one of the chief items of Sir Douglas Haig's military policy until a late period of the War. It was a policy which often brought him into discussion both with the French generals and with the French statesmen, who were continually pressing him to take over a larger extent of front. Sir Douglas Haig pointed out that it was not possible to compare a national army created during the course of the War with one which had been long established in time of peace, and that the Germans throughout the War maintained a greater density of men opposite the British lines than they did elsewhere. In the event, his policy was justified by the fact that in the latter half of 1918 the British Army, was as a whole, at least as efficient as any which was then fighting in the War.

The campaigns and battles of the British Army in France and Belgium are dealt with elsewhere and it is here only necessary to refer to the principles which guided Sir Douglas Haig in certain of the crises of the War. The first of these during his command arose out of the German attack on Verdun during the first half of 1916. On that occasion he assisted the French by relieving their troops in the front and by preparing for the battle of the Somme. While that battle disclosed defects both of preparation and of execution, its results convinced Sir Douglas Haig that it had caused such exhaustion of the German armies as should be exploited at the earliest possible moment. He therefore agreed with Joffre to renew the battle early in 1917.

But the battle of the Somme had caused grievous losses and the gains of ground as shown on the maps appeared trifling. Therefore, neither French nor British statesmen were prepared to agree to a policy which to their minds seemed likely to exhaust their resources before it caused the enemy to yield. The consequence of this was the replacement of Joffre by Nivelle and the assembly of an Allied Conference at Calais at the end of Feb. 1917, at which it was decided to give Nivelle the general direction of the British Army, while he was at the same time to be in active command of the French Army. This arrangement, militarily unsound, early produced friction. For Nivelle, who was ill-informed of events on the British front, issued to Haig instructions which were inappropriate both as to form and substance. These differences were adjusted at a further conference in London, but they created the impression that Haig was opposed to any form of unity of command, which was not true.

The direct result of the failure of Nivelle's campaign was a wave of depression which spread through the French Armies and resulted in serious mutinies. Pétain, who had succeeded Nivelle, appealed to Haig to keep the Germans occupied while he was restoring the morale of the French troops. To this appeal Haig responded by opening in the summer of 1917 a campaign in Flanders, which began with Plumer's victory at Messines and was followed by the battle of Passchendaele. It was only with difficulty that Haig won the consent of the British Govt. to this campaign. By the middle of Oct. of that year Pétain was able to tell Haig that the French Army was sufficiently restored to be able to look after itself; and it might have been wiser to have stopped the battle of Passchendaele then, as no adequate return was gained for the exhaustion caused by the prolongation of the attack in execrable weather.

The crisis brought about by the success of the German-Austrian attack on the Italians at Caporetto following on the collapse of Russia, resulted in the creation in Nov. 1917 of the Supreme War Council, the first meeting of which was held at the end of the following January. This meeting had been preceded by a renewal of French demands for an extension of the British front, which Haig eventually met by agreeing to take over a portion of the line at and south of Peronne with his V. Army. At this meeting a difference of policy between Haig and his Govt. was disclosed. The commander-in-chief anticipated an early attack by the Germans and asked for reinforcements: the Prime Minister wished for an offensive campaign in Palestine, and won his way; and at this same conference, it was decided to create an Allied general reserve on the Western Front under the control of the military representatives of the Supreme War Council with Foch as chairman. During Feb. 1918 Haig became more than ever convinced that a great German attack on his front was imminent, in which he differed from the military representatives, who did not expect it before May. When the military representatives applied to him for divisions for the general reserve, he answered that in view of the lack of reinforcements, the extension of his front and the massing of German troops, he would be unable to furnish these divisions, and the formation of the general reserve broke down.

With what calm determination Haig met the great German offensive of the spring of 1918 is described elsewhere. In the most critical days of that offensive it was Haig's direct intervention with the British Govt. which brought Lord Milner to France, a visit which resulted eventually in giving Foch direct control of the Allied Armies. With Foch Haig's relations were as harmonious as they had been with Joffre, and in the late summer of 1918 the British commander-in-chief reaped at last the reward of his patient policy. When in Aug. 1918 Rawlinson's IV. Army won the victory of Amiens, Foch desired that Rawlinson should follow up his success. Haig, convinced that this would result in another deadlock, and confident now in the superior morale and efficiency of his army, persuaded Foch to agree to an extension of the battle northwards, and so came about the breaking of the Hindenburg line which made it clear that victory could be won in 1918.

For his great services Sir Douglas Haig was raised to the peerage as Earl Haig and Baron Haig of Bemersyde and was given a grant of £100,000. The Order of Merit was also conferred upon him, and the ancestral home of the Haigs at Bemersyde was purchased by national subscription and presented to him. On returning home he was for a short time commander-in-chief in Great Britain, but when that position was abolished he refused other offers of employment and devoted himself wholly to the welfare of ex-service men. He succeeded in uniting other organisations with the British Legion, of which he became president. He also created and became president of the British Empire Services League, a union of the ex-service men's organisations of Great Britain and the Dominions; he was also appointed chairman of the United Services Fund, which together with the fund he established for the benefit of ex-service men forms one of the largest benevolent organisation in the country. (*See* Loos; Neuve Chapelle; Somme and articles on other battles of the World War; also Western Front.) See *Sir Douglas Haig's Despatches*, ed. J. H. Boraston (1920) (F. B. M.)

HAINISCH, MICHAEL (1858–), Austrian statesman, was born Aug. 15 1858, at Aue, near Gloggnitz, Lower Austria, the son of a manufacturer, and Marianne Hainisch, a pioneer of women's rights. After a short career in the Austrian public service, he devoted himself to the study of social and agricultural questions. He was founder with Engelbert Pernerstorfer of the Gesellschaft der Fabier on the model of the British Fabian Society. Hainisch, who was particularly active in the cause of popular education, founded and endowed many hundreds of popular libraries. His works include: *Die Zukunft der deutschen Oesterreicher* (1892); *Voraussetzungen und Berechtigung des Sozialismus* (1919); *Die Landflucht* (Jena, 1923). Hainisch was elected first President of the Austrian Republic in Dec. 1920 and re-elected unanimously for a further period of four years, Dec. 1924.

HAITI (*see* 12.824), a republic in the West Indies and a member of the League of Nations. Its area is 10,204 square miles. No reliable census of the population has been taken. Estimates vary from 1,500,000 to 2,500,000, the most reliable giving 2,028,000 in 1924.

I. POLITICAL HISTORY

The principal event in Haitian affairs in the period 1910–25 was the military intervention on the part of the United States, which developed into a close political and fiscal protectorate. The first part of the period was marked by constant revolutionary turmoil and by rapid political disintegration. In July 1911

President Simon was overthrown and on Aug. 14 1911 Cincinnatus Leconte became president. A year later (Aug. 8 1912) the presidential palace was blown up and Leconte and a number of his followers killed. The National Assembly at once elected Tancrede Auguste, a prominent planter; he died the year after, and on May 4 1913, Senator Michel Oreste was elected.

Intervention of the United States.—Dec. 1913 ushered in a period of political turbulence, and three military presidents assumed office in quick succession: Oreste Zamor, on Feb. 8 1914; Davilmar Theodore, on Nov. 7 1914; and Vilbrun Guillaume Sam, on March 4 1915. The last named, after withstanding the attacks of his opponents for several months, was compelled to seek refuge in the French legation in the night of July 26 1915, while 200 political prisoners in the gaol of Port-au-Prince were massacred by order of one of his followers. At the funeral of the victims a party of mourners invaded the French legation, dragged out the ex-president, handing him over to the mob for death, and killed the ex-gaoler. Two hours later a U.S. cruiser arrived at Port-au-Prince and landed marines. U.S. forces occupied the country, disarmed the natives and restored order. Although U.S. naval officers assumed charge of most administrative functions, the Haitian governmental organisation remained intact. On Aug. 12 1915 Sudre Dartiguenave was chosen by the Haitian Congress as president. A treaty having been accepted by the Haitian Govt. in 1916, the U.S. Senate advised ratification. Ratifications were exchanged at Washington and the treaty was proclaimed on May 3 1916.

Modelled upon the American-Domingo Convention of 1907 (*see* 24.194), this instrument was designed to secure political stability and economic development in Haitian affairs by a political and fiscal protectorate, to remain in force for a period of 20 years. By its terms the President of Haiti appointed, on the nomination of the President of the United States:—

(*a*) a receiver-general of customs to take charge of the customs houses;

(*b*) a financial adviser to be attached to the Ministry of Finance;

(*c*) American officers to organise and command a Haitian constabulary (gendarmerie) which was to replace the Haitian armed forces, such officers to be later succeeded by qualified Haitians;

(*d*) engineers and doctors to supervise the public works department and public health services respectively.

Haiti agreed not to increase the public debt and not to modify the customs duties without the consent of the United States; the United States undertook to intervene when necessary for the preservation of Haitian independence and the maintenance of a stable and effective government. The treaty provisions were promptly put into effect, and determined entirely the subsequent course of events.

In the early period of American intervention the division of authority caused friction, but with the appointment in 1922 by the President of a high commissioner to supervise and co-ordinate the activities of the treaty officials and the military occupation, native irritation and the friction between the American authorities and the Haitian Govt. disappeared. The U.S. marines were later withdrawn from all interior points and concentrated at Port-au-Prince and Cape Haitien. The maintenance of order was placed in the hands of the Haitian gendarmerie. This was composed of native troops, but the officers generally were officers and enlisted men of the U.S. Marine Corps.

The future of Haiti presented in 1921 the gravest problem of United States influence in the Caribbean (*q.v.*). Early termination of military occupation was, in the opinion of those in responsible charge, certain to result in reversion to old conditions. On the other hand, public sentiment in the United States did not view with satisfaction the definitive abandonment of the one great opportunity left the negro race to demonstrate, even after repeated trial, an ultimate capacity for self-government. Until 1921 the establishment of civil order had engaged the best energies of the American officials. With this accomplished, opportunity was afforded for rendering the further offices contemplated by the treaty in a way conducive to the ultimate assumption of civil authority by the Haitian Govt.; subject only to those reservations as to political stability and fiscal solvency in force in other areas within the range of American influence in the Caribbean.

Borno as President.—Louis Borno, who was elected on April 10, was inaugurated on May 15 1922 as president of the republic. He found civil order firmly established through an efficient native gendarmerie. Roads had been constructed and banditry eliminated, and the peasantry enjoyed, for the first time perhaps in their country's history, complete freedom. Public health services had been greatly improved under American supervision, great progress being made in town sanitation. A vigorous policy of financial reform was adopted, with very satisfactory results. The public debt, which in 1915 amounted to $36,000,000, had been reduced to $22,046,252 at the close of the fiscal year 1924–25. The budget had been balanced and a comfortable surplus realised by 1923–4, thus enabling the Govt. to spend substantial sums on public works and other developments. Borno was re-elected president in 1926.

II. ECONOMIC HISTORY

Production and Trade.—The chief crop is coffee, which represented in 1925 some 75% of the total income of the country. Other important products are cotton and sugar. Great efforts are being made to develop systematic cultivation, for even in 1925 coffee and cotton grew semi-wild. An agricultural school had been established at Port-au-Prince, experimental stations set up under American officials, a system of premiums inaugurated to encourage coffee growers, and attempts made to improve the coffee and sugar crop and encourage the growth of other crops, such as cocoa, sisal, hemp and tobacco. A modern sugar-cane mill and refinery were erected at Port-au-Prince, as well as a smaller plant near Cape Haitien, and also cotton ginning plants, etc. Means of communication and transport are being improved in order to open up the country and develop the agricultural, forest and mineral resources; in 1925 some 7,500 m. of road were open to traffic, motor roads totalling about 650 m. linking up the chief towns. Only some 60 m. of railway line were in operation in 1925, but the lines were being extended. Banking is in the hands of the National Bank of Haiti, a subsidiary of the National City Bank of New York, and the Royal Bank of Canada.

Foreign trade had greatly improved between 1915 and 1925. The following table shows the value of imports and exports from 1916 to 1924:—

	Imports	Exports
	$	$
1916–7	8,606,086	8,932,887
1917–8	10,180,693	7,743,530
1918–9	17,117,608	24,762,220
1919–20	27,398,411	21,620,928
1920–1	11,957,206	6,590,409
1921–2	12,350,271	10,712,210
1922–3	14,157,963	14,591,012
1923–4	14,696,128	14,176,332
1924–5	20,237,565	19,403,762

The chief articles of export in 1923–4 were coffee, valued at $10,361,776; raw cotton, $2,068,628; raw sugar, $620,412; logwood and logwood extract, $440,670; cotton seed, $202,580; and cocoa, $139,341. Exports to France were valued at $9,369,923; the United States, $1,329,251; Denmark, $847,118; the United Kingdom, $722,699; Germany, $652,688; and Belgium, $509,375. Imports were mainly from the United States, $11,817,376; the United Kingdom, $984,600; France, $885,228; and Germany, $447,999. Both imports and exports increased during 1924–5, when the total trade approximated $40,000,000, with a small balance in favour of Haiti.

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HALDANE, RICHARD BURDON HALDANE, 1ST VISCOUNT (1856–), British statesman, philosopher and lawyer (*see* 12.831). In 1910 he was appointed chairman of the royal commission on university education in London. To organise a university of the first order in, of, and for London, which should secure for science and scholarship, under wise conditions, the full use of the great resources, human and material, of the capital of the British Empire, was a task demanding constructive statesmanship in a high degree. The report of this commission (Cd. 6717) dated Dec. 1911 dealt faithfully and vigorously with the problems placed before it. Effect has not yet been given to its

recommendations. Time may show that the university will and can reform itself from within. If, and when, the university sets itself, or is set, in order, the counsels of this commission, which bear the impress of the chairman's mind, will form the basis of its new activities.

In March 1911 he was raised to the peerage and appointed a member of the Judicial Committee of the Privy Council—that most important tribunal which constitutional lawyers know to be a practical bond of Empire. As a student of the principles which underlie all systems of law, he found the cases brought before the committee to be of absorbing interest, perhaps, most especially, those from India, where the fundamental principles of Hindu law are based on religious duty and philosophic concepts, unfamiliar to the west.

In 1912, at the request of the Cabinet, he visited Berlin to discuss disarmament proposals and on his return reported to the Cabinet information he gathered there as to the attitudes and conditions of those then guiding the policy of Germany. To be a messenger of conciliation and co-operation between the two nations was a duty for which he was in every sense especially equipped, but he was, and soon knew he was, to be baulked by the conditions under which Germany was then ruled. Much party capital was made out of this visit, both then and later during the War. To have refused the opportunity was impossible. To have sent any other member of the Cabinet, would have been infructuous. Something resulted from the mission, but not all that he had hoped for. Lord Haldane accepted the thwarting of the full result he had looked for with characteristic courage and dignified silence. In 1912 he succeeded Lord Loreburn as Lord Chancellor and presided over the House of Lords with dignity and efficiency.

When the War broke out in 1914, the great reorganisation of the War Office which he had effected was tested to the extreme. His labours were justified by their fruit. A new model had been created. There was a new spirit in the army. It had been set on the way of becoming a learned and scientific profession. It had been organised in accord with sound principles and its constituent elements had been brought into close relationship and enabled to co-operate with and understand one another. By the creation of the Officers' Training Corps in 1909, the universities and schools were able to contribute in the time of need exactly the type of officer required. The Militia had been replaced by a Special Reserve of real value as events showed. The Territorial Army had been created, and saved the situation more than once. The General Staff was brought into existence by the issue of a special army order, establishing it on the footing it held during the War and after. To Lord Haldane, again, is due the decision of the Dominion Conference in 1907, accepting the principle of an Imperial General Staff, by which concerted action and intelligent co-operation between armies drawn from all parts of the Empire was made possible. The experimental mating of Minerva with Mars had, indeed, been fruitful and felicitous.

Practical reasons and popular prejudice account for his absence from the first Coalition Ministry in 1915, when he received the Order of Merit. He was then free—as free as any patriot of his nature and temperament could be in such stressful days—to turn to philosophy. He published in 1921 *The Reign of Relativity*, a masterly presentment of profound, scientific and metaphysical thought, and in 1922, *The Philosophy of Humanism*, an abiding memorial of the dictum *Das Geistige allein ist das Wirkliche*. When Einstein came to England to lecture, he was the guest of Lord Haldane, who presided over the gathering which heard the exposition of the theory of relativity from its discoverer. Always eager to promote national education, Lord Haldane devoted much time and energy to the Workers' Educational Association, which owes much of its success to his support.

Lord Haldane was Lord Chancellor in the Labour Ministry of Mr. Ramsay MacDonald (1924), and working chairman of the Committee of Imperial Defence, where his experience, tact and indefatigable industry were invaluable, and, on the fall of the Labour Ministry, Mr. Baldwin invited him to continue his long association with it. The report of the Machinery of Government Committee (Cd. 9230, 1918), of which Lord Haldane was chairman, pointed out that "Further provision is needed in the sphere of civil government for the continuous organisation of knowledge and the prosecution of research in order to furnish a proper basis of policy." Accepting this declaration of principle, Mr. Baldwin established in 1925 the Committee of Civil Research, on which Lord Haldane has served as a member. Thus, through every department of State, in education, in university life, in the army, in the law and in industry are found the effects of his master mind, of his clear vision, of his resolute adherence to first principles and of his practical philosophy. Elected first Chancellor of Bristol University, he has been Lord Rector of Edinburgh, and has received many honorary degrees. His book, *Before the War*, gives an account of his political activities at that time.

HALE, GEORGE ELLERY (1868–), American astronomer, was born at Chicago, Ill., June 29 1868. He studied at the Harvard College Observatory and the Massachusetts Institute of Technology, graduating in 1890. He was director of the Kenwood Astrophysical Observatory, in Chicago, from 1890 to 1896. From 1892 to 1905 he was at the University of Chicago as associate professor of astrophysics, professor, from 1897, and director of the Yerkes Observatory, after 1895. In 1904 he became director of the Mount Wilson Solar Observatory (Cal.) of the Carnegie Institution of Washington, a position which he held till 1923, when he became honorary director in charge of policy and development. He invented the spectroheliograph first used in 1892 for photographing solar prominences, and won an international reputation for his solar and stellar spectroscopic work. He was awarded the Janssen Medal by the Paris Academy of Sciences in 1894, the Rumford Medal by the American Academy in 1902, the Draper Medal in 1903, a gold medal by the Royal Astronomical Society in 1904, the Bruce Medal by the Astronomical Society of the Pacific in 1916, and the Janssen Medal by the Astronomical Society of France in 1917. He was the author of *The Study of Stellar Evolution* (1908) and *Ten Years' Work of a Mountain Observatory* (1915), besides numerous papers in scientific publications.

HALIFAX, Nova Scotia (*see* 12.843).—The population of the city in 1921 was 58,372. The public buildings and many of the houses built of stone show a considerable taste in architecture. Much of this stone was brought from the dismantled homes and fortifications of Louisburg. About one-tenth of the city area was devastated by the explosion on Dec. 6 1917, of a French steamer carrying 3,000 tons of T.N.T., on colliding with a Norwegian steamer on its way with a relief cargo for Belgium. The reconstruction of a Greater Halifax has been carried out on modern lines of town planning.

The harbour is accessible all the year round to the largest vessels. New docks and railway stations, in course of construction, will give it an area of over 200 ac. and make it one of the best equipped ports in the world. Grain elevators and conveyor systems will meet the needs of expanding commerce. Halifax claims to have the lowest port charges on the Atlantic coast. There are a number of manufacturing industries, including the largest sugar refinery in Canada, and the city is also an important distributing centre. Halifax is the chief winter port of Canada and the Atlantic terminus of the Canadian National Railways. It has a naval dockyard and training school.

HALL, GRANVILLE STANLEY (1846–1924), American psychologist and educationalist, was born at Ashfield, Mass., Feb. 1 1846. He graduated from Williams College in 1867 and took the degree of Ph.D. at Harvard in 1878. After holding the chair in psychology at Antioch College, 1872–6, he pursued further studies at Berlin, Bonn, Heidelberg and Leipzig. He was professor of psychology in Johns Hopkins University, 1881–8, and was then elected the first president and made professor of psychology of the newly formed Clark University, Worcester, Mass. which, under Hall's personal leadership, was devoted, during its first two decades, chiefly to educational research. He became widely known as an exponent of the culture-epoch theory of

mental development, a doctrine set forth in his most influential work, *Adolescence*, 2 vol. (1904). During the later years of his presidency his influence perceptibly diminished, this being partly due to the lack of scientific method in his work. He resigned in 1920 and died April 24 1924.

Hall's numerous published works include: *Educational Problems* (2 vol., 1911), *Founders of Modern Psychology* (1912), *Senescence* (1922), and *Life and Confessions of a Psychologist* (1923).

HALLE, WILMA MARIA FRANCISCA, LADY (1839–1911), Anglo-German musician (*see* 12.853), died in Berlin April 15 1911.

HALSBURY, HARDINGE STANLEY GIFFARD, 1ST EARL OF (1823–1921), British lawyer and politician (*see* 12.867), died in London Dec. 11 1921. The year of his birth, earlier given as 1825, was subsequently found to have been wrongly stated. The records of Merton College, Oxford, show him to have been born on Sept. 3 1823.

HAMBURG, Germany (*see* 12.871), with a population in 1922 of 1,025,502, is the second city of Germany. Its commerce, industry and shipping had been increasing up to the outbreak of the World War, which sharply arrested its development, but after the Armistice it began to recover. In 1923 the port was entered by 13,192 seagoing vessels of 15,344,999 tons, as compared with 16,427 of 14,185,496 tons in 1913. Traffic at the end of 1925 was about 90% of the pre-War figure. The proportion of shipping flying the German flag was only half what it had been, and emigrant and tourist traffic much less. The Hamburg-Amerika line, which had made great strides before the War, had 89 steamers of 386,000 tons in 1924. Since 1910 new docks have been built on Waltershof Is., forming a second free port, and large shipyards were laid down at Finkenwerder in 1918. New buildings include the Trade Corporation House (1912–6) in Neustadt, the Museum of Hamburg Antiquities (1914–20) and two ten-storyed office buildings of vitreous brick on the Messberg. The Exchange was rebuilt in 1908–12, and the Institute for Tropical Diseases in 1914. Great S. Michael's Church, burnt down in 1906, has been re-erected on the old lines and the Kunsthalle, to the east of the Binnen-Alster, has been much enlarged. The tunnel under the Elbe from the St. Pauli district to Steinwärder, which is entered by lifts, was finished in 1911; but a two-storyed bridge over the river, begun in 1914, was still unfinished in 1925.

The university, founded in 1918, with a democratic constitution, is in Rotherbaum, to the north of the city, in a building originally designed as a lecture hall. Near it is a statue of Hermann von Wissman, the explorer, which was erected at Dar-es-Salaam and removed here in 1922. Space in Ohlsdorf cemetery for 700 graves of men who died in the district during the World War has been acquired by the British Government. A memorial commemorating the seamen of Hamburg who died as prisoners of war in America was unveiled in 1920.

In 1917 a commission was appointed to bring about a reform of the class franchise which had hitherto existed in the Hanseatic cities, and a measure of electoral reform was adopted. The city and territory had nevertheless as severe an experience of the revolutionary movement as any region of Germany. The Council of Workmen and Soldiers assumed complete political power in Nov. 1918. The region of Cuxhaven belonging to Hamburg declared its independence in Jan. 1919 under Communist leadership, but the republic only lasted four days. In Jan. and Feb. 1919 Communist disturbances broke out in the city itself. The new constitution adopted in 1920, reduced the authority of the senate, and the power which it formerly wielded is now in the hands of the Bürgerschaft (representative assembly), which consists of 160 members elected on the system of proportional representation.

HAMBURG, UNIVERSITY OF.—By a process of natural development the University of Hamburg was formed in 1919 from the material of the Colonial Institute, and consists of the faculties of law, medicine, philosophy and natural science. Special facilities exist for study of the history and culture of the Orient generally, of India, China, Japan, Africa and the South Seas. Anthropology, folklore and missionary problems are among the many notable features of the courses—especially the summer course, which attracts a large number of students.

HAMILTON, SIR IAN STANDISH MONTEITH (1853–), British soldier, was born at Corfu Jan. 16 1853. Educated at Wellington College and in Germany, he joined the army in 1872. He served with the 92nd Highlanders in the Afghan War and the Boer War of 1881, and was severely wounded on Majuba Hill, one arm being permanently disabled. He was then for several years intermittently on the staff of Sir F. (Lord) Roberts. He served in the Nile Expedition of 1884–5, in Burma in 1886–7, and on the staff of the Chitral Relief Force in 1895. He commanded a brigade on the North-West Frontier in 1897, and afterwards the School of Musketry, Hythe. In the South African War he commanded a mounted infantry division during the advance from Bloemfontein to Pretoria and into the eastern Transvaal. He returned home early in 1901 to become military secretary at the War Office, but towards the end of the year went back to South Africa nominally as chief of the staff to Lord Kitchener, although in reality he was employed chiefly as the commander-in-chief's deputy to control particular groups of operations from time to time during the closing stages of the struggle.

He was afterwards again military secretary and then quartermaster-general at the War Office, and in 1904 he went out to the Far East to accompany the Japanese armies in the field. His impressions under the title *A Staff Officer's Scrap Book* (2 vol., 1906–7), by reason of the interest of its subject, the charm of the author's style, and the combination of war experience and of imagination which inspired his judgments and criticisms, at once took rank in Europe as a modern military classic. His literary ability, though a token of unusual imagination and clearness of thought, rather prejudiced him throughout his career in the eyes of old-fashioned soldiers. On his return he had charge of the Southern Command until 1909, and was afterwards adjutant-general at the War Office for a year. He took a prominent part on behalf of the voluntary service system during the campaign in favour of compulsory service led by Lord Roberts, and in the course of this controversy he published a book *Compulsory Service* (1910), which he wrote at the request of Lord Haldane. In 1910 he was appointed commander-in-chief in the Mediterranean and inspector-general of the Overseas Forces.

On the outbreak of the World War in 1914 Hamilton served for some months as commander-in-chief of the Home Defence Army in England. Then in March 1915, he was selected to take charge of the Mediterranean Expeditionary Force (*see* DARDANELLES CAMPAIGN). The naval effort to force the Dardanelles having failed, he found himself obliged to undertake operations in the Gallipoli Peninsula, and although his army was very ill-equipped for the task, he succeeded in landing it in the face of the enemy, but was brought to a standstill. Having, after considerable delay, received substantial reinforcements, he made a great effort in Aug. to improve his position, but partly through the inertia of some of the local commanders, sent out without consulting him, the operations miscarried, and a situation of stalemate arose. The Government consulted him in Oct. as to the expediency and feasibility of withdrawing from the peninsula, and on his pronouncing himself strongly opposed to such a policy he was replaced by Sir C. Monro and returned home. In 1920, after the issue of the *Report* of the Dardanelles Commission, he published his own story of the campaign under the the title of *Gallipoli Diary* (2 vol., 1920), and in 1921 *The Soul and Body of an Army*. For this *Encyclopædia* Sir Ian wrote a brilliant article on WAR. (B. H. L. H.)

HAMILTON, Ontario (*see* 12.891), had in 1921 a population of 114,351. It was estimated (1924) at 120,235. Hamilton's geographical position gives it excellent shipping facilities on the Great Lakes. The city is on the Canadian Pacific and Canadian National Railways and is connected with several lines of the United States. It is the centre of a system of city and suburban lines, and the municipal supply of electric power is cheap and practically unlimited. Hamilton has about 700 factories, including

the largest plough works and implement works in the British Empire. Besides its Anglican and Roman Catholic cathedrals, the city has 89 churches, 50 banks, 45 schools (public, private and technical), five hospitals and three public libraries.

HAMMARSKJÖLD, HJALMAR (1862–), Swedish statesman, was born at Tuna Feb. 4 1862 and educated at the University of Upsala, where in 1891 he was appointed professor of civil law. After establishing his reputation as a jurist, he played an important part in national politics and became Minister of Justice in the Van Otter Cabinet, holding this post from 1901–2 when he was appointed president of the Göta high court. In 1905 he was Minister of Education in the Lundeburg Cabinet and also a delegate to the conference with Norway at Karlstad at the time of the dissolution of the union. He was Swedish Minister in Copenhagen from 1905–7 when he became governor (landshörding) of the province (län) of Upsala. He had been Swedish delegate at the Hague conferences in regard to private international law in 1900 and 1904, and from 1904 was Swedish member of the Hague International Board of Arbitration. In 1907 he was Sweden's leading delegate to the Hague Peace Conference and in 1909 acted as president of the Franco-German board of arbitration in regard to the Casablanca affair. He presided in 1913 over the Franco-Italian arbitration court regarding the seizure of vessels during the Tripoli War. In Feb. 1914 he succeeded Staaff as Prime Minister, retaining this post during the World War until 1917 (*see* SWEDEN). Hammarskjöld became a member of the Institut de Droit International and a curator of the Académie de Droit International at The Hague. In Dec. 1924 he was appointed by the Council of the League of Nations chairman of the commission relating to the codification of international law.

HAMMERSTEIN, OSCAR (1847–1919), American musical director, was born in Berlin. He went to the United States in 1863, where he made money as an inventor of cigar manufacturing machinery. In 1870 he became lessee and manager of a Bowery theatre and after 1880 built and operated the Harlem Opera House, the Olympic, the Victoria and other theatres. In 1906 he built the Manhattan Opera House, in avowed rivalry with the Metropolitan Opera House. In the operas which he produced there he broke away from the classics and presented the works of modern composers, for example Massenet's *Thäis*, Debussy's *Pelléas et Mélisande* and Charpentier's *Louise*. He secured artists such as Melba, Tetrazzini, Bonci and Renaud with Campanini as conductor and artistic director. In 1911, however, he was compelled to sell his concern to the Metropolitan Opera Company, agreeing to abstain from producing grand opera for 10 years within the latter's territory. He then went to London and built the London Opera House, but here again he failed to make a commercial success of the undertaking. Returning to New York in 1912 he built another theatre for the purpose of entering his former field of grand opera, but the Metropolitan Opera Company secured an injunction prohibiting him from so doing. He opened his new house under the name of the Lexington Theatre in 1914, with the usual form of theatrical programme. He died in New York City Aug. 1 1919.

HAMMOND, JOHN HAYS (1855–), American mining engineer, was born in San Francisco March 31 1855. He studied at the Sheffield Scientific School, Yale University (Ph.B., 1876), afterwards taking a course at the Royal School of Mines, Freiburg, Saxony. In 1880 he was engaged in the U.S. Geological Survey of the California gold fields, afterwards practising as consulting engineer, in which capacity he visited most of the countries of North and South America. In 1893 he became associated with Barnato Bros. and Cecil Rhodes in South Africa, acting as consulting engineer for the Consolidated Gold Fields Co. of South Africa, the British South Africa Co., and the Randfontein Estates Gold Mining Company. As one of the leaders of the Rand faction, he was, in Jan. 1896, after the Jameson Raid, arrested and condemned to death, but the sentence was commuted, and later he was released on payment of a $125,000 fine. In 1900 he returned to the United States and became largely interested in mining properties and irrigation projects both in the United States and Mexico. He was president of the Panama Pacific Exposition Commission to Europe, 1912; chairman of the World Court Commission, 1914–5; and chairman of the U.S. Coal Commission 1922–3. He became general manager and consulting engineer of the Guggenheim Exploration Company.

His son, JOHN HAYS HAMMOND, JR. (1888–), American inventor, was born in San Francisco April 13 1888. He studied at the Sheffield Scientific School, Yale University (B.S., 1910). Devoting himself to electrical developments and experiment, he invented a torpedo for coast defence controlled by wireless energy, a system of radio control of ships and a system of selective radio telegraphy; also various electrical devices the use of which for military purposes was secured by the U.S. Government.

HAMSUN, KNUT (1859–), Norwegian author, was born Aug. 4 1859 at Lom in the Gudbrandsdal Valley, the son of poor parents. He started to write at the age of 19 when he was a shoemaker's apprentice at Bodö in North Norway, and for the next 10 years earned his livelihood in various ways such as coal trimmer and country schoolmaster. He eventually went to America, where he became a tram conductor in Chicago and a farm labourer on the prairies. In 1888 he published, in a Danish magazine, the fragment of a novel, *Sult*, which was later translated into English, as *Hunger*. This work at once attracted attention by the beauty of style and originality of treatment. His works from this time onward revealed a richness of talent which rapidly increased his reputation. He is akin to the Russians in his psychological analysis of morbid types, but the American influence is apparent in his use of startling metaphors and the aptness of his expressions. An intense love of nature also characterises his work. He is chiefly known to the English-speaking world by his three novels, *Hunger*, *Growth of the Soil* and *The Woman at the Well*. In 1920 Hamsun was awarded the Nobel Prize for literature.

HANDICRAFTS, ARTISTIC (*see* ARTS AND CRAFTS, 2.700).—The revival of interest in and the practice of the artistic handicrafts which was organised in the early 'eighties in England by Morris, Crane, W. A. S. Benson, W. R. Lethaby and their associates exercised an influence which soon extended to other European countries, the United States and Canada. Although it must be admitted that the dream of its founders has not been and cannot be realised, that influence is not dead. The quality of production may and must vary from time to time with the varying skill of the worker; but a standard of excellence has now been promulgated which is—if not yet equal to the hopes of the pioneers of the movement—at least well advanced in that direction.

The arts and crafts movement was, and is, a protest against machine-made goods and commercialism, and though these, in the nature of things, must continue, definite results have been achieved. The influence of the movement upon the trade side of art-industry has been undeniable. The machine-made article cannot—or, at all events, does not yet—equal in technical execution the hand-made article. But in colour, in pattern, in form, one has only to compare the shop-window display of the period since 1910 with that of the earlier period, to see how great has been the advance of taste. And there has never been so great a demand for books, magazines and the written word generally relating to the arts, as there is at present; in itself a fairly convincing evidence of the growth of interest in the subject on the part of the public.

I. HANDICRAFTS IN GREAT BRITAIN

An effort is being made, in Great Britain, by various societies and with some support from the Govt., in the direction of a general revival of village handicrafts. It is too soon to measure its success; but the movement is worthy of record.

Furniture.—While it is true that the most important of the industrial arts, the making of furniture, is suffering to some extent from a fashion for 18th-century reproductions, steady progress is being made towards what may turn out to be a veritable 20th-century style, of which the distinctive features appear to be simple construction based on good joinery rather

than on cabinet-making. The use of woods selected for their natural beauty and undefiled with polish or stain is another characteristic. Ornament is scantily applied and with increasing attention to utility and comfort; and the general tendency is towards rather substantial and even massive forms, although work on more delicate lines is not wanting. Undoubtedly the most distinguished figure in these, and in other, branches of craftsmanship was Ernest Gimson, whose style seems to be well on its way to becoming a tradition. But distinguished work in England has also been done by E. A. and S. H. Barnsley, P. Waals, A. Romney Green, S. Gordon Russell, C. A. Richter and Ambrose Heal. The wood carving of G. Jack and Lawrence Turner and the carved wood puppets and other figures by William Simmonds are especially notable. Continental furniture follows much the same principles, with perhaps more reliance on mass than on line; as for instance in the work of Louis Sognot of Paris, Hans Hloucat of Vienna and the productions of the Deutsche Werkstätten, Munich.

Silversmiths' Work.—In silversmiths' work, progress has hardly been maintained so far as regards a demand on the part of the public for really fine personal craftsmanship, although, again, the design characteristic of the revival is being reflected to some extent in commercial products. Most of those who are concerned with presentation plate still seem afraid to entrust their commissions to artists whose names and individuality would enhance values. For church purposes, however, admirable work has been done, especially as altar furniture, pastoral staves, etc., by Alwyn Carr, Henry Wilson, Omar Ramsden, Edward Spencer and others; and the series of episcopal and other seals engraved by Cecil Thomas would come into this category. A search for variety has revived, in new form, a combination of shagreen with silver or copper, worked with considerable success by Paul Cooper. Modern jewellery, with its distinctive use of stones *en cabochon* rather than cut, has perhaps kept its small place, but has not affected the more popular taste to any appreciable extent, and of enamels it can only be said that the art has lost rather than gained ground. The silversmiths' work of the Scandinavian group shows promise and originality, and French artists still display extraordinary technical skill and ingenuity; but for obvious reasons there is little new movement to record.

Textiles.—Textile fabrics generally show a tendency towards simple and effective colouring, side by side with a revival of the brocade and chintz patterns of the 18th century, and a still powerful oriental influence. Patterns directly based on flower and plant form have no longer the vogue of the earlier years of the century; though the renaissance of good needlework, due very largely to the efforts of Miss May Morris and Mrs. A. H. Christie, as well as to the effective work done by the Dept. of Textiles of the Victoria and Albert Museum under Mr. A. F. Kendrick, seems to be firmly established in Great Britain. On the Continent, peasant design has influenced pattern, and a definite revival of tapestry in Sweden is to be noted. In this class reference must be made to the effect of the costume designs of Léon Bakst originating a new movement which has spread far beyond its original purpose. Design in carpets and rugs, so far as it exists at all, appears to be almost entirely subservient to Persian and Near Eastern motives; apart from these, however, public taste seems to prefer unpatterned colours to an increasing extent.

Glass.—Much more attention has recently been given to original design in glass-ware on the continent of Europe than in Great Britain; and while there is perhaps too strained an effort in this direction, it cannot be denied that a fair amount of good work is being done. That of Marinot of Paris is decidedly in this class, for it keeps well within reasonable limits in appropriate treatment of the material and yet achieves a novel and highly decorative effect. Some excellent glass for table use is being made in Sweden and Denmark; and the more highly elaborated designs of E. J. Margold of Darmstadt and of the cut-class made under the direction of Prof. G. Beckert of Czechoslovakia are enterprising in pattern and by no means without interest. If in this department Great Britain is behind, in stained glass she has made distinct progress. A Gothic tradition is, in this instance, almost essential; but its treatment of subject can be, and is, sufficiently modern for all practical purposes. The designs of Christopher Whall, P. Woodroffe, G. Kruger Gray, G. Parlby and others have continued and developed the new life instilled in this art by William Morris and Sir P. Burne-Jones.

(E. F. S.)

II. HANDICRAFTS IN THE UNITED STATES

In the first quarter of the 20th century the artistic handicrafts, or arts and crafts, have made substantial progress in the United States of America. When the revival began with the Boston Exhibition in 1897, the standards were not particularly high and the amount of work being done throughout the country was insignificant. The Boston Society of Arts and Crafts was organised in this year and has maintained its leadership in the movement ever since. Its annual sales have increased from $4,000 in 1901 to over $200,000 in 1925.

The arts and crafts were taken up with fervour and a large number of societies were soon organised. The result was that with the showing at the St. Louis Exposition in 1904 and at the Boston Exhibition in 1907, fairly good standards were established in all branches of craft work. It must be admitted that craftsmen who were foreign-born and trained contributed largely to this rapid advance. While some of the initial enthusiasm died down after a few years, there has been a decided renewal of interest since the World War. Distinguished work is now being done, which has had considerable influence on commercial work and in the improvement of popular taste.

Probably the most important advance has been made in the field of stained glass, in which it may be said that an outstanding American style has been established, notable for its decorative character and its emotional quality of colour. While it very definitely carries on the traditions of the early stained glass, it is already adding traditions of its own. The fact that the importation of fine stained glass from Europe has dropped off at least 75% in the last ten years, although there has been an unprecedented number of fine churches built, is due to the work of such men as Charles J. Connick, Nicola D'Ascenzo, Henry Wynd Young, J. Gordon Guthrie, Lawrence Saint and Joseph G. Reynolds.

In metal work, there has been the greatest advance in ironwork and jewellery. Samuel Yellin is doing some masterly work in iron, as well as Frank L. Koralewsky, Morgan Colt and Miss Marie Zimmerman. In quality of design and technique, high standards have been reached by such jeweller-craftsmen as Frank Gardner Hale, Edward E. Oakes, Herbert Kelley, Miss Margaret Rogers, Mrs. Josephine H. Shaw, Mrs. Eda Lord Dixon and Horace E. Potter. The early American silversmiths carried their art to a high point of perfection, and those of the present generation have been content to follow along the Colonial lines without attempting much originality or change. American silver is characterised by good lines and plain surfaces, with less decoration than is usual in Europe. The marked increase in the demand for handwrought silver is due to the notable work of Arthur J. Stone, George C. Gebelein, James T. Woolley, George E. Germer (who has done some fine ecclesiastical pieces), Douglas Donaldson, George J. Hunt, Porter Blanchard, Karl F. Leinonen, John P. Petterson and F. J. R. Gyllenberg. A growing demand for pewter is recently apparent, stimulated by the work of Lester H. Vaughan.

The leading American woodcarver is undoubtedly I. Kirchmayer, who has developed a style of his own which he calls American Gothic, characterised by the introduction of architectural motives in the drapery, but more especially by strength of character, reverence and a mastership of all the best traditions. In furniture, as in silver, there has been a harking back to Colonial times, and the standards of public taste have been raised enormously through the great vogue of antique pieces and good modern reproductions. No new styles have been developed.

In textiles the advances have been largely in batik and block

printing. The names of Miss Lydia Bush-Brown, Miss Helen Dryden, Charles S. Todd, Jean Paul Slusser, Arthur Crisp, Miss Nell Witters, Gilbert Fletcher and Mrs. Marion Maercklein Woodbridge stand out prominently. Weaving has been restricted largely to Colonial models.

Creditable work is being done in pottery. The porcelains of Mrs. Adelaide A. Robineau and the tiles of Henry C. Mercer and Mrs. Mary Perry Stratton have a high reputation. Other master potters are Charles F. Binns, Arthur E. Baggs, Edmund de F. Curtis, H. Varnum Poor and R. Guy Cowan.

Some excellent illumination has been done by Sister Olive Frances, Sister Magdalen, Miss Winifred M. Crawford and Mrs. Gertrude S. Bassett. The demand for hand bookbinding must always be limited, but good work was done by Miss Mary Crease Sears, Mrs. Averill Cole Howland, John F. Grabau and Miss Eleanor I. van Sweringen. In the field of fine printing and typography it is generally conceded that such men as Bruce Rogers, D. Berkeley Updike, and T. M. Cleland are among the leaders. The demand for good commercial printing and binding has stimulated many of the leading publishers to put out books of really artistic merit. American craftwork is holding its own with that of Europe and, in comparison, its dominant characteristics seem to be its conservatism and restraint.

(H. P. M.)

HANGAR: *see* AERODROME.

HANIHARA, MASANAO (1876–), Japanese statesman, was born in Yamanashi-Ken. He graduated from Waseda University, Tōkyō, in 1897 and entered the diplomatic service. In 1899 he went to the legation at Seoul (Korea), as attaché, being transferred to Washington in the same capacity in 1901. After a year of service there, he was made secretary, invited specially to study American affairs, and later became chief secretary for foreign affairs. He felt that American-Japanese relations were unsatisfactory and wished to impress upon the citizens of the United States the necessity for friendly co-operation with the Japanese. He was sent to San Francisco as consul-general in 1916, remaining until the end of 1917. Returning to Tōkyō he first became director of political affairs and then, in 1919, Vice-Minister for Foreign Affairs. As vice-minister he was one of the four delegates to the Washington Conference 1921–2. In 1923 he was appointed Japanese Ambassador to Washington, and it is maintained in America that his reference, in a public speech, to the " regrettable consequences which would follow the passage " of the Immigration bill, was responsible for the bill becoming law. The Japanese Govt., realising that some blunder had been made, recalled Hanihara in 1924.

HANKOW, China (*see* 12.919).—A great commercial entrepôt is provided for China by the three large cities, Hankow, Hanyan and Wuchang, at the point where the Han flows into the Yangtze Kiang. The population was given in 1923 as 1,646,800. In summer the surrounding country is flooded, and vessels drawing 29 ft. can get up to Hankow, but during the winter the port is accessible only to vessels drawing 12 ft., even at favourable periods, and as the water falls hulks are moved out from the banks, with which they are connected by staging. In 1921, however, a river commission was formed, and the work of levelling the river bed from Hankow downstream was begun. The advisability of flood prevention works is also being investigated. Hankow, owing to its strategical importance, suffered considerably during the Revolution of 1911, and in Nov. two-thirds of the city was destroyed by fire, as a result of bombardment by the Imperialists. By 1914 80% of the area was again covered with houses on the old pattern. Several new roads, however, have since been laid out to the rear of the native city on reclaimed land, and a scheme for housing large numbers of the poorer classes on new areas, to relieve the housing problem, has been promulgated.

The industrial development of the district, increasingly active after the World War, is reflected in the building of a number of factories and workshops, and foreign interests are largely increased. The British Bund has become the banking and commercial centre, and a number of imposing banks and offices have been erected, including a customs house, a large Chinese hospital in European style in the native quarter, and a church in the French Concession. The British Concession has been enlarged, and the concessions, each with its own municipal council, now extend for over 2 m. along the river. Those of the Germans and Russians have been taken over by the Chinese authorities. The water supply of the city is good, and there have been no recent outbreaks of cholera. After the World War trade expanded steadily, though the black tea trade, Hankow's staple industry in former days, has declined, largely because of the elimination of the Russian market. The interruptions to communications and the constant impositions which have resulted from the internal troubles of China, as also the increased competition since the re-entry of German traders, have greatly troubled exporters.

HANN, JULIUS (1839–1921), Austrian meteorologist and climatologist, was born near Linz, Upper Austria, March 23 1839. In 1865 he became editor of the *Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie*, and from 1877 was occupied in the Central Meteorological Institute at Vienna. In 1873 he was appointed professor of physics at the University of Vienna. He acquired a world-wide reputation for his works on atmospheric dynamics and thermodynamics, the " atmospheric pulse," cyclones and climatology. His principal works are *Die Erde als Ganzes; Die Atmosphäre und Hydrosphäre* (1872); *Handbuch der Klimatologie*, 3 v. (1908); *Lehrbuch der Meteorologie*, 3d ed. (1914) and many papers in his own *Zeitschrift* and the reports of the Akademie der Wissenschaften. He died in Vienna Oct. 1 1921.

HANUSCH, FERDINAND (1866–1923), Austrian politician, was born Nov. 9 1866 in Oberndorf, Silesia, the son of a poor Silesian weaver. After a childhood of crushing poverty, Hanusch became in 1900 secretary of the Austrian Textile Workers' Union. In 1907 he entered Parliament as a deputy. He was a pioneer of the Austrian trade union movement, especially in his own branch of industry, and did much to improve conditions for this class of labour, which were abnormally bad. In Oct. 1918 he became secretary of state in the new ministry of social welfare, and was author of most of the social legislation of the period, including the eight-hour day, the Works Councils Act, the law compelling employers of 14 hands or more to increase their staffs by 20% in order to reduce unemployment, and the laws dealing with the unemployment dole. He was universally respected for his personal probity and first-hand knowledge of labour problems and conditions. He died Sept. 28 1923.

HARA, TAKASHI (1856–1921), Japanese politician, was born at Morioka. After studying law and practising journalism he entered the diplomatic service, and was *chargé d'affaires* in Paris in 1886. In 1892 he was appointed director of the commercial bureau at the Foreign Office, and in 1895 became Vice-Minister of the department. He acted as minister to Korea from 1896–7, when he became chief editor of the Osaka *Mainichi*. Still deeply interested in politics he became the leading spirit of the Seiyu-Kai (Liberal) party. From the end of 1900 to May 1901 he was Minister of Communications in the Ito Ministry. He then reverted to journalism, and became chief editor of the Osaka *Shimpo*, and was elected a member of the House of Representatives for Morioka in 1902. Definitely abandoning journalism he was appointed Minister for Home Affairs in the first Saionzi Ministry of 1906, in the second Saionzi Ministry of 1911 and in the Yamamoto Ministry of 1913. On Sept. 29 1918 Mr. Hara, as the first commoner to become Prime Minister of Japan, formed a Cabinet based, for the first time in the history of Japanese politics, on strictly parliamentary principles. He was assassinated by a demented youth in Tōkyō on Nov. 4 1921.

HARBORD, JAMES GUTHRIE (1866–), American soldier, was born at Bloomington, Ill., March 21 1866. He graduated from the Kansas state agricultural college, Manhattan, Kan., taking the degree of B.S. in 1886. He joined the 4th Infantry in 1889 and was commissioned in the cavalry in 1891. Serving in the 5th, 11th, 10th and 1st Cavalry, he became a major in 1914. From 1903 to 1914 he served in the Philippine Constabulary. He became brigadier-general in 1917, and was chief of staff of the American Expeditionary Force in France 1917–8. He com-

manded the Marine Brigade near Château-Thierry, June 1918, being appointed major-general on June 26. He commanded the 2nd Div. A.E.F. in the Soissons offensive under Mangin, July 1918, after which he was placed in command of Service of Supply. He was reappointed chief of staff A.E.F., May 26 1919, and was head of the American military mission to Armenia, Aug. 1919. He served as deputy chief of staff, U.S. Army, 1921–2. Retiring from the army Dec. 29 1922, he became president of the Radio Corporation of America.

HARCOURT, LEWIS VERNON HARCOURT, 1ST VISCOUNT (1863–1922), British politician, was born in London Feb. 1 1863, the elder son of Sir William Harcourt (*see* 12.939). He was educated at Eton and afterwards travelled widely, becoming well known for his interest in art. In 1899 he married the only daughter of Walter H. Burns, of New York. In 1904 he was elected Liberal M.P. for the Rossendale division of Lancs., retaining the seat until 1916, and on the formation of Sir Henry Campbell-Bannerman's Government (1905) he became First Commissioner of Works. In 1910 he became Secretary of State for the Colonies in the Asquith Cabinet, and on the formation of the Coalition Government in 1915 again became First Commissioner of Works. In 1917 he was raised to the peerage. He died in London Feb. 24 1922, leaving a young son who succeeded to his title.

HARDIE, JAMES KEIR (1856–1915), British politician, was born on Aug. 15 1856 at Legbrannock in Lanarkshire of very poor parents. He was a message boy at six, and at 10 a "trapper" in a mine. After 13 years underground he became a miners' agent and helped to form the Ayrshire Miners' Union which was the first organised body to put forward the demand for a Labour party. In 1888 he stood as Labour candidate for Mid-Lanark and in the same year formed the Scottish Labour party. In 1892 he was elected for West Ham as the first Independent Labour M.P. At the formation of the Independent Labour party in 1893 he was made chairman, and eventually succeeded, with James Ramsay MacDonald, in forming the Labour party. He lost his seat in 1895, but was returned for Merthyr in 1900, 1906 and 1910. In 1894 he founded *The Labour Leader*. In 1908 he made a tour of the world. As a begetter of the Labour party and on account of his personality and courage he is considered one of the party's heroes. He died in Glasgow on Sept. 26 1915.

See J. B. Glasier, *Keir Hardie; the Man and His Message* (1919); W. Stewart, *J. Keir Hardie. A Biography* (1921); F. Johnson, *Keir Hardie's Socialism* (1922); D. Lowe, *From Pit to Parliament; the Story of the Early Life of James Keir Hardie* (1923).

HARDINGE OF PENSHURST, CHARLES HARDINGE, 1ST BARON (1858–), British diplomat, was born in London June 20 1858, second son of the 2nd Viscount Hardinge. He was educated at Eton and Trinity College, Cambridge, and in 1880 entered the diplomatic service. He became secretary of legation at Teherān in 1896, and in 1898 went to St. Petersburg as secretary of embassy. In 1903 he returned to England and became assistant Under-Secretary for Foreign Affairs, becoming later (1906–10) permanent Under-Secretary. In the latter capacity he accompanied King Edward VII. on his foreign visits. He was created K.C.M.G. in 1904, G.C.M.G. in 1905 and K.G. in 1916. From 1904 to 1906 Sir Charles Hardinge was ambassador to Russia, and in 1910 was appointed Viceroy of India and raised to the peerage. Lord Hardinge returned to England in 1916 and was reappointed to the post of permanent Under-Secretary of Foreign Affairs. In Nov. 1920 he succeeded Lord Derby as ambassador in Paris, retiring in 1922.

HARDING, WARREN GAMALIEL (1865–1923), 29th President of the United States, was born at Corsica (then Blooming Grove), Morrow co., Ohio, Nov. 2 1865, son of George Tyron Harding, a farmer and country doctor, and Phebe Elizabeth Dickerson. He studied in the common schools, and from 14 to 17 at the Ohio Central College at Iberia. He taught in a country school for a year, read law for a short time, worked in a newspaper office and in 1884 became editor and proprietor of the *Marion Star*. On July 8 1891 he married Florence Kling. Having attracted the notice of Senator Joseph B. Foraker (*see* 10.628), he was encouraged to enter state politics, and was early recognised as an effective speaker. He served two terms in the Ohio senate (1900–4), and during the second was influential in securing Senator Foraker's re-election to the U.S. Senate. From 1904 to 1906 he was lieutenant-governor of Ohio, but in 1910, when nominated for governor by the Republicans, was defeated by a plurality of 100,000. In the campaign of 1912 his paper supported President Taft. In 1914 he defeated Foraker in the Republican primaries as candidate for the U.S. Senate, and was elected with a majority of 100,000 for the term of 1915–21; but his friendship with Foraker remained unabated.

In 1916 Mr. Harding was delegate-at-large from Ohio to the Republican National Convention, of which he was chosen permanent chairman. In the Senate he was regarded as a "safe" man, who could be relied upon to support orthodox Republican policies. In 1915 he urged "preparedness" for naval defence. In 1916 he voted against the confirmation of Louis D. Brandeis as associate justice of the U.S. Supreme Court. In 1917 he gave his support to the declaration of War against Germany, and also to all the War measures, including the Selective Draft and Espionage bills. He favoured the death penalty for spies, but after the War advocated amnesty for political prisoners. He opposed the suggested Federal control of food and fuel. He favoured the Prohibition Amendment, and voted for the Volstead Act, enforcing War-time prohibition, over the President's veto. He favoured the anti-strike clause of the Cummins Railway bill, and voted for return of the lines to their owners within a year after the end of the War. He was for exempting American shipping from Panama Canal tolls and also supported woman suffrage. He was opposed to the Covenant of the League of Nations, holding that "either the Covenant involves a surrender of national sovereignty and submits our future destiny to the League, or it is an empty thing, big in name, and will ultimately disappoint all of humanity that hinges its hopes upon it." He voted for the Lodge reservations and also for the Reed reservation that the United States alone should judge whether matters of direct interest to it should be brought before the League; and finally he voted against ratification of the Treaty as submitted by President Wilson. He maintained that Americans should show chief concern for America, and opposed all tendencies toward internationalism. He supported the Knox resolution declaring that war with Germany was ended.

At the Republican National Convention in 1920 Mr. Harding was not at first among the prominent candidates for president. On the first ballot he received 65½ votes (493 being necessary for choice), 39 of these being from his own state. On the eighth ballot he received 133½ votes, on the ninth 374½ votes, and on the tenth he secured the nomination with 692½ votes, the result being due largely to the support of certain influential U.S. Senators, delegates to the convention, who hoped that as president he would be amenable to the Senate. He did not "stump" the country, but conducted his campaign from the "front porch" of his own home. Mr. Harding based his campaign chiefly upon criticism of the Wilson administration, denouncing especially the excessive power that, as he maintained, had been exercised by the executive as a result of War centralisation; he demanded as speedy as possible a return to normal conditions, political and industrial.

While opposing the Covenant of the League of Nations, Mr. Harding gave to many of his supporters the impression that he desired an "association of nations" which, without the characteristics of a super-state (such as he believed the League to be), might safeguard peace. But he retained the political support of many who were opposed, like Senators Borah and Johnson, to any sort of international association. In the Nov. elections he won an overwhelming victory over James M. Cox, the Democratic nominee, also from Ohio; he carried, generally by immense majorities, all the northern states and all but one of the states on the border between North and South, and he cut down materially the Democratic majorities in the South. The electoral vote was 404 for Harding against 127 for Cox. The popular vote was 16,138,000 for Harding against 9,142,000

for Cox. In Ohio the popular vote was 1,182,000 for Harding against 780,000 for Cox. The sweeping character of his victory was due less to his own personal strength or to the weakness of Cox than to the national reaction against the Democratic party and the popular feeling against President Wilson. Mr. Harding resigned from the U.S. Senate in Dec. 1920, and was inaugurated March 4 1921, the sixth President to come from Ohio.

The promise frequently made by Republican campaign leaders that Mr. Harding would surround himself with advisers of capacity and experience, seemed to be fulfilled by his choice of Cabinet members. The outstanding names were those of Charles E. Hughes and Herbert C. Hoover, who became Secretary of State and of Commerce respectively. The distinguished career of the former and the widespread confidence in his ability and political integrity had marked him for the most important position in the Cabinet; and there had been a general demand that the new administration should utilise the organising ability displayed by Hoover in many fields. Various elements in the Republican party, nevertheless, had stoutly opposed their appointment, so that the President's choice showed that he was prepared to exert his independence of party managers and to insist upon administrative efficiency. The choice of Andrew W. Mellon, a wealthy banker and ironmaster of Pittsburgh, as Secretary of the Treasury, was welcomed by men of business; and though that of Will H. Hays to be Postmaster-General was in the nature of payment of a political debt to the man who had been the manager of the Republican campaign, it was early justified by his administration of the Federal postal service.

Mr. Harding's inaugural address, and his first message to Congress, delivered in person on April 12, voiced his desire to return to "normalcy," as he expressed it. Retrenchment in expenditure formed a major item in his programme, together with a prompt and thorough revision of taxation. He advocated the adoption of a national budget system, and the Congress having passed a Budget bill similar to that vetoed by Mr. Wilson in 1920, he approved it on June 10 1921; it provided for a Budget Bureau in the Treasury Department and the appointment of a director of the budget, the first being Charles G. Dawes, formerly general purchasing agent of the American Expeditionary Force. President Harding's first budget was presented Dec. 5 1921. The President was insistent upon the need of repealing the excess profits taxes and reducing transportation taxes and income surtaxes. The need of financial retrenchment led to his opposing the proposal that War veterans should receive a cash bonus. In this matter, as in others, he proved his ability at this early stage to resist political pressure. As regards the tariff he advocated, as a temporary stop-gap, the passing of the emergency tariff, which had been vetoed by President Wilson, but which with slight alteration was approved by Mr. Harding on May 27 1921. He urged the need of adopting a permanent tariff policy, and on Dec. 5 1921 suggested a "flexible tariff" which might provide for the adjustment of rates to meet unusual and changing conditions. Such adjustments might be made, in his opinion, by the executive on the advice of the Tariff Commission.

Mr. Harding's interest in agricultural problems was keen; in his first message he asked special protection for agricultural interests, and in his second he declared that something more than protection must be given the farmers, advocating warmly the encouragement of co-operative marketing plans. As regards domestic legislation, the President, in general, assumed the rôle of moderator. He disclaimed any desire to enlarge the powers and responsibilities of the executive, which, he declared, were already too large; and he aimed at close co-operation with Congress. In marked contrast to his predecessor, he left administrative responsibility to the members of his Cabinet. Foreign policy was largely determined by Hughes, financial by Mellon, and the problem of unemployment was thrown upon Hoover. The President, however, frequently played an active rôle in the conferences necessary to secure general agreement, as on Aug. 9 1921 when an accord was reached between the Treasury and the Representatives on the taxation plan.

The foreign policy of the administration at first seemed likely to emphasise independence of action, on contradistinction to that of President Wilson; the threatened war between Panama and Costa Rica was prevented by a sharp note from Secretary Hughes; the claims of the Japanese to a mandate over Yap were stoutly denied; the administration refused to follow Great Britain in resuming trade relations with Soviet Russia. President Harding made plain in his first message that the United States would not enter the League of Nations. But he expressed himself warmly in favour of active co-operation with other nations of the world, and by accepting the invitation to participate in inter-Allied councils indicated that he would avoid a policy of isolation. In rejecting the League Covenant, he said "we make no surrender of our hope and aim for an association to promote peace, in which we would most heartily join." The President advocated a declaration of peace with Germany by resolution, and the immediate negotiation of a treaty. This policy was adopted by Congress, which agreed upon a joint peace resolution, signed by him on July 2. On Aug. 25 1921, a treaty with Germany was signed, embodying the President's plan of including most of the stipulations of the Versailles Treaty, but repudiating adherence by the United States to any clause referring to the League of Nations. This treaty and similar pacts with Austria and Hungary were ratified by the Senate, Oct. 18 1921.

The most important step taken by President Harding during the first year of his administration was the calling of an international conference on the limitation of armaments. On May 25 1921 the Senate had adopted an amendment of Senator Borah to the Navy bill, authorising and inviting the President to call such a conference. Mr. Harding's preliminary invitations to the principal naval Powers (Great Britain, Japan, France and Italy) were sent July 10, and formal invitations Aug. 11. He made clear his belief that the question was closely connected with the problems of the Pacific and Far East, and invitations were also sent accordingly to China and to the smaller European Powers with Far-Eastern interests—Holland, Belgium and Portugal. The invitations were accepted, and the conference assembled at Washington on Nov. 12. President Harding avoided the example set by his predecessor, and did not himself participate as a delegate. He displayed his political tact in the choice of the American delegation, which was led by Secretary Hughes and included, besides Elihu Root, two members of the Senate, Lodge and Underwood, the Republican and Democratic leaders respectively. The policy drafted by the President and Mr. Hughes was direct and vigorous. They refused to permit the vital problem of limitation of armaments to be side-tracked, and surprised the conference by proposing a 10-year naval holiday and a drastic scrapping of tonnage by the three chief naval Powers. The President made it clear that he regarded the conference merely as a step in securing international understanding and goodwill; he advocated the convening of succeeding conferences as a possible means of securing an international association for the promotion of peace, and he approved the principle of substituting an understanding between the United States, Great Britain, France and Japan regarding Far-Eastern problems, for the existing Anglo-Japanese Treaty. (*See* WASHINGTON CONFERENCE.)

The Washington Conference was the highwater mark of the Harding Administration. Thereafter he faced the development of blocs in the Republican party which destroyed its solidarity, and the growth of criticism which was manifested by the elections of 1922, as a result of which the Republican majority in the House was reduced. Mr. Harding's veto of the Bonus bill indicated his unwillingness to sacrifice principle to expediency. But he found difficulty in explaining the administrative incompetency, or worse, of office-holders in Washington; resentment was felt against the Republican national organisation controlled by the Old Guard; there was outspoken criticism of the new tariff; keen discontent among the farmers led to the election to the Senate of Shipstead and Magnus Johnson. Again the threat of a Third party became imminent.

In the summer of 1923 Mr. Harding set forth on a tour across the United States and to Alaska, designed to reassure the

farmers and reawaken enthusiasm for the Administration. The President, already tired, became ill on the trip back from Alaska and was stricken with pneumonia in San Francisco. On Aug. 2 1923 he died suddenly. (C. SEY.)

HARDY, THOMAS (1840–), English novelist (*see* 12.946); in later years received increasing recognition, not only as a great novelist but also as a poet. His great epic-drama *The Dynasts* (1904–8), a chronicle play of England's struggle against Napoleon, with an accompaniment of philosophic comment chanted by a chorus of "phantom intelligences," was in part produced at the Kingsway Theatre, London, in the early months of the World War, and again at Oxford in 1920. several volumes of lyrical poetry followed (*Selected Poems* in 1916; *Collected Poems* in 1919—but now incomplete). His first wife died in 1912, and in 1914 he married Florence Emily, daughter of Edward Dugdale, herself a writer of children's books and articles in periodicals. Both on his 70th and on his 80th birthday he received tributes of respect and admiration throughout the English-speaking world.

Thomas Hardy's career naturally divides itself into three periods. The first of these contains his work as a novelist, and ends with *Jude the Obscure* in 1896 (*The Well-beloved*, published in book form in 1897, appeared serially in 1892). The second period consists of *The Dynasts*, the three parts of which were issued separately in 1904, 1906, 1908: no doubt the greatest single achievement of his career. The third period may be said to begin with *Time's Laughing-stocks* in 1909, and is wholly devoted to lyrical poetry. It is not often that an artist's life can be divided so definitely into separate stages, each stage characterised by the use of a different form; and, next to its length and plenty, and consistently noble idiosyncrasy, this tripartite division is perhaps the most remarkable feature of Mr. Hardy's career as a whole. The lyrical period, however, does not give us an entirely new development of his genius.

While he was writing novels, he had occasionally experimented with poetry, and some of the results were published, in *Wessex Poems* (1898) and *Poems of the Past and the Present* (1901), between *Jude the Obscure* and *The Dynasts*. The volumes published since *The Dynasts* also contain a good many more of these earlier poems. But from 1909 onwards Mr. Hardy wrote nothing but lyrical poetry, and this may therefore truly be called his lyrical period. (*A Changed Man* in 1913 merely rescued from the periodicals of former years several stray pieces of minor fiction.) It represents a new concentration of his power, but certainly no diminution of it. Devotion to lyrical expression has produced a mastery almost as signal in its kind as his command of the art of fiction; and his 70th year saw him beginning, with *Time's Laughing-stocks*, the series of volumes—*Satires of Circumstance* (1914); *Moments of Vision* (1917), *Late Lyrics and Earlier* (1922), *Human Shows, Far Phantasies* (1925), which has shown him to be the most original, the most poignant, and also the most copious, of contemporary lyrical poets.

The originality of the technique in these volumes does not by any means consist in a mere breach with the accepted conventions, but rather in its highly individual—to some, perhaps, rather disconcerting—compound of the conventional and the unconventional. Most of these lyrics maintain an exact and even rigid formality of stanza, in which a scheme of rhymes is imposed, as it seems, arbitrarily and at all costs. The effect is sometimes justified by its music; but more often by the compact force its pressure gives to language almost conversational in its idiom and choice of words. Yet the diction which defies poetic tradition and seems to despise the magic of elaborated verbal suggestion, is oddly blended with stiff literary phrases and even with words that one might expect only lexicographers to think of. The truth seems to be that, in lyrical technique, Mr. Hardy has no prejudices either for or against the conventions. He is simply concerned with the matter which intense feeling and profound understanding have enabled him to imagine in a way peculiarly his own, and to express this faithfully he has forged a technique peculiarly his own, out of whatever the language of literature or of speech could offer him. Readers who are willing to allow him this liberty can hardly fail to be impressed, as perhaps nowhere else in recent poetry, by the subtlety, depth and variety of his versions of the experiences common to humanity: the commonplace becomes in his hands something rich and strange. Naturally the habit of thought and outlook on the world, which we find progressively insistent in the series of the Wessex novels, and which inspire the turbulent matter and monumental structure of *The Dynasts*, are very evident also in the lyrics; which indeed are often in the nature of marginal comments on themes previously used.

But something like the quintessence of his tragic power may be found in such ballads as "A Trampwoman's Tragedy," or such keen discrimination of pathos as "Near Lanivet," and something too like the quintessence of his irony to be altogether comfortable in *Satires of Circumstance* or "Ah, are you digging on my grave?" Nor is the rustic humour of his beloved Dorset villagers wanting, nor the vivid delight in nature, in the extraordinary range of his lyrical art. It is, in fact, the same Hardy in the lyrics as in the novels and *The Dynasts;* but a Hardy who, if his lyrics were all we had of him, would surely, by virtue of them alone, hold a secure, indeed a unique, position in modern English literature. (L. AB.)

HARE, SIR JOHN (1844–1921), British actor (*see* 12.948), died in London Dec. 28 1921. He made his latest appearance on the stage in a revival of Grundy's *A Pair of Spectacles* at Wyndham's Theatre in 1917.

HARINGTON, SIR CHARLES HARINGTON (1872–), British soldier, was born at Chichester May 31 1872 and commissioned in the King's (Liverpool) Regiment in 1892. After service in the South African War, he held a series of staff appointments, and on the outbreak of the World War went to France as general staff officer, 2nd grade, of the III. Corps. His ability brought him rapid promotion and in June 1916 he became major-general, general staff of the II. Army. He remained chief of staff to Gen. Plumer in France for nearly two years, with the exception of a short interval in Italy. The combined talents of the two men were such that the II. Army became proverbial for its excellent staff work and for carrying out any operation with the maximum economy of life. Messines 1917 was perhaps their most brilliant feat. In April 1918 Harington was recalled to the War Office to become deputy chief of the Imperial General Staff. In the following year he was created Knight commander of the Bath. In Sept. 1920, he succeeded Gen. Milne as Commander-in-chief of the British forces, and subsequently of the Allied forces at Constantinople and in the Black Sea. His tact and diplomacy in a difficult situation, especially during the Chanaq incident, helped to avert serious complications, and was fittingly acknowledged in Parliament. On his return to England in Oct. 1923 he was appointed to the Northern Command.

HARLAN, JOHN MARSHALL (1833–1911), American jurist (*see* 12.954), died in Washington, D.C., Oct. 14 1911.

HARPIGNIES, HENRI (1819–1916), French painter (*see* 13.15), of whose drawings there was an exhibition in London in March 1910, died in Burgundy Aug. 25 1916.

HARRIGAN, EDWARD (1845–1911), American actor (*see* 13.17), died in New York City June 6 1911.

HARRISON, FREDERIC (1831–1923), British man of letters (*see* 13.23). Frederic Harrison's death at Bath from sudden heart failure at the age of 92, on Jan. 14 1923, closed an unusually long and active career devoted to literature and religious service.

In his last book *De Senectute* (1923), which he did not live to see published, he re-affirmed his life-long principle and attachment to the religion of Auguste Comte, and no estimate can do him justice which does not take into account the essentially religious character of his life, of which all his written works may be said to be a contributory expression. Though Frederic Harrison originally came into prominence in the days (1850–80) of fighting agnosticism, he was never himself an "agnostic," and in fact was severely criticised by the leading agnostics, notably by Huxley and Herbert Spencer, etc.; moreover, as a Positivist, he was a republican in spirit and, what was new at that period, a sociologist. It was this positivist sociology which caused him as a young

man to espouse the cause of trade unionism, which he did with such energy and legal skill as adviser to the Royal Commission on Trade Unions in 1867, that he was really the inspirer and founder of the trade union law as it existed from 1868 to 1906. None the less, his religion did not permit him to embark upon a public career. He virtually retired from politics (in the party sense) and from legal practice in mid-life, this latter very largely as the enforced consequence of his pioneer fight on behalf of trade unionism, and took to letters.

At the age of 80 he published his *Autobiographic Memoirs*, 2 vol. (1911). Among the books that flowed almost annually from his pen may be mentioned: *Memories and Thoughts* (1906); *National and Social Problems* (1908); *Tennyson, Ruskin, Mill and other Literary Estimates* (1899); *George Washington, etc.* (1901); *The Creed of a Layman* (1907); *Realities and Ideals* (1908); *Novissima Verba* (1920); *De Senectute* (1923). As an historian Frederic Harrison did not belong to the modern school of specialisation, and ranks as a "literary-historian"; as essayist, he excelled, occupying a distinguished place both for the soundness of his judgment and for the vigour and clarity of his style. Politically, he stood in the position of an unofficial proconsul, and for some years before the World War he repeatedly warned his countrymen of the impending crisis arising out of the armed system of Europe, and of the necessity of British preparation to meet it. An article he wrote in *The English Review* in 1913 proved to be only too prophetic. During the War he stood unfalteringly for victory and for the cause of France. His son, René, was killed in Flanders in 1915.

Frederic Harrison can hardly be classified either as a pure man of letters or as politician by virtue of his religious opinions which debarred him from active participation in worldly affairs, and even as a critic the humanist motive was uppermost. His life may be described as an attempt to introduce Comte's Humanist sociology into this country, to which end he devoted all his energies. For 20 years he was the leader of English Positivism and regularly lectured at Newton Hall, being also a co-founder of and contributor to *The Positivist Review*. His political views were zealously put forward in that organ. He was not a Radical in the party sense though always a Liberal in spirit. Internationally, he was a life-long supporter of France, and in 1870 vehemently urged British support of Gambetta as against Bismarckianism. If he was a "Little Englander," it was because of his championship of the "Little Peoples," and during the Boer War his pronounced anti-jingoism led him into acute controversy. Publicly, his attitude was often misunderstood for that reason. He may be said to have been a republican in spirit, a humanist by conviction and a "meliorist" as politician.

Frederic Harrison had not originally wished to found a Positivist centre or sect, but after the secession of Dr. Congreve on the crucial issue of allegiance to French Comtists, he virtually had no alternative, and it was thus that Newton Hall came into being. As the head of that body, Frederic Harrison found copious use for his scholastic knowledge and energies as lecturer and teacher, and though in that position he was "labelled," the sincerity and disinterestedness of his opinions were so universally recognised that his public moral authority did not lose through isolation. In this way he occupied a kind of "chair" of public morals, such as is hardly conceivable in any other country, hence his unflinching war determinism in 1914 caused him to be more popularly known and appreciated in extreme old age than had been the case during the Victorian epoch when, as a humanist, he found himself neither on the one side nor the other of the great Victorian struggle for "liberty of thought," the foundation of which intellectually had been laid by Auguste Comte and Charles Darwin.

In this great battle of "reason," which started at Oxford, Harrison played a conspicuous part, though never as an iconoclast and in interest, spiritually; *i.e.*, outside the intellectual ethicism arising out of the new criticism, for he neither adhered to the utilitarianism of Mill nor to the "dry light" of the debaters in the famous Metaphysical Society of which he was a member. Positivism was at that time regarded as a "heresy" both by orthodoxy and by the agnostics, and in the controversies that ensued Harrison drifted somewhat out of the movements of his time. He was perhaps the last survivor of the "great" Victorians. He will be remembered as a supreme individualist, a slashing controversialist, as a practical idealist and citizen. Thus he consistently advocated the return of the "Elgin Marbles" to Greece on the ground that the statuary belonged to the historical religion of the Greeks. He was a friend of President Roosevelt and twice lectured in the United States. He was at his best as critic of life and art in the relation of the past to the present, which was Comte's "law" of continuity, but Harrison was alive to the academic weaknesses in Comte's *Polity* and rejected any dogma. In his latter years he resided at Bath, of which city he was given the freedom. He refused all titles or "honours." His ashes, mingled with those of his wife, repose in an urn placed in the chapel of Wadham College, Oxford, according to his last wishes. See Austin Harrison, *Frederic Harrison: Thoughts and Memories*, 1925. (A. Hn.*)

HART, SIR ROBERT (1835–1911), Anglo-Chinese official (*see* 13.30), died at Great Marlow, Bucks., Sept. 20 1911.

HARTLEPOOL, England (*see* 13.34), had a population (1921) of 20,997 and an area of 924 acres. It is connected with West Hartlepool by rail and tramway over Hartlepool Bay. West Hartlepool had in 1921 a population of 68,689 and an area of 2,958 acres. The parish church was restored in 1921, and the Baptist church, destroyed by bombardment, was rebuilt. An obelisk has been erected in Victory Square, West Hartlepool, as a war memorial. In 1924, 5 ac. of land were levelled for additional timber storage, and a quay was built for the fishing industry in 1910. The total area of docks in the Hartlepools is now 200 acres. In Dec. 1914 the towns were shelled by German cruisers and a little damage was done.

HARTLEY, SIR CHARLES AUGUSTUS (1825–1915), British engineer (*see* 13.35), died in London Feb. 20 1915.

HARTLEY, JONATHAN SCOTT (1845–1912), American sculptor (*see* 13.35), died in New York City Dec. 6 1912. Among his last exhibits were "Young Hopi Stick Thrower" (1911) and "The Cradle of Pan" (1912).

HARVARD UNIVERSITY (*see* 13.38).—The history of Harvard University after 1909, when Abbott Lawrence Lowell succeeded Charles William Eliot as president, is one of change and growth to meet new needs and opportunities.

Buildings.—Three residence halls for freshmen (Gore, Standish and Smith) accommodating about 450 men, built near the Charles river at a cost of approximately $2,500,000, were opened in 1914; and in 1919–20 a number of other dormitories, originally erected by private enterprise, were purchased by the university, thus largely increasing the residence halls under its control; in 1924–5 over half the undergraduates of Harvard College and a considerable proportion of the students in the graduate schools located in Cambridge were housed in buildings owned by the university. In 1925–6 Massachusetts Hall, which was a residence hall from 1720 to 1870, was again occupied by students, and two new dormitories, Lionel and Mower halls, became available for seniors; the erection of a third dormitory in the Yard was begun, while by the Charles river a fourth large dormitory for freshmen was under construction. Two new chemical laboratories, the Wolcott Gibbs and the Thomas Jefferson Coolidge, Junior, Memorial, were opened in 1913–4; these facilities for the study of chemistry were, in 1925–6, being increased by large laboratories, which at time were under construction at a cost of approximately $2,000,000.

During 1914–5 the university's museum buildings as originally planned by Louis Agassiz in 1859 were completed by an addition to the Peabody Museum. A building for the Music Dept. and the Cruft High-Tension Laboratory were also opened in 1914–5. In the same year the Widener Library, the largest of college libraries, erected by his mother in memory of Harry Elkins Widener, of the class of 1907, who lost his life in the "Titanic," was first used. The Germanic Museum, to exhibit the evidences of Germanic civilisation in the widest sense, was completed and opened in 1921. The new Counting-House, finished in 1925, provides

adequate offices for the officials, except the treasurer, who have charge of the university property and accounts. In the same year work was begun on the buildings for the Graduate School of Business Administration, provided through the gift of $5,000,000 by George F. Baker; these buildings occupy a large tract on the Boston side of the Charles river. The erection (1925–6) of a new Art Museum at a cost of $1,200,000 to take the place of the Fogg Museum, long outgrown, was also made possible by friends of the university. Improvements have been made in athletic fields, gymnasia, etc.

Endowments.—The period under consideration was remarkable for the rapid increase of funds. In spite of the World War, graduates and friends gave approximately $17,000,000 in the decade 1909–19. Of this about $5,000,000 was for buildings and immediate use; $12,000,000 for permanent endowment. With the close of the World War the alumni revived a project, started before the War but then suspended, to secure additional endowment, and organised in 1919 a committee for the purpose. At the close of the fiscal year 1924–5 over $14,000,000 had been subscribed, of which over $12,875,000 had been paid into the treasury. The total productive endowment of Harvard University on the same date was approximately $70,000,000.

New Plan of Admission.—In 1910–1 a new plan of admission to Harvard College was adopted, which endeavours to test the intellectual condition of the applicant for admission and to establish a closer co-operation with preparatory and high-school authorities. From experience the plan is found to secure closer articulation, especially with public schools, and to provide the college with a better grade of student. In its essential features the "new plan" has been followed by a number of other important colleges. In 1923 the experiment was begun of admitting without examination students who have completed in regular course in a good secondary school a programme of study which fulfils in all respects the requirements for admission to the privileges of examination under the new plan, provided they have ranked in scholarship in the last two years of their school course among the highest seventh of the boys in the graduating class and are recommended by their school. So far as can be judged, students so admitted are above the average of their class in scholarship. In 1924, 48·4% of the freshman class entered from public schools.

The former free elective system, which furnished little or no direction to a student's choice of studies, was modified in 1910 by requiring each student to choose enough courses in one field of knowledge to enable him actually to gain considerable knowledge of that subject; and by distributing a certain number of courses among other fundamental subjects to secure a more systematic and well-rounded education. At the same time the "degree with distinction" was established for high attainment in general, coupled with distinguished success in the subject to which the student has given most attention. Beginning with 1916, general final examinations on the student's field of concentration were introduced in the departments of history, government and economics for all students; the plan was later extended to all other departments except the natural sciences.

In the years following 1916 a system of tutors was developed to direct the private reading of the students. The tutor meets his men individually each week and advises as to their private study; he is in no sense a coach. The results thus far show that the tutorial system is of great educational value; it encourages the student to think of his chief subject as a whole, and to read independently in his field; while the general final examination gives an opportunity to test his capacity at the end of his course. The two have resulted in increased interest on the part of the students and in higher scholarship among students of varying abilities. In 1925 out of the 516 students who presented themselves for the general final examinations in their several fields, 111, or 21·4%, obtained degrees with distinction.

The Engineering School.—In 1915–6, after the Massachusetts Institute of Technology had decided to move from Boston to Cambridge, all instruction in engineering was virtually transferred to it under a co-operative agreement entered upon between the Institute and Harvard. There being doubt, however, as to whether such co-operation was allowed under the terms of the Gordon McKay bequest which was given to Harvard University to further applied science, application was made by the university authorities to the Supreme Court of Massachusetts. The decision of the court in 1917 was adverse, and Harvard again established a School of Engineering Sciences, which, in spite of conditions caused by the World War, made a successful beginning, and in 1924–5 had 36 instructors and 258 students on the register.

Graduate Schools.—The period under review was marked by constant developments in the graduate schools of the university. The Graduate School of Arts and Sciences grew steadily in numbers, although in common with other departments it suffered a temporary check by the World War. Its students are mostly preparing for careers as teachers and scholars; and, in spite of the economic disadvantages under which the profession of teaching still labours, it is impossible to meet all requests coming to the school for teachers and research workers. In 1924–5 the total attendance was 763. The preparation for the scientific management of business given to young men by the Graduate School of Business Administration won wide appreciation, causing large resort to the school (614 in 1924–5) and it became necessary to limit the number of students. In the Law School a post-graduate year of study was established, leading to the degree of S.J.D., intended especially for men wishing to prepare themselves for teaching law and for research in jurisprudence. In 1924–5 the number of teachers was 24 and of students 1,201, representing 175 colleges. In the Medical School departments of pharmacology, of tropical medicine and industrial medicine were organised, and a School of Public Health was established. Affiliation with hospitals, many of them grouped near the school, and changes in the faculties secured one of the largest and strongest organisations for the teaching of medicine and for medical research in the United States.

A separate faculty of architecture was established in 1914, having under its charge the Graduate Schools of Architecture and of Landscape Architecture, which respectively had (1924–5) 48 students from 19 colleges, and 39 students from 22 colleges. In 1920 the instruction in education, which had previously been given under the faculty of arts and sciences, was organised as the Graduate School of Education with a separate faculty. To this school women, as well as men, who hold an academic degree are admitted, this being the only part of the university where co-education is recognised. In the year under review the school had 37 instructors and 272 students, representing 86 colleges. The Theological School was created in 1922 by an affiliation between the Harvard Divinity School (1816) and Andover Seminary (1808); but this union was dissolved by a decree of court in 1925. With the Divinity School are associated the Episcopal Theological School (in Cambridge), Boston University School of Theology and Newton Theological Institution. The degrees of Master of Theological Science (S.T.M.) and Doctor of Theology (Th.D.) were established for those wishing to continue their studies after obtaining the ordinary degree, and the ordinary degree itself (S.T.B.) is now given on the basis of a general examination at the end of the student's three-year course.

University Extension.—Subsequent to 1909 Harvard University united with Boston University, Boston College, the Massachusetts Institute of Technology, Simmons College, Tufts College, Wellesley College, the Boston Museum of Fine Arts, the Massachusetts Board of Education and the School Committee of the City of Boston in offering courses in university extension. These courses are given ordinarily in Boston to a considerable number of students each winter.

War Services.—Ten thousand Harvard graduates and students entered the army or navy of the United States during the conflict; of these 70% received commissions. No complete records exist of those who engaged in non-military service, but it may safely be said that over half the Harvard men of every age took an active part during the World War. The Roll of Honour contains 372 names of men who gave their lives.

The number of students in 1924–5 was as follows:—

College	3,009
Graduate School of Arts and Sciences	763
Special Students	32
Engineering School	258
Theological School	74
Law School	1,201
Medical School	506
Dental School	204
School of Public Health	30
Graduate School of Business Administration	614
Architecture	87
Graduate School of Education	272
Bussey Institution	25
Summer Schools of 1924	2,686
(446 deducted for duplication)	
Total	9,315

In 1908–9 the corresponding total was 5,250. The number of officers of instruction and administration in 1924–5 was 1,319; in 1908–9, 743. The total number of volumes and pamphlets in the university library in 1924 was over 2,320,000. Radcliffe College (for women), in which instruction is given by Harvard teachers, although not part of Harvard University, had in 1924–5 908 students. (C. H. M.)

HARVEY, GEORGE BRINTON McCLELLAN (1864–), American editor and diplomat, was born at Peacham, Vt., Feb. 16 1864, and was educated at the Peacham Academy. At the age of 18 he became a reporter on *The Springfield* (Mass.) *Republican*, and later on *The New York World*. In 1885 he was appointed by Governor Green of New Jersey as aide-de-camp on his staff, and was reappointed by Governor Abbett. The latter also made him insurance commissioner of New Jersey in 1890. During 1891–4 he was managing editor of *The New York World*. Then for several years he was engaged in the construction of electric railways, and in 1898 organised a syndicate which secured possession of the lines in Havana, Cuba. The following year he purchased *The North American Review*, which thereafter he edited for several years. During 1900–15 he was president of the publishing house of Harper & Bros., and during 1902–13 was editor of *Harper's Weekly*. In 1903 he purchased *The Metropolitan Magazine*.

Harvey was said to have been the first to suggest (in 1906) Woodrow Wilson, then president of Princeton, as a presidential possibility. In the campaign of 1912 he gave Wilson strong support; but after the latter's nomination an estrangement developed, due, as it was generally understood, to the fact that Wilson intimated that his cause was being jeopardised by Harvey's officiousness. In 1916 Harvey urged the election of Charles E. Hughes, the Republican candidate for President. He was strongly opposed to the League of Nations, on the ground that it involved the yielding of national sovereignty. In 1918 he established *The North American Review's War Weekly*, later called *Harvey's Weekly*, which bitterly denounced the Wilson administration. In 1921 he was appointed ambassador to England by President Harding, a position which he held till Nov. 1923. He became editorial director of *The Washington Post* in May 1924, resigning May 31 1925. Harvey's books include *Women* (1908) and *The Power of Tolerance, and Other Speeches* (1911).

HARWICH, England (*see* 13.47), with a population of 13,046 in 1921, and an area of 1,541 ac., including Halstead, added to the borough in 1917, is the most important naval base on the east coast of England. Flotillas operating from the harbour did magnificent work during the World War, particularly in mine sweeping in 1917. The main quay was extended by 1,000 ft. in 1911, and there are now berths for nine steamers, and moorings for nine more in the river. A train ferry to Zeebrugge was inaugurated in 1924. The parish of Dovercourt has been united with that of Harwich for purposes of local government. A cemetery was opened at Parkeston in 1910. The electricity supply was taken over by the municipality in 1925.

HAUPTMANN, GERHART (1862–), German dramatist (*see* 13.68), hardly added to his reputation as a dramatist after 1909. He produced *Kaiser Karls Geisel* (1908); *Griselda* (1909); *Die Ratten* (1910), the latter in his earlier realistic manner; *Gabriel Schillings Flucht* (1912); *Das Bogen des Odysseus* (1914); *Winterballade* (1917); *Indipohdi* (1921) and *Peter Brauer* (1921). His novels include *Der Narr in Christo Emanuel Quint* (1910); *Atlantis* (1912); *Der Ketzer von Soana* (1918); *Phantom* (1923) and *Die Insel der Grossen Mutter oder Das Wunder von Île des Dames* (1924). In 1921 appeared *Anna*, an epic poem.

See C. Holl, *Gerhart Hauptmann*, etc. (1913); W. Bonsels, *Das junge Deutschland und der grosse Krieg, aus Anlass des Briefwechsels Romain Rollands mit G. Hauptmann über den Krieg und die Kultur* (1914); A. Esprey, *G. Hauptmann und wir Deutschen* (1916); P. A. W. Gaude, *Das Odysseusthema bei Hauptmann* (1916); J. H. Marschan, *Das Mitleid bei G. Hauptmann*, with bibliography (1919); Paul Fechter, *Gerhart Hauptmann* (1922).

HAVANA, Cuba (*see* 13.76).—The population of Havana, the capital of Cuba, was 360,517, according to the census of 1919. Since that time it is estimated that there has been a still further increase to perhaps 500,000 inhabitants in 1926, for which immigration, mainly Spanish, is largely responsible. Havana, once rather backward in civic improvements, now compares as favourably with other cities of the world in its attractive, up-to-date appearance as it does in commercial and industrial importance. Motor cars swarm the streets, which for the most part are very narrow, but this condition has been relieved by having traffic go one way in all but the wider thoroughfares. In keeping with the wealth of Cuba, the capital has an unusual number of splendid private residences, excellent hotels, and luxurious club houses. The Spanish clubs are astonishingly rich. One of them, the Galician Club, has 67,712 members, while the Asturian Club has 60,351. The university of Havana, the principal educational institution of Cuba, has over 4,000 pupils, of whom some 3,000 are in daily attendance.

Havana is the economic, as well as the political, social, and intellectual centre of Cuba. Nearly all of the larger commercial companies and banks have their main offices there. The volume of trade through the port of Havana surpasses that of any city in the Western Hemisphere, except New York. About 75% of all Cuban imports enter at Havana, but the proportion of exports is considerably less. The customs receipts at this port are some 75% of the total collected in the island. Havana is connected with other parts of the world by means of a number of steamship lines and cables. There is even through freight train service from the United States, making use of a ferry from Key West, which is six hours away. (C. E. Ch.)

HAVRE, LE (*see* 13.82), the second seaport of France, had a pop. of 163,374, including the garrison, in 1921. Work has been continued on the last stages of the 1909 programme of port improvement, which includes a large graving dock and wharfage in the tidal basin, a floating dock and pontoons, a basin for large oil tankers and reservoirs in the outer harbour, and a wharf and mole for goods storage in the north part of the port. A petroleum pipe-line to Paris has been built, but Havre is still only linked by one line of railway to the capital, and is badly connected with other towns in its own district. An escalator is to be built in Rue de Montmorency, one of the steepest streets. In Aug. 1924 a monument was unveiled commemorating the hospitality shown by the town during the War to the Belgian Government, which was housed in a hostel at St. Adresse to the northwest of Havre, after the fall of Antwerp. At the same time a golden sword of honour was presented to the King of the Belgians on behalf of the French people. During the World War large numbers of British and American troops and vast quantities of ordnance and stores passed through the port, and after the Armistice it formed one of the American embarkation points. Trade has again reached its highest pre-war point. In 1924, 4,021 vessels of 8,264,645 tons entered and cleared the port, as compared with 4,018 vessels of 5,671,975 tons in 1907, previously the highest figures recorded.

HAWAII (*see* 13.83).—A group of islands in the North Pacific Ocean, annexed to the United States on Aug. 12 1898, and now represented in the American Congress by a delegate elected biennially. In 1925 the population, including military and naval personnel of 17,094, was 323,645 (an increase, exclusive of such personnel, of 59·7% since 1910).

Race must not be confused with nationality. Birth in Hawaii, as well as elsewhere in the United States, makes one an American citizen. Of the above total, 202,165 were Americans and 121,480 (including Filipinos who are neither citizens nor aliens) were not. Immigration of Orientals in the earlier stages produced an abnormal ratio not only of aliens to citizens but of adults to children and males to females, but later there was a rapid tendency toward normality. Except among Americans and Filipinos, the increase in population was in 1925 mainly through births. Departures have latterly exceeded arrivals, and the departures have been largely of adult aliens. The birth-rate was 41·57 and the death-rate 12·74 per 1,000 in 1925. While there was a growing tendency toward intermarriage among all races, the extremists in preserving racial solidarity are the Koreans and Japanese. The most noticeable social feature in Hawaii is the comparative absence of those racial antagonisms and prejudices prevailing in Asia and Europe.

Immigration has been occasioned by the rapid growth of industries. Many Latin and Oriental unskilled labourers were assisted to reach the country but this is now impossible under the immigration laws. Many of these with their children under improved conditions become skilled labourers. Hence the constant need of replenishing the supply of unskilled labour. The last immigration assisted by the Government (1906–12) comprised 5,288 Spanish, 4,962 Portuguese and 2,056 Russians. Since then the only assisted immigration has been of Filipinos by the sugar producers. These increased from 2,318 in 1910 to 49,335 in 1925. Chinese immigration, restricted previously, has been prohibited since 1898. The Chinese decreased until 1910, but have since increased slowly. The Portuguese, Porto Ricans and Koreans are increasing slowly and the Spanish are decreasing. The Japanese departures have exceeded arrivals since the "Gentlemen's Agreement" of 1907. The native-born Japanese, being American citizens, present the most important problem for the future. They increased from 4,855 in 1900 to 70,860 in 1925. Experience tends to show that the Japanese as well as the Chinese vote will be intelligent and conservative. Notwithstanding the comparatively small percentage of Anglo-Saxon Americans, the atmosphere—political, social and commercial—is conspicuously American.

Industries and Commerce.—Due mainly to the enterprise of the Anglo-Saxon element, the application of scientific methods, favourable soil and climatic conditions, location at the cross-roads of the Pacific and the American protective tariff, Hawaii has enjoyed prosperity for half a century.

Although prices of the principal products were low in 1925 the gains since 1910 were marked. Exports increased from $47,029,631 to $105,599,818; imports from $26,152,435 to $81,802,547; taxable property from $150,268,467 to $360,832,895; bank deposits from $13,324,305 to $60,809,716. Trade was chiefly with the mainland of the United States—$104,095,273 of exports and $72,145,418 of imports in 1925. The exports comprised sugar, $71,468,150; fruits and nuts, chiefly canned pineapples, $27,943,493; coffee, $1,197,535; sugar machinery, $616,270; and smaller values of molasses, hides, tallow, wool, canned fish, bananas, rice, honey and other products. Imports from foreign countries are largely nitrates from Chile, bags from India, and food supplies from Japan.

The sugar crop has increased considerably in recent years, not by increase of acreage, but by scientific discoveries of better methods of cultivation, fertilisation and irrigation, and new varieties of cane. The most striking feature in Hawaiian industries is the extent to which science is applied—through such agencies as the sugar planters' and U.S. experiment stations, the University of Hawaii and the territorial Bureau of Agriculture and Forestry. The yield of sugar per acre is larger than in any other country; but the cost is greater and 18 months is required for a crop. In 1925 the crop was 776,000 short tons—an average of about 6½ tons per acre. A few fields yielded over 18 tons, and one plantation averaged over 12 tons throughout. Half the acreage is irrigated by means of conduits from mountain streams, storage reservoirs and pumping from artesian and surface wells. The crops from the irrigated lands, though more costly, are so much greater as to be more profitable in general than those from the unirrigated lands in the wetter districts. The industry is conducted by corporations owning the mills and raising the cane. The capital stock is widely distributed and bought and sold freely on the exchange. The labourers receive house, fuel, water and medical attendance free. Day labourers, few in number, receive a minimum of a dollar a day plus a turnout bonus of 10% if they work 23 or more days a month plus a profit-sharing bonus of 1 % for each $\frac{1}{10}$ of a cent by which the average price of sugar for the month exceeds 4½ cents. About 95 % of the labourers take work by contract, as this gives them greater remuneration and more independence. Much has been accomplished in improving the living conditions of the employees by replacing tenements with cottages and garden space, providing hospitals, entertainment halls and motion-pictures, play-grounds, kindergartens, social-service workers, instruction in industrial methods and creating an *esprit de corps* by various means.

The canned pineapple industry is entirely a growth of recent years. Its output in 1925 was 8,728,580 cases of two-pound cans. One factory is the largest fruit cannery in the world. The crop has been increased materially by the use of mulching paper. This is rolled out on the fields in long strips, through holes in which the plants are set out. It serves many purposes, such as preventing weeds from growing, conserving moisture, etc. While Hawaii exports and imports a larger percentage of what it produces and consumes than most countries, there is nevertheless much subsistence farming, and several industries, such as the livestock and fishing industries, figure largely in local trade. Much attention has been given to the importation and raising of thoroughbred stock. The principal food of the Hawaiians is *poi*, manufactured from the root of the *taro*. There are no mineral products except building stone, lime and salt. Although Hawaii is essentially an agricultural country, the industries are such as require much manufacturing, not only directly, as in sugar, rice and coffee mills and fruit and fish canneries, but also indirectly, as in iron and fertiliser works and can factories of large size. Manufactures of other products, such as biscuits, macaroni, starch, shoes, clothing, boats, etc., are on a small scale. Strikes of serious extent have occurred only twice, in 1909 and 1920, and unionism has obtained little foothold. There is a compulsory Workman's Compensation law.

Communications.—Commerce on the Pacific is growing rapidly owing to industrial development on both sides of the ocean and the construction of the Panama Canal. The Federal and territorial Govts. and private enterprises have developed shipping facilities in Hawaii, located as it is at the commercial cross-roads provided facilities at lesser ports for inter-island traffic; and developed the principal port on each of the four large islands for trans-Pacific and inter-island traffic. All the newer wharves are of concrete. At Honolulu there are electrical freight-handling apparatus, automatic coal-handling plants, oil storage tanks connected with the wharves by pipe line and floating dry-docks. From 1910–25 the number of deep-sea steamers, exclusive of naval vessels, army transports and coal-bunker vessels, increased from 545 to 1,037; while sailing vessels decreased from 232 to 31, and the combined tonnage increased from 2,589,097 to 7,993,137 tons. Some of these vessels ply solely between Hawaii and ports of the United States, mainly San Francisco, Los Angeles and Seattle, but in part Atlantic ports; others are trans-Pacific, making Hawaii a port of call between San Francisco and the Orient, Canada and the Antipodes, the Orient and Mexico or South America, while others are round-the-world steamers. A fleet of 13 steamers is engaged exclusively in the inter-island trade. There are 350 m. of seven railways on the four principal islands and over 600 m. of private railways on the sugar plantations. Hundreds of miles of concrete and macadam roads have been constructed. Besides a cable there are four powerful wireless plants for trans-Pacific communication, and smaller stations for communication between the islands and with ships at sea. The five larger islands are well covered with efficient telephone systems.

Administration.—A direct primary law has been in operation since 1913 and woman suffrage since 1920. Racial distribution of voters differs much from that of population, depending in the case of each race partly on eligibility to naturalisation and partly on the percentage born in the United States and the length of time the race has been in Hawaii. Hawaiians and part-Hawaiians are citizens; adult immigrant Portuguese, Spanish and Porto Ricans have generally been ineligible for naturalisation because of illiteracy; and Chinese, Japanese and Koreans are ineligible under the Federal laws. In 1924 the registered voters comprised 21,575 men and 13,164 women, as follows: Hawaiian and part-Hawaiian, 16,685; Latins, 5,203; other Caucasians, 9,124; Chinese, 2,016; Japanese, 1,711. There are two main political parties, Republican and Democratic, with the former usually in the majority.

Finance.—The bonded debt of the territory on June 30 1925 was $17,990,000. This has been incurred since 1910 for public improvements. Much current revenue also is expended on public improvements. The only local-government indebtedness consists of $2,080,000 public improvement bonds of the city and county of Honolulu and $1,280,293 district improvement bonds, the latter payable solely by the property benefited, but $6,776,872 of the territorial debt has been incurred for county improvements, for which the counties reimburse the territory in interest and sinking funds. The total revenue of the territory and counties for the year ending June 30 1925 was $17,756,070 of which $8,283,262 went to the territory and $9,425,390 to the counties ($47,418 undistributed) as compared with $2,621,758 and $1,394,695 respectively in 1910. The Legislature has recently provided for a territorial budget system, a pension system for territorial employees, and a uniform accounting system for the counties.

Education.—The educational system of Hawaii ranks high in efficiency. It includes all grades from kindergarten to university as well as a normal school and schools for the physically defective and feeble-minded. There is much manual work and industrial training. Medical inspection of pupils is regularly made and treatment is furnished free or at moderate prices and attention is given to nutrition. The university, established in 1907, has 1,096 students. It possesses an aquarium and marine biological laboratory, conducts extension work and performs important services in industrial experimental and research work. The number of pupils in the schools increased from 25,537 in 1910 to 64,916 in 1925, of whom 55,044 were in the public schools and 9,872 in private schools. The cost of the public school system is about $5,000,000 a year. More than half the pupils are Japanese. In addition the Japanese maintain an extensive system of so-called language schools. In 1920–5 laws were passed subjecting all foreign-language schools, including some Chinese and Korean, to the supervision of the Department of Public Instruction, limiting the sessions to shorter periods restricted to after public school hours, requiring the teachers to pass satisfactory tests in the English language, American history and institutions and ideals of democracy, and providing for textbooks of superior pedagogical value and more suitable in subject matter for American pupils. In 1912 a territorial library was opened in Honolulu, with numerous stations throughout the territory which it supplies through travelling libraries.

Charities.—Of all the departments of the territorial government none except that of education is of wider scope or expends more out of current revenues than that of public health. Physicians are employed or subsidised so that all, however indigent or remote from population centres, may have proper medical attendance. The principal territorial institution under this department is the leper settlement on the island of Molokai, with its auxiliary hospital in Honolulu. Formerly emphasis was laid on isolation, but since 1909 emphasis has been placed on treatment, with the result that the number of lepers has been greatly reduced. Much progress has been made through scientific research and experimentation in effecting cures. Charitable and welfare institutions abound in Hawaii.

History.—Hawaii's recent growth in importance has been marked not only in the scientific development of industries and as the commercial cross-roads of the Pacific, but as a great tourist resort, as the great western military and naval outpost of the United States, and as the friendly meeting-place of East and West. The tourist business has come to rank third in extent. In 1909 the chain of small islands extending 1,200 m. to the northwest of the larger islands was created a bird reservation—the largest and most numerous bird colony in the world. In 1916 the active volcanoes of Kilauea and Mauna Loa and the extinct crater of Haleakala were created a national park. The capital city, Honolulu, has grown rapidly. The naval station and military post in Oahu Island are the greatest belonging to the United States. Honolulu has been the seat of numerous Pan-Pacific conferences to foster among Pacific peoples the spirit of inter-racial brotherhood and promote co-operation among them for their common welfare—scientific, educational, press, commercial and food conferences in 1920–4 under the auspices of the Pan-Pacific Union, and the Institute of Pacific Relations, patterned after the Williamstown Institute in 1925 under independent auspices. These unofficial conferences as well as the official Washington Conference bear witness to the growing importance of the Pacific area in world affairs. In 1920 the centenary of the landing of the missionaries was celebrated. The governors since 1907 have been: W. F. Frear, 1907–13; L. E. Pinkham, 1913–8; C. J. McCarthy, 1918–21; W. R. Farrington, 1921–.

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HAWTREY, SIR CHARLES HENRY (1858–1923), British actor (*see* 13.104), was knighted in 1922 and died in London July 30 1923.

HAYASHI, TADASU, COUNT (1850–1913), Japanese statesman (*see* 13.109), died at Tokyo July 10 1913.

HAYES, PATRICK JOSEPH (1867–), American Cardinal, was born in New York City Nov. 20 1867. Graduating from Manhattan College in 1888, he continued his studies at St. Joseph's Seminary at Troy, N.Y., and was there ordained priest in 1892. After a graduate course at the Catholic University of Washington, he became curate of St. Gabriel's parish in East 37th St., New York City. In 1903 Archbishop Farley of New York, who had been his parish priest, appointed him his secretary and chancellor. In the same year Cathedral College was opened, and he became its first president, an office which he held for 11 years. In 1914 he was consecrated titular bishop of Tagaste and bishop auxiliary of New York. In the following year he was made rector of St. Stephen's Church, and on Nov. 24 1917 was appointed Catholic chaplain bishop for the U.S. Army and Navy, in which capacity he travelled extensively, appointing chaplains to the various camps. He was made Archbishop of New York in 1919. Early in 1924 he was summoned to Rome by Pope Pius XI. and was made a cardinal at a consistory held on March 25, being assigned the Church of Santa Maria in Via as his titular church.

HAZLITT, WILLIAM CAREW (1834–1913), British bibliographer (*see* 13.120), died at Richmond, Surrey, Sept. 8 1913.

HEALTH: *see* PUBLIC HEALTH.

HEALTH, MINISTRY OF.—The English Ministry of Health was set up by statute in 1919. The Act had as its principal object the concentration of the health services of England under a single Minister responsible to Parliament. These services had grown up under many departments: The Local Government Board, the Insurance Commissioners, the Privy Council, the Home Office and the Board of Education. The Act established a Minister of Health for England and Wales with a parliamentary under-secretary. Wales was given a Board of Health separately constituted but responsible directly to the minister. A similar Act was passed in the same year setting up a Scottish Board of Health. This last is a separate organisation and its parliamentary chief is the Secretary for Scotland, who has a parliamentary under-secretary for health for Scotland. There are thus two separate national health administrations in Great Britain whose only link is the association of their parliamentary chiefs in the Cabinet.

Powers of the Ministry.—The main organisation in the new Ministry of Health was the transformed Local Government Board, and this explains many of the functions, remote from its title, which the Ministry still exercises, such as, for example, its power over the finance of local authorities. When the Ministry came into being (July 1 1919) it assumed from that date the whole of

the powers and duties of the Local Government Board, and of the English and Welsh Insurance Commissioners, save for the powers of the latter over the Medical Research Council (then the Medical Research Committee). The powers of the Privy Council relating to midwives were immediately vested in the new Ministry. On Oct. 1 it took over, as provided by the Act. the powers of the Board of Education with respect to the health of mothers and young children, and of the Home Office in relation to infant life protection under the Children Act 1908. On Dec. 1 the Ministry further assumed responsibility for the duties of the Board of Education regarding the medical inspection and treatment of children and young persons. Arrangements had, however, to be made to enable certain of these latter duties to be carried out by the Board of Education on behalf of the Minister of Health.

In May 1920 the Ministry took over from the Home Office the administration of the Anatomy Acts and of certain powers and duties in relation to lunacy and mental deficiency. Many powers inherited from the Local Government Board have been similarly transferred to other departments, such as the Home Office, the Board of Education, the Electricity Commissioners and the Ministry of Transport. An example of this process may be seen in the Order in Council dated May 27 1921, transferring the powers of the Ministry over electoral registration and elections to the Home Office.

Activities of the Ministry.—The activities of the Ministry are classified in five main sub-divisions: (1) public health, (2) local administration and taxation, (3) housing and town-planning, (4) administration of the Poor Law and of the Old Age and Widows and Orphans, Pensions Acts, (5) national health insurance. Of these, housing is the greatest purely post-War development, and has under the 1919 (Addison) Act and the 1923 (Chamberlain) and 1924 (Wheatley) Acts expanded so greatly as to form almost a Ministry in itself. Important matters relating to health services and administration are still under other departments. Of these the Privy Council holds perhaps the greatest share, though the Home Office has duties in relation to the inspection of factories and workshops, etc., of much importance to national health. The Medical Research Council, as stated above, was not transferred to the Ministry with the other branches of the Health Insurance Commissions, but passed under the Privy Council. (The Medical Research Council originated under the Insurance Act of 1911 as the Medical Research Committee.) In addition the General Medical Council, the controlling body of the medical profession, is under the Privy Council and not the Ministry of Health.

The Scottish Board.—The Scottish Board of Health performs duties in Scotland almost identical with those of the Ministry of Health in England. It is derived similarly from the Scottish Local Government Board and the Scottish Insurance Commission. The only service with no English counterpart is that financed from the Highlands and Island Medical Services Fund (instituted by statute in 1913), which provides practically a State medical service in these areas and is subsidized directly from the Exchequer.

It will be seen that the Ministry of Health is in no sense a department corresponding, say, to the Ministries controlling any of the fighting services, with a unified authority and sole responsibility for one task and one task only, which in this case would be the safeguarding of the nation against disease and the increase of its physical efficiency. The fact that the health services are worked almost entirely through local authorities, themselves popularly elected, would make this in any case impossible. It is not yet certain, even, whether these "health" functions will ever form a major portion of the Minister of Health's task. So far, the housing problem, the supervision and overhauling of local government, and, from time to time, the solving of vexed questions in the national insurance schemes have thrown altogether into the background the direct purposes from which, presumably, the Ministry originally received its name. It is indeed more than doubtful whether the health problems of the nation, affected as they are so intimately by finance, by food supply and by distribution of population, can ever be satisfactorily separated from the other activities with which they interlock.

BIBLIOGRAPHY.—Very full information on all the subjects referred to will be found in the annual *Reports* of the Ministry and of the Scottish Board of Health. Health questions in particular are exhaustively dealt with in the separately published *Annual Report* of the Chief Medical Officer "On the State of the Public Health."

(W. E. EL.)

HEALTH INSURANCE: *see* INSURANCE, SOCIAL.

HEALY, TIMOTHY MICHAEL (1855–), was born at Bantry on May 17 1855, the son of Maurice Healy, clerk of the Bantry Union. His mother was the daughter of a schoolmaster in this little west Cork town. Three of her brothers, A. M., T. D. and Donal Sullivan, became Members of Parliament, as did three of her sons, Thomas, Maurice and Timothy Healy. The eldest married his cousin, a daughter of T. D. Sullivan. This group of closely related politicians was the nucleus of the "Bantry Band" which included also W. M. Murphy, M.P., founder of *The Irish Independent.* In the succeeding generation, Kevin O'Higgins, Timothy Healy's nephew by marriage, became vice-president of the Irish Free State when his uncle was made its first governor-general.

But the future governor-general inherited nothing but brains and a strong nationalist tradition. He began to earn his living at 13, and his early youth was spent as a shorthand clerk in a railway office at Newcastle-upon-Tyne. Here he became well known in Irish political and literary societies. In 1878 he moved to London and began in his spare time to contribute to the New York *Nation.* In 1879 Parnell on his first mission to America found that he needed a secretary and wired for Mr. Healy, who was already known to him. In 1880, after Parnell had been elected chairman of the Irish party, a parliamentary vacancy occurred in Wexford City, and Mr. Healy was elected.

From the first he slapped the House of Commons in the face, but he attended very closely to all its business. In 1881 Mr. Gladstone's Land Bill began the revolution which gave the Catholic Irish ownership of the land instead of being mere cultivators under landlords. Mr. Gladstone said that with the exception of three Irish law officers only Mr. Healy understood it, and it is doubtful whether anybody but Mr. Healy understood the effect of the famous "Healy clause." Introduced as an amendment, this guaranteed that in future rent should not be chargeable on tenants' improvements. When the bill became an act, Mr. Healy, called to the bar in 1884, defended the tenants' interests in innumerable cases that arose in its application. In 1883 his audacious tongue secured him the distinction of being sent to gaol. Later in the year when a Liberal seat became vacant in County Monaghan he was selected to make the first Nationalist inroad on Ulster. He won. At the general election of 1885 with the extended franchise Monaghan became a safe seat. Mr. Healy attacked South Derry and won the constituency—by surprise tactics. In 1886, however, he was defeated, but was returned for North Longford.

His relations with Parnell now became less friendly, and he joined Biggar in opposing the candidature of Captain O'Shea for Galway City. The opposition was only overborne by Parnell's personal intervention. But in 1889, when the divorce petition against Parnell was undefended, Mr. Healy drafted the resolution carried by the party in favour of Parnell remaining at his post. "Parnell," he said, "is not a man, but an institution." Later, however, in face of Mr. Gladstone's declaration, he changed his mind, and from the time the "split" began, no speeches were so envenomed as Mr. Healy's. He was twice publicly beaten; but no form of menace had ever the least effect on him. In 1892 he became member for North Louth, and, as a member of the anti-Parnellite party to which the large majority of Irish Nationalists belonged, he was specially supported by the Catholic clergy. His rivals for leadership, Mr. O'Brien and Mr. Dillon, had more following among the laity, but Mr. Healy was always a priests' man. At this time he devoted less time to politics, for his practice at the bar was increasing, and in 1899 he became Q.C.

On the reunion of parties in 1900 he joined Mr. O'Brien in urging that Mr. Redmond, leader of the Parnellite minority, rather than Mr. Dillon, leader of the anti-Parnellites, should be chosen as chairman of the united body. But a long indulgence in the savage spirit of faction which followed the Parnell " split " had rendered Mr. Healy difficult to work with, and in 1902, on the motion of Mr. William O'Brien, he was expelled from the United Irish League, though he retained the support of the Catholic hierarchy and of Mr. Murphy's influential newspaper. In 1906 Mr. William O'Brien, having split away from Redmond's main body with a few followers, made a working alliance with his former adversary and his brother Maurice, member for Cork City. In 1910, when Mr. Healy was beaten in North Louth, Mr. O'Brien provided him with a constituency in north-east Cork.

Mr. Healy joined the English bar in 1903 and took silk in 1910. He was unceasingly employed on English cases, more especially of a political character, and defended many of the suffragettes. In Parliament no speaker was more able to draw a crowded house, and his wit and eloquence were specially popular with the Tories, because he said more biting things of the Nationalist party than Englishmen could invent. With Mr. O'Brien he opposed the Budget of 1909 which led to the clash with the House of Lords; and on the Home Rule measure of 1912, while giving it general support, he furiously opposed partition.

In 1914 he was a vigorous supporter of Britain in the World War, but the course of events from 1916 onwards, culminating in the introduction of conscription, drove him finally to side with Sinn Fein, and in 1918 he resigned his seat to allow an imprisoned Sinn Feiner to be returned. Little was publicly heard of him during the years of turmoil which followed until, at the close of 1922, the constitution of the Irish Free State having been made law by the Irish Parliament, and subsequently by the British, the office of governor-general had to be filled. When Mr. Healy's name was first mentioned for the post there was general incredulity, but the appointment soon commended itself to Irishmen of all sections. The Free State Government, speaking through the mouth of Mr. Healy's nephew, Mr. Kevin O'Higgins, defended the choice of " an old man of the people," while others realised that Mr. Healy, though an extreme nationalist, had in many respects a most conservative mind. Those who feared the worst from a tongue and a temper which he had never before governed were surprised by the result; for during his continuance in office as the representative of King George Mr. Healy in no way added to the Government's difficulties, while he did more perhaps than any other person to cultivate the good will of the Protestant minority. (S. G.)

HEARST, WILLIAM RANDOLPH (1863–), American newspaper proprietor, was born in San Francisco, Cal., April 29 1863. He entered Harvard in 1882, but left after three years without finishing his course. As the only child of George F. Hearst, a mining man of great wealth, he had the use of ample capital at the outset of his career. In 1886 he became proprietor of *The San Francisco Examiner*, the first of a long chain of papers to come under his control. In 1895 he bought the New York *Journal* and in the following year founded *The Evening Journal*, the morning paper being known after 1902 as *The New York American*. Other papers founded by him were *The Chicago American* (1900); *The Chicago Examiner* (1902); *The Los Angeles Examiner* (1902); *The Boston American* (1904); and *The Atlanta Georgian* (1906). He also purchased *The Boston Advertiser* (1917); *The Chicago Herald* (1918), thereafter combined with *The Examiner* as *The Herald and Examiner; The Washington Times* (1919); and the Milwaukee *Wisconsin News* (1919). He was likewise proprietor of *The Cosmopolitan Magazine; Good Housekeeping Magazine; Harper's Bazaar; Hearst's Magazine; Motor Magazine;* and *Motor-Boating Magazine*.

Hearst's papers were sensational in form and contents and had an enormous popular circulation. They upheld the cause of the people against the moneyed interests, but the charge was often brought that they appealed to the baser passions. They were America's chief representatives of " yellow journalism " (*see* 19.569). In 1916 they were barred from circulation in Canada " because of garbled dispatches " concerning the World War. After America's entrance into the War they were frequently charged with disloyalty, and in many towns attempts were made to suppress them. From 1903 to 1907 Mr. Hearst was representative in Congress from New York, and in 1904 had support as presidential candidate at the National Democratic Convention. In 1905 he was Democratic candidate for mayor of New York on the Municipal Ownership ticket, and four years later on the Independence League ticket; in 1906 he was candidate for the governorship of New York on the Democratic and Independence League tickets, being defeated in every instance. He strongly opposed the League of Nations. He became head of the news syndicate known as the International News Service.

HEART, DISEASES OF THE (*see* 13.132).—The years from 1910 to 1925 have been a brilliant epoch in the history of cardiology. Most of the credit for this must be given to British workers, amongst whom the late Sir James Mackenzie and Sir Thomas Lewis have been pre-eminent. For a long time Mackenzie had been carrying out his memorable investigations on the venous pulse, using for this purpose a modification of Dudgeon's sphygmograph; but it was not until after his invention of the Mackenzie ink polygraph in 1908 that the investigation of cardiac arrhythmia by graphic records became at all general as a clinical routine. By means of this instrument, or better still by Lewis's modification of it, it is easy to obtain a prolonged simultaneous record of the arterial and venous pulses together with time marks of $\frac{1}{5}$ of a second. The careful study of such records yields much valuable information.

Electrical Records.—Electrical records of the heart beat have given even more accurate results. A minute electrical current is generated when the heart, or any other muscle, contracts; and in 1887 Waller was able to record the electrical current generated by the human heart beats, using for this purpose the capillary electrometer. In 1903 Einthoven, of Leyden, invented his string galvanometer (*see* 11.430), an extremely sensitive instrument capable of detecting a current of less than $\frac{1}{60,000}$ millionth of an ampère; this has the advantage of being practically aperiodic and free from " lag," grave defects of galvanometers previously used. It consists essentially of a powerful electro-magnet, between the poles of which is stretched a very fine fibre, usually a filament of drawn quartz, silvered to facilitate conduction.

If a minute electrical current passes along this fibre the fibre moves across the magnetic field in one direction or the other according to the direction of the current through it. By putting the human heart in electrical connection with the fibre, either by means of contacts from the chest wall in front of the heart, or, more conveniently, by three electrodes in which the two hands and one foot are immersed, the fibre is found to oscillate with each heart beat. The movements of the fibre are magnified by a projection lantern and photographed on a moving plate; the source of light is interrupted rhythmically at a known rate (usually every 1/25 of a sec.), and thus is obtained a curve of the electrical variations associated with each heart beat together with appropriate time marks. On such a curve the variations due to auricular and ventricular contraction respectively can be very clearly differentiated, the wave representing auricular contraction being designated arbitrarily as " P," and that representing the commencement of ventricular contraction " R." The time interval between these two components of each normal heart beat can be measured very accurately.

Heart Block.—In health this time interval is between 0·18 to 0·20 sec.; if the junctional tissues between auricle and ventricle are injured, either by disease or by cardiac poisons, conduction between auricle and ventricle is delayed and the " P.R." interval may become 0·24 sec., or even more. This state of affairs is known as heart block, and in its early stages can be recognised only by means of graphic records. With more severe damage of the junctional tissues, higher grades of auriculo-ventricular block ensue; thus the ventricle may respond only to every alternate auricular beat, or to every third or fourth auricular beat; or, finally it may be impossible for any stimuli to reach ventricle from auricle, in which case there is complete

dissociation between the upper and lower chambers of the heart, the former beating at their usual rate of 60–80 per min. while the ventricles take on a rhythm of their own, usually at a rate of about 35–40. This condition is known as complete heart block. The presence of these more serious grades of heart block can often be surmised on clinical grounds, but graphic records are essential for their certain recognition. Heart block is one of the rarer causes of irregular heart action.

Other Features.—There are other causes of cardiac arrhythmia, some of which are benign, others serious. Quite early in the century it was impossible to differentiate with certainty between the benign and the serious types. Now, thanks to the knowledge derived from graphic records, this differentiation can be made with confidence, and often without the necessity for taking polygraphic or electro-cardiographic tracings. For instance, previously "intermissions" of the pulse were always considered to be serious. Probably many an operation has been unnecessarily postponed or cancelled on account of what are known as "premature beats"; these are extra-contractions which arise, either in auricle or in ventricle, independently of the ordered sequence of normal beats, every one of which arises in the upper part of the right auricle (the sinu-auricular node) and spreads thence from auricle to ventricle. These premature beats are now easily recognised and, in itself, this type of arrhythmia is devoid of serious import; no surgeon would now think of postponing an operation merely because of the presence of this type of arrhythmia, which is almost invariably present from time to time in most elderly subjects.

Auricular Fibrillation.—But there is another common type of cardiac arrhythmia known as auricular fibrillation which is of much more serious prognostic significance. Here, as a result of serious pathological changes in the heart muscle, the auricles cease to contract rhythmically as a whole in a series of orderly beats; but the auricular musculature is in a constant state of incoordinate and futile twitchings; in consequence, the ventricles, instead of being stimulated from above rhythmically at the rate of about 70 per min., now are overwhelmed by a series of stimuli which pour down on them like an avalanche. They do their best to respond, and contract rapidly and irregularly at a rate of 120–180 per minute. This condition, sometimes known as "delirium cordis," is very constantly associated with cardiac failure, usually ending in dropsy, shortness of breath and eventually, if progressive, in death. It is a dangerous condition, but when recognised—and about its recognition there is now seldom any difficulty—it may be controlled by the administration of digitalis. This drug depresses the conductivity between auricle and ventricle, and consequently only the more powerful auricular stimuli reach the ventricle after its use; the ventricle now beats, still irregularly, but more slowly, and consequently, having time for a longer rest between each beat, more powerfully. The auricles may fibrillate in paroxysms lasting a few minutes, hours or days; but more commonly the condition is a permanent one. It brings about a very considerable degree of disability, but, if properly controlled by the use of digitalis and if the patient is content to live within his limits, it is often compatible with 10, 15 or even 20 years of very fair health.

The Circus Movement.—Lewis has recently demonstrated by means of the string galvanometer that in auricular fibrillation, as in its sister condition, auricular flutter, instead of each auricular beat arising, as described above, in the sinu-auricular node and radiating thence throughout the auricles, a "circus movement" takes place in the auricular muscle, often around the mouths of the great veins entering the right auricle. We have to conceive of a wave of contraction whirling around, usually in an irregular circle, and one whose disposition in space varies from beat to beat. From this contractile path are projected into the surrounding auricular muscle countless stimulating impulses, very much as sparks are thrown out from a catherine wheel, and, as a result, the whole of the auricular musculature is thrown into incessant, shimmering contractions. So soon as this explanation of auricular fibrillation was put forward and accepted, it was manifest that, if we could bridge the gap between the advancing crest and the retreating wake of the contracting wave in its "circus," the heart might revert to normal rhythm. It has been found that quinine and its allied alkaloids, of which quinidine is the one usually employed, have such an effect. In rather more than 50% of cases of auricular fibrillation it is possible to bring about a reversion to normal rhythm by the use of quinidine. Unfortunately the process is not devoid of risk, and there is a tendency for many of the cases to relapse into fibrillation when quinidine is withdrawn, so that cases for quinidine therapy should be carefully selected and its administration should not be attempted by those inexperienced in its use.

Paroxysmal Tachycardia.—This is yet another condition the recognition of which is often possible only with the aid of electrocardiographic records. Here the heart beats with great rapidity (rates of 150–200 per min.), but regularly. There is an abrupt transition from the normal and slow, to the abnormal and rapid rhythm; the attack may last for a few seconds, or for a few days, and ends as abruptly as it began. Such attacks may be associated with great respiratory and mental distress, and may lead to cardiac failure. Their differentiation from a purely nervous form of rapid heart action may be impossible without an electrocardiogram taken during both normal and abnormal periods. It is very important from the point of view of both outlook and treatment to be able to decide whether a case of palpitations is a purely nervous phenomenon, or true paroxysmal tachycardia, a more serious and intractable condition.

X-rays in Cardiology.—Of recent years X-rays have been used more and more in the investigation of cardiac disease. By their help alone really accurate information can be obtained as to the size of the heart and aorta. Percussion of the chest wall, and the location of the apex beat of the heart by the finger, are all we have to rely on, apart from X-rays, in estimating the size of the heart, and the information derived therefrom is vague and often misleading. By means of the X-rays the dimensions of the cardiac silhouette can be determined to a nicety, and much work has been done, particularly by French physicians, in ascertaining the normal standards of measurement of this cardiac silhouette and in tabulating departures from such standards in various pathological states.

Vital Capacity.—Much work has been done with regard to the vital capacity in health and disease. The vital capacity is the maximal amount of air which an individual is able to expire from the lungs after taking the deepest possible inspiration. As a result of vast numbers of observations by many different investigators all over the world we now know what the vital capacity of any healthy individual of a given height and weight should be. Disease of either heart or lungs may very materially diminish the vital capacity, and the figure obtained for an individual's vital capacity increases or diminishes according as the disease in question advances or tends to recovery. This, therefore, is a means of recording numerically a functional disability and its progress. This is a possibility the value of which is greater than is at first apparent. Unfortunately, the statement of a patient that he is better or worse is not always a true index as to the progress of his disease; and even when his doctor thinks there is an improvement, sometimes the wish is father to the thought.

The trend of all this instrumental investigation of the heart's action has been to stress the importance of the heart's muscle in cardiac pathology and to minimise the effect of valvular lesions, to which so much attention was formerly paid. Possibly the pendulum has swung a little too far in this direction, with the result that there has been a tendency to make light of, or even altogether to ignore, quite definite valvular lesions in the absence of any evidence of muscular defect. Such an attitude is deplorable, for it is doubtful if the heart's valves are ever diseased without, at the same time, some defect in the heart's musculature, and, in any case, it is manifest that a heart of which one of the valves either leaks or is narrowed is not as efficient an organ as one whose valves are healthy. The essential point is that the physician should refrain from diagnosing valvular disease unless he is sure of his grounds. Many of the cardiac mur-

murs heard through the stethoscope are not necessarily indicative of valvular or of any other disease. The innocuous nature of these " exo-cardial," " cardio-respiratory," or " haemic " murmurs, had long been known to the more experienced physicians, but it required the mass experiment of the World War to teach the lesson to the rank and file of the profession.

Lessons of the War.—During the early stages of the War thousands of healthy men were refused for general service on the grounds of such murmurs, and many thousands more were unnecessarily invalided out of the army, often with pensions, by reason of the discovery of such murmurs after enlistment. Another lesson of the War was that the condition known as soldier's heart is usually not associated with any disease of the heart itself. The rapid heart action which is the most striking feature of this condition, though it is, in fact, only one of many symptoms present, is due to a general rather than to a local condition.

In Dec. 1925 Yandel Henderson, of Yale University, published some work which may well prove to be of the greatest importance in clinical medicine as well as in physiology. He has succeeded in perfecting a comparatively simple method of determining in adult or child, healthy or sick, the output of the heart per beat. From this it is easy to calculate the actual work done by the heart, and to recognise with certainty departures from the normal standards of efficiency. Thus we now have, at last, a simple method of ascertaining with accuracy whether a heart is functioning normally or not, and of re-examining the patient from time to time, and observing whether a defect of cardiac function previously discovered is stationary, improving or deteriorating.

However valuable may be the information derived from electro-cardiographic and X-ray examination, from analyses of inspired and expired air, or of arterial and venous blood, and from many other modern methods of clinical investigation, no one of these ancillary diagnostic aids as yet surpasses or equals in importance the old-fashioned method of medical history taking. Symptoms properly elucidated and interpreted, are to-day, as previously, more important than physical signs and laboratory tests. An ache beneath the breastbone brought on by exertion and passing away with rest, is of more significance than an aberrant electro-cardiogram. It will be a bad day for clinical medicine when physicians devote their time entirely to laboratory methods of investigation and neglect the less dramatic but equally vital elucidation of the patient's symptoms.

(M. A. C.*)

HEART AND LUNG, SURGERY OF (*see* 13.133).—Since 1910 new surgical work on the heart has been mainly devoted to three subjects.

I. SURGERY OF THE HEART

Removal of Foreign Bodies Retained in the Heart Wall.—The safety of the methods of surgical approach to the heart has been further demonstrated. Surgeons in many countries have removed war missiles from the wall of the heart and from the pericardium with a surprisingly small mortality. R. le Fort (*Bull. et Mém. Acad. de Méd.*, vol. 80, p. 147, 1918) removed 11 foreign bodies from nine patients, with one death. Roberts successfully removed a bullet from the posterior wall of the left ventricle, which had been present for seven years and was causing cardiac disturbance. The approach by resection of one rib and traversing the pleura was excellent. He had also removed four fragments of shell from the pericardium in four patients by the same route, with no mortality.

Operations for Stenosis of the Valvular Orifices of the Heart.—A new field for surgery in the treatment of what has for long been a purely medical subject is being opened up by work which is at the present moment largely experimental. The subject is still in its infancy, but enough has been done to show that with further experience certain selected cases of mitral stenosis, in which the musculature of the heart has not been too much damaged, may be submitted to operation with a fair prospect of improvement. Duff S. Allen and E. A. Graham (*Jour. Amer. Med. Assoc.*, Sept. 23 1922 and *Arch. of Surg.*, Jan. 1924) have invented an instrument which they call a cardioscope. This is a tube, closed at one end by a lens, which is introduced into the heart through a small incision. When the lens is pressed against the heart wall so that no blood intervenes, the endocardium, illuminated by a small electric bulb, is clearly visible. In the wall of the tube is fitted a rod ending in a small knife, with which a stenosed valve may be incised under direct vision. In dogs, when the incision to introduce the cardioscope was made in the auricular appendix, all the dogs recovered. E. C. Cutler and S. A. L. Levine (*The Boston Med. and Surg. Jour.*, June 28 1923), believing that a mere incision in the stenosed ring will heal without relief of the stenosis, invented an instrument which punches out a piece of tissue.

They have used this successfully in the case of a girl, aged 12, suffering from mitral stenosis. She was alive 10 months later and was still improving. H. S. Souttar (*Brit. Med. Jour.*, Oct. 3 1925) reports a brilliant operation on a girl of 15 with mitral stenosis and regurgitation. He exposed the heart by a flap operation, and placed a light clamp on the base of the auricular appendix. After two guide sutures had been inserted, the appendix was incised and drawn over the finger like a glove, haemorrhage being thus obviated. The interior of the auricle was easily explored by the finger, no effect on the pulse being noted. The blood pressure instantly fell to zero as the passage of blood through the orifice was abolished. Souttar intended to divide the stenosed orifice with a knife passed along the finger, but as the stenosis was found to be of moderate degree with little thickening of the valve, he contented himself with stretching the orifice with the finger. The appendage was ligated at its base and the wound of the chest wall closed. The patient's condition was improved and she was well three months later, though still somewhat breathless on exertion.

Cervical Sympathectomy for Angina Pectoris.—The cause of this very distressing disease is not settled with certainty. But as changes in the cardiac muscle, coronary arteries and aorta are usually present it may be considered.

Jonnesco, of Bucharest, in 1916 first performed the removal of the left cervical sympathetic chain, including the upper and middle cervical ganglia and the first thoracic ganglion. The result, followed for four years, was complete relief from symptoms. T. Jonnesco operates under spinal anaesthesia (*La Presse Méd.*, April 26 1922). W. B. Coffey and P. K. Brown (*Arch. Int. Med.*, vol. 31, p. 200, 1923) report six cases with one death and great improvement in the other five, H. Lillienthal (*Arch. of Surg.*, vol. 10, p. 531, 1925) three cases. In one, the cervical sympathetic was removed on both sides. All were cured. H. H. Kerr (*Ann. of Surg.*, vol. 82, p. 354, 1925) reports five cases. He removes the superior cervical ganglion only, under local infiltration anaesthesia by novocain, and obtains the same results as the others by the more formidable operation performed by Jonnesco.

II. SURGERY OF THE LUNG

Since the World War the surgery of the lung has made great strides, and in all countries is engaging the attention of active workers. While differential pressure anaesthesia of some kind is still advisable, the introduction of intra-tracheal insufflation has enabled the elaborate and costly pressure chambers to be dispensed with. For many types of operation ordinary inhalation anaesthesia, especially by nitrous oxide and oxygen, suffices. Local infiltration anaesthesia, combined with nerve blocking by novocain or some similar drug, is largely used, and for some operations is essential. It is being combined with light analgesia by nitrous oxide and oxygen, or even ether by some surgeons in the case of nervous patients, for whom deep general anaesthesia is inadvisable (*see* ANAESTHETICS).

Surgical Treatment of Pulmonary Tuberculosis.—Direct operations on the tuberculous lung, either by drainage of tuberculous cavities or the resection of one or more lobes of the lung, have been abandoned by the majority of thoracic surgeons. The great advance in latter years has been in devising methods of collapsing the affected lung either temporarily or permanently.

Principles of Collapse Therapy.—In all other parts of the body it is found that rest of the affected part is beneficial, but in the case of the lung the respiratory movements, exaggerated by coughing, continue unless the lung is compressed. By collapse, stasis in the lymphatic vessels occurs, preventing spread of tubercle bacilli to other parts of the lung and diminishing the entrance of toxins into the general circulation with consequent improvement of the general resistance of the body. Congestion of the collapsed lung with blood appears to occur, favouring the formation of fibrous tissue and healing of the lesions. Mechanically, the effect is to allow the retraction of the new formed fibrous tissue and to collapse cavities and dilated bronchi. This prevents the retention of secretions, which often become secondarily infected with other organisms, and allows the walls of the cavities to come in contact and so to heal. This retraction occurs normally to a limited extent by the pulling up of the diaphragm, the pulling over of the mediastinum, and the assumption of the expiratory position by the ribs, but falls far short of that necessary for complete obliteration of the cavities.

Methods of Producing Collapse.—Artificial pneumothorax was first proposed by James Carson, of Liverpool, in 1821, but was introduced into practice by Forlanini, of Pavia, in 1882 (*Gazz. d. Osp.*, 1882). It is now extensively practised by physicians all over the world. By the introduction of air, oxygen or nitrogen through a hollow needle into the pleural cavity the lung may be more completely collapsed than by any other method. As this method is simple and satisfactory it is the method of choice, and other operations are only undertaken when this is impossible, through the presence of adhesions binding the two layers of the pleura together (*see* PNEUMOTHORAX).

Division of Adhesions.—Where the adhesions are few and bandlike, so that a partial collapse only can be obtained, it is necessary to divide them. The operation of thoracotomy and division of the bands by direct vision is unnecessarily severe. Jacobaeus, of Stockholm, in 1913 devised an instrument similar to a cystoscope, which he calls a thoracoscope. After the induction of a pneumothorax this is introduced under novocain anaesthesia through a canula. Through a smaller canula a galvanocautery is introduced. Thus the adhesions may be burnt through under the vision of the operator without opening the chest cavity (H. C. Jacobaeus, *Proc. Roy. Soc. Med.*, 1922–3, vol. 16, p. 45). By using the cautery at a red heat only, haemorrhage is avoided. The adhesions often pull out a cone of lung substance in which may be a prolongation of a lung cavity, so that it is important to burn the adhesions through as near the chest wall as possible.

Paralysis of the Diaphragm.—Stuertz first proposed this operation by division of the phrenic nerve in the neck, which was independently devised by Sauerbruch. The result of depriving the diaphragm on one side of its motor innervation is that it rises in the thorax as much as 2½ to three in., thus allowing the lower lobe partially to collapse and putting it at rest. The operation is easily done in a few minutes under local anaesthesia by novocain, the nerve being found running obliquely across the scalenus anticus muscle in the neck. At first the nerve was simply divided, but it was found that accessory fibres joined it below the point of section in 20–30% of individuals. W. Felix's operation of " Exairesis " (*Deutsch. Ztsch. f. Chir.*, No. 171, p. 283, 1922) has gained favour. In this modification the lower end of the divided nerve is seized in forceps and gradually drawn out of the thorax. Sometimes the whole length of the nerve as far as the diaphragm is successfully extracted, but in any case the collaterals which join it in its upper part are also severed so that the paralysis is complete. The operation is used where basal adhesions are preventing full collapse in pneumothorax, as an addition to thoracoplasty, in some cases of early tuberculosis of the lower lobe only and for the relief of pain in the region of the diaphragm on coughing.

Extrapleural Pneumolysis.—The operation consists in separating the parietal layer of the pleura from the chest wall over a limited area and filling the space thus formed with some material which is not absorbed, thereby compressing the lung beneath. A portion of one rib is resected and the posterior periosteum and endothoracic fascia are carefully incised. The gloved finger then separates the outer surface of the parietal pleura from the inner surface of the endothoracic fascia. As the air which enters the cavity thus formed is rapidly absorbed it is necessary to provide some filling. Tuffier, in 1910, first used fat obtained from omentum or a lipoma. This has become one of the favourite methods, the fat being obtained from the patient's thigh (Tuffier, *Bull. et mém. Soc. de Chir. de Paris*, vol. 49, 1249, 1923). If a very careful aseptic technique is not followed the fat may be extruded. Owing to the difficulty of obtaining enough fat, Baer, in 1913, used a paraffin filling (H. Baer, *Münch. med. Wochenschr.*, vol. 68, 1921). This is readily available but is heavy, and tends to be extruded later in many cases. E. W. Archibald, of Montreal (*Am. Rev. of Tubcrc.*, vol. 4, p. 828, 1921), has used a pedicled muscle graft obtained by detaching the pectoral muscle.

The operation is almost confined to apical lesions and is used either alone, or following thoracoplasty, in cases where the apex of the lung is incompletely collapsed. It may also be of service where the apex alone is adherent and a satisfactory pneumothorax has collapsed the lower part of the lung.

Extrapleural Thoracoplasty.—Collapsing operations on the chest wall were suggested as long ago as 1888 (Quincke) and 1890 (Spengler). In 1907 Brauer and Friedreich removed large portions of the ribs in their lateral portions. Wilms, in 1911, removed portions both posteriorly and anteriorly. The modern operation of paravertebral thoracoplasty is due to Sauerbruch and the Scandinavians: Bull, of Osol; Saugman, of Veilefiord; Jacobaeus and Key, of Stockholm. The operation may be done in one, two or more stages and consists essentially in resecting a portion of the first to the 10th or 11th ribs posteriorly through a long incision posterior to the scapula and turning forwards along the 10th rib. The muscles attached to the scapula are divided and the scapula is turned forwards. It is essential that the ribs should be resected as far back as the tips of the transverse processes of the vertebrae. The length of rib removed varies from ½ in. of the first rib to 7 or 8 in. of the middle and lower ones. The operation is a severe one, but the mortality, which was at first about 8% has been reduced by proper selection of cases to about 2% in the hands of experienced operators. Many operators still prefer a local anaesthesia by novocain, but the tendency now, except in cases with profuse sputum, is to operate under general anesthesia by nitrous oxide and oxygen preceded by an injection of morphine and hyoscine. The results of these operations have shown that in cases of unilateral or mainly unilateral pulmonary tuberculosis which are not improving under sanatorium treatment a new field of hope is opening out. F. Sauerbruch (*Chir. der Brustorgane*, 1920), H. C. Jacobaeus and E. Key (*Acta Chir. Scand.*, 1923); P. Bull (*Proc. Roy. Soc. Med.*, 1924, vol. 17, p. 1); J. Alexander (*Surg. of Pulmon. Tub.*, 1925); J. Gravesen (*Surg. Treat. of Pulmon. and Pleur. Tub.*, 1925).

Bronchiectasis.—Three types of operation are used in the treatment of this distressing condition: (1) Drainage operations, (2) operations to collapse the lungs, (3) radical excision of the affected part of the lung. (1) Drainage operations are palliative only and aim either at drainage of abscess cavities or, by making a permanent bronchial fistula, at reducing the amount of sputum. (2) All the forms of collapsing operations which are in use for pulmonary tuberculosis have their place in the treatment of bronchiectasis. They are phrenicotomy, pneumothorax, extrapleural pneumolysis and extrapleural thoracoplasty. The principles involved are, firstly, that the spaces in which secretions collect and decompose are obliterated by the collapse of the lung, and secondly that the new formed fibrous tissue in its contraction no longer pulls open the walls of the bronchi softened by inflammation, but can now pull inward the mobilised walls of the thorax. (3) In certain types of bronchiectasis the results of collapsing operations are not satisfactory, and in consequence amputation of the affected lobe or lobes of the lung has been performed. This procedure has produced real cures but the mortality of the operation is high. The longest series of cases is that published by H. Lilienthal, of New York (*Arch. of Surg.*,

vol. 8, 1924), whose mortality is nearly 50%. Many of his patients were, however, desperately ill. Evarts A. Graham (*Arch. of Surg.*, vol. 10, p. 392, 1925) has practised pneumectomy by the actual cautery, in one or several stages, on 20 patients. Of these, 50% were cured, 30% improved and 20% died.

Intrathoracic Tumours.—Innocent intrathoracic tumours are being diagnosed with greater frequency owing to the increasing use of X-rays. H. C. Jacobaeus and E. Key (*Acta. Chir. Scand.*, vol. 53, p. 573, 1921) have successfully removed four fibromata by the transpleural route. T. P. Dunhill (*Br. Jour. of Surg.*, 1922) removed a fibroma by Gask's modified sternum splitting operation. J. E. H. Roberts (*Tr. Roy. Soc. Med.*, 1926) has removed four innocent tumours, two fibromas, an encapsuled endothelioma and a dermoid cyst, three by the transpleural route and one by sternum splitting.

Malignant Tumours of the Lung.—Radical operations for the removal of carcinomata of the lung are rarely possible owing to the later stage at which patients come under observation. F. Sauerbruch (*Chir. der Brustorgane*) has operated in five cases: One, with a carcinoma of the lower lobe the size of a small fist, was alive five years later; another was alive after three years. Sauerbruch advises a two-stage operation or three-stage operation, ligature of the branch of the pulmonary artery to the affected lobe being done as a preliminary followed by thoracoplasty and resection of lung.

Palliative operations often give great relief from distressing symptoms and prolong life for many months; they are (1) drainage of a secondary lung abscess or empyema, (2) drainage of a sterile abscess due to necrosis of growth, (3) exposure of the growth for the insertion of radium, (4) treatment by X-rays.

BIBLIOGRAPHY.—F. Sauerbruch's monumental work, *Chirurgie der Brustorgane*, 2 vol. (1920 and 1925); L. Guibal, *Traitement chirurgical de la dilatation bronchique* (1924); D. S. Allen, "Intracardiac Surgery," *Arch. Surg.*, vol. 8, 317–25 (Jan. 1924); J. Alexander, *Surgery of Pulmonary Tuberculosis* (1925); J. Gravesen, *Surgical Treatment of Pulmonary and Pleural Tuberculosis* (1925); D. S. Maguire, "Successful Cardiorrhaphy," *Surg., Gynec. & Obst.*, 40, 623–5 (May 1925); C. S. Beck and R. L. Moore, "Significance of Pericardium in Relation to Surgery of the Heart," *Arch. Surg.*, 11, 550–77 (Oct. 1925); J. H. Long, "Cardiorrhaphy," *Boston M. and S. J.* (Dec. 24 1925); H. Lilienthal, *Thoracic Surgery*, 2 vol. (1925).

(J. E. H. R.)

HEAT (*see* 13.135).—The summary of recent works, given below, is arranged for convenience as far as possible in the order of the earlier articles connected with heat in the 11th ed. of the *E.B.*, as enumerated in 13.157, and references to them are made where necessary.

International Notation.—The symbolic notation here adopted is based on that recommended by the International Commission for the Unification of Physico-Chemical Symbols at their meeting at Brussels in 1913, as extended by a special Committee of the Physical Society of London under the presidency of Sir J. J. Thomson. Fortunately their recommendations coincide in the main with the notation employed in the 11th ed. of the *E.B.*, but a few changes have been made for the sake of uniformity, as indicated in the following list.

Alphabetic Index of Symbols.

A = 1/J, Reciprocal of mechanical equivalent of heat.
a, Numerical factor for reducing PV to heat units.
B, Constant of integration in expressions for E and H.
b, Co-volume in characteristic equation of gas.
C, Cooling-effect of Joule and Thomson (*see* 27.901).
c, Co-aggregation volume in gas-equation.
E, Intrinsic energy.
G, Gibbs' function, $T\Phi - H$.
H, Total heat of vapour, $E + aPV$.
h, Total heat of liquid.
J, Joule's equivalent.
K, *k*, Thermal Conductivity, and Diffusivity.
L, Latent heat.
M, Mass.
m, Molecular weight or mass-flow.
N, Number of atoms or molecules.
n, Index in formula for *c*.
P, Pressure generally.
p, Saturation-pressure.
Q, Quantity of heat energy.
R, Gas-constant in PV = RT.
S, Specific heat of vapour; *s*, of liquid.
T, Absolute temperature; *t*, from 0°C.
U, Velocity of motion.
V, Specific volume of vapour; *v*, of liquid.
W, Work.
X, Cross-section of pipe or nozzle.
Φ, Entropy of vapour; ϕ, of liquid.
β, Radiation constant in $\beta\nu/T$.
γ, Ratio of specific heats of gas.
Λ, Velocity of light, 3×10^{10} cms/sec.
λ, Wave-length; ν, frequency.
η, Viscosity of gas.

CALORIMETRY

Units of Heat.—One of the most fundamental points in the measurement of heat is the relation between the practical units corresponding to the various methods discussed in the earlier article (*see* 5.60), in which the most important experimental evidence then available was described and reviewed. Some of the conclusions reached have since been contested, but additional experimental evidence has been obtained which seems to confirm the views previously maintained.

The experiments of Rowland by the mechanical method, agreeing closely with those of Joule when reduced to the scale of the gas thermometer, showed that the gram-calorie at 20° C. (defined as the quantity of heat required to raise the temperature of 1 gram of water at 20° C. under atmospheric pressure by 1° C. on the scale of the hydrogen thermometer) was equivalent to 4·180 joules of mechanical energy. Those of Reynolds and Moorby between 0 and 100° C. gave the equivalent of the gram-calorie as 4·1832 joules for the mean of the whole range, showing that the mean calorie was nearly the same as the calorie at 20° C., in contradiction to the results of earlier experimentalists who had obtained much higher values for the mean calorie. The best of the previous results by the method of mixtures for the variation of the specific heat of water between 0° and 100° C. were those of Lüdin (*see* 5.64, fig. 6), which gave a somewhat improbable curve for the variation, indicating a value 4·206 joules for the equivalent of the mean calorie, if the calorie at 20° C. was equivalent to 4·180. Most of the older results for the mean calorie, *e.g.*, those of Dieterici (*Wied. Ann.*, 33, p. 417, 1888), giving 4·244 by an electrical method with an ice-calorimeter, were much higher than Lüdin's. On the other hand, the continuous electrical method (*see* 5.65), in which platinum thermometers were employed in place of mercury thermometers, while agreeing very closely with Rowland's results from 5° to 30° C., gave a much slower rate of increase than Lüdin's for the specific heat between 40° and 100° C., and a value 4·186 joules for the mean calorie, confirming Reynolds and Moorby.

The later experiments of Dieterici, by the method of the ice-calorimeter employing a 10 times smaller current with a coil of higher resistance in order to reduce the uncertain errors of the electrical measurement, gave an equivalent 4·192 joules for the mean calorie. He also redetermined the constant of the ice-calorimeter, using water at 100° C. sealed in thin bulbs of quartz-glass, and obtained a value 15·491 milligrams of mercury per mean calorie, appreciably higher than the value 15·44 previously employed. This has since been confirmed by E. Griffiths (*Proc. Phys. Soc.*, 26, p. 1, 1913) who found the value 15·486 for a mean calorie of 4·184 joules. Owing to the smallness of the quantities of heat available for measurement at low temperatures, the ice-calorimeter is unsuitable for investigating the variation of specific heat in the neighbourhood of the freezing-point, but the observations of Dieterici at temperatures above 100° C. by the same method gave a rate of increase of the specific heat of water slightly exceeding that found by Regnault, which could not be reconciled with Lüdin's curve showing a maximum of specific heat at 87° C.

Messrs. W. R. and W. E. Bousfield (*Phil. Trans.*, A, 211, pp. 199–251, 1911) succeeded in reproducing Lüdin's results with remarkable fidelity by a most ingenious method of electric heating with a vacuum-jacket calorimeter. The heating-coil consisted of a long spiral of small-bore glass tubing filled with mercury, the expansion of which in a capillary tube was made to indicate the actual temperature of the mercury at any time when traversed by the electric current. The observers were thus enabled to avoid the source of error due to the superheating of the conductor above the temperature of the calorimeter. The uncertainty of heat-loss by evaporation from the surface of the water was minimised by protecting the surface with a cover in the form of a metal box maintained as nearly as possible at the same temperature as the water during an experiment. The rise of temperature over predetermined ranges, 0°–13°, 13°–27°, etc., was observed with suitable mercury thermometers of limited scale, standardised at the National Physical Laboratory. The corresponding quantities of electrical energy supplied, when corrected for external heat-loss and for the thermal capacity of the calorimeter, gave the increase of total heat of water, or the mean specific heat over each range. By adding the increments of total

heat for each range, the *variation* of the total heat h, or the small difference $h-t$, could be obtained at each of the points of observation, as in the following table:—

Temperature C.	13°	27°	40°	55°	73°	80°	100°
Bousfield	0·058	0·058	0·059	0·124	0·242	0·306	.....
Lüdin	0·057	0·059	0·064	0·119	0·285	0·371	0·633
Formula (1)	0·070	0·072	0·054	0·038	0·046	0·062	0·159
Dieterici	0·010	0·011	0·013	0·031	0·090	0·128	0·303

Bousfield's observations did not extend beyond 80°, owing to the difficulty of excessive evaporation with an open calorimeter. According to his curves, the corresponding values of the specific heat appear to be approaching a maximum at 80° C., a little lower than that shown by Lüdin's curve. The value of the specific heat at 80° C., according to Lüdin's formula, is 1·0184 in terms of the specific heat at 20° C. taken as unity, and exceeds the value given by the continuous electric method by 1·55 %. This looks alarming at first sight, but the method of comparison in terms of the actual specific heat, though commonly adopted, is really unfair, because the quantity actually observed in Lüdin's method is the total heat, which shows a difference of only 0 31 calorie according to the above table at 80° C. Dieterici's observations at 100° C., where they were most reliable, differ by only 0·14 % from the continuous electrical method, and he does not claim an order of accuracy greater than 0·1 % for the ice-calorimeter.

Continuous Mixture Method.—Since the number of separate determinations of the specific heat of water at points between 50° and 100° C. by the continuous electric method was only 12, and since these were made under conditions of exceptional difficulty, and differed most widely from the values found by Lüdin and Bousfield, it was felt to be desirable to confirm the variation in this region by an entirely independent method of equal accuracy. The continuous mixture method (Bakerian Lecture, *Phil. Trans.*, A, 1912, vol. 212, pp. 1–32) was devised for this purpose, and consisted in passing a steady current of water, initially at 100° C., through an interchanger, in which it gave up a large part of its heat to a current of cold water initially at 25° C., emerging at a temperature in the neighbourhood of 70° C., without having actually mixed with the cold current. The same current was then cooled to an accurately regulated temperature in the neighbourhood of 25° C., and re-entered the interchanger as the cold current. The point of the method is that the circulation is continuous, so that the water equivalent of the interchanger is not required, and that the hot and cold currents are *the same*, so that the quantity of the current divides out of the equation (except in the small term representing the external heat-loss) and need not be determined with an accuracy greater than 1 %, since the external heat-loss can easily be reduced to a small fraction of 1 % of the heat-exchange between the currents. The actual temperatures t_1 and t_2 of the hot current on entering and leaving the interchanger, and those of the cold current, t_3 and t_4, were observed with platinum thermometers to 0·001° C. If s' is the mean specific heat of the hot current between t_1 and t_2, and s'' that of the cold current between t_3 and t_4, we have the equation

$$s'(t_1-t_2)=s''(t_4-t_3)+X/M,$$

where X is the external heat-loss in gram-calories per second, and M the value of the water current in grams per second. The heat-loss was determined, as in the continuous electric method, by varying the flow M while keeping the temperatures the same. In a large number of trials it was found that the ratio of s' to s'' agreed with the value 1·0050 given by the continuous electric method, but disagreed materially with the value given by Lüdin's formula. It was concluded that the discrepancy from Lüdin's formula was probably to be attributed to the unavoidable errors of his method, due to losses by evaporation at temperatures above 50°, and to the uncertainties of zero-point and stem-exposure which cannot be eliminated in the employment of mercury thermometers.

Formulae for the Specific Heat of Water.—It is usual to employ an empirical formula of the type, $s=1+at+bt^2+ct^3+$etc., which is familiar and convenient for the application of the method of least squares to the results of observation. The formulae most often quoted for water are those of Lüdin and Dieterici, which are as follows in terms of the calorie at 20° C.:—

Dieterici, $s=1\cdot0013-0\cdot0104(t/100)+0\cdot0208(t/100)^2$

Lüdin, $s=1-0\cdot07668(t/100)+0\cdot196(t/100)^2-0\cdot116(t/100)^3$
$\pm0\cdot00025 \qquad \pm0\cdot040 \qquad \pm0\cdot030$

The probable errors of the coefficients, as given by Lüdin, are shown in the line below his formula. The formula of Dieterici represents his observations satisfactorily from 50° to 300° C., but does not apply to the variation near the freezing point, which cannot be represented satisfactorily by this type of formula without an additional term. The formula of Lüdin is fairly accurate between 0° and 25°, but appears to give results about 1 % too high between 60° and 90° C. It is also inconvenient in practice, because the coefficients are large and of opposite signs, giving the small variation required as a difference between relatively large terms. In the preliminary reduction of the results of the continuous electric method (*B. A. Rep.*, 1899) it appeared that a formula of this type would be unsuitable, and the observations were accordingly represented by three simple formulae for different ranges of temperature between 0° and 200° C., as given in the previous article (*see* 5.66). These have since been combined into a single equivalent formula, which is more convenient for several purposes:—

$$s=0.98536+0\cdot504/(t+20)+0\cdot0084(t/100)+0\cdot009(t/100)^2 \qquad (1)$$

The value of the constant is adjusted to make $s=1$ when $t=20°$. The other terms are small and positive, and can be calculated with sufficient accuracy for all possible purposes by means of a 10-in. slide rule. This formula agrees very closely with the table previously given, but represents a later and more accurate reduction. It is of no theoretical significance, and cannot safely be extrapolated much above 100°C., but still agrees very closely with Regnault's observations at 160° C. Above 100° C. it is better to use the thermodynamical formula (*see* 27.903) suggested by McF. Gray, which agrees very closely with experiment from 40° to 100° C., but does not represent the increase of specific heat with fall of temperature near the freezing point. Gray's formula was re-defined by Callendar as representing the change of total heat of water under saturation pressure, and then agrees very closely with the observations of Dieterici at high temperatures, when corrected to give the change of total heat in place of the intrinsic energy. It has a simple theoretical foundation, and greatly simplifies the thermodynamical relations between liquid and vapour. There is good reason to believe (Callendar, *Properties of Steam*, pp. 160, 196) that it continues to hold satisfactorily right up to the critical point, where the specific heat becomes infinite.

By experiments on the supercooled liquid, Prof. H. T. Barnes has shown that the increase of specific heat with fall of temperature continues to follow the same curve above and below the freezing point. By very accurate experiments on mercury, using the continuous electric method, he has shown that a diminution of the specific heat with rise of temperature occurs as in the case of water, but persists up to a minimum at 140° C. It appears probable that a similar phenomenon would be found for all liquids at low vapour pressures, but it is masked in the case of volatile liquids by the opposite effect of the vapour-molecules, as represented by the thermodynamical formula. The diminution of the specific heat of water was attributed by H. A. Rowland to the presence of a small proportion of solid-molecules in the liquid near the freezing point. The rapid increase of the specific heat of a solid as the fusing-point is approached may similarly be attributed to the presence of a small but rapidly increasing proportion of liquid-molecules in the solid. The proportion required in either case, to explain the diminution of hardness and rigidity of the solid, or the anomalous expansion of water near the freezing point, is small, but cannot be calculated with certainty on account of our imperfect knowledge of molecular forces and dimensions. Such a theory would be difficult to verify in any case by experiment for the liquid and solid molecules.

Specific Heat of Gases and Vapours.—The continuous electric method was first applied in the case of steam (*see* 27.901) and gave results near 100° corroborating Regnault's value at higher temperatures. The same method was applied to air and CO_2 by W. F. G. Swann (*Phil. Trans.*, A, 1910, vol. 210, p. 199), who found results from 2 to 5 % higher than those of Regnault. Swann's formula has since been verified by Holborn and Jakob (*Zeit. Ver. Deut. Ing.*, 58, p. 1429, 1914) and it is now generally recognised that this method is the most accurate for the determination of the specific heat of any fluid at constant pressure. Swann's values for air at 20° and 100° C. were closely consistent with those of Joly at constant volume (*see* 5.67), and gave a ratio of specific heats very nearly equal to 1·40, as required by the kinetic theory for a diatomic gas. They also showed a very small increase with temperature at the rate of only one-half of 1 % for 100° C. His values for CO_2 verified with improved accuracy the rapid increase with temperature found by Regnault and Wiedemann for this gas, which amounted to 12 % for 100°. This increase of specific heat was not accounted for on the kinetic theory, which required that all the degrees of freedom of a gas molecule should be equally excited, and should contribute constant terms to the specific heat. The apparent discrepancy was explained (*B. A. Rep.*, 1908, p. 340) by supposing that a natural frequency of the gas-molecule would be excited by radiation in direct proportion to the intensity of the corresponding frequency at each temperature. It was shown that a natural frequency having a wave-length of the order of 15 microns would be competent to produce the observed effect in the case of CO_2, contributing, when fully excited, a term R to the specific heat. An attempt was accordingly made to investigate the relation between the variation of the specific heat of gases and the absorption and emission bands in their infra-red spectra. Some qualitative agreement was found, but it was very difficult to make quantitative measurements of the kind required, or to frame a consistent theory. For instance, there is a strong band at 4·4–4·5 microns both in the emission and absorption spectra of steam. This band corresponds to the maximum ordinate of the wave-length spectrum of full radiation at a temperature T=647° C., the critical point of water, and appears to be closely related to other properties of steam. There is no doubt

that the properties of any substance are intimately related to the natural frequencies of the molecules, but the form of the relation cannot be predicted with certainty; and the quantitative measurements are not yet sufficiently exact to distinguish between many possible hypotheses.

The experiments of A. Eucken (*Sitz. Akad., Berlin*, 33.1, p. 141, 1912) on the specific heat of hydrogen at low temperatures were very instructive in this connection. The gas was electrically heated at various temperatures in a thin steel vessel under considerable pressure at constant volume. The specific heat was found to diminish from nearly $5R/2$ at ordinary temperatures to nearly $3R/2$ at $T=60°$, after which it remained practically constant down to $T=35°$. The experiments were undoubtedly of considerable difficulty, but there seems no reason to doubt their substantial accuracy.

Eucken's results have recently been confirmed with remarkable precision by J. H. Brinkworth (*Proc. Roy. Soc.* (A) 207, p. 542, 1925) using an entirely independent method of experiment. He observed the cooling effect in adiabatic expansion with a compensated platinum thermometer at various temperatures between 20° C. and −183° C., and deduced the corresponding values of the ratio of the specific heats at constant pressure and at constant volume. The actual specific heats at any temperature could be deduced with certainty from these observations. This method is unaffected by the thermal capacity of the containing vessel, whereas in Eucken's method the thermal capacity of the vessel must be known with considerable accuracy. Brinkworth also showed that the heat-loss could be most satisfactorily eliminated by using vessels of different sizes. Assuming that the variation of the specific heat was due to the response of some particular frequency of the molecule to the same frequency in natural radiation at each temperature, he states that Callendar's radiation formula fits the observations better than Planck's but that satisfactory agreement cannot be obtained by assuming a *single* frequency. Reiche's calculations do not seem to improve the agreement. The effect is probably due to an absorption band of $\lambda=25$–30μ in the infra-red.

Specific Heat of Solids at Low Temperatures.—The early experiments of Sir J. Dewar, Sir W. A. Tilden and others, had shown that solids at low temperatures deviated from Dulong and Petit's law of the constancy of atomic heat in the same way as carbon, boron and silicon, at ordinary temperatures, but they failed to show the full extent of the deviation, or to indicate a probable explanation. A. Einstein suggested (*Ann. Phys.*, 22, p. 180, 1907) that the atom of a solid might be regarded as an electric resonator with three degrees of freedom possessing a particular frequency, independent of the temperature, and capable of responding to the same frequency of radiation. Adopting Planck's theory and radiation formula, he showed that the specific heat at constant volume should approach the limit $3R=5{\cdot}94$ calories per gram-atom at high temperatures, as required by Dulong and Petit's law, but that the variation at low temperatures should be given by the expression

$$s=3Rz^2e^z/(e^z-1)^2=3Rf(z) \qquad (2)$$

where $z=\beta\nu/T=C/\lambda T$, as in Planck's formula. The symbol ν denotes the natural frequency of the atoms, and λ the corresponding wave-length in cm. such that $\nu\lambda=\Lambda=3\times10^{10}$, the velocity of light. The constant, $\beta\Lambda=C$, is Wien's constant of radiation. Taking H. F. Weber's observations on the variation of the specific heat of the diamond, extending from $T=222°$ to 1258°, Einstein showed that they agreed qualitatively with this formula, if we could assume the diamond atoms to possess a single frequency corresponding to the wave-length 11 microns. Taking the substances, CaFl, NaCl, KCl, $CaCO_3$ and SiO_2, for which the optical frequencies in the infra-red were known, he showed that the frequencies agreed in order of magnitude with those required by his formula, but that the observed wave-lengths were somewhat shorter than those calculated from the specific heats. This could be attributed to the fact that most of the substances showed more than one frequency, and that the frequencies were not strictly monochromatic, as indicated by the width of the corresponding absorption bands. In any case there were other effects, such as work of expansion, included in the specific heats as ordinarily measured, and it might be doubted whether the optical frequencies corresponded exactly with the thermal vibrations of the atoms.

An important series of experimental measurements, extending down to the temperature of liquid hydrogen, was made by W. Nernst, F. A. Lindemann and their collaborators (*Sitz. Akad., Berlin*, p. 494, 1911), on a number of metals and other solids, including those for which the optical frequencies were known. They found, as already indicated, that Einstein's formula gave too low values for the specific heats at low temperatures, if the optical frequencies were assumed in calculating the value of $f(z)$, and that much better agreement could be obtained by taking the mean of $f(z)$ for the optical frequency, and a similar term, $f(z/2)$ at half the optical frequency:—

$$s=3R[f(z)+f(z/2)]/2=3Rf''(z) \qquad (3)$$

The same function, $f''(z)$, of z was assumed to apply to other substances, such as the metals, but the appropriate values of z were selected to fit the observations on the specific heats. Some substances, such as SiO_2 (in the forms of quartz and quartz-glass) and benzine, C_6H_6, which gave a different type of curve, were represented by formulae with two or three different values of z, each value of $f''(z)$ being multiplied by a fractional coefficient representing the proportion in which the corresponding molecule was supposed to be present. But such cases could not be regarded as a verification of the theory, because it would obviously be possible to represent almost any type of variation in this way. Einstein objected that even the simplest of these formulae, namely (3), was too empirical to be satisfactory from a theoretical standpoint; that a cubical crystal, such as KCl, or NaCl, could not have two different frequencies; and that there was no evidence in either case of an optical frequency with half the experimental value, since, according to Rubens, the crystals became again transparent before this frequency was reached, and had a value of the refractive index which was nearly normal. He also indicated two other objections to the "quantum" theory on which Planck's formula was based. (1) According to the quantum theory it did not follow, as required by the classical mechanics, that the oscillator with three degrees of freedom would have three times the energy of a linear oscillator. (2) It was very difficult to conceive the distribution of energy among the oscillators at low temperatures required by the theory. Thus for the diamond at $T=73°$ only one molecule in 100 millions would possess a single quantum of energy, all the rest would be absolutely quiescent. It was physically impossible to conceive such a distribution of energy, which moreover would make the thermal conductivity of the diamond at such temperatures entirely negligible, whereas, according to Eucken, it was nearly as great as that of copper at ordinary temperatures. For these reasons Einstein preferred to rely mainly on the expression for the energy of an electric oscillator in equilibrium with radiation as deduced from Maxwell's equations, and to regard Planck's formula for the distribution of energy in full radiation simply as representing the results of experiment.

Debye's Theory of Specific Heat of Solids.—The theory now most commonly accepted is that of P. Debye (*Ann. Phys.*, 39, p. 789, 1912), who attributes the heat energy to mechanical or acoustic vibrations of the solid with all possible frequencies up to a certain limit ν_m. According to a theorem attributed to the late Lord Rayleigh (*Sound*, i., p. 129, 1877) the number of possible degrees of freedom of a system of N discontinuous mass-points will be 3N. According to another theorem by the same author (*Phil. Mag.*, 49, p. 539, 1900), the number of possible frequencies in a given volume of a *continuous* medium between the limits ν and $\nu+d\nu$ may be represented by $C'\nu^2d\nu$, where C' is a constant depending on the volume and the velocity of propagation. The total number of possible frequencies from 0 up to a limit ν_m is $C'\nu_m^3/3$. If we equate this to 3N, we find $C'=9N/\nu_m^3$. Adopting Planck's expression for the energy of an electric oscillator with one degree of freedom as applying to each possible frequency of the N atoms in a gram-atom, we obtain the energy $(RT/N)z/(e^z-1)$ for each frequency. Multiplying this by the number of frequencies between ν and $\nu+d\nu$, namely $(9N/\nu_m^3)\nu^2d\nu$, and integrating from 0 to ν_m, we obtain the energy of a gram-atom at T, from which the specific heat at constant volume is obtained by differentiation with regard to T. Unfortunately the integral cannot be expressed in finite terms and is too complicated to reproduce here. It is evident, however, that it will be a function of z_m, or $\beta\nu_m/T$, or T_m/T, where $T_m=\beta\nu_m$.

Thus the *form* of the curve representing the variation of the specific heat (which depends on a single parameter T_m or ν_m) is the same for all substances on Debye's theory, if the temperature scale is altered for each in proportion to ν_m. This point has been very carefully tested by E. H. Griffiths and E. Griffiths (*Phil. Trans.*, A, 214, pp. 319–357) for the metals Al, Ag, Cd, Cu, Fe, Na, Pb, Zn. Their results indicate qualitative agreement with the theory, but show characteristic differences, greatly exceeding the limit of experimental error, which may possibly be attributed to other effects not included in the simple theory. Thus the curve for Fe differs from that for Cu by nearly 20% between corresponding temperatures, which may be attributed to the magnetic properties of Fe. The curve for Na shows a rapid rise towards the melting point, reaching an excess of 25% above 3R, followed by a diminution of specific heat for the liquid, as in the case of water and mercury. Many simple compounds, such as NaCl, show curves of a very similar type to the metals, which has been used as an argument that the specific heat must be attributed entirely to the atoms, and that the free electrons supposed to exist in metals cannot make any appreciable contribution. Thus if there were two free electrons per atom, as required by some theories, the electrons alone would account for the whole specific heat according to the kinetic theory at ordinary temperatures; and it would be necessary to suppose that the number of free electrons diminished to zero at low temperatures, which would make it difficult to account for the enormous increase in electric conductivity of pure metals demonstrated by Kamerlingh Onnes in the neighbourhood of the absolute zero.

One of the commonest objections to Debye's theory is the arbitrary nature of the assumption of an abrupt limit of frequency ν_m. This assumption is made on account of its simplicity, but is highly improbable from a physical standpoint, though it might be expected to give results of the right order of magnitude. W. Sutherland (*Phil. Mag.*, 20, p. 657, 1910) had previously shown that the wave-length of the elastic vibrations of solids was of the same order of magnitude as the distance between the atoms for frequencies corresponding to the optical frequencies in the infra-red, so far as these were known. If the forces holding the atoms in place in a crystal lattice are electromagnetic, as commonly assumed, we should expect that the energy would be shared between matter and aether, and that the natural frequencies of the optical and mechanical vibrations would be the same. The wave-length and velocity of the natural

frequency as measured outside the crystal would be reduced inside the crystal in the same proportion as the ratio of the velocity of light to that of an elastic vibration, or of the wave-length outside the crystal to the lattice constant, *i.e.*, in the case of rocksalt, NaCl, about in the ratio 2×10^5 to 1. Since the energy in the cube of the wave-length remains constant, the energy-density of the external radiation of the natural frequency would be increased in the cube of this ratio, and would be of the right order of magnitude to explain the specific heat of the solid on the usual theory of resonance as applied by Einstein. We have seen, however, that the assumption of Planck's radiation formula gives too low a value for the specific heat at low temperatures on Einstein's theory. If on the other hand we interpret Lord Rayleigh's formula, namely $C'Te^{-z}\nu^2d\nu$, as representing the *partial pressure* $pd\nu$ of radiation between the limits of frequency ν and $\nu+d\nu$, the latent heat of emission or absorption of radiation per unit volume between the same limits, according to Carnot's principle, is represented by the expression

$$T(dp/dT)=C'T\nu^2(1+z)e^{-z} \qquad (4)$$

and the total heat of a gram-atom of solid in equilibrium with radiation having this distribution of energy is given by

$$H=3RT(1+z)e^{-z} \qquad (5)$$

The specific heat as ordinarily measured, when the external pressure is small as compared with internal pressure, will be simply

$$s=3R(1+z+z^2)e^{-z} \qquad (6)$$

This expression, unlike that similarly deduced from Planck's formula, gives good agreement with the observed value of the specific heat in the case of rocksalt, when the optical frequency corresponding to 51 microns is assumed, at a temperature corresponding to the maximum of the frequency curve, where $z=2\cdot732$, $T=100^\circ$, and $s=8\cdot67$ (doubled for a gram-molecule of NaCl). We should expect to get good agreement at this point, in spite of the fact that the actual vibrations in a solid cannot be strictly monochromatic (as Einstein pointed out) but extend for a distance of an octave or more on either side of the maximum, as indicated by the absorption spectrum. The effect of this is to reduce the steepness of the monochromatic curve, bringing it into good agreement with observation at high and low temperatures, without materially affecting the agreement at the mean point corresponding to the maximum of the frequency curve. If we assume the value $\lambda_mT=0\cdot290$ for the wave-length λ_m (corresponding to the maximum ordinate of the wave-length spectrum of full radiation at T), in deducing the appropriate value of Wien's constant $\beta\Lambda$ in formula (4), the maximum ordinate comes out the same as in Planck's formula, provided that the same value of the Stefan-Boltzmann constant σ is assumed in the fourth power law σT^4 for the total radiation. The two curves also agree so closely throughout their whole extent that it would be very difficult to decide between them by experiments on radiation. We should therefore be justified, according to Einstein's reasoning, in applying formula (4) in the deduction of the specific heat of a solid, especially when we find that the result gives such good qualitative agreement with the optical frequencies.

An obvious objection to Debye's theory in the case of transparent substances, such as quartz and rocksalt, is that, if the atoms have all possible frequencies below a certain limit, they ought to be completely opaque in this region, and to become suddenly transparent when the limit ν_m is surpassed. Experiment shows, however, that, *e.g.*, quartz, which begins to be opaque at about four microns, and has optical frequencies corresponding to 9 and 21 microns approximately, and possibly one lower, becomes almost perfectly transparent below 100 microns. The variation of its specific heat is of an entirely different type to that given by Debye's theory but corresponds closely, according to formula (4), with its optical frequencies. Ice and benzol, which are also hexagonal, show a variation of specific heat similar to quartz, according to Sir J. Dewar. The corresponding optical frequencies have not yet been observed, but it appears that water must have some frequencies below 100 microns to account for its remarkable opacity to long wave-lengths, and the variation of its specific heat. We should naturally expect that the torsional vibrations of an elastic solid, which are of the same kind as those of light, would be excited by radiation, and would be intimately connected with the optical frequencies. It is quite possible, however, that the compressional vibrations, which are of a different type, and propagated with a different velocity (that of sound), would continue to exist at low temperatures without affecting the transparency. These acoustic vibrations, though not capable of being excited directly by radiation, would be necessarily excited by the impacts of the molecules of the surrounding gas, with a distribution of energy corresponding to the Maxwellian law, and might be expected to provide a term in the specific heat of a somewhat similar character to the Debye term for compressional waves at low temperatures. It is noteworthy that Nernst and Lindemann in their latest reductions have found it necessary to retain the original Einstein term $f(z)$ for transparent substances in their formula (3), but have replaced the hypothetical term $f(z/2)$ by a term of the Debye type. The appropriate frequencies are calculated in most cases by Lindemann's semi-empirical formula from the molecular weight m, the atomic volume V, and the temperature of fusion T_f, but with different values of the constants for the two terms, as follows:—

$$\nu_e=2\cdot12\times10^{12}(T_f/m)^{1/2}V^{-1/3}$$
$$\nu_m=3\cdot08\times10^{12}(T_f/m)^{1/2}\ V^{-1/3} \qquad (7)$$

of which the first gives the optical frequency of Einstein and the second that of Debye. The cube root of the atomic volume is proportional to the lattice constant, and the elastic constants of a solid must be closely related to the temperature of fusion. Nernst and Lindemann assign equal importance to the two terms, but we should naturally expect from elastic theory, as given by Debye and other previous writers, that the numerical coefficients should have different values, and should be proportional to $1/u_1^2$ for the compressional waves, where u_1 is the velocity of sound, and $2/u_2^2$ for the torsional waves, where u_2 is the velocity of light *in the solid* for the particular optical frequency considered. This may not fit so well with Planck's radiation formula for the Einstein term, but appears to give better agreement with experiment if formula (4) is substituted for Planck's. The appropriate frequencies cannot be calculated from the elastic constants for a discontinuous medium without introducing arbitrary hypotheses, which are unsatisfactory, because the effect of the hypothesis selected is most important at the point where the discontinuity commences and it is difficult to avoid selecting an hypothesis to give the desired result. There is the further difficulty that the values of the elastic constants are somewhat uncertain and liable to vary with temperature and to depend on the particular specimen tested, especially with metals.

Sir J. Dewar (*Proc. R. S.*, 1913, A, 89, pp. 158–169) has measured the mean specific heats of the elements between the boiling points of hydrogen and nitrogen by means of his liquid hydrogen calorimeter. The results for the specific heats, when plotted against the atomic weights, give a curve showing a most remarkable coincidence with the well-known curve of atomic volume as a periodic function of the atomic weight. In other words, the specific heat is nearly proportional to the atomic volume, or to the cube of the lattice constant, for similar substances, at this low temperature, corresponding to a mean about $T=50^\circ$. The relation does not pretend to be exact, though it is a fair approximation over the range 20° to 80°, but it illustrates the point that the atomic volume is the most important factor in determining the frequencies.

In the case of the metals, which are opaque to all frequencies below a certain limit, we should expect the possible frequencies to extend over a considerable range, and to be grouped about a mean in a similar way to the velocities of gas molecules on the kinetic theory. But there are many possible alternatives to the somewhat arbitrary hypothesis of Debye. We might suppose, for instance, that of N molecules in a gram-molecule, the number possessing the frequencies between the limits ν and $\nu+d\nu$ was represented by an expression of the type

$$(N/2)e^{-x}x^2dx \qquad (8)$$

in which $x=\nu/\nu_0=\beta\nu/T_0=\theta z$, where z denotes $\beta\nu/T$, and $\theta=T/T_0$. Multiplying this by expression (6) divided by N for the specific heat of a single molecule of frequency ν, at a temperature T, and integrating the product from 0 to ∞, we obtain for the specific heat of a gram-molecule

$$s=3R(\theta^3/(1+\theta)^3)(1+3/(1+\theta)+12/(1+\theta)^2) \qquad (9)$$

This is much simpler than Debye's expression, but gives a very similar curve. The *mean* frequency, $\nu_m=3\nu_0$, is nearly the same as Debye's limiting frequency. More accurately, Debye's characteristic temperature corresponds to $2\cdot91T_0$, in place of $3T_0$, on account of the difference in the values of the constant β, which are in the ratio $4\cdot9651/4\cdot8284$ in Planck's and Rayleigh's formulae for radiation. If Debye's scale is multiplied by $2\cdot91$, his curve agrees very closely with (9) from $\theta=0\cdot6$ to $\theta=1\cdot0$. Below $\theta=0\cdot6$, (9) agrees better with the Nernst-Lindemann curve (3), except that (9) tends to vary as T^3 at very low temperatures, instead of vanishing exponentially. Above $\theta=1$, the curve (9) lies above Debye's by a quantity corresponding to the difference of the specific heats at constant pressure and volume. This is to be expected, because (9) represents the rate of change of total heat, which is the same as that of intrinsic energy for all practical purposes under the condition of small external pressure and negligible expansion. Thus in the case of water under atmospheric pressure, the increase of total heat between 0° and 100° C. is 100 cals. C., and exceeds that of intrinsic energy between the same limits by only 0·001 cal. C., which is 100 times smaller than the limit of accuracy of observation; whereas the change of total heat *at constant volume* between the same limits in the case of water exceeds that of intrinsic energy by 21 cals., approximately; but the correction from constant volume to constant pressure is very uncertain, even in the best known cases. It therefore appears to be more logical to employ a formula giving the specific heat at constant pressure directly, in place of applying an uncertain correction. It should be observed, however, that (9) assumes the mean frequency ν_m to be independent of T, as in Debye's formula, which may be a good approximation in many cases, but cannot be exactly true if the molecule changes its state. Curve (9) reaches $s=3R$ a little above $\theta=2$, attains a maximum $3\cdot195R$ at $\theta=4$, and falls again to 3R at $\theta=\infty$. The fall is of the right

order of magnitude to explain the diminution of specific heat in the case of water, mercury and sodium. The distribution postulated in (8) appears to apply fairly to most of the metals, but it fails notably for many other substances. Such cases might be treated empirically by modifying the distribution, or assuming special frequencies, but such hypotheses would be of little value unless their physical meaning could be interpreted with reference to other properties of the substances.

Conduction of Heat

In 1910 the very attractive theories of P. Drude and H. A. Lorentz were still commonly maintained, and were continually being applied to the explanation of electrical and thermal effects. According to their views a metal contained a number of free electrons moving in all directions with velocities corresponding to those of gas-molecules on the kinetic theory. Drude showed that this assumption led to an approximately correct value of the ratio of the thermal to the electric conductivity in the case of pure metals, and Lorentz showed that it accounted for the long wave radiation from hot bodies. There were numerous other applications of the theory which appeared to correspond in a remarkable manner with experimental facts, but there were also serious difficulties which appeared to render the adoption of such a theory premature.

The fluid state of scientific opinion on the subject in 1911 is well illustrated by the views expressed about that time by J. H. Jeans. In the report of the Solvay Congress, 1911, *On the Theory of Radiation and Quanta* (Gauthier Villars, Paris, 1912), assuming that there were two free electrons per atom of the metal, Jeans took the view that the specific heat of metals was entirely due to the movement of free electrons and not at all to the movements of the atoms, " a hypothesis which accords well with our knowledge of the internal movements of solids." On the other hand, in his report on the quantum theory (*Phys. Soc.*, London, 1914), he adopted the theory of Debye (according to which the specific heat was entirely due to the movements of the atoms) as probably " destined to be final," and concluded that the free electrons do not contribute sensibly to the specific heat.

Sir J. J. Thomson, *Corpuscular Theory of Matter* (1907), had already pointed out that the number of free electrons required to explain thermal and electric conductivity was too large to reconcile with the facts of specific heat on the assumption that the electrons possessed the same energy of agitation as gas molecules at the same temperature, and had proposed an alternative theory (*loc. cit.*, p. 86) previously suggested in his *Applications of Dynamics to Physics and Chemistry* (1888). According to this view, the metallic atoms, owing to their close proximity in the solid state, were capable, under the influence of an electric field, of forming Grotthus chains, along which they could exchange electrons. There were no free electrons in the sense contemplated by Drude and Lorentz, with velocities depending on the temperature and contributing to the specific heat, but the thermal agitation of the atoms tended to break up the chains, so that their number and length varied with the electric field in the manner required to explain the relation between electric and thermal conductivity and many other effects.

In a later paper (*Proc. Phys. Soc.*, 27, p. 527, 1915), the same theory was applied to explain the striking phenomena of superconductivity discovered by Onnes, who found that at very low temperatures, in perfectly pure metals, a current once started might continue for days instead of stopping almost instantaneously on the cessation of the exciting field. According to J. J. Thomson's theory, it would naturally follow that, below a certain point, the thermal agitation would be insufficient to break up the chains when once they were formed, which would explain why it is that the electric resistance of most pure metals tends to vanish (apart from impurities) at a temperature *above* the absolute zero. A working hypothesis of this kind is very useful to the experimentalist as affording a mental picture of the physical conditions, and may help to explain the remaining difficulties with regard to the specific heats.

Conductivity of Gases.—Prof. Knudsen drew special attention (*Solvay Report*, p. 133) to the data for the thermal conductivity of gases, as being more scarce and discordant, owing to experimental difficulties, than determinations of other properties, and as requiring attentive examination for the elucidation of the law of action between molecules. The hot-wire method of T. Andrews (*Phil. Trans.*, 1840) offers special facilities for relative measurements, such as the comparison of conductivities of different gases, or of the same gas at different temperatures, and has frequently been applied with this object in recent years. It has also been improved by introducing the usual compensation for end-effects, and employing more accurate methods of electrical measurement. But it remains liable to the difficulties depending on the small dimensions of the wire, and the uncertainty of the corrections for convection and radiation. For these reasons the parallel plate method, adopted by E. O. Hercus and T. H. Laby (*Proc. R. S.*, A, 95, p. 190, 1918) for measuring the *absolute* conductivity of air, deserves special mention, owing to the great care with which the method was applied, and the complete elimination of convection effects. They also give a very complete reduction of previous results for different gases with the view of testing the value of the numerical coefficient f in the relation, $k=f\eta s$, between the conductivity k, the viscosity η, and the specific heat s at constant volume. According to the theoretical investigations of S. Chapman (*Phil. Trans.*, A, 211, p. 433, 1911) the value of the coefficient f should be 2·5 for a gas constituted of spherically symmetrical molecules, which agrees with Maxwell's theory based on the inverse fifth-power law of force, and also with experiment for monatomic molecules. Unfortunately the variation of viscosity with temperature does not satisfy the fifth-power law, which requires that the viscosity should be directly proportional to T. The conclusion is that monatomic gases may have spherically symmetrical molecules, but that the law of force is different. Theory gives no clear indication with regard to the appropriate value of f for other types of molecules. Experiment gives approximately a linear relation, $f=2{\cdot}816\gamma-2{\cdot}2$, between f and the ratio of the specific heats. This gives $f=7/4$ for diatomic gases, which show fair agreement with each other. The experimental values for polyatomic gases are much less certain.

Thermodynamics

Since the general principles of thermodynamics have not undergone any material change for the last 50 years, it will readily be understood that such progress as there is to record relates chiefly to matters of expression or convention, and to the practical application of the principles to engineering problems. The evolution of the steam turbine and the internal combustion engine, along thermodynamical lines, has illustrated the importance of an exact and consistent theory of the conditions limiting the efficiency, and of an accurate experimental study of the properties of the working fluid in either case. Thus the improvement of the internal-combustion engine has depended greatly on the extension of the thermodynamical efficiency of the cycle by using higher compression-ratios, which has necessitated careful attention to the reduction of heat-losses, to the properties of various fuels in respect of detonation, and to the specific heats of the products of combustion at high temperatures.

The displacement of the reciprocating engine by the turbine for large power units has similarly depended on the possibility of improving the economy by utilising high vacua. The high speed of the turbine has directed special attention to the importance of losses due to friction and supersaturation, which depend on the rapidity of expansion. The turbine realises the ideal condition of steady flow with an exactitude unattainable by the reciprocating engine. This has made it worth while for engineers to adopt the thermodynamical definition of total heat first proposed by Callendar in the 10th ed. of the *E.B.*, in place of Regnault's definition, which had sufficed for many years, but continually gave rise to minor difficulties and complications when applied to the turbine. In the article cited, and as repeated in the 11th ed. (*see* 26.811), the total heat was defined as the thermodynamic function E+PV, and was denoted by the special symbol F in order to distinguish it from Regnault's total heat H, representing the quantity of heat added to the fluid under the condition of constant pressure equal to that of vaporisation. By general convention, the symbol H has now been defined as representing E+PV, a property of the substance depending only on the state, and the symbol Q has been allocated to any quantity of heat added under special conditions.

Equations of Steady Flow.—These depend on the law of conservation of mass, and on the law of conservation of energy, of which they afford some of the simplest possible illustrations. If a fluid is flowing steadily at a constant rate M (mass per second) through a

circuit (pipe or nozzle) of variable cross-section X, at a point where the mean volume is V per unit mass, and the mean velocity U units of length per second, we have $MV = kUX$, where the constant k is unity in any consistent system of units, *e.g.*, if U, X and V are measured in ft., sq. ft. and cu. ft. respectively. It is common practice, however, to measure X in sq. in., which must be reduced to sq. ft. by putting $k = 1/144$; and similarly for other arbitrary systems. If we consider any two points (1 and 2) of a circuit for which M and X are known, the relation $MV = kUX$ makes it possible to determine either U or V at each point if the other is known. A second relation is obtained from the conservation of energy. Suppose for example that the points 1 and 2 represent the admission and exhaust of a turbine. When the flow is steady, for each unit mass entering at 1, unit mass must leave at 2. Unit mass entering at 1 carries with it its intrinsic energy E_1 and its kinetic energy $U_1^2/2g$, in addition to which work P_1V_1 is done by the pressure P_1 in forcing the volume V_1 into the turbine. Reducing these to heat units by the appropriate numerical factors, a and J, we have finally for the total energy entering the turbine with each unit mass of fluid, $H_1 + U_1^2/2Jg$, where H_1 is the initial value of the total heat, which is always tabulated in heat units per unit mass. Similarly the total energy carried out per unit mass at 2 is $H_2 + U_2^2/2Jg$. Since the total quantity of energy existing in the turbine remains constant when the conditions are steady, the excess of the energy carried in over that carried out must be equal to the external work W/J done by the turbine together with the external heat-loss Q, both expressed in thermal units per unit mass passing through the turbine. We thus obtain the general equation representing the conservation of energy:—

$$\text{Heat-Drop, } H_1 - H_2 = W/J + Q + (U_2^2 - U_1^2)/2Jg \qquad (10)$$

The reduction factors, a, J, g, can be omitted for absolute or C.G.S. units, but it is better to retain them explicitly, because the various quantities can seldom or never be measured in absolute units in practical work and the retention of the symbols saves much trouble and many mistakes.

In this equation, as applied to a turbine, the term W/J, representing the external work, is the most important on the right-hand side. The external heat-loss Q, and the leaving-loss, depending on the kinetic energy wasted in the exhaust, can be reduced to small corrections, which are readily applied. The external work is the equivalent of the corrected heat-drop, which can be calculated if the initial and final states of the steam are known. The equation takes exact account of any work wasted in internal friction, which does not appear explicitly in the equation because it affects both sides equally. The same equation can be applied to a reciprocating engine, or to any appliance admitting of steady flow.

Joule and Thomson (*Phil. Trans.*, 1854–62; *Proc. R. S.*, 1856) were the first to employ the function E+PV in their experiments on the flow through a porous plug or orifice. They discussed the various terms in the equation with great precision, but did not apply it to a steam engine, which was first done by Hirn and Rankine, though the equation is commonly attributed to Zeuner. In an ideal throttling experiment, such as that designed by Joule and Thomson, the equation shows that the total heat remains constant, $H_1 = H_2$, provided that $U_1 = U_2$ and that W and Q are negligible. The lines of constant total heat on the PT diagram can be determined by observing the initial and final values of P and T in a sufficient number of throttling experiments. It is then possible to deduce the actual values of H under any conditions by measuring the specific heat and latent heat at any one pressure, preferably atmospheric for most fluids.

In applying the equation to the discharge through an orifice Joule and Thomson showed that the kinetic energy generated was equivalent to the drop of E+PV, or H, which follows immediately from equation (10) if W and Q are negligible. In the usual case, starting from rest, U_1^2 is negligible as compared with U_2^2, so that U_2 is given by the simple relation

$$U_2 = (2Jg)^{\frac{1}{2}} (H_1 - H_2)^{\frac{1}{2}} \qquad (11)$$

For given conditions, V_2 is known in terms of H_2 and P_2, so that the discharge M/X per unit area can be deduced by applying the relation $M/X = kU/V$. Joule and Thomson showed that the discharge would reach a maximum in the case of air under adiabatic conditions when the final pressure after passing the orifice was 0·52 of the initial pressure, a result which had previously been deduced in a similar way by de St. Venant and Wantzel (*Comptes Rendus*, 1839) from Poisson's equation for the adiabatic, namely $PV^\gamma = \text{constant}$. They also showed that the velocity of the discharge under this condition was simply related to the velocity of sound in the air at the original temperature and pressure, but they failed to interpret the relation. Osborne Reynolds (*Phil. Mag.*, 1886, p. 194), using the same equations for a perfect gas, showed that the velocity at the throat or minimum area of the stream was *the same* as that of sound in the gas under the same conditions, so that, when this velocity was reached, no further lowering of pressure beyond the throat could possibly increase the discharge. The same result is easily shown to apply to any fluid, either liquid or gas, in the absence of friction. The condition that M is to be a maximum for a given value of X gives $d(M/X) = 0$, whence $dU/dV = U/V$. Eliminating dU/dV by differentiating (11), we obtain, for isentropic flow (Φ const.)

$$U^2 = aJgV(dH/dV)_\phi = aJgV^2(dP/dV)_\phi \qquad (12)$$

which is the expression for the velocity of sound. This equation also gives the maximum discharge by substituting M/X for kU/V.

In steady-flow calorimetry the drop of H between given initial and final states can be deduced from equation (10) by observing the quantity of heat Q which must be abstracted, under conditions such that W and U^2 are negligible. The pressure is usually constant, but if there is a large drop of pressure between the initial and final states, as in Regnault's experiments on the total heat of water, the difficulty is avoided, without changing H_1, by using a throttle, which is precisely what Regnault did, though he was unable, owing to the defective state of thermodynamics at that time (1847), to appreciate the exact effect of this proceeding. The same method can be applied for measuring the total heat of steam in any state, including the latent heat. In all cases of steady flow the quantity measured is the change of total heat, which is the most important property to determine for steam engines or refrigerating machines working on any modifications of the Rankine cycle. On the other hand the intrinsic energy E is the property required for the constant volume cycle of the internal-combustion type.

A very simple and instructive illustration of the equation of steady flow is that of the temperature gradient in a fluid under gravity. If a current of air is flowing steadily upwards at a moderate speed, the external heat-loss Q and the change of kinetic energy are negligible, and the drop of total heat is equivalent to the work done against gravity, giving $W/J = 1$ calorie C. for each 1,400 ft. of ascent. This would evidently be the same for any fluid whatever. In the case of dry air the specific heat is nearly independent of the temperature and pressure, and the change of H is equal to $S(t_1 - t_2)$, where $S = 0{\cdot}241$ is the specific heat at constant pressure. The drop of temperature will therefore be $1/0{\cdot}241 = 4{\cdot}15°$ C. in 1,400 ft.; or the temperature gradient, 0·296° C. per 100 ft. This result is evidently quite independent of the initial temperature, or pressure, or height, so long as we can afford to neglect the small variations of S and g. In an ascending column of *damp* air, condensation sets in with formation of cloud as soon as the temperature falls below the dew point. The drop of H remains 1 calorie per 1,400 ft., but the temperature gradient is greatly reduced by the liberation of the latent heat of the vapour. On the other hand, in a descending current, as in the ventilating shaft of a mine, the temperature increases with depth at the rate of nearly 3° C. per 1,000 ft., which, however, is usually much less than the natural gradient of underground temperature (due to outflow of heat through the earth's crust), which sometimes exceeds 10° C. in 1,000 ft. In this case there will be no condensation, but the air may be cooled by evaporation, if the mine is kept wet to reduce dust, as is usually the case.

According to equation (10) the rate of increase of temperature with depth, denoted by dt/dx, is equal to $1/JS$, and is uniform in adiabatic flow if S is constant. The *pressure* gradient, dp/dx, in gravitational units, is equal to the density $1/V$, or p/JRT, if R is expressed like S in calories per 1°. Dividing by dt/dx, we have $dp/dt = Sp/RT$, giving the adiabatic equation, which is commonly assumed as the starting point to find the temperature gradient. But the reverse order is more instructive as showing why the temperature gradient dt/dx is uniform.

Properties of Radiation.—The flow of heat by radiation from one body to another at a lower temperature is the commonest case of steady flow. Owing to the high velocity of radiation and the absence of thermal capacity in the circuit, the steady state is established in a small fraction of a second if the temperatures of source and sink are constant. The quantity measured in a radiation experiment is not the energy E of the radiation, as is frequently assumed, but the total heat E+PV, which is the same in the case of radiation as the latent heat of emission, namely $VT(dP/dT)$, for a volume V, according to Carnot's principle. This is universally admitted in the deduction of the fourth-power law (*see* 13.155), which follows from the fact that the pressure of full radiation is one third of the energy-density, so that the latent heat of emission per unit volume is four times the pressure. The quantity directly measured in experiments on full radiation is the quantity of heat emitted per sq. cm. per second from a black-body or perfect radiator at a temperature T, and is denoted by σT^4, where σ is the Stefan-Boltzmann constant of full radiation. By the geometrical conditions of the problem, the quantity σT^4 is $\Lambda/4$ times the latent heat per unit volume, or $\Lambda/3$ times the energy-density in an isothermal enclosure at T, where Λ is the velocity of light. The qualitative verification of the fourth-power law requires only a receiver capable of giving correct relative values of the radiation received, and is now generally accepted as satisfactory; but the absolute measurement of the value of the constant σ is a much more difficult problem, which has frequently been attacked in recent years without obtaining so high a degree of concordance as is desirable in so fundamental a research. The value $5{\cdot}32 \times 10^{-5}$ ergs per sq. cm. per second, found by F. Kurlbaum in 1898 (*see* 13.155), was accepted for several years, though it rested on a somewhat doubtful value of the absorption coefficient of the bolometer. Moreover, the assumption that the radiant energy measured was equivalent to the electric energy required to

produce the same rise of temperature in the bolometer, was rendered somewhat uncertain by conduction effects at the ends of the strips. A similar bolometer, with the end-effects compensated, as employed in the solar eclipse of 1905, gave the somewhat higher value $5{\cdot}60\times10^{-5}$. Kurlbaum (1912) gave the corrected result $5{\cdot}45\times10^{-5}$. F. Paschen and W. Gerlach, by a modification of Ångström's method (*Ann. Phys.*, 38, p. 41, 1912), found the value $5{\cdot}80\times10^{-5}$, which was confirmed by G. A. Shakespear (*Proc. R. S.*, A, 86, p. 180, 1912), and by H. B. Keene (*Proc. R. S.*, A, 88, p. 49, 1913), who found $5{\cdot}67\times10^{-5}$, and $5{\cdot}89\times10^{-5}$, respectively. W. Coblentz (*U.S. Bur. St.*, 12, p. 553, 1916), by a method similar to that of Paschen and Gerlach, found the value $5{\cdot}72\times10^{-5}$, which is a fair mean of the previous results. One of the most promising methods is that of the radio-balance (*Proc. Phys. Soc.*, 23, pp. 1–34, 1910), in which radiation received through a measured aperture is completely absorbed in a small copper cup, and is compensated by the Peltier cooling-effect due to a current through a thermojunction. Unfortunately, these experiments were interrupted by the War, and the final reductions have not yet been completed. There seems to be little doubt that Kurlbaum's original value was too low, but there are many pitfalls in such difficult experiments, and most of the methods adopted are liable to some objections.

It is generally admitted that the distribution of energy in the spectrum may be represented within the limits of experimental error by Planck's formula (*see* 13.156), namely,

$$E d\lambda = C'\lambda^{-5} d\lambda/(e^{c''/\lambda T}-1) \qquad (13)$$

If this formula is integrated from 0 to ∞, and equated to σT^4, assuming that it represents the distribution of energy in the spectrum as observed experimentally, we find for the constant C', in terms of c' and σ, $C'=15\sigma(c'/\pi)^4$. The value of the distribution constant c' is most readily deduced from the wave-length λ_m corresponding to the maximum ordinate of the energy curve at T, since by Wien's law the product $\lambda_m T$ is the same for all temperatures. According to Planck's formula the maximum occurs at the point $\lambda_m T = c'/4{\cdot}9651$. Planck took $\lambda_m T = 0{\cdot}294$, and $\sigma = 5{\cdot}30\times10^{-5}$, giving $C'=3{\cdot}735\times10^{-5}$, and $c'=1{\cdot}460$. But if $\lambda_m T = 0{\cdot}289$, and $\sigma = 5{\cdot}72\times10^{-5}$, then $C'=3{\cdot}708\times10^{-5}$ and $c'=1{\cdot}435$, according to the latest values of $\lambda_m T$ and σ. A comparatively small error in c', which is raised to the fourth power, suffices to neutralize the error in σ. The weak point of the method is that the position of the maximum of an experimental curve cannot be fixed with any certainty when the curve (as in this case) is far from symmetrical on either side of the maximum.

It is too commonly assumed that Planck's radiation formula, in spite of the weighty objections that have repeatedly been urged against it, is so firmly founded in theory and experiment, that no other formula is worth considering in comparison with it. It is also frequently asserted that no formula based on the "classical" mechanics can possibly satisfy the required conditions. The argument is somewhat as follows. The number of possible vibrations per unit volume of a continuous medium possessing the properties of the ether, between the limits λ and $\lambda+d\lambda$ of wave-length, should be represented by $8\pi\lambda^{-4}d\lambda$, according to Lord Rayleigh's method of calculation (*Phil. Mag.*, 49, p. 539, 1900), if the length of path between each reflection is restricted to an integral multiple of half a wave-length. If the different frequencies are regarded as separate inconvertible entities, like the molecules of different gases, between which the energy must be equally divided, the whole of the energy would accumulate in the infinitely short waves, which is absurd and contradicts experiment. It would be more natural, however, from a physical standpoint to regard Lord Rayleigh's formula

$$(8\pi RT/N)e^{-c''/\lambda T}\lambda^{-4}d\lambda \qquad (14)$$

as corresponding to the partition of energy among a number of *similar* molecules, according to Maxwell's law, which is universally admitted in the kinetic theory of gases, as resulting from the steady state produced by collisions. The steady distribution of energy of radiation in equilibrium with matter arises in a similar manner from the Döppler effect, by which the energy of a group of waves is changed in the same proportion as the frequency at each encounter with a moving obstacle. The frequency, or the reciprocal of the wave-length, corresponds to the energy, and occurs in much the same way in Rayleigh's formula, as the square of the velocity, or the kinetic energy, in Maxwell's law. On this view, Lord Rayleigh's formula evidently represents the distribution of pressure-energy between the different wave-lengths about a mean value RT/N, which, according to the law of equipartition, should be the same as the pressure-energy of a single gas-molecule at the same temperature.

If we take Rayleigh's formula as representing the pressure distribution in full radiation, the expression for the latent heat of absorption L as measured experimentally (corresponding to (4) above, but expressed in terms of the wave-length λ in the normal spectrum) may be written

$$L d\lambda = C''(T+c''/\lambda)\lambda^{-4}e^{-c''/\lambda T}d\lambda \qquad (15)$$

Integrating from 0 to ∞ we find $C''=\sigma c''^5$. The maximum of this curve occurs at the point where $c''/\lambda T = 2+2\sqrt{2}$, whence $c''=4{\cdot}8284\lambda T$. The absolute value of the maximum ordinate comes out $0{\cdot}65603(\sigma T^4/\lambda_m)$. The value of the same ordinate, calculated in the same way for Planck's formula (13), but with $c'=4{\cdot}9651\lambda_m T$ comes out $0{\cdot}65755(\sigma T^4/\lambda_m)$. It is a curious and significant fact that the maxima should be so nearly the same when the same values of the experimental data are assumed for both curves. The total areas of the two curves are the same, and they agree so closely throughout their whole extent that it would be practically impossible to distinguish between them with certainty by experiments on the distribution of heat in the spectrum. The greatest difference amounts to about 1% of the maximum ordinate, and occurs near the point $\lambda=\lambda_m/2$ on the short wave-length side, where the curve is very steep. This difference becomes quite appreciable in the specific heats, when the curves are differentiated, and seems to lead to better agreement with experiment than Planck's formula as explained above.

The most serious difficulty from an experimental standpoint in applying Planck's formula, is that the latent heat of emission per unit volume is always tacitly assumed (following Planck) to be the same as the energy-density, without taking any account of the pressure, whereas the existence of the radiation pressure is universally admitted as the basis of the deduction of the fourth-power law. The work done by the pressure, if it exists, cannot consistently be neglected in experimental measurements of radiation in steady flow. This is one of the most fundamental points in practical thermodynamics, but had not up to 1921 received sufficient attention from the mathematicians who have worked so elaborately on the theory.

Vaporisation

A good deal of attention has been devoted in recent years to the study of the properties of vapours employed in heat engines and refrigerating machines. The importance of the thermodynamical aspect of the problem has been widely recognized by engineers as the only sure guide to improvements in efficiency, and it has been realised that equations employed to represent the properties of the working fluid must be exactly consistent with the laws of thermodynamics, if it is desired to avoid discrepancies in the results of calculations by different methods. The principal properties of vapours were discussed from this point of view in the earlier article (*see* 27.897). The theory there given still holds good, but it will be of interest to discuss some of the evidence which has since accumulated on the experimental side. The case of steam, for which the experimental data are more accurate than for any other substance, will be taken, as being far the most important to engineers, and as illustrating the properties of vapours at moderate pressures. At high pressures, on the other hand, in the neighbourhood of the critical point, the data for steam are somewhat deficient, owing to the difficulty of the experiments, and the impracticability of using steam as a working fluid under these conditions. In the critical region the properties of carbonic acid have been most widely studied on account of its use for refrigeration.

Properties of Steam.—The equations for steam, first proposed by Callendar in the 10th ed. of the *E.B.* (1902), were founded on experimental measurements (1) of the specific heats, s and S, of water and steam by the continuous electric method, (2) of the Joule-Thomson cooling-effect C with a differential throttling calorimeter and (3) on the adiabatic index γ for dry steam with a very sensitive platinum thermometer. These experiments, taken in conjunction with the laws of thermodynamics, sufficed to determine all the required properties fairly accurately at moderate pressures.

The experiments on the specific heat of water extended from 0° to 100° C., and, when taken in conjunction with those of Regnault at higher temperatures, showed that the total heat h under saturation pressure could be represented, with sufficient accuracy for the purpose, by the thermodynamic formula

$$h = st + av\mathrm{T}(dp/d\mathrm{T}) = st + v\mathrm{L}/(\mathrm{V}_s - v) \qquad (16)$$

in which the constant $s=0{\cdot}99666$ is chosen to make h at 100° C. = 100 cals. C., or 180 B.T.U. per lb. at 212° F., reckoned from 32° F. The symbol a is the factor for reducing any product of dimensions pv to heat units. When p is in lb. per sq. in. and v in cu. ft. per lb., the reciprocal $1/a$ (which it is most convenient to use with a slide rule) has the value 9·722 on the Centigrade scale, and 5·401 on the Fahrenheit scale of temperature. V_s and v are the volumes of the dry saturated vapour and the liquid respectively, and $dp/d\mathrm{T}$ is rate of increase of saturation pressure p with temperature. When taken in conjunction with Clapeyron's equation for the latent heat, formula (16) gives a very useful relation between the total heat H and the volume V for *wet* saturated steam in any state,

$$\mathrm{H} - st = a\mathrm{V}(dp/d\mathrm{T}) = p\mathrm{V}/\Pi \qquad (17)$$

The factor $\Pi = p/a\mathrm{T}(dp/d\mathrm{T})$, which varies slowly and is independent of the wetness, has been tabulated, as affording the most

expeditious and accurate method of calculating either H or V when the other is known. The relation between H and V when p is given is that most commonly required in practical work. The same formula leads to a simple expression for the entropy Φ,

$$\Phi = s \log_e (T/T_0) + aV(dp/dT) \qquad (18)$$

which applies to wet steam of volume V, and also to the liquid if v is substituted for V. T_0 represents the freezing point, 273·1° C. or 491·6° F.

Values ranging from 0·305 at 0° C. to 0·665 at 160° C. had been proposed by various writers in 1900 for the specific heat of steam, but the direct measurements by the continuous electric method at atmospheric pressure from 100° to 160° C. gave results but slightly exceeding those of Regnault over the range 124° to 224° C., and showed that the limiting value S_0 at zero pressure was probably nearly constant and equal to 0·477. This was confirmed by L. Holborn and H. Henning (*Ann. Phys.*, 18, p. 739, 1905) in a qualitative manner by comparison with air over the range 110° to 820° C.

The experiments on the cooling-effect C, when combined with those of the specific heat S, showed that the product SC was a function of the temperature only, and gave the simple expression for the total heat,

$$H = S_0T - SCP + B \qquad (19)$$

for dry steam at any pressure P. The values for dry *saturated* steam, given by putting the saturation pressure p in this expression, while differing materially from Regnault's formula, gave good agreement with the experiments (*see* 27.902) of Dieterici at 0° C., and of Griffiths at 30° and 40° C., when the constant B was deduced from Joly's observations at 100° C. with the aid of the experiments on the specific heat of water. This formula was closely confirmed by the observations of H. Henning (*Ann. Phys.*, 21, p. 849, 1906) on the latent heat between 30° and 100° C. His later observations (*Ann. Phys.*, 29, p. 441, 1909) also gave good agreement with the same curve at 180° C., but showed a discontinuity at 120° C., which may be attributed to inevitable experimental errors in such difficult work. At higher temperatures, up to 260° C., equation (19) received theoretical confirmation from the formula for the latent heat proposed by M. Thiesen, namely, $L = L_1(t_c - t)^{1/3}$, based on the vanishing of the latent heat at the critical temperature t_c. As first applied by Thiesen himself (*Ann. Phys.*, 9, p. 80, 1902) to the case of steam, with 365° C. for the critical temperature, this formula gave results which were much too low for the latent heat. It was shown, however, by Traube and Teichner (*Ann. Phys.*, 13, p. 620, 1904) that the true value of t_c was 374° C., which brought Thiesen's formula into agreement with (19) to less than 1 in 1,000 all the way from 0° to 260° C., when the constants were properly determined from the known values at 0°, 100°, 180° and 374°, giving the result

$$\log L = 1·9638 + 0·3151 \log (374 - t) \qquad (20)$$

in the logarithmic form as required for practical calculations. The importance of this formula arises from the fact that direct determinations of H_s (for dry saturated steam) become exceedingly difficult and uncertain at temperatures above 180° C., owing to errors from leakage and wetness, and that a formula of this type has been verified for many other substances in the critical region, so that it affords the best guide to the probable variation of H_s between 200° and 374° C.

The throttling experiments showed that there must be a considerable variation of S with pressure, corresponding to the variation of SC with temperature. But the experiments on the adiabatic expansion of dry steam showed that the index $n+1$ in the equation $P/T^{n+1} = \text{constant}$, was very nearly constant and equal to 13/3 over a wide range of P and T. Since $S_0/R = 13/3$, it followed that the total heat of dry steam must be expressible in the form

$$H = (13a/3)P(V - b) + abP + B \qquad (21)$$

giving the convenient expression for the volume of dry steam,

$$V = (3/13a)(H - B)/P + 10b/13 \qquad (22)$$

It also followed that the coaggregation volume $c = c_0(T_0/T)^n$ in the equation

$$V - b = RT/aP - c \qquad (23)$$

must vary with temperature according to the index $n = 10/3$, giving for the variation of S and C, in terms of c, the formulae

$$SC = a(n+1)c - ab \qquad (24)$$

$$S = S_0 + an(n+1)cP/T \qquad (25)$$

It was obvious that these could not apply accurately at high pressures in the critical region, but they afford ample accuracy for all purposes in the pressures required in steam-engine practice.

The Munich experiments (*Forsch. Ver. Deut. Ing.*, 21, 1905) by O. Knoblauch, R. Linde and K. Klebe, on the volume of steam, proved to be quite inconsistent with the well-known equation of Zeuner, then commonly accepted, but showed the most remarkable agreement up to 180° C. with formula (23) deduced from the throttling experiments.

The variation of S with pressure given by (25), as predicted by the experiments on C, was qualitatively confirmed by the experiments of O. Knoblauch and M. Jakob (*Forsch. Ver. Deut. Ing.*, 36, p. 109, 1906) extending to 8 atmospheres.

Knoblauch and his collaborators have since extended their observations on the specific heat up to 30 atm. (425 lb.), and have published Steam Tables (Oldenbourg, Munich, 1923) extrapolated to 60 atm. (850 lb.). These results are in very fair agreement with (19), (22) and (23), especially near the limit of 850 lb. at a moderate degree of superheat, but show a rapid fall of total heat on approaching saturation. (See also "World-Power," for May and June 1924, and June 1925.) Callendar has since extended his observations with the differential throttling calorimeter to 1,000 lb. pressure, and finds (as explained in *Properties of Steam*, p. 83) that the assumption that the cooling-effect C is a function of the temperature only gives better agreement with experiment at high pressures near saturation than the Joule-Thomson equation (23), though both are in practical accord at moderate pressures or high superheats. There is always a difficulty in securing accurate observations of the total heat or specific heat of *saturated* steam owing to systematic errors of wetness, but results accurate to 1 in 1,000 may readily be obtained at a moderate degree of superheat.

Adiabatic Heat-drop.—The change of total heat H in frictionless adiabatic expansion or compression is frequently of considerable interest as representing the work done by or on the fluid in the ideal case, when there is no internal friction, and when no heat is supplied or lost externally. If the laws of thermodynamics are summarised in the form

$$dQ = Td\Phi = dH - aVdP \qquad (26)$$

in which dQ represents heat supplied per unit mass by friction or otherwise, we observe that, in the case of isentropic flow, for which $d\Phi = 0$, the change of H is equal to the integral of $aVdP$ along the adiabatic, which is readily obtained by substituting for V in terms of H and P from (22) or (17), for any given initial state and final pressure. We may also obtain the general expression for Φ from those for H and V by integrating $d\Phi = dH/T - (aV/T)dP$. These expressions may be put in various forms according to the purpose for which they are required. One of the most useful for dry steam is

$$DH_\phi = (H' - H'')_\phi = (H' - B - abP')(1 - T''/T') + ab(P' - P'') \qquad (27)$$

in which H', P', T', and H'', P'', T'', represent the initial and final states. An exact expression for the adiabatic heat drop DH_ϕ, in the case of wet saturated steam, is readily obtained in terms of H' and T', T''. But in practice it is usually more convenient to tabulate H and ϕ, and the Gibbs' function $G = T\phi - H$, which has the advantage of being a simple function of the temperature only, and independent of the wetness for a mixture of water and steam in any proportions. From the definition of G, if ϕ is constant at its initial value ϕ'', we obtain immediately the convenient expressions

$$DH_\phi = (T' - T'')\Phi' - G' + G'' = H' - H_s'' + T''(\Phi_s'' - \Phi') \qquad (28)$$

The first expression is general, and is readily applied if G' and G'' are tabulated. The second is obtained by substituting for G' and G'' in terms of H and ϕ, but is applicable only if the final state is saturated, so that H_s'' and ϕ_s'' are the tabulated values for dry saturated steam.

Effects of Supersaturation.—For the general theory of the behaviour of a vapour when cooled below the saturation temperature without condensation *see* 27.898–9. The state of supersaturation is very common, in rapid expansion, and has proved to be of some practical importance, as affecting the discharge through a nozzle, and the efficiency of a turbine. It appears that steam usually follows the dry adiabatic, $P/T^{13/3} = \text{constant}$, for some distance below the saturation point. The drop of temperature is about three times as rapid as along the wet adiabatic, and the volume is smaller than that of saturated steam at the same P and H. The heat-drop, and the velocity generated, are also smaller, for a given pressure drop, than in the case of steam which is assumed to remain in the equilibrium state of saturation throughout the expansion. If the initial steam is dry saturated, it usually remains dry for some distance beyond the throat of a nozzle, so that the discharge, as given by equation (12), is obtained from the dry adiabatic, by substituting $(dP/dV)_\phi = 1·3P/V$ at the throat, which leads to values about 5 % larger than those given by the equations for wet steam. This is confirmed by experiment, and is represented by the numerical formula for the discharge M/X_t in lb. per sec. per sq. in. of throat, when P' is in lb./sq. in. and V' in cu. ft./lb. in the initial state,

$$M/X_t = 0·3155(P'/V')^{\frac{1}{2}}, \quad P_t/P' = 0·545 \qquad (29)$$

in which the small quantity b is neglected as being usually beyond the limits of possible accuracy of measurement.

The defect of heat-drop on reaching the throat is about 5 %. If the steam continued to follow the dry adiabatic to low pressures, the defect of heat-drop would often reach 20 %, which would be very serious. But soon after passing the throat, the coaggregated molecules begin to act as condensation nuclei, according to Kelvin's equation (*see* 27.898). When this limit is reached, the condensation takes the form of a very thick fog of exceedingly fine particles, and is extremely rapid, owing to the enormous number of nuclei available, about 10^{22} per lb. of steam. If the expansion is relatively slow, the steam is transformed into the saturated state, and remains nearly saturated for the rest of the expansion. But if the expansion is very rapid, as in an expanding nozzle at a velocity of 3 or 4,000 ft./sec. the steam will remain near the supersaturation limit with a loss of heatdrop amounting to nearly 8 % at low pressures, involving a corresponding loss of efficiency. According to Wilson's experiments at low pressures (*see* 27.899), the supersaturation limit is reached when the pressure is about 8 times the normal saturation pressure corresponding to the actual temperature of the steam. The equivalent wetness of the steam at this point, when transformed to the

saturated state at the same P and H, would be about 3%. This appears to be confirmed by turbine tests at these pressures, but Wilson's experiments do not afford any direct evidence with regard to the limit at which condensation starts at higher pressures. It appears on theoretical grounds that the pressure ratio corresponding to the supersaturation limit should not be so high as 8 at high pressures, which would require an excessive increase in the drop of temperature and in the equivalent wetness of the steam at high pressures.

There is some evidence that the equivalent wetness at the supersaturation limit is the same, namely 3%, at high as at low pressures. This would permit a very simple method of calculation, but more experimental tests are required to decide the point. The effect of initial superheat in improving the efficiency of a turbine cannot be satisfactorily explained on the older theory that the steam is in the equilibrium state of saturation throughout the expansion, but is a necessary consequence of the phenomenon of supersaturation. The loss due to supersaturation may be entirely eliminated if the superheat is sufficient to prevent supersaturation. In any case the loss will be greatly reduced by superheat, and the results of calculation appear to indicate that the improvement of efficiency may be exactly accounted for in this way. This point has been very fully discussed by H. M. Martin, in "A New Theory of the Steam Turbine" (*Engineering*, vol. 106, 1918); and also by H. L. Callendar, *Properties of Steam*, pp. 305–12.

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HEATING AND VENTILATION (*see* 13.160 and 27.1008).—The close association between heating and ventilation, especially in modern practice, makes it desirable to treat the two subjects together.

I. HEATING

When the temperature inside a building is maintained above that out-of-doors, a sufficient quantity of heat must be continuously supplied to replace that which passes by conduction through the walls and roof of the building and to warm the considerable quantity of in-leaking air. The heating system has to produce the proper amount of heat and to distribute it.

The earlier forms of heating apparatus, such as the stove and the fireplace, deliver their heat to the room principally by radiation. In general, heating by convection is to be preferred from a standpoint of comfort in severe climates, and for this reason and because of the dirt and labour necessitated by their care, the stove and the fireplace are being largely superseded, especially in North America, by the warm-air furnace or by steam and hot-water systems. In Great Britain the fireplace is still an acceptable method of heating because of the relatively mild climate.

Warm Air Furnace.—The warm-air furnace system satisfies the requirement of a source of heating removed from living quarters, gives a fairly successful distribution of heat throughout the house and is very low in cost compared with steam and hot-water systems.

It consists of a firepot in which the fuel is burned and a more or less extended flue for the gases of combustion, the whole being surrounded by a sheet-metal casing through which a current of air passes, absorbing heat from the hot surfaces of the firebox and flue and passing thence through metal ducts to the rooms above. Air is supplied to the base of the furnace casing either from out-of-doors or, more economically, by a return duct from some central room of the house. The fundamental difficulty with the warm-air furnace is that the force producing the circulation of air through the system, being due only to the difference in the densities of the heated air in the pipes and the unheated air without, is necessarily very small and consequently it is difficult to heat rooms remote from the furnace, particularly under adverse wind conditions.

Steam-Heating.—This system consists of a boiler in which the steam is generated, a number of so-called radiators located in the rooms to be heated, and a system of piping which conveys the steam to the radiators and returns the water of condensation to the boiler.

The Vapour System.—The so-called vapour system is a steam system operating at a pressure of only a few ounces above atmosphere as compared with a pressure of one to five pounds for the ordinary steam system. In the vapour system the steam enters the radiator through a valve near the top and the displaced air and the water of condensation are conveyed away by return piping, the air being finally discharged from the system through a vent near the boiler. To prevent the flow of steam from the radiator into the return piping, a trap is usually installed at the discharge end of each radiator.

For large buildings the vacuum steam system is used very extensively. The arrangement of the radiators and piping is nearly the same as in the vapour system, and a vacuum pump is connected with the return piping. This increases the differential pressure through the system and promotes the rapid flow of steam to the radiators and the complete removal of air.

Hot-water System.—In the hot-water system, which is widely used in Great Britain, water is heated in a central heater, flows through pipes to the radiators, where it delivers its heat, and thence back to the heater. Circulation is produced, in the simple gravity type system, by the difference in weight of the column of heated water in the supply pipe and the column of cooler water in the return pipe. Most large systems employ forced circulation, produced by a pump in the circuit, thus insuring positive flow and permitting the use of smaller pipes. The hot-water system, because of the thermal capacity of the water contained in it, gives a less fluctuating output of heat to the rooms, but is for the same reason less readily capable of responding when the outside temperature changes. The hot-water system, using forced circulation, is frequently employed in heating groups of buildings because the heat output can be readily controlled from a central point by adjusting the temperature of the water.

Steam is produced for a heating system by a boiler which usually has the furnace or firepot incorporated in it. Where electricity is used for heating—a procedure sometimes employed where coal is expensive and electric current cheap—the boiler is fitted with electric heating elements of the submerged resistance type. In recent years, due to the increasing cost and scarcity of anthracite coal, boilers have been developed which will burn bituminous coal successfully and without excessive smoke. (*See* BOILERS.) This is accomplished by the introduction of air at certain points in the furnace or by other means for burning the volatile matter before it is chilled by contact with the cold boiler surfaces.

Temperature Control.—Temperature control is frequently applied to schools, offices and public buildings in order to secure constant room temperatures. There are several systems in use which regulate the flow of steam to radiators and adjust the position of dampers, under the control of a thermo-stat. Compressed air or electricity are used to furnish the power required.

Central Heating.—In Great Britain, and in Europe generally, the term central heating usually refers to the heating of a building by means of a furnace instead of fireplaces. As understood in North America, however, the term refers to the supplying of heat to a number of separate buildings from a central plant. When portions of a city are thus heated the term district heating is often synonymously used.

Either steam or hot water may be used as the medium for conveying the heat from the central plant. The pipes are carried either in tunnels, permitting ready access to them, or are buried a few feet below the surface enclosed in some form of conduit to insulate the pipe against excessive loss of heat and to protect it. The conduit sometimes consists of a thick-walled wooden box or tube in which case the wood serves as the insulating material; or it is made of concrete or clay tile and a layer of magnesia or asbestos is applied to the pipe as an insulator.

There are extensive systems of this type distributing steam commercially for heating, cooking and to some extent for power in New York City, Detroit, Pittsburg, Rochester, St. Louis and elsewhere. The largest areas covered are about one sq. m. in extent. Business districts and good residential districts of high class are the desirable territory.

Frequently the exhaust steam from electrical generating plants is utilised and is distributed at a pressure of from 2 to 10 lb. above atmosphere; but in some cities steam direct from the boilers at pressures up to 100 lb. or more is used. The consumption of heat by the individual buildings is metred either by a steam meter in the supply pipe or by a meter which measures the water of condensation as it is drained from the heating system of the building. Losses of all kinds between the boiler outlet and the consumer's meter are, in the more efficient systems, from 15 to 20% of the steam sent out from the boilers. Hot water is used as the distributing medium in some cases, but is not regarded as commercially satisfactory, largely because of the lack of a suitable means of measuring the amount of heat used by each consumer.

II. VENTILATION

The modern conception of ventilation (*see* PUBLIC HEALTH) distinguishes between the internal and the external effects of the atmosphere upon the body. Those factors having an internal effect are chiefly the humidity of the air affecting the mucous membranes in the respiratory passages, the amount of dust and bacteria in the air and the nature and strength of odours. Externally, the temperature, humidity and motion of the air play perhaps an even more important part by controlling the rate of heat loss from the skin. It is only recently that this cooling power of the air in ventilation has been quantitatively studied. In 1913 Sheppard and E. V. Hill established by tests a comfort zone, which showed, for still air, the relation between temperature and humidity necessary for comfort. More recently Houghten, Yaglou and others, in an investigation sponsored by the American Society of Heating and Ventilating Engineers, the U.S. Bureau of Mines and the U.S. Public Health Service determined the complete relations between temperature, humidity and air motion as they affect bodily comfort.

An adequate system of ventilation must supply a sufficient quantity of air, properly heated and humidified, so that its cooling effect will be correct. Dust and bacteria must be reasonably absent, and odours not excessive. In the more elaborate systems of ventilation, such as are used in schools, theatres, auditoriums and other densely occupied buildings, the air used for ventilation is drawn by a centrifugal fan over steam coils, passed through an air washer for cleaning and humidification, and forced by the fan through a system of ducts to the various inlet points of the rooms to be ventilated. Air is withdrawn from each room, through properly located outlets, into an exhaust duct and discharged to the outside by the exhaust fan.

Arrangement of Ventilating System.—The air washer consists of a spray chamber, in which the air is humidified, followed by a series of baffles wet by sprays which remove most of the dust, and finally there are a number of dry baffles which serve to remove any entrained water. The ventilating system may be used for heating as well as for ventilation.

Artificial cooling is sometimes used in theatres by supplying refrigerated water to the air washer (*see* REFRIGERATION).

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HEBREW LITERATURE (*see* 13.169).—Modern Hebrew literature, the beginnings of which go back to the 18th century, is universal in scope and secular in spirit, thus contrasting with the purely legal, ritualistic or homiletic works of earlier times. This literature took its rise in Italy (M. H. Luzzatto, 1707–47), whence it shifted to Germany, showing at first, notably through the influence of Moses Mendelssohn (1729–86), a rationalistic and cosmopolitan tendency.

Following a brief period of activity in Galicia dominated by Biblical criticism and historical scholarship (Krochmal, 1785–1840; Rapoport, 1790–1867), Hebrew literature assumed a new character in Russia and Lithuania, where the so-called Haskalah movement developed—a humanistic and humanitarian spirit which set itself against the traditional exclusiveness of the Jew. It found expression in the historical and scientific compendia of Kalman Schulman (1819–99), in the novel (Mapu, 1808–67) and in poetry (Lebensohn, 1828–52; J. L. Gordon, (1831–92). The novelist P. Smolenskin (1842–85) heralded a reaction, hastened by the pogroms against the Jews, towards a Jewish national policy, which culminated in Zionism. Since his day Hebrew literature has been largely dominated by the idea of a national revival. This idea has found its most complete expression in the essays of Asher Ginzberg (Ahad Ha'am) who has resisted the tendency to lay undue stress on the economic and political factors in Zionism and has insisted on the conception of Palestine as the cultural centre of the Hebrew race.

The individualistic and symbolic spirit in Hebrew literature has been greatly influenced by the modern mystic movement among the Jews known as Hassidism. In the sphere of fiction this spirit found its foremost representative in Isaac Loeb Perez (1851–1915), whose stories are distinguished by artistic beauty and tenderness. Humour is the dominant characteristic of two other famous Hebrew story-writers—S. J. Abramowitsch (known as "Mendele," 1835–1918) and S. Rabinowitz (known as "Sholem Aleichem," 1859–1916). Judah Steinberg (1863–1908), author of many stories, excels in the delineation of character, and in him the individual finds more complete and varied representation than elsewhere in Hebrew literature. This fact, and the clearness and fluency of his style, give him high rank among Hebrew novelists. Another novelist of some distinction is R. A. Brandes (1851–1902), who chose the struggle for religious reform as the theme of his principal novels.

Poetry has made rapid strides in modern Hebrew literature. There is a host of contemporary poets, the most representative of whom is Hayyim Nachman Byalik (1873–). With the exception of Judah ha-Levi (fl. 12th century) he is perhaps the leading Jewish national poet, inheriting the idealism and the prophetic seriousness of his people. He is pre-eminently the poet of Jewish woe. To Jewish national hopes and aspirations he seldom gives expression in his verse. None of the Hebrew poets has grasped and represented the spirit of the Ghetto and its poetry with so much sympathy and so much tenderness of feeling as Byalik. The ideas of Ahad Ha'am and the influence of Gordon's style and form are traceable in his poems. Next to Byalik and in strong contrast with him stands Dr. Saul Tschernichowski (1875–). He was the first to introduce into Hebrew poetry an admiration for the Greek spirit and the sense of complete enjoyment of life. His work is remarkable for its easy gracefulness and its varied rythms and metrical forms. Dr. Jacob Cahan (1880–) is an idealist, whose poems bear the stamp of a marked individuality. In the poems of Zalman Schneor (1886–) there is at times a gentle pessimistic vein, and his verse is full of life and beauty; the rhythm has harmony and tunefulness, the imagery is rich, varied and striking, and the movement quick and bold. His prose, too, is marked by the same qualities. Among a list of poets of less distinction may be mentioned, Jacob Steinberg, Jacob Fichman, Isaac Katzenelson, J. J. Koplewitz, David Schimonwitz, the brothers Simon and Pesach Ginsburg, Hillel Bavli, Judah Karni, A. Schlonsky, Uri Zebi Greenburg, Avigdor Feuerstein, Benjamin N. Silkiner and Simon Leo Halkin. Modern Hebrew poetry, like Hebrew poetry in general, has been strongest in lyric.

The various transformations of Jewish life brought about by the Zionist and other Jewish movements and the influence of foreign literatures had their effects upon the shaping of contemporary Hebrew fiction, notably the short story and the novel. There has been created a Hebrew short story, artistic in technique and generally psychological in presentation, delineating the individual in a variety of moods and situations; but at the same time marked by a minute, torturing self-analysis, by an impotence in the will of the heroes and by an outlook upon life that is gloomy and despondent. The creators of these stories are followers of Micah Joseph Berdyczewski (1865–1921), who in his view of life was influenced by the individualistic theories of Nietzsche. Among the most notable story-writers of this group are Isaiah Domosehvitzky (known as J. Bershadsky, 1870–1908), Joseph Hayyim Brenner (1881–1921), Gershon Schofmann, Uri Nisan Gnessin (1880–1913), Hirsch David Naumberg and Isaac Dob Berkowitz. The melancholy and morbid spirit which some of these writers have introduced into the Hebrew sketch and novel is almost entirely traceable to the influence of the Russian and Scandinavian literatures of the last few decades. A notable exception to this tendency is S. J. Agnon, an original symbolico-mystical writer of short stories and a master of Hebrew style. Other writers of fiction who are free from this pessimistic strain are A. A. Kabak, Moses Smilansky, L. A. Orloff, S. Ben-Zion Guttman, Eliezer Steinman, Asher Barash and A. Reubeni.

The adaptation of the Hebrew language to the needs of modern life owes much to Eliezer Ben-Yehuda (1858–1923), one of the pioneers of the idea of a Jewish national renaissance, whose ten-volume Hebrew dictionary (*Thesaurus totius Hebraitatis*) is a monument of a life's devotion to the revival of Hebrew. The talent of David Frischmann (1863–1922)extended over the domains of the feuilleton, the short story, poetry and criticism. Dr. Joseph Klausner (1874–), the editor of the leading Hebrew monthly *Hashiloah*, is active in many fields—criticism, history, scholarship and journalism. He possesses considerable erudition and historic insight. Hillel Zeitlin, a mystic, has made original contributions to various phases of modern Hebrew literature. The greatest Jewish journalist, writing for Jews in Hebrew and in many other languages, is Nahum Sokolow. Reuben Brainin is a fine stylist and an able critic but his literary ideas and tastes are perhaps too much determined by outside influences. In Dr. Simon Bernfeld (1860–) Hebrew literature has a many-sided and very prolific writer with a gift for presenting the results of scholarly research in attractive literary form. Wolf Jawitz (1847–1924) was a historian and a philosopher of religious romanticism. David Neumark (1866–1924) made original contributions to the study of Jewish philosophy. Jacob Klatzkin, Fishel Lachower, S. B. Maximon, Dr. S. M. Melamed, Joel Blau, Osias Thon, Mordecai Ehrenpreis, S. I. Hurwitz and others have contributed much to the development of the essay in Hebrew literature.

Hebrew literature, including its vernacular is a primary factor responsible for the rejuvenation of the national Jewish spirit and for the emancipation of Jewish life from external influences. Literary activity came to a virtual standstill as a result of the World War and its consequences, which bore with especial severity on eastern Europe, formerly the chief centre of Hebrew literature. During the last few years there has been a revival in eastern Europe, and a certain development in America; but the centre of this activity has shifted to Palestine.

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(Jo. B.)

HECTOGRAPH: *see* OFFICE APPLIANCES.

HEDIN, SVEN (1865–), Swedish explorer, was born in Stockholm Feb. 19 1865. He was educated at the högskola in Stockholm, and Uppsala University and later studied at Berlin and Halle. In 1885–6 he travelled through Persia and Mesopotamia, and in 1890 was attached to King Oscar's Embassy to the Shah of Persia. In the same year he visited Khurasan and Turkestan and reached Kashgar in 1891. He is best known through his travels in Tibet, which placed him in the first rank of modern Asiatic explorers. Between 1893 and 1897 he travelled across the Asiatic continent from Orenburg by the Ural over the Pamirs and the plateau of Tibet to Peking. During two other expeditions, (1899–1902, 1906–8) he made valuable additions to the scientific knowledge of these tracts and explored specially the sources of the Sutlej and the Brahmaputra. In 1902 he became a Swedish noble, and in 1909 the Indian Government invested him with the K.C.I.E. During the War he made frequent visits to the Turkish front and in 1923 he travelled round the world, through the United States, Mongolia and Russia.

Sven Hedin's writings include: *Journey through Persia and Mesopotamia and the Caucassus* (1887); *Journey through Khorasan and Turkestan* (1892–3); *Through Asia* (1898); *Central Asia and Tibet* (1903); *Adventures in Tibet* (1904); *Scientific Results of a Journey in Central Asia 1899–1902*, 8 vol. (1904–7); *Transhimalaya*, 3 vol. (1909–12); *Overland to India*, 2 vol. (1910); *Bagdad, Babylon, Nineveh* (1917); *To Jerusalem* (1917); *Southern Tibet*, 12 vol. (1917–22); *Eine Routenaufnahme durch Ostpersien*, 2 vol. (1918–24); *My Life as an Explorer* (1926).

HEDJAZ: *see* HEJAZ.

HEIDENSTAM, VERNER VON (1859–), Swedish writer, was born July 6 1859 in Olshammar. He lived for several years in the south of Europe, Egypt and the East. On his return home, he began his literary career with a collection of poems entitled *Vallfart och Vandringsaar* (Pilgrimage and Years of Wandering) (1888) based on oriental life, and which formed a protest against the naturalism then prevalent in Swedish literature. This led to the great literary renaissance of 1890 in Sweden. In 1889 he published *Endymion*, an oriental story, and in 1892 his great work, *Alienus*, a fanciful romance concerning a pilgrimage in search of beauty through various ages and countries. His other collection of *Poems* (1895) indicates the author's transition to national ideas. This national tendency attained its zenith in his great prose work, *Karolinerna* (The Carlists), translated into English in 1902, a collection of stories about the time of King Charles XII. Then followed *Den Hellige Birgittas Pilegrimsfaerd* (St. Bridget's Pilgrimage) in 1901, besides descriptions of Sweden in ancient times and in the Middle Ages in *Folkungaträdet*, 2 vol. (1905, 1920), and *Svenskarna og deres höfdinger* (Swedes and Their Chieftains), 2 vol. (1908, 1909). In 1915 Heidenstam published *Nya Dikter* (The New Poet), and in 1916 was awarded the Nobel Prize for literature. See F. Böök, *Sveriges moderna litteratur*, 2nd ed. (1921).

HEIJERMANS, HERMAN (1864–1924), Dutch writer (*see* 13.212). His later plays include *Schakels* (1904); *Allerzeilen* (1906); *De Groote Vlucht* (1908); *Ahasuerus* (1912) and *Eva Bonheur* (1919). He lived for a few years in Berlin, but returned to Holland in 1912 in order to manage a society of players, and devoted himself to that work. He died in 1924.

HEJAZ (*see* 13.217).—Under the Ottoman régime the Hejaz, extending from Ma'an and 'Aqaba in the north to Hali Point on the Red Sea coast in the south, formed a *Vilayat* with a *wali* resident at Mecca, controlling a garrison of about 7,000 troops. In 1904 Turkish control of the northern part of the Hejaz was strengthened by the completion of the Hejaz Railway down to Medina. In 1908 Husain ibn 'Ali was appointed to be Amir of Mecca, and soon set himself to thwart the Turkish Govt., particularly in the matter of the extension of the railway to the city of Mecca.

The War Period.—The proclamation of a *Jihad* by the Turks at the outset of the World War made Arabia a source of potential danger to the Allied cause. Effective control of the Hejaz would have enabled the Turks and their Allies to threaten the sea route to the East, and Great Britain sought to counter this danger by entering into negotiations with Sharif Husain. The latter, inspired by great personal ambition, was ripe for rebellion against the Turks, and, after a lengthy correspondence on the subject of the terms on which he should espouse the Allied cause, raised the standard of revolt on June 5 1916. Mecca and Jidda (the latter after bombardment by British ships) were soon wrested from the Turks, and Taif surrendered to the Sharifian forces in September.

The Sharifian armies were unable to make any impression on the strong Turkish defences at Medina, but at this time Col. T. E. Lawrence appeared upon the scene, and in concert with Husain's third son, Amir Faisal, organised a brilliant guerilla campaign against the Hejaz Railway and the Turkish positions further north. The ports of Yenbo', Wejh and 'Aqaba (1917) fell in rapid succession, and with the subsequent capture of Ma'an and Shaubak, the Hejaz reached the northern frontier which it kept till July 1925. Medina, successfully defended by Fakhri Pasha till the end of the War, only surrendered on the receipt of explicit orders from Constantinople in Jan. 1919. The Amir Faisal represented Husain, who had assumed the title of king in 1916, at the Peace Conference of 1919 at Paris, and the Hejaz was admitted as an original member of the League of Nations, but King Husain eventually refused to ratify the Peace Treaties. In March 1919 King Husain's relations with Ibn Sa'ud became strained owing to a dispute over the oasis of Khurma, and in May his forces advanced to occupy the place. They were routed by the Wahhabis at Turaba, and later (1922) Khaibar and Taima were in turn occupied by Ibn Sa'ud.

Meanwhile, in the summer of 1921, Lawrence visited Jidda on behalf of the British Govt. to negotiate a treaty with King Husain, but negotiations broke down owing to the latter's inability to accept the *de facto* position in Palestine. Negotiations were subsequently kept alive by Dr. Naji al Asil, Hashimite representative in London, but were finally abandoned on the outbreak of war between Nejd and Hejaz in Sept. 1924.

Post-War Events.—The Sharifian administration, mild enough during the War, became more and more autocratic and even tyrannical with the passage of time. King Husain alienated the sympathies of his own people, and went out of his way to court the enmity of his neighbours. By the terms of the Peace Treaties he undertook to maintain the annual pilgrimage under satisfactory conditions for all Moslems, but this part of his administration left much to be desired. There was much corruption in all government departments. Education was wholly neglected. Even the army was not maintained on an efficient basis. An Air Force was inaugurated in 1921, but was allowed to disintegrate owing to the King's parsimony—it was revived in the autumn of 1924 by his successor and reorganised in 1925. An effective scheme of wireless communication, with eight or nine well-equipped stations, was perhaps the brightest feature of King Husain's administration. The nucleus of a transport fleet (four ships) was also formed by him, and proved invaluable during the war with Nejd. A local coinage and stamp issue emanated from Mecca during these years, and a semi-official newspaper (*Al Qibla*) was started by the King for propaganda purposes.

Meanwhile the storm was approaching. King Husain refused until too late to send a representative to the Conference convened at Kuwait by the British Government. In Jan. 1924 he arrived in Transjordania on a visit to his son, 'Abdullah, and, while there, he assumed the vacant title of *Khalifa* on the deposition of the Turkish Sultan-Khalifa by the Kemalist Govt. of Angora. He then hastened back to Mecca to issue invitations to the Moslem world to recognise his new status, but his overtures met with little success, and the Wahhabi Sultan realised that his ambitious enemy must be crushed at once.

Husain Abdicates.—In Sept. 1924 Ibn Sa'ud launched his armies on the Hejaz. Taif fell without a show of resistance. Consternation reigned at Mecca, and King Husain, under pressure from the notables of Jidda, abdicated on Oct. 5 in favour of his eldest son, 'Ali, who was acclaimed as "King of the Hejaz only." King 'Ali evacuated Mecca and hastily recruited an army from Palestine, Syria and Transjordan to defend Jidda. Tahsin Pasha al Faqir, the commander of the so-called "Victory" division, organised a strong defensive position of trenches and barbed-wire entanglements in a semi-circle round the town. Ibn Sa'ud himself arrived at Mecca in Dec. and the attack on Jidda began on Jan. 4 1925. The Wahhabis occupied the few villages outside the entrenched position, but had not succeeded in reducing the town at the end of June when the siege was temporarily raised to enable them to perform the pilgrimage. Meanwhile Ibn Sa'ud, having occupied the ports of Qunfida and Lith south of Jidda and that of Rabigh north of it, extended his operations further north. Medina and its seaport Yenbo' were invested, while Umlaj, north of the latter, was occupied. On Dec. 5 Medina surrendered and Wejh followed suit. King 'Ali realised that his situation was hopeless and abdicated on Dec. 19. Jidda then surrendered simultaneously with Yenbo', and Ibn Sa'ud was master of all Hejaz, of which he was formally proclaimed King at Mecca on Jan. 8 1926. For bibliography *see* ARABIA. (H. St. J. B. P.)

HELFFERICH, KARL (1872–1924), German financier and politician, was born in Neustadt-on-the-Havel July 22 1872. In 1901 he became a professor of political science in Berlin, and in 1906 went to Constantinople as manager of the Anatolian Railway. He returned to Berlin in 1908 to take up the chairmanship of the Deutsche Bank. In 1913 he was the chief German delegate at the Paris conference for the settlement of Balkan financial affairs. In 1915 Helfferich was appointed Secretary of State for the Imperial Treasury, where he followed the principle of defraying the cost of the War by borrowing rather than by fresh taxation, relying on a final German victory. In June 1916 he left the Treasury for the Home Office. In June 1918 he was appointed to succeed Count Mirbach, who had been assassinated, as Germany's representative in Moscow. He was, however, unable to occupy this post, and returned to Berlin to conduct the economic and industrial demobilisation of Germany after the Armistice. He was fatally injured in a railway accident near Bellinzona April 23 1924.

HELICOPTER: *see* AIRSCREW.

HELIGOLAND BIGHT, BATTLE OF THE.—This naval action was fought in the Bight on Aug. 28 1914 between British and German naval forces. According to the original British plan three submarines were to lie off Heligoland to attack German cruisers, while three others were to be posted to the west to entice their destroyers out. The Harwich flotillas were then to come in from the north and, sweeping on a nine miles front to the westward, were to cut off any light craft patrolling to the west of Heligoland. Adml. Jellicoe proposed to reinforce the flotilla with Vice-Adml. Beatty's battle cruisers and the 1st Light Cruiser Squadron. This proposal was only approved on Aug. 26 and, as there was no time to send the operation orders north, Beatty left Scapa with only a general idea of the plan and no details of the intended movements of the submarines. The forces from Harwich had already sailed and did not know that Beatty was on his way to reinforce them.

British Forces.—On Aug. 27 the British forces were all on their way to the Bight, organised as follows:—

TABLE I.

Sweeping Force (Commodore Reginald Tyrwhitt): "Arethusa," 2 6-in., 6 4-in., 28·5 knots; "Fearless," 10 4-in., 26 knots. Third Flotilla, 1st, 2nd, 3rd and 4th Divs., 16 destroyers; First Flotilla, 1st, 2nd, 3rd and 5th Divs., 15 destroyers. Total: 2 light cruisers, 31 destroyers.

Submarine Force (Commodore Roger Keyes): "Lurcher," "Firedrake," E4, E5, E9 (off Heligoland); E6, E7, E8 (west of Heligoland).

Battle Cruiser Force (Vice-Adml. Sir David Beatty): 1st Battle Cruiser Sqn., "Lion," "Queen Mary," "Princess Royal," all 8 13·5-inch.

Light Cruiser Squadron (Commodore W. E. Goodenough): "Southampton," "Falmouth," both 8 6-in.; "Birmingham," "Nottingham," "Lowestoft," 9 6-in.; "Liverpool," 2 6-in., 10 4-inch.

Cruiser Force K (Rear-Adml. Sir A. G. Moore): "Invincible," "New Zealand," with four destroyers.

Cruiser Force C (Rear-Adml. A. Christian): "Euryalus," "Bacchante," "Cressy," "Hogue," "Aboukir," all 2 9·2-in., 12 6-in.; "Amethyst," 12 4-in.

Total Forces: 5 battle cruisers, 9 light cruisers, 5 armoured cruisers, 37 destroyers, 6 submarines.

It was light at 4 A.M. Goodenough with the 1st Light Cruiser Squadron had met Tyrwhitt at 3:45 A.M. and was at first mistaken for an enemy, but the cruisers were recognised in time. By 5 A.M. the sun had risen, and the forces were in position some 60 m. northwest of Heligoland. It was a fine morning with a smooth sea and a gentle breeze blowing from the northwest. Beatty's battle cruisers were some 30 m. to the westward and all was ready. The flotillas started off to the southeast at 20 knots, the "Arethusa" and 3rd Flotilla ahead, with the "Fearless" and 1st Flotilla 2 m. astern. The 1st Light Cruiser Squadron followed 8 m. behind. From a point 12 m. west of Heligoland, which he should reach at 8 A.M., Tyrwhitt intended to turn west and sweep anything in the Bight into his net. The Germans knew nothing of the impending attack. Posted round Heligoland in a semi-circle they had two lines of patrols, an outer line of nine destroyers 25 m. from the island and an inner line of older vessels (3rd Minesweeping Div.) 13 m. from it. These were supported by a flotilla at Heligoland, three cruisers on outpost duty, and a battleship in the Jade.

German Forces.—The German disposition in detail was as follows:—

TABLE II.

Outpost Forces: Outposts, Outer line, 9 destroyers; Inner line, 11 torpedo boats.

In Support of Outposts: 11 destroyers, 5th Flotilla (Heligoland). Light cruisers, "Stettin" (10 4·1-in.), "Hela," 4 4·1-in. (off

Heligoland), "Frauenlob," 10 4·1-in. (off Jade). Battleship, "Heligoland," 12 12-in. (in Jade).

In Wilhelmshaven Roads, Wilhelmshaven and off the Ems: Light cruisers, "Ariadne," "Kolberg," "Cöln" (Rear Adml. Maas, First Leader of Flotillas), "Strassburg," "Stralsund," "Rostock," "Mainz" (off the Ems). Battle cruisers, 1st Scouting Group, "Seydlitz," "Moltke," "Von der Tann," "Blucher." Battleships: 1st and 3rd Sqdns. (7 dreadnoughts).

Total Forces: 8 battleships, 4 battle cruisers, 10 light cruisers, 20 destroyers, 11 torpedo boats, 8 submarines.

The movements of the heavy German ships were governed entirely by the time of low water on the outer Jade bar. This was at 9:33 A.M. and meant that between 7 A.M. and noon no German battleship nor battle cruiser could put to sea.

The Early Operations

The activities of this eventful day started at 4:45 A.M. when the British submarine E7 fired a torpedo at the destroyer G194 patrolling some 25 m. northwest of Heligoland, and Rear-Adml. Maas, the German flotilla admiral, at 6:45 A.M. sent out the 5th Flotilla from Heligoland to hunt the submarine. The sea was smooth, the sky overcast and weather dull. At 6:53 A.M. the "Arethusa" struck the outer patrol line and sent G194 flying towards Heligoland with the "Laurel" and her division in hot pursuit. They drew away to the east and at 7:26 A.M. Tyrwhitt turned to the southeast to support them. A few minutes later they sighted the German 5th Flotilla coming up, and sent it also flying back.

The report from G194 reached the German flagship about 7:30 A.M., and on it becoming clear that a considerable force of British destroyers had penetrated into the Bight, the light cruisers were ordered to proceed. The "Stettin" was already on her way at 7:58 A.M., though she had not raised a full head of steam. By this time the German 5th Flotilla was calling loudly for cruiser support. The alarm had gone at Heligoland, and by 7:50 A.M. the whole fortress was standing to its guns. The visibility was then about 16,000 yd., and German destroyers came into view driving pell-mell towards the island. The British were overhauling them. One of the destroyers had been hit in the stokehold at 7:50 A.M. and her position was becoming critical, when at 7:58 A.M. the "Stettin," coming round the north of Heligoland, appeared on the scene and opened fire on the "Laurel's" division at 9,300 yards. A 8:05 A.M. the "Fearless" sighted her and opened fire; the "Stettin" retired behind Heligoland to get up steam for full speed, while the "Fearless," receiving a signal at 8:12 A.M. to alter course to west-quarter-south, turned accordingly to begin the sweep.

This brief respite had enabled the German 5th Flotilla to get clear and they came streaming in towards Heligoland. The inner patrol line was under a heavy fire from the "Arethusa," and the torpedo boats D8 and T33 suffered severely, but at 8:08 A.M. the "Frauenlob" arrived on the scene from the south and engaged the "Arethusa" on a southwest course. A sharp action ensued at 6,500 to 4,000 yards. Only the forecastle gun of the "Arethusa" remained in action, and eight men were killed. The "Frauenlob" received some 10 hits and had nine killed and 28 wounded. At 8:25 A.M. the "Arethusa" turned to west-quarter-south and the "Frauenlob" turning south broke off the action.

The Second Phase (see fig. 1).—By 8:30 A.M. this phase of the operation was over and both flotillas were proceeding to the west with the "Fearless" some 6 m. north of the "Arethusa." Goodenough's light cruisers had also turned west at 8:30 A.M. and were some 12 m. to the westward. Beatty was moving to and fro with his battle cruisers about 45 m. to the northwest. The attack had not developed according to plan, for the German patrols had broken back and reached home with one exception. This was V187, the flotilla leader's boat, which the "Fearless" sighted to the westward at 8:15 A.M., and which was sunk after a hot chase by the "Goshawk," "Phoenix" and "Ferret" at 9:10 A.M. The destroyers had lowered boats to rescue the survivors, but the "Stettin," which had now got steam up, reappeared on the scene and drove them off. Five boats in the scurry had to be left behind, but E4 (Lt.-Comm. E. W. Leir), emerging suddenly, rescued the "Defender's" men, took an officer and two of V187's crew "as a sample," then disappeared as suddenly and silently as she came. By 8:55 A.M. the "Fearless" had rejoined the "Arethusa" and the flotillas were now from 12 to 15 m. west of Heligoland steering west-quarter-south.

Commodore Keyes, in the "Lurcher," not knowing Goodenough's cruisers were on the scene, had mistaken them for the enemy and asked for help, but recognised them at 10 A.M., and as the "Southampton" had already attempted to ram E6, Goodenough decided to withdraw to the west and leave the field clear for the submarines. Tyrwhitt had turned boldly back to help Keyes at 9:45 A.M. The "Arethusa" stopped for repairs at 10:17; her engines were disabled and she was only able to go 10 knots. A lull of half an hour ensued. By this time the Germans were beginning to appreciate the situation. At 8:20 A.M. the commander-in-chief, Adml. von Ingenohl, had taken over the command from Hipper, the admiral of scouting forces, and had ordered the battle cruisers to raise steam and to proceed as

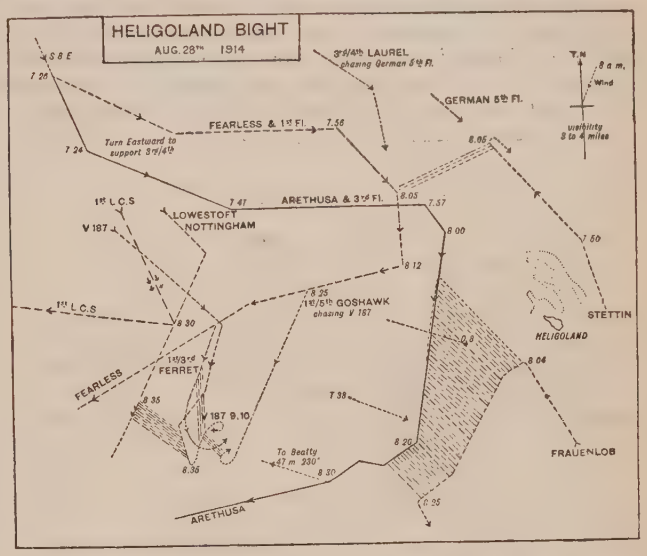

FIG. 1.—Flotillas at 8:30 A.M.

soon as there was water on the bar. The German light cruisers, eager to attack, were pushing out as soon as they could raise steam. They now began to appear on the scene.

The "Arethusa" had got under way again at 10:40 A.M. and was making slowly to the west when at 10:46 A.M. the "Strassburg," which was trying to get in touch with the "Stettin," appeared in the southeast, coming up on a north-north-west course. She opened fire at about 8,400 yd., crossed the "Arethusa's" stern, turned and disappeared to the north in the mist. The "Cöln" had come up behind her at 11:5 A.M., but after exchanging a few salvos she too passed on. At 11:16 A.M. the "Strassburg" reappeared to the north and steering a parallel course to the west opened a heavy fire at 8,650 yards. The 1st and 2nd Divs. of the 3rd Flotilla went off to the northwest and, joined by the 1st Div. of the 1st Flotilla, attacked her at 11:35 A.M. Two torpedoes ran past her and she disappeared in the mist. The destroyers rejoined the "Arethusa" and continued their course to the westward.

When the "Cöln" appeared Tyrwhitt had signalled for support, and when the "Strassburg" came in sight the second time, Capt. Blunt of the "Fearless," foreseeing the concentration which the German light cruisers were striving to achieve in the mist, sent an urgent signal to Beatty for assistance. Beatty had been waiting and watching round a position in 54° 28′ N., 6° 20′ East. The situation was obscure, but between 11 and 11:30 A.M. it was clear that Tyrwhitt was engaging a cruiser some 30 m. to the eastward, and at 11:20 A.M. Goodenough was ordered to support him. Then came Capt. Blunt's signal from the "Fearless" couched in terms of urgency. Beatty did not know that the "Arethusa" could only go 10 knots, but he knew that

the flotillas were only 26 m. from Heligoland, and that the German base at Emden lay close to their flank. He decided at once to take his whole force in the Bight. At 11:24 A.M. his battle cruisers had been formed in single line ahead, and working up to full speed he proceeded east-south-east to throw their tremendous weight into the issue of the day.

The Main Action

The "Mainz" had left the Ems shortly after 7 A.M. and was making at full speed to the east to cut off the British destroyers and to join the "Strassburg" and the "Stettin." At 11:30 A.M. she was sighted almost right ahead by the 2nd, 3rd and 5th Divs. of the British 1st Flotilla as they came west with the "Fearless" and "Arethusa" some miles behind. The "Mainz" turned to the north and opening a heavy fire chased the destroyers to the north for 20 minutes. But at 11:50 A.M. the situation suddenly changed. Out of the mist to the north-north-west there appeared four light cruisers coming down at high speed. They were Goodenough's cruisers. For an anxious minute the destroyers were uncertain whether they were friend or foe, then they recognised them and turned eagerly to join them. The "Mainz" recognised them too and fled to the southward at 25 knots. The range was over 7,000 yd.; she received two hits and drew away in the mist, sending at noon a signal—

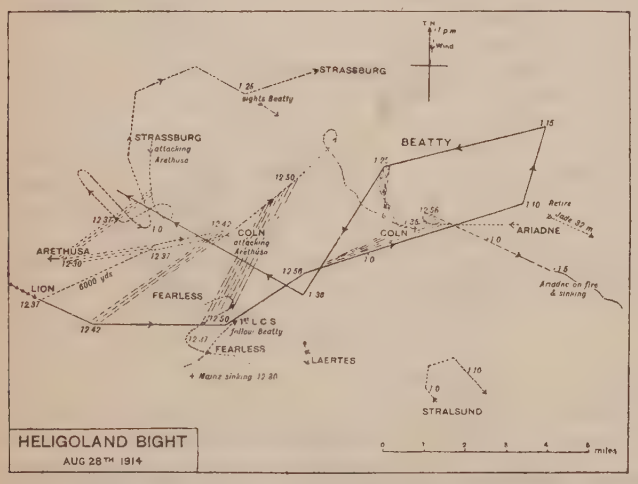

FIG. 2.—Beatty Enters the Fight.

the last she sent—that she was being chased by a battle cruiser. It was received at 12:05 P.M. and the "Moltke" and "Von der Tann" were ordered to proceed, screened by the German 8th Flotilla. In the river it was clear, and no one had informed the German command of the mist prevailing in the Bight. The "Mainz," running to the southeast had hardly drawn away from the light cruisers when at 12:08 P.M. she sighted the "Fearless" and the 3rd Flotilla coming west. She swung round to south as the 1st and 2nd Divs. of the British 3rd Flotilla turned to north and the 4th Div. to south to engage her.

Sinking of the "Mainz."—In the action that ensued the "Mainz's" rudder was damaged and her port engine brought to a stop. She then concentrated her fire on the 4th Div. at about 5,000 yards. The "Laurel" was hit by the first salvo; the fourth blew up a number of lyddite shells, and with her captain severely wounded and her after funnel blown away, she crawled away hidden in her own smoke and steam. The "Liberty" had her mast shot away and her captain killed. The "Laertes" was hit four times by a single salvo at 4,000 yd., and stopped dead. But the "Mainz" had been hit at 12:15 P.M. on the port side amidships by a torpedo fired by one of the destroyers, and Goodenough's cruisers which were now closing, opened a deadly fire which reduced her quickly to a wreck. At 12:25 P.M. they ceased fire; the "Lurcher" coming alongside saved her crew and at 1:08 P.M. she settled by the bows and sank.

British Battle Cruisers in Action.—The situation was still far from clear; the flotillas were scattered; the "Strassburg" and "Cöln" had appeared to the northeast and opened a heavy fire. Then suddenly out of the mist there emerged Beatty's four great battle cruisers steaming at high speed. They swept past the sinking "Mainz" and on to the northeast with Goodenough and his light cruisers following in their wake. The German cruisers fled, but it was too late. At 12:37 P.M. the "Lion" sighted the "Cöln" on the port bow and opened fire at 3,800 yd.; the "Cöln" ran desperately to the northeast, but a heavy shell disabled her engines. Then she gained a brief respite, for the "Ariadne" was sighted by the "Lion" trying to cross her bows on a southeast course. Fire was opened on her. She was hit by the first two salvos and disappeared in the mist to the southeast, on fire and sinking.

Beatty now decided to withdraw, and at 1:10 P.M. made the signal to retire. The "Lion" came gradually round to a westerly course and at 1:25 P.M. sighted the "Cöln" again, steering slowly to the southeast. Her admiral had fallen; her captain was seriously wounded. The "Lion" sent a 13·5-in. shell into her; she listed to port and sank with flag flying at 1:35 P.M. By this time both the "Stettin" and "Strassburg" had sighted and reported the British battle cruisers, and at 1:50 P.M. the German light cruisers were ordered to fall back on the "Moltke" and "Von der Tann." It was not, however, till 2 P.M. that the battle cruisers passed the bar of the Outer Jade. The German battleships were then raising steam, and the battle cruisers were ordered (2:41 P.M.) not to advance against the British, but to wait for the "Seydlitz" 25 m. west of Heligoland.

By 3:50 P.M. the three German battle cruisers had reached that position, and there they were joined by the "Strassburg," "Kolberg" and "Stralsund." They made a short sally, but there were no signs of any British ships, and they turned back before reaching the spot where the "Cöln" had sunk. For the British it remained only to get home. At 4:30 P.M. Rear-Adml. Campbell's cruisers met the destroyers and the "Laurel" was taken in tow by "Amethyst." The "Arethusa" struggled on at six knots till 7 P.M., then signalled for assistance, and at 9:30 P.M. was taken in tow by the "Hogue" and returned safely.

Results of the Battle.—Mist, uncertainty and the speed of the German light cruisers had hampered the British submarines. The German submarines had all been held back off Heligoland and by the time they were finally dispatched to attack the British battle cruisers, the latter were out of reach. The engagement was a severe blow to the German fleet. They lost three light cruisers and one destroyer, and their casualties were 63 officers and 649 men killed, 20 officers and 361 men wounded, nine officers and 140 men prisoners; a total of 1,242 against the British 35 killed and some 40 wounded.

The engagement had important ulterior consequences. When Beatty swooped down on the Bight, he drove a great wedge into German naval policy, for the loss of the cruisers confirmed the Kaiser in his determination to restrict the German fleet to a strictly defensive policy. For the British Navy and Nation the victory came at an opportune time. The irresistible advance of the German Army had filled many with something like dismay. The news of a naval victory at the very gates of the enemy lightened the gloom, and gave the nation faith in the navy's ability to face its gigantic task.

BIBLIOGRAPHY.—J. S. Corbett, *History of the Great War: Naval Operations* (1920); E. Mantey, *Der Krieg zur See.* (A. C. D.)

HELIOTHERAPY (*see* PUBLIC HEALTH; THERAPEUTICS).—Heliotherapy, or treatment by sunlight, has been intermittently practised since the dawn of history, but its scientific exploitation dates from the time of Finsen, who especially developed light treatment by the employment of artificial sources of light, notably the carbon arc. It owes much to the work of Bernhard and Rollier, who commenced treatment with natural sunlight early in the present century. The latter especially, by the brilliance of his results and his enthusiastic advocacy, has done much to popularise its use, especially in nonpulmonary tuberculosis.

Its employment on an extensive scale in Great Britain was initiated with the establishment of the Treloar Cripples' Hospital at Alton. It was employed to some extent with gratifying results on septic wounds contracted during the War, but interest

has been especially aroused since that period, the abnormally fine summer of 1921 and the institution of Daylight Saving calling general notice to the importance and significance of sunlight in our lives both in health and disease. Further researches of numerous investigators have done much to demonstrate the manner in which sunlight is of therapeutic value.

Essential Conditions.—The most obvious benefits are noted by clinical observation on patients suitably exposed to solar rays. Certain essentials are necessary to demonstrate these beneficial results. The patient exposed to the sunlight should first be acclimatised; he must never be too hot or too cold; in brilliant sunshine his head should be protected, and if there is much glare his eyes should be shielded by dark goggles. Exposure should be gradual: first the feet are sunned for short periods daily, the length of exposure and the area exposed being increased slowly, so that at the end of a fortnight exposure of the whole body may be generally tolerated with safety. Periods of exposure are gradually lengthened, until eventually the patients are often able to tolerate and benefit by exposure of the nude skin for from three to four hours daily.

There are great variations in the optimum exposure of different individuals. Generally speaking, brunettes tolerate exposure better than blondes; individuals who freckle but whose skins do not brown must be exposed with great caution, while albinos can barely tolerate exposure at all. On the normal skin an erythema develops within six hours of exposure; care should be taken not to exceed this erythema, and blistering is to be avoided. Gradually the skin becomes bronzed, and as this bronzing or pigmentation deepens so may exposure be prolonged, the pigment protecting the patient from the harmful effects of the actinic rays.

Insolation necessarily involves exposure of the body to the cold air, and the latter has been shown to increase the metabolic activity of the subject treated. The rays of greatest therapeutic value are the ultra-violet or actinic rays, the light waves of shortest wave-length in the solar spectrum. These are most intense at the seaside or on the mountains. Excess of heat rays is to be avoided, and insolation for its therapeutic value is thus better carried out in temperate than in tropic regions. Properly timed exposure on the individual responding to treatment is associated with a tonic and exhilarating effect; exposure unduly prolonged results in fatigue and exhaustion, and is to be avoided.

Effects of Insolation.—While properly applied insolation exercises a tonic effect on the body, it has been demonstrated that it is equally stimulating to the mind. The exposed subject is notably more cheerful and exhilarated, and evidence has been adduced to show that mental responses are brisker and mental activities more pronounced. On the body the effect of insolation may be described as local or direct and remote or indirect. Light exercises a beneficial effect on superficial lesions by reason of the direct bactericidal action of the actinic rays, assisted by the favourable inflammatory response which carefully timed exposure elicits.

The remote beneficial effects are more marked but less easy to explain. Eidenow has shown that the haemobactericidal power is often raised after an erythema dose. This enhanced power of the blood to destroy pathogenic organisms is obtainable equally when a portion or the whole of the skin is exposed, and, if increased haemobactericidal power is alone sought, fractional exposures of different portions of the skin at consecutive sessions is the method of treatment of choice. Sonne has demonstrated that the visible rays of the solar spectrum have considerable penetrative power, pass through the skin, and are absorbed in the subjacent blood, their physical being transformed into thermal energy. He has suggested that this local heating effect is of value in destroying deleterious circulating toxins. Investigations have shown that the calcium, phosphorus and iron content of the blood may be raised by insolation.

Sunlight treatment has its greatest therapeutic value in increasing and maintaining bodily tone and energy, in the treatment of the various manifestations of surgical tuberculosis, in the treatment of rickets and the relief of nervous asthma. It is of proved value in certain affections of the skin, notably psoriasis. It is of great assistance in a variety of conditions, accelerating and consolidating the cure, particularly in convalescence from debilitating diseases such as infectious fevers. Its stimulating effect is seen in increasing fecundity and in the treatment of certain defects of the endocrine glands. The range of its usefulness is being rapidly extended, in the main, as an aid to cure rather than as a specific treatment. See A. Rollier and others, *Heliotherapy* (1923). (H. J. G.)

HELIUM (*see* 13.233).—Helium, next to hydrogen, is the lightest of all the chemical elements. Except at exceedingly low temperatures, it exists only in the gaseous form.

Sources of Helium.—Investigations carried out since 1895 have shown that helium is widely diffused throughout the earth. It can be obtained from many types of rocks, minerals and earths, and it is present in varying amounts in probably all natural gases and spring waters. It is present, too, in the atmosphere of the earth to the extent of about one part in 185,000 by volume. Evidence that helium is universally distributed is afforded by the fact that many of the white stars exhibit its absorption spectrum, while certain other stars and nebulae show the bright line spectrum of the gas. Helium has also been found in a meteorite that reached the earth at Augusta Co., Va., United States of America.

Helium from Rocks and Minerals.—In the case of most of the rocks and minerals that contain helium in appreciable amounts the gas is present as a result of the radioactive disintegration of the uranium or of the thorium present in them. Of all the minerals examined, thorianite, which consists chiefly of thorium oxide, is probably the richest in helium. It has been found to contain 9·5 cu. cm. of helium per gramme.

Monazite, a phosphate of thorium and other rare earths, contains on the average about 1 cu. cm. per gramme. Cleveite, samarskite and fergusonite contain a little more than monazite. Helium is found in minute quantities in practically all the common minerals of the earth, and its origin in them has been traced to radioactive matter that is universally distributed in minute amounts in the material constituents of the earth's crust. In two cases helium has been found in minerals in the absence of appreciable amounts of uranium and thorium compounds, namely in beryl and in sylvine (potassium chloride). It is interesting to note, however, in this connection that potassium and rubidium in their elemental state as well as in the form of chemical compounds have been shown to be radioactive at least to the extent of emitting beta rays. In extracting helium from the mineral thorianite, which is imported from Ceylon usually for the manufacture of thoria, the method generally followed is that given by Lord Rayleigh. The mineral dissolves readily in strong nitric acid, and the helium contained is then liberated. The gas contains a certain amount of hydrogen and of oxides of carbon, also traces of nitrogen. To get rid of carbon some oxygen is added to the helium and the mixture is exploded with an electric spark.

All the remaining impurities, including the excess of oxygen, can then be taken out of the gas by Sir James Dewar's ingenious method of absorption with charcoal cooled in liquid air. Helium is but slightly absorbed by the cold charcoal, and consequently can be pumped off from the vessel containing the charcoal in a state of the highest purity. If liquid air is not available helium can be purified by the methods employed for argon, the various impurities present being removed by one or other of the agents —calcium carbide or metallic calcium, copper oxide, caustic potash and phosphorus pentoxide. If thorianite is not available, monazite, which is more abundant, may be utilised. In 1895 Lockyer showed that the helium contained in minerals could be extracted from them by heat; J. A. Gray (*Proc. Roy. Soc.*, 82A, p. 301, 1909) confirmed this discovery at a later date, and showed that helium could also be extracted by simply grinding the minerals into a fine state of division.

Helium from the Atmosphere.—Helium may be extracted from the atmosphere by passing ordinary air through tubes cooled with liquid hydrogen. At the temperature of liquid hydrogen all elements in the air become solidified excepting helium, and the latter, after passing through the tubes, can be collected in a highly

purified state. In the process of the liquefaction of air, or in that of extracting nitrogen or oxygen from the air by liquefaction and rectification in large industrial plants, it has been found feasible to include in the machines used for the purpose devices that allow the helium and the neon of the air to be separated out, these two gases being the only constituents of the atmosphere that remain in the gaseous form when air is liquefied. As charcoal cooled with liquid air has more condensing power for neon than for helium, it is generally used to separate out the helium from a mixture of these two gases. Final purification, however, is best effected by the use of liquid hydrogen.

Helium from Mineral Springs and Natural Gases.—Helium is found in the gases evolved from many thermal water springs. Moureu and Lepape, who made an exhaustive determination of the helium content of the gases evolved from mineral springs in France, found that many of them contained a considerable proportion of helium. At one spring in Maizières it amounted to 5·92%, and at two others in Santenay (Côte d'Or) helium contents of 8·4% and 9·76% by volume were found. In the hot springs of Bath, England, the helium amounts to about one-thousandth part of the gas evolved. Traces of helium have been found in the gases of the thermal springs in Iceland, and also in many of the natural gases of the other countries in Europe. The quantities involved in the latter, however, are extremely small and the occurrences unimportant. Lord Rayleigh has suggested that the helium found in hot springs may be derived from the disintegration of common rocks at great depths.

By far the best practical sources of helium are the natural gases of America. In Canada, while natural gases are found in all the provinces, they exist in commercial quantities only in the provinces of Alberta, Ontario and New Brunswick. The helium content of these gases has been determined on several occasions, and the latest results are those given by the Mines Branch of the Dept. of Mines of Canada. This report shows that while helium is found in all the Canadian gases it has not been found to be present in any of them to a greater extent than 1%. A conservative estimate of the amount of helium recoverable from the natural gases of Canada would be 5,000,000 cu. ft. per annum.

In the United States of America the main helium resources occur in the Texas, Mid-continent and Appalachian natural gas-fields, where the supplies of helium-bearing gas are widely distributed, and where in some localities they are of great magnitude. The helium content of the gases from a majority of the wells is not greater than 0·6%, but in Kansas a number of wells exist that give a supply of natural gas containing from 1·5% to 1·84% of helium. It is estimated that it would be possible to extract nearly 50,000,000 cu. ft. of helium yearly from the natural gases of the United States.

Properties of Helium.—Helium is less soluble in water than any other gas, and recent determinations by Antropoff give the following values for its solubility: 0° C. ·00967, 10° C. ·00991, 20° C. ·00996, 30° C. ·01007, 40° C. ·01029, 50° C. ·0108. Quartz glass at a red heat is freely permeable to helium. The effect is even perceptible at a temperature as low as 180° Centigrade. At 500° C. quartz glass has been shown by Williams and Ferguson to be 22 times as permeable to helium as to hydrogen (*Jour. of Am. Chem. Soc.*, Oct. 1922). This property has been put forward as the basis of a practical method of separating helium from other gases. M. Travers has suggested, also, that it may explain the liberation of helium from minerals by heat, the gas being enabled to permeate the siliceous materials in which it is enclosed. Thorianite, however, contains no silica, and until it is shown that metallic oxides are permeable to the gas this explanation can scarcely be accepted as valid. With rubbered balloon fabrics the permeability to helium has been found to be less than to hydrogen, the ratio of helium to hydrogen permeability being about 0·7. With skin-lined fabrics the ratio of helium to hydrogen permeability has been found to be about unity. The temperature coefficient of increase of pressure at constant volume is perfectly normal for helium, and has a value of 0·0036614 (Fourth Int. Cong. on Refrigeration, June 1924). The thermal conductivity at 0° C. is given by Schwarze as 0·0003386, and the viscosity as determined by Schultze at 15° C. is 1·086 compared with that of air as unity. This determination has been confirmed by Rankine.

The velocity of sound in helium at 0° C. is 971 metres per sec., and the ratio of the specific heats, C_p/C_v, has the value 1·671 at 180° C. and 1·659 at 18° C., which indicates the monatomic character of the gas. At 18° C. the specific heat at constant pressure, C_p, is 1·251, and the atomic heat consequently 5·004. The refractive index of helium at normal pressure and temperature for the wave-length 5890Å is 1·000035. Helium has two resonance potentials, 19·77 volts and 20·5 volts, and its ionisation potential is 24·5 volts. The minimum sparking potential for helium is 261 volts. Gaseous helium at normal pressure and temperature has for its dielectric constant 1·000074. Helium as a gas is diamagnetic, and according to Hector (*Phys. Rev.*, Oct. 1924, p. 148) it has a volume magnetic susceptibility of $-0{\cdot}78\times10^{10}$ at 20° C. and 760 mm. pressure.

Helium Atoms and Nuclei.—The atomic weight of helium is 4, and its density is 1·995. Since the gas is monatomic its atomic and molecular weights are the same. Of all the rare gases helium alone has no isotopes (*q.v.*). The square root G of the mean square molecular velocity of the atoms of gaseous helium at 0° C. is $13{\cdot}11\times10^4$ cm. sec^{-1} and the mean free path at normal pressure and temperature is $28{\cdot}5\times10^{-6}$ centimetre. The molecular diameter as deduced from the viscosity of the gas is $2{\cdot}18\times10^{-8}$ centimetre. Like the atoms of other elements, those of helium have a nuclear structure, the positive electric charge on the helium nuclei being 2ϵ where ϵ is the elemental charge of electricity. The two electrons that neutralise the nuclear charge are supposed to describe about the nucleus two nearly circular orbits with planes inclined to each other at an angle of 120° Centigrade. The radius of these orbits is approximately $1{\cdot}25\times10^{-9}$ centimetre. Spectroscopic evidence goes to show that while helium in its normal state exists in the form of atoms with crossed electronic orbits it can also, under electric excitation, be transformed into a metastable state designated as orthohelium. With atoms in the latter state the electronic orbits are supposed to be in the same plane with one orbit circular and the other elliptical, the major axis of the elliptical orbit being approximately four times as great as the diameter of the circular one.

For spectroscopic purposes helium, with its atoms in the normal state, is sometimes given the designation parhelium. The alpha rays expelled by radioactive substances have been shown to be helium nuclei. The initial velocities with which they are expelled from such substances vary from $2{\cdot}22\times10^9$ cm. sec^{-1} to $1{\cdot}45\times10^9$ cm. sec^{-1} according to the radioactive substance that gives rise to them. The corresponding kinetic energies are $1{\cdot}53\times10^{-5}$ and $0{\cdot}645\times10^{-5}$ ergs. It was by observations on the scattering of alpha rays of very high speeds through large angles by thin sheets of matter that Rutherford in 1911 established the view that atoms generally possess a nuclear structure.

Through phenomena associated with this scattering of alpha rays by matter it has been shown that the nucleus of a helium atom possesses very great stability. Helium nuclei themselves are supposed to be complex in their structure and to consist of four hydrogen nuclei and two electrons. Numerous experiments lead one to take the view that a helium nucleus or alpha particle behaves in impacts with nuclei of other atoms as if it were a perfectly elastic body, spheroidal in shape, with its minor axis 4×10^{-13} cm. in the direction of motion and its major axis 8×10^{-13} centimetre. The mass of a helium atom is slightly less than the combined masses of the hydrogen nuclei and electrons of which it is constituted, and this indicates that a large amount of energy must be liberated during its formation in the form of radiation of wave-length approximately $1{\cdot}75\times10^{-11}$ centimetre. A view held by astrophysicists generally is that the exceedingly high temperature of certain stars that exhibit a helium hydrogen spectrum can be accounted for by assuming them to be the seat of the formation of helium out of hydrogen. By bombarding the nuclei of the atoms of various elements with alpha rays, Rutherford has proved that atomic nuclei generally have a complex structure with hydrogen nuclei and electrons as primary constituents, and in some cases with helium nuclei as secondary ones.

Liquid Helium.—The liquefaction of helium was achieved by H. Kammerlingh Onnes at Leyden in 1908. In Jan. 1922 a cryogenic laboratory was instituted in the University of Toronto and helium was liquefied in Jan. 1923. Finally, in the summer of 1925 helium was liquefied in small quantities in the Reichsanstalt, Charlottenburg, Germany. Liquid helium is a colourless, very mobile liquid with a low surface tension. According to Onnes and Boks (*Leyden, Comm.*, No. 170) the density of liquid helium has a maximum value of 0·1462 at 2°·39 K with a value 0·1404 at 3°·19 K. and one of 0·1456 at 1°·49 K. assuming the absolute zero to be −273°·09 Centigrade.

The saturation vapour pressure (p. in mm.) of liquid helium is 4·15 at 1°·475 K., 359·5 at 3°·516 K., 757·5 at 4°·205 K., 1329 at 4°·9 K. and 1668 at 5°·16 Kelvin. The heat of vapourisation at 4°·25 K. has been estimated to be 19·38 gr. calories. The critical temperature of helium is 5°·19 K., the critical pressure (p. in Int. Atm.) 2·26, and the critical density 0·066. The "slope diameter" is −0·0033 and the boiling point at atmospheric pressure is 4°·21 Kelvin. The triple point temperature and pressure (p. in Int. Atm.) are respectively less than 0°·89 K. and 0·002 (see *Report* of Fourth Int. Cong. on Refrigeration, June 1924). According to Kammerlingh Onnes the Boyle point lies close to 20° K. and the "inversion temperature" to 40° Kelvin.

From certain considerations brought forward by Perry (*Jour. of Phys. Chem.*, vol. 28, No. 10, Oct. 1924) it can be shown that the optimum working pressure to use when liquefying helium, after cooling it with liquid hydrogen, is between 15 and 20 atmospheres. The lowest temperature attained by H. Kammerlingh Onnes with liquid helium boiling under low pressure was a few hundredths of a degree below 0°·9 kalium. The vapour pressure corresponding to this temperature was estimated to be 0·013 millimetres of mercury.

Liquid helium has been extensively used as a refrigerating agent by H. Kammerlingh Onnes and his collaborators and by others when investigating the physical and chemical properties of various substances at the lowest attainable temperature. Though the great majority of the investigations carried out have been connected with the thermal properties of substances, others dealing with the phenomena of phosphorescence and fluorescence, magnetism and magneto-optics, crystal structure, radioactivity and electrical conductivity have led to results of great scientific value. Probably the most interesting phenomenon discovered and investigated by H. Kammerlingh Onnes through the use of liquid helium is that of electrical super-conductivity in metals. In this field of investigation Onnes has shown that at temperatures attainable only with liquid helium the metals mercury, lead, tin, indium and thallium offer no resistance to the passage of electric currents through them and become perfect electrical conductors. It may be added that up to 1926 helium, alone of all the elements, had not been solidified.

Chemical Activity of Helium.—Although helium is chemically inert under ordinary conditions, evidence obtained in recent years suggests the possibility of its exhibiting chemical activity under certain very special conditions. Particularly under the influence of the electrical discharge, helium atoms may be united with other helium atoms in the same state or with atoms of other elements, to form compounds either of a fugitive or a permanent character. The fact that helium under certain conditions can be made to emit a band spectrum in addition to its line spectrum connotes the possibility of the gas existing in the molecular form.

Experiments made by E. H. Boomer (*Proc. Roy. Soc.*, vol. 109, No. A 749, p. 198) with an intense electric discharge from an incandescent tungsten filament in helium at low pressures show that a distinct and stable compound can be formed out of tungsten and helium with the formula $W He_2$. Boomer has also obtained evidence of chemical combination of helium with the vapours of mercury, iodine, phosphorus and sulphur. These compounds are fugitive in character and appear to be stable only at very low temperatures.

Industrial Uses.—In 1914 Sir Richard Threlfall put forward a suggestion to the Board of Inventions of the British Admiralty, that if helium were available in large amounts it might be used to replace hydrogen as a filling for airships. The fact that helium is non-inflammable and non-explosive and possesses 92% of the lifting power of hydrogen makes it a most suitable material for giving buoyancy to airships. Following up the suggestion, Prof. McLennan and his associate Mr. John Patterson initiated experiments for the British Admiralty on a semi-commercial scale on the natural gases of Canada. A machine was designed, constructed and successfully operated, with results that showed it was quite feasible to extract helium economically from natural gases when helium was present in them to the extent of only 0·33%. At the same time vastly greater experiments were initiated and carried through independently by the military and naval authorities of the United States, in co-operation with the Bureau of Mines of that country. Enormous quantities of helium were extracted from the natural gases of Texas, and the possibility of separating out the helium from the natural gases at a low cost was fully demonstrated.

In the electrical industry helium may be used for the construction of thermionic amplifying valves of the ionisation type and of gas arc lamps. In spectroscopy, especially for investigations in the ultra-violet region, helium is of use and possesses an advantage over most other gases in that it is transparent to light of extremely short wave-lengths. Owing to its high dielectric properties and its high heat conductivity it has been proposed to use helium in place of oil as a filling for transformers and for surrounding the switches and circuit-breakers of high tension electric transmission lines. Tests have been made by the General Electric Co. of the United States on the use of hydrogen as a cooling medium for large electric generators. These machines were operated in an atmosphere of hydrogen, with the result that owing to the lightness of hydrogen the windage loss was reduced, and owing to its high heat conductivity compared with air, the generators were made to give a 30% greater output with the same temperature rise. Since helium is also a light gas with a thermal conductivity slightly greater than that of hydrogen and can be used without the danger of explosions occurring, it would appear that it may be used for the same purpose if obtainable in large quantities at a low cost.

In 1917 considering the hygiene of labor, it was suggested by Elihu Thomson and others that if divers and workers in tunnelling operations carried on under high atmospheric pressures were supplied with a mixture of oxygen and helium in place of air the liability to caisson disease might be minimised or perhaps eliminated. Preliminary tests made in this direction by R. R. Sayers, W. P. Yant and J. H. Hildebrand for the United States Bureau of Mines (*Reports of Investigations*, Serial No. 2,670) have shown that through the use of helium and oxygen mixtures as a substitute for air in diving work the time of decompression can be materially reduced. This results from the fact that helium diffuses more readily out of the blood and body tissues than nitrogen. As the depths at which divers can operate depend largely on the duration of the period of decompression these experiments open up the possibility for extending somewhat the safety depth limit for diving operations.

Spectra Modified by Action of Helium.—A number of investigators, including Merton, Barrett, Johnson, Cameron and others, have shown that profound modifications may be observed in the spectrum of an element when it is present in small quantities in a discharge tube containing helium at a comparatively high pressure. As an example, the "comet-tail" spectrum discovered by Fowler is greatly enhanced by high-pressure helium. Merton and Pilley, too, were able with the addition of helium not only to bring out the hitherto practically unknown arc spectrum of atomic nitrogen, but also to isolate it completely from the spark spectrum of this element. McLennan and Shrum recently made some observations on the spectrum of small quantities of air in a large admixture of helium, and analysis of the spectrum obtained by them with these mixtures showed the presence of a line at $\lambda = 5577{\cdot}35$ Ångström units. When mixtures of oxygen and helium were used and an uncondensed discharge passed through, the line $\lambda = 5577{\cdot}35$ Å. was enhanced.

The line was obtained with the strongest intensity when the partial pressure of the oxygen in the mixture was about ⅔ that of helium, the partial pressure of the latter being about three centimetres. The line was also obtained with pure oxygen, which shows that it belongs to the spectrum of this element. As the intensity of the line when obtained with pure oxygen is low, it would appear that the function of the helium is to maintain the oxygen atoms in a state that permits them to radiate the light $\lambda = 5577{\cdot}35$ when once they are brought into that state by electrical stimulation. These results have a bearing on problems connected with the identification of the lines in the auroral spectrum, and McLennan and Shrum's experiments are of interest in that the wave-length $\lambda = 5577{\cdot}35$ Å. which they obtained with oxygen is identical with that of the green line in the spectra of auroras that has long defied identification. The result is also interesting in that it may be taken as evidence of the existence of helium containing a small amount of oxygen in the upper atmosphere, for it is known that auroral displays originate at atmospheric heights of about 100 kilometres.

The Spectrum of Helium.—Both theory and experiment indicate that in the ultra-violet spectral region the radiation emissible by helium does not include any wave-length shorter than $\lambda = 228$ Ångström units. The line spectrum of helium as observed ordinarily in vacuum tubes consists of a system of singlet series and a system of doublets. The doublets are very close and are somewhat unusual in that in the sharp diffuse series the more intense component is on the more refrangible side, while the first principal line has its stronger component on the side of the greater wave-length. It is generally accepted by spectroscopists that the singlet series of wave-lengths in the spectrum of helium originate in parhelium, and that the doublet series have their origin in atoms in the metastable or orthohelium state. Besides the line spectrum there is, as previously stated, an interesting band spectrum of helium which is well developed under appropriate conditions. Fowler has shown that the heads of some of the stronger bands, in contrast with all other known band spectra, are arranged in accordance with the laws of line series. There is, however, no apparent relation between the band and the line series, except that the main series of bands runs nearly parallel with the principal series of helium doublets.

All lines in the helium spectrum that have been investigated are resolvable by magnetic fields into normal Zeeman triplets. Recently Curtis and Jevons (*Nature*, Nov. 21 1925) showed that a Zeeman effect can be obtained with certain lines in the band spectrum of helium. The wave-lengths of a number of lines in the spectrum of helium were accurately measured by Merrill at the Bureau of Standards, Washington (*Astrophys. Jour.*, 46, p. 357, 1917) and are now accepted as secondary standards for the purpose of spectrum analysis. They are as follows:—

(I.A.)	(I.A.)	(I.A.)
2945·104	4026·189	4921·929
3187·743	4120·812	5015·675
3613·641	4143·759	5047·736
3705·003	4387·928	5875·618
3819·606	4437·549	6678·149
3888·646	4471·477	7065·188
3964·727	4713·143	7281·349

Bibliography.—An extensive bibliography of the work on helium is given in *Circular* of the Bureau of Standards, Washington, No. 81 (1919).

For the results of low-temperature investigations the *Communications* from the Physical Laboratory of the University of Leyden should be consulted. (J. C. McL.)

HELSINGFORS or Helsinki (*see* 13.252), the capital, chief seaport and only large town of the republic of Finland, had a population in 1922 of 201,435. The chief buildings are largely classical in style, but a number of modern ones showing the national spirit by using local materials and peasant decorative motives, have been erected, in particular a church overlooking the town, the cyclopean parliament buildings on the heights of Brunnparken, a new railway station and a fine memorial to those who fell in the Finnish fight for freedom. The town is an industrial centre, and the harbour accommodates the largest vessels, but it is usually closed by ice from Jan. to the end of April, except for a channel kept open by an ice-breaker. The harbour has been much improved in recent years, and had over 7,000 yd. of quays in 1924; in 1925 a coal wharf was in erection, and a goods station was to be built alongside the harbour. In 1918 civil war, promoted by Bolshevist intrigues, broke out in Finland, and Helsingfors was occupied by Red Guards. Later they were defeated by Finnish nationalists under German leadership.

HEMY, CHARLES NAPIER (1841–1917), British painter (*see* 13.265), died at Falmouth Sept. 30 1917.

HENDERSON, ARTHUR (1863–), British politician, was born in Glasgow of working class parents Sept. 15 1863; but his work and interests subsequently lay at Newcastle (where he served an apprenticeship as moulder at Robert Stephenson & Co.'s works), and in the county of Durham. He became prominent in the trade union movement, and after a while took a leading part in local affairs, being for some years a member of the Newcastle city council and the Darlington borough council. He was mayor in 1903; and was made a magistrate for the county of Durham. He entered Parliament for Barnard Castle, as a Labour member, at a by-election in 1903, and soon made his mark. In 1908 he was elected chairman of the party, a post which he held for two years and to which he was re-elected after the outbreak of war in 1914, when the then chairman, Mr. Ramsay MacDonald, had to resign owing to his pacifist views. As chairman, at the opening of the new session in that autumn, Mr. Henderson promised the full support of organised Labour in maintaining the " splendid unity " of the nation.

When the first Coalition Ministry was formed by Mr. Asquith in 1915, Mr. Henderson was included in the Cabinet mainly as adviser of the Government on labour questions arising out of the World War, with the office, first of President of the Board of Education, and afterwards of Paymaster General. He showed himself resolved on a strenuous prosecution of the War, strongly advocating both the Munitions Bill and the Registration Bill, and having no hesitation in taking the further step of compulsory service. He followed up this action by urging the Labour party to rally in Dec. 1916 to Mr. Lloyd George, and by accepting himself the position of an original member of the War Cabinet of four without portfolio. In the spring of 1917 he visited Russia, just after the Revolution, on behalf of the British Govt., and found the then provisional Govt. at St. Petersburg (Leningrad) strongly in favour of an international Labour and Socialist conference, which was to meet at Stockholm under the auspices of the International Socialist Bureau. He came to the conclusion that, provided the Conference were merely consultative, it would be better that British representatives should go, rather than permit Russian representatives to meet German representatives there alone; and accordingly, on his return to England, being still secretary of the Labour party as well as a member of the War Cabinet, he promoted the participation of British Labour therein. But public opinion in general was strongly against any conference with Germans in the midst of war; the Sailors and Firemen's Union refused to carry the delegates; French, Belgian, Italian and American Labour declined to have anything to do with the conference; and all his Labour colleagues in the Government opposed his views. On Mr. Lloyd George expressing the surprise of the rest of the War Cabinet at his action, and their dissent from his policy, he resigned.

Mr. Henderson warmly espoused the Labour decision of the latter part of 1918 to take the Labour men out of the government and to appeal for support on a purely Labour platform in conjunction with the pacifist wing of the party. This cost him his seat in Parliament at the general election of Dec. 1918, when no pacifist Labour candidates were successful. Indeed, ill-luck pursued him also at the next two general elections, in 1922 and 1923; but in all three cases he returned to the House of Commons a few months later at a by-election. In the Parliament of 1923–4 he had the satisfaction of having two sons as fellow members, though they were both defeated in the autumn of 1924. In MacDonald's Ministry he was secretary of state for home affairs;

but he was not conspicuous either in administration or in debate. He actively endorsed the policy of his party in 1925–6 in severing themselves definitely from the Communists who advocated armed revolution; and he protested strongly, in March 1926, against the suggestion made by the Independent Labour party for the formation of a comprehensive international society which should include the Communists. (G. E. B.)

HENRI, ROBERT (1865–), American painter, was born in Cincinnati, O., in 1865. In 1886 he entered the Pennsylvania Academy of the Fine Arts, Philadelphia, Pennsylvania. Proceeding to Paris in 1888 he studied at Julien's and the École des Beaux Arts and visited Spain and Italy. Returning to the United States he became in 1891 an instructor at the Women's School of Design, Philadelphia. In 1896–1900 he was again in Paris and exhibited at the Salon. During an extremely active life as a painter, he found time to teach, many of his pupils attaining marked distinction. During the period 1915–23 he taught at the Art Students' League, New York City, and also travelled extensively. His portraits are distinguished for their vigour and vivacity. Of his works, "La Neige" was purchased in 1899 for the Luxembourg in Paris, and "Girl in White Waist" (later destroyed by fire) was purchased by the Carnegie Institute, Pittsburgh, in 1904. His other works include "Young Woman in Black," in the Art Institute, Chicago; "The Spanish Gypsy," in the Metropolitan Museum, New York City; and "Indian Girl in White Ceremonial Blanket," in the Corcoran Gallery, Washington, D.C. He wrote *The Art Spirit* (1923).

HENRY, EDWARD LAMSON (1841–1919), American painter (*see* 13.299), died at Ellenville, N.Y., May 9 1919.

HENRY, O. (1862–1910), American short story writer, was born in Greensboro, N.C., Sept. 11 1862. His real name was William Sydney Porter. Until the age of 15 he attended school, then for five years served as clerk in his uncle's drug store. The indoor employment threatened his health, and in 1882 he went to a friend's ranch in La Salle co., Texas. Here he spent two years, absorbing the colour and robust life of the southwest. In 1884 he moved to Austin, Texas, worked as bookkeeper and then spent four years in the General Land Office.

In 1887 he was married, and about this time he began to send paragraphs and humorous sketches to newspapers. During 1891 he was teller in the First National Bank of Austin. In 1894 he bought Brann's *Iconoclast*, a satiric weekly, and transformed it into an extraordinarily humorous farrago of skit and burlesque, illustrated by himself; the venture was not a success and in 1895 he joined the staff of the Houston *Post*, writing a daily column. In 1896 he was indicted on a charge of having embezzled funds (amounting to about $1,150) from the bank in Austin. The details of this affair have never been cleared up; there seems no doubt that he was innocent; the bank's affairs were very slipshod; he may have been shielding some friend; in any case, in a moment of insane impulse he fled from trial and went to Honduras. The fatal illness of his wife brought him back in 1897. While waiting for trial he had the first news of acceptance of some of his stories by important magazines. In 1898 he was sentenced to five years in the Ohio Penitentiary. His term was reduced to three years and three months for good behaviour. In prison he seriously settled down to story-writing, and probably took his famous pseudonym from the name of a French pharmacist mentioned in a dictionary of drugs. He left prison in 1901 and went to New York in 1902. In 1903 he contracted to do a short-story a week for the New York *World*, at $100 each. His first book, *Cabbages and Kings*, was published in 1904. In 1907 he was married to Miss Sarah Coleman, a boyhood friend. He died in New York June 5 1910, and was buried in Asheville, North Carolina.

The varied phases of O. Henry's life are reflected in his stories. The extraordinary productivity of his eight years in New York brought him rapid fame, though he himself lived secluded and known to few. The sale of his books has been enormous and they have been translated into many languages. For ingenuity of plot and racy vividness of narration he has rarely if ever been surpassed, but he has been sharply criticised for turning the short story into a "vaudeville stunt." But the genial magic of his fine imagination, antic humour and brilliant narrative skill triumph over the occasional journalism of his method. Subsequent tendencies in literary technique run in an altogether different current, yet O. Henry remains endlessly and enchantingly rereadable. His New York stories are the most famous, but it is probable that some of the southern and western tales, in which there is less strain for glittering effect, are of more lasting value. The tragedy of his own life taught him a chivalrous tenderness for the unlucky; some of the greatest native endowments a writer can have were undeniably his, but his reckless use of them often arouses the trained reader's amazement. Of him, as much as of any modern writer, it can be said that he had "no talent, only genius."

O. Henry's stories were collected in book form under the following titles: *Cabbages and Kings* (1904); *The Four Million* (1906); *The Trimmed Lamp* (1907); *Heart of the West* (1907); *The Gentle Grafter* (1908); *The Voice of the City* (1908); *Roads of Destiny* (1909); *Options* (1909); *Whirligigs* (1910); *Strictly Business* (1910); *Sixes and Sevens* (1911); *Rolling Stones* (1912); and *Waifs and Strays* (1917).

See C. Alphonso Smith, *O. Henry Biography* (1916) and also posthumous collections of sketches and fragments, *e.g.*, *O. Henryana* (1920), *Letters to Lithopolis* (1922), *Postscripts* (1923). (C. My.)

HENRY, VICTOR (1850–1907), French philologist (*see* 13.301), died at Sceaux, near Paris, Feb. 8 1907.

HERBERT, VICTOR (1859–1924), American musical composer, was born in Dublin, Ireland, Feb. 1 1859. His musical education was received in Germany, where he studied under the leading masters. He became principal violoncello player in the Court Orchestra, Stuttgart, also appearing as a soloist on the concert platform in European musical centres. In 1886 he accepted a position as solo violoncellist in the Metropolitan Orchestra, New York City, being subsequently connected with other orchestras as soloist and conductor. In 1894 he was appointed bandmaster of the 22nd. Regt. (N.Y.) Band. In 1898 he became conductor of the Pittsburgh Orchestra. He composed the music for a number of light operas, of which his greatest successes were *Babes in Toyland* (1903), *Mlle. Modiste* (1905), and *The Red Mill* (1906). In 1904 he organised Victor Herbert's New York Orchestra. In 1911 he wrote a grand opera, *Natoma*. More successful, however, was the music which he composed for the photoplay, *The Birth of a Nation*. In his later years he composed much for musical revues. He died in New York City May 26 1924.

HERCEGOVINA: *see* BOSNIA-HERCEGOVINA.

HERCZEG, FERENCZ (1863–), Hungarian novelist and dramatist, was born at Versecz (Viršet) of a family of German extraction. He decided first to adopt a legal career, but soon turned to literature, and after the publication of his first novel his reputation and popularity steadily increased. He became honorary president of the Petöfi Society and a member of the Hungarian Academy. He was several times elected a deputy and through the medium of his review, *Magyar Figyelö*, showed himself to be a staunch supporter of Count Tisza. He was a master of the psychological novel, excelling in the analysis of the feminine mind and in depicting the life of the nobility and of the well-to-do *bourgeois* class. Among the most notable of his historical novels are *Pogányok* (The Pagans) (1902) and *A hét sváb* (The Seven Swabians), while his tragedy *Byzance* (1912) is considered a masterpiece. His novels and plays have been translated into nearly every European language.

HEREDITY (*see* 13.350 and BIOLOGY; CYTOLOGY; EMBRYOLOGY; EVOLUTION; MENDELISM; SEX).—Heredity is the relation of organic continuity between successive generations. It is a genetic or flesh-and-blood relation, effected by the germ-cells which are liberated from parents and develop into offspring. Heredity secures the continuance of a specific organisation; it implies some measure of racial entailment or organic inertia; and yet it does not preclude variability, that is to say the occurrence of marked differences between offspring and their parents.

Even if there had been no evolution there would still be heredity; it would be the genetic relation between successive

generations of unprogressive Protists. But there could be no evolution without heredity, for heredity implies the possibility that new departures can be entailed from generation to generation. It is possible that in early times and among simple types there was greater variability than is common nowadays and among more advanced types, and that the evolution of the hereditary relation, *e.g.*, in the advance from asexual to sexual reproduction, put a useful check on the occurrence of variations. But it does not conduce to clearness to say that variation is older than heredity, or to make any antithesis between the two sets of facts. There is a contrast between complete hereditary resemblance in successive generations, which might be compared to inertia in the physical domain, and marked variation, which might be compared to kinetic divergence; but the hereditary relation is such, especially in sexual multiplication, that it allows of novelties or new departures. In short, heredity includes the possibility of variation.

Vehicle of the Inheritance

By inheritance is meant all that the organism is or has to start with in virtue of its hereditary relation to its parents and ancestors. Thus it does not include ante-natal infection, or any imprint impressed on the embryo before birth, or any result of being nurtured in the same environment as the parents. In asexual multiplication the vehicle of the inheritance is obviously the separated off-bud or portion, and it is of interest that a small fragment of a polyp or of a leaf may develop into a perfect organism, always provided that the initial amount be not too minute, that it contain a fair sample of the different kinds of cells in the body, and that it find the appropriate environment. Thus drops of minced sponge, forced through a sieve, may develop into typical forms.

In sexual reproduction the vehicle of the inheritance is obviously in the sex-cells or gametes, but the question arises whether the cytoplasm counts at all as a bearer of hereditary qualities, or whether these are restricted to the chromosomes. That the latter bear many of the hereditary characters is practically proved by Mendelian and micro-dissection experiment, and it is believed by many students that the characters or, more strictly, their initiatives, technically called "factors" or "genes," lie in linear order in each individual chromosome.

The Chromosome Theory.—Some of the arguments for this chromosome theory of inheritance may be briefly stated (*see* Mendelism). (1) There must be significance in the persistence of a particular number of chromosomes for each species, *e.g.*, two for the threadworm of the horse and 48 for man. (2) There is a parallelism in oögenesis and spermatogenesis such that the normal number of chromosomes is reduced to one half by a chance meiotic division, and this conforms to the facts of Mendelian inheritance. (3) In fertilisation there is a restoration of the normal number ($\frac{n}{2}+\frac{n}{2}=n$), and homologous chromosomes from the two parents unite in couples. The two parents contribute in equal amounts the chromosomal warp and woof of the offspring web, as Van Beneden first showed in his famous paper of 1883. But the full force of this cannot be realised without linking the fertilisation to the antecedent maturation. As McClung puts it:—

> In preparation for the union of the sperm and ovum in fertilisation, by which the duplex chromosome series is established in a new individual, each of these germ-cells reduces its own duplex state to a simplex one by segregating its maternal and paternal members of each pair into different cells by chance distribution in relation to the others.

We may perhaps say that this shuffling of the hereditary cards is one of the opportunities for the origin of fresh permutations and combinations—new departures in short. But there is another suggestion of variability in the fact that in the pairing of chromosomes before maturation-division there is an intimate physical contact (synapsis) in virtue of which there may be interactions and resulting changes. This may be another fountain of variation. (4) In related species there is often a close resemblance in the shape and structure of the chromosomes, and several cases are known in which the numbers of the chromosomes in a group of species form an arithmetical series, such as multiples of seven in roses. (5) In some cases there is strong evidence to warrant associating a particular chromosome with a particular character in the organism, notably McClung's correlation of the accessory chromosome with sex (*see* Sex).

An individual chromosome with a recognisable peculiarity of shape has sometimes been traced from generation to generation, and there is no getting past the large fact that the chromosomes are the only individualised elements that perpetuate themselves with precision from generation to generation. (6) In some cases the unit characters or separably hereditary characters of an organism form a number of linked groups of unequal numerical value, and with these there is sometimes correlated a similar number of chromosomes, differing proportionally in size. (7) Here also may be noted the growing evidence that there is in the chromosomes of the various individuals of a species a definite and constant linear arrangement of factorial areas or chromomer. Plainly, then, there are many reasons for regarding the chromosomes as the bearers of the hereditary factors.

The Cytoplasm in Inheritance.—On the other hand, the cell is a unity, and a physiological firm, so that the cytoplasm of the ovum may be very important although it is not the bearer of the hereditary factors. The experiments of Wilson, Conklin and others show that an egg-cell may contain definitely localised materials that are made use of in the development of particular structures in the embryo. These, therefore, must be components contributing to the resultant, yet it has to be kept in view that the organisation of the materials in the egg is effected under the control of the nucleus and its chromosomes.

Since modern studies of genetics have had very largely to do with the newer and more external specific characters, it seems premature to shut out the possibility that the vehicle of the older and fundamental hereditary characters may be in part at least carried by the cytoplasm of the egg-cell, which would not necessarily mean that they were outside nuclear influence. Loeb maintained that racial characters were cytoplasmic and specific characters chromosomal. Yet, since the quantity of cytoplasm in the spermatozoön as compared with the ovum is very minute, on Loeb's view the female parent should count more predominantly than it does. The question should not be foreclosed.

Fundamental Facts of Heredity

The largest fact is that all kinds of inborn characters, normal or abnormal, "bodily" or "mental," important or trivial, structural or functional, except complete sterility, may be continued on in the next generation. Even subtle characters, such as longevity and fecundity, may form part of the hereditary organisation which is continued on in the lineage of germ-cells. The term "transmitted" should be given up, since it suggests the erroneous idea that the parent makes and endows the germ-cells that become the offspring. The parent is more like a trustee.

Continuity of the Germ-Plasm.—The large fact of the persistence of a general resemblance from generation to generation depends on the continuity of the germ-plasm. What Weismann and Galton suggested has been confirmed in detail, that the germ-cells from which offspring develop are continuous along an unspecialised cell lineage with the fertilised ovum that gave rise to the parent. In many cases the future germ-cells are segregated at an early stage in development (even at the first cleavage in Ascaris), but whether they are set apart very early or not, the germ-cells are those cells which have remained unspecialised, with approximately the whole inheritance intact, not having shared in body-making and the differentiations therein involved. Some saving clauses must be added:—(*a*) for plants where the distinction between germ-plasm and somatoplasm is only incipient (a piece of leaf readily developing into a whole plant, flower and all); (*b*) for animals in which the reproductive organs are late of being recognisable, *e.g.*, when there is a prolonged asexual larval period as in Echinoderms and many of the higher insects; and (*c*) for a few more difficult cases, known experimentally in adult higher animals, such as the frog, where body-cells are said to be

able to form germ-cells. But on the whole, the fact of the continuity of the germ-plasm is a firm foundation-stone.

Germinal Origin of Variations.—It follows theoretically from the continuity of the germ-plasm that any novel peculiarity in the germ-cells, still more in the fertilised egg-cell, may be continued in the germ-cell lineage of the offspring and thus reappear in the next generation, and so on. But what is possible on general grounds must be proved for particular cases; and it is known of many new departures of germinal origin that they come to stay. The variants breed true. This leaps to the eye when the novelty is pathological, but it holds even more true of the normal. It holds (*a*) for what may be called " recombination-characters," where the novelty is interpretable as a reshuffling of ancestral factors, yielding, as it were, a new pattern; and (*b*) for mutations which are more distinctively novel—brusque emergences of some feature which was not distinctly represented in the ancestry. Thus new combinations and mutations agree in being in many cases very heritable, whereas it is uncertain that this can ever be said of exogenous " modifications," which do not emerge from within but are imprinted from without.

In his prolonged studies of garden snapdragons, Prof. Erwin Baur finds that there is an abundant occurrence of small mutations (of unexplained germinal origin) which are hereditarily entailed and summed up into stable varieties. For this organism it seems that the minute mutations count for more than striking large mutations in the establishment of stable cultivated races; and it is interesting to note that they correspond closely to the small variations that Darwin started with as his main form of evolutionary raw material. In other organisms, however, new combinations may count for most, and in others large mutations; the indispensable quality is that the germinal new departures are such that they can be hereditarily continued.

Disappearance of a Germinal Variation.—The non-continuance of a variation of germinal origin may come about in different ways. Its chromosomal representative (a " factor " or " gene ") may be lost in a maturation-division, *e.g.*, in the formation of the first polar body which is given off from the ripening egg-cell and never comes to anything, though it carries off one member of each of the chromosome-pairs. Or it is possible that when two homologous chromosomes are coupled in intimate synapsis, an influence passing from one to the other may change the nature of a factor. When they eventually separate they may have lost or gained by " crossing-over " (*see* MENDELISM). Or it may be that a factor or gene changes in character just as a microbe sometimes does, perhaps in response to a subtle environmental stimulus.

Another possibility is that the new departure may be fatal or lethal, or that it may result in a sterile organism. What often happens is that a variation seen in the first filial generation does not reappear in the next owing to the absence of some environmental or nurtural influence necessary for its developmental expression. But what is common to all theories of evolution is the verifiable postulate of *the heritability of variations*. What distinguishes the Lamarckian school is the inclusion of somatic " modifications " as part of the evolutionary raw material.

Unit Characters.—Another foundation stone laid by experimental work is the concept of unit characters, features that are continued on, intact, from generation to generation, without blending or fractioning, either present fully or absent altogether. In other words, unit characters illustrate Mendelian inheritance, and the analysis of the organism into a bundle of unit characters has for its corollary the germinal representation of these unit characters by a set of factors or genes in the chromosomes of the germ-cells. What a " gene " is, we do not know; perhaps a group of molecules in some particular collocation. They are often compared to ferments. The progress of investigation has indicated that genes are not immutable, that they may influence one another and be influenced by their cellular environment, that they may be distributed in linked groups, that several different genes may be concerned in the development of one character, that one gene may influence several different characters. Finally, the expression that the genes find in development may be dependent on the presence of the appropriate liberating stimulus in the environment.

What has been actually proved is that the organism includes a congeries of unit characters which are hereditarily continued as units, somewhat like the radicals in chemical reactions. It is possible, however, that part of the inheritance consists of a consolidated bloc of fundamental racial characters, which undergo little if any change in the course of generations. It is possible, for instance, that the characters constituting a rabbit a rodent are not hereditarily continued in the same way as the unit characters that constitute the rabbit an Angora.

Galton's Two Laws.—Also important as averaging statistical conclusions are Galton's laws of inheritance. According to the law of ancestral inheritance an inheritance is not merely dual, it is multiple; and the average contributions made by grandparents, great-grandparents and so on, are definite and diminish in a precise ratio according to the remoteness of the ancestor. The two parents between them contribute, on the average, one-half of each inherited faculty, each of them contributing one-quarter of it. The four grandparents contribute between them one-quarter, or each of them one-sixteenth; and so on backwards. This will not apply to cases which illustrate clear-cut Mendelian inheritance; but when characters blend, or have so many factorial units involved that they seem to blend, there may be value in Galton's conclusion that on the average the inheritance of an individual is a mosaic of ancestral contributions. The second law is that of filial regression, or what might be called the tendency to approximate either upwards or downwards to the mean or average of the stock. As Galton said:—

> The more bountifully a parent is gifted by nature, the more rare will be his good fortune if he begets a son who is as richly endowed as himself, and still more so if he has a son who is endowed yet more largely. But the law is even-handed; it levies an equal succession-tax on the transmission of badness as of goodness.

The value of a fine parentage is obvious, but " the ablest of the children of a few gifted pairs is not likely to be as gifted as the ablest of all the children of a great many mediocre pairs." On the other hand, two gifted members of a poor stock may be personally equivalent to two ordinary members of a good stock, but the children of the former will tend to regress; those of the latter will not. To take Prof. Karl Pearson's illustration, the mean height of the sons of, say, 1,000 six-ft. fathers will be 70·8 in.; the mean height of the sons of 1,000 66-in. fathers will be 68·3 in., again a regression toward the mean of the general population. " The father with a great excess of the character contributes sons with an excess, but a less excess of it; the father with a great defect of the character contributes sons with a defect, but less defect of it. The general result is a sensible stability of type and variation from generation to generation." Galton's laws are statistical, not physiological; they require correction in regard to characters which are subject to persistent keen selection, either natural, sexual or artificial; they will not apply to sharply defined " unit characters " which do not blend. The data which Galton utilised were chiefly the records of family faculties, as to stature, eye-colour, temper, artistic ability and so on, but they were to some extent supplemented by measurements in Galton's anthropometric laboratory, and by observations on plants and animals. The most reliable data were those relating to stature, and they are open to the criticism that they included indiscriminately what is due to somatic modification and what is due to germinal constitution. In the view of many biologists this greatly lessens the value of Galton's laws.

The Past in the Present.—Looked at broadly, the facts of heredity illustrate the way in which the past lives on in the organism, active and acting. The inheritance includes many items of different degrees of antiquity, some very ancient. These have for the most part useful inertia, but there is often a striking persistence of anachronisms, both of structure and function. There is a remarkable staying power in characters that illustrate Mendelian inheritance, whether for good or ill. There is an indubitable recapitulation of phylogeny in ontogeny,

especially in organogenesis; and it is the continuity of the germ-plasm that makes all this possible. For the same reason, there is a conservation of advantageous tentatives in so far as these are the outcome of germinal variations. In short, heredity and development show us the organism as a historic being, and moreover as one that enregisters the ages that are past.

Heredity and Development

The most elusive of problems concerning heredity is the most familiar one: how does the hereditary material in the chromosomes and in the cytoplasm develop into the organism. There is a hereditary preformation of some sort in the chromosomes with their genes, and to this the cytoplasm—with so little in the way of organisation to start with—responds in a perfectly precise and controlled way; but physiological embryology, though rapidly progressive, is still a long way from an understanding of what occurs. As to the mind of Aristotle, so to the biologists of to-day, development remains a central secret (*see* Embryology).

Transmissibility of Somatic Modifications.—Some advance has been made in regard to the long-standing problem often designated "the inheritance of acquired characters." The history of the discussion shows that Weismann and Spencer, who took opposite sides, meant by "acquired characters" only one kind of thing—those somatic changes that are directly due to some peculiarity in use and disuse, nutrition, or environmental influence, and which persist in the individual, for some time at least, after the inducing conditions have ceased to operate. It is irrelevant and illegitimate to maintain that "acquired characters" should mean something else. As long as the Weismann-Spencer argument continues, it is necessary to keep to the original use of the terms. That there are corollaries must be allowed, such as (*a*) the transmissibility of the secondary effects of modifications, or (*b*) the possibility of a specific influence being impressed simultaneously on soma and on germ-cells. But the main question is a precise one: Can a modification, as defined, affect the germ-cells in such a specific or representative way that the offspring will, through its inheritance, exhibit, even in a slight degree, the modification which the parent or parents acquired? May there come about in the germ-cells a heritable registration of some specific modification imprinted on the parental body?

To get a clear issue, as regards the precise problem, there should be an avoidance of (*a*) data referring to Unicellulars, where there is only a beginning of the contrast between somatoplasm and germ-plasm; (*b*) data which involve the possibility that the germ-cells may be influenced along with the body by some penetrating toxin or hormone or radiation or the like, connected with the imprinting of the original modification and (*c*) data relating to viviparous organisms, *e.g.*, mammals and seed-bearing plants, where it may be that a modification of the parent, such as acquired immunity or acquired evergreenness, comes to be shared by the offspring because of the intimacy of the antenatal partnership. If this occurred it would have in the first generation the same practical result as if there had been a specific repercussion on the germ-cells, but it would not be a convincing case, unless it held good when the modification was exhibited by the male parent only. Both for placental mammals and for seed-bearing plants it is easy to conceive of specific metabolic products or metabolites passing from the mother to the offspring before separation occurs.

Need for Data from at Least Three Generations.—When organisms are transferred to novel surroundings or conditions of life, such as those of a colder climate, it often happens that an advantageous modification is induced, such as a longer coat of hair in a mammal; and it may be that this modification appears in increased expression in the next generation. But this would prove nothing more than modifiability, for the second generation was exposed for a longer time than the first to the modifying influence. But if the character in the third generation was larger in amount than in the second, an interesting fact would be established.

Changed Environment.—Yet the crucial cases must be those where the offspring of modified parents develop in an environment which does not include the modifying factor which effected the change in the parental soma. Thus in Prof. W. E. Agar's model experiments, specimens of the entomostracan Simocephalus that were reared in water with certain nutritive peculiarities, showed a distinctive reversal of their two shell-valves doubtless due to the altered metabolism. They were reared to maturity and then transferred to ordinary water where they liberated their ova. These developed into individuals which showed the modificational peculiarity that their parents had acquired.

Later on, however, when the parents again liberated ova, the abnormal effect was seen only to a very slight degree, and in a third brood (not generation) it had dwindled away. This very instructive case suggests that the abnormal nurture had resulted, not in any disturbance of the inheritance, but in the formation of some peculiar non-living metabolite, which was included in the cytoplasm of the egg, passed passively into the body which developed from the egg, and there produced on the body of the offspring the same effect as it originally produced on the body of the parent which acquired the character in question. As the supplies of the metabolite were exhausted, its influence dwindled in the second brood, and disappeared in the third. This illustrated the importance of changing the environment in such experiments.

Alcoholised Animals.—Many experiments have been made on the effect of alcohol (usually inhaled fumes) on animals, but the results are not altogether in accordance. Thus while there may be no observable deterioration in the treated guinea-pigs, there is clear evidence of this in their untreated offspring. On the other hand, Prof. Raymond Pearl found that after alcohol treatment his fowls produced offspring which were superior in a marked degree to those produced by non-treated controls. Pearl's interpretation of this is that the alcoholic treatment eliminated all the inferior germ-cells in the ovary of the fowls, leaving the coast clear for the superior ones to produce the next generation. Of the reality of this process of germinal selection there is some histological evidence.

In Dr. F. B. Hansom's experiments on white rats there was no observable effect on to the end of the second generation. Those that were subjected to inhalations of alcohol were in no way different from their relatives that breathed normally. Moreover, the treated offspring of the treated parents were indistinguishable from their first cousins, the untreated offspring of untreated parents. But in the third generation, a change occurred. At the age of 20 days, before any individual treatment, the members of the treated lineage showed themselves inferior in body weight, body length and tail length, when compared with their counterparts on the untreated lineage. When alcohol-inhalation began, the difference became more marked, as if the animals were responding to the abnormal condition with a new susceptibility. It reached a maximum of nearly 10 times the probable error.

Now the natural inference at this stage in the experiments would have been that the influence of two previous generations of alcoholic inhalation was beginning to make itself felt. And as the effects were observable before individual treatment began, the inheritance of the generally deteriorative influence of alcohol might have been held as proved. But the remarkable fact is that the fourth generation showed a marked improvement! "The treated side of this generation for the first half of its growth curve is back to the fold with the first two generations. Later there is some response to the treatment and a consequent dropping off in the curve." This remarkable result suggests that some process of germinal selection may have been at work, an elimination of inferior germ-cells; but it also suggests caution.

Prof. Charles R. Stockard's experiments on alcoholised guinea-pigs, continued for 13 years, showed no deterioration of the treated parents up to seven years, which is a great age for these animals. But the deteriorative influence on the immediate offspring and on later descendants was shown in debility, short life and arrested development. Yet there was no evidence of the transmission of any particular character. The probability is that the alcohol, saturating through the body of the parent, poisoned the germ-cells and deteriorated the constitution of the offspring

in a general way. But here, again, there was the remarkable phenomenon, that after three generations of treating, there was a marked improvement. The members of the fourth filial generation of treated "pigs" were actually superior in vitality to the controls. This may have been due to the elimination of the weaklings and defectives, perhaps also to a sifting out of germ-cells.

Other Striking Experiments.—Dr. Bentley and Dr. Griffith found that some of the progeny of rats rotated for a long time on a round-about showed a high degree of disequilibration and deterioration, but it is possible, as Dr. Detlefsen has suggested, that some microbic infection (causing inflammation of the auditory labyrinth) may have complicated the issue.

Pointing towards a transmission of specific modifications are the intricate experiments of Prof. M. F. Guyer and Dr. E. A. Smith on the continuance of artificially induced eye-defects in rabbits. Very suggestive in the same direction are Dürken's experiments on the colour of the pupae of the common white butterfly, where there seemed to be a hereditary effect of artificial illumination. To many biologists it seems that there is unquestionable validity in the numerous experiments of Kammerer which point in several cases to the hereditary continuance of a parental modification. Thus when the young of the spotted salamander are kept on black backgrounds the black patches on their skin increase in size, while if they be kept on yellow backgrounds the yellow patches increase. This change towards greater blackness or towards greater yellowness was found to be to a considerable extent heritable, for the offspring of the modified parents showed a similar change in a marked degree. Indeed they began in a colour phase nearly, though not quite, as advanced as that at which their parents left off.

Thus it would be possible to continue citing cases first on one side and then on the other, on both sides open to detailed criticism. But the moral seems to be that this long-discussed question cannot even now be regarded as closed. There must be a patient accumulation of more data, more rigorously tested or verified; and the question at issue is of such importance as to forbid any hurry to a conclusion.

Nature and Nurture

Wider than the question of the transmissibility of somatic modifications is that of the relation between hereditary nature and environing nurture. The difference between the two complementary factors is referred to in Prospero's description of Caliban as "a devil, a born devil, on whose nature nurture will never stick." It is evident, however, that the two factors should not be opposed as if they were antithetic, for while no amount of nurture will make a bad inheritance good, there can be no development at all without a minimum of nurture, and on the generosity of the nurture the development of the heritable character will in some measure depend.

At the beginning of the individual life the implicit organism and the inheritance are one and the same, but by subjecting germ-cells and embryos of the same origin to different "nurture" (functional, nutritional and environmental) it can be shown that there are different reactions according to the developmental conditions. The young proteus kept in darkness remains unpigmented, but its neighbour reared in a well-lighted laboratory becomes dark. A Chinese primrose (*Primula sinensis*) reared at 25° C. will have white flowers (var. *alba*), but its neighbour, or, later on, itself brought under the influence of higher temperature (30° C.), shade and moisture, will have red flowers (var. *rubra*). According to diet a tadpole may become large and poorly differentiated, or small and well-differentiated. There are scores of such cases.

Eggs, embryos, larvae and so on, of the same genetic origin, may develop very differently according to the conditions of life, and, conversely, differently endowed young organisms may develop very differently though reared in nurtural conditions which are precisely the same, as we see when good seed and poor seed are sown in the same plot. Therefore, it is legitimate to distinguish the hereditary factor in development from the functional or the environmental factor. As we have said, an antithesis between hereditary "Nature" (Galton's "natural inheritance") and extrinsic "Nurture" (all manner of environs mental, nutritional and functional influences) is illegitimate, since both are necessary components of a resultant, as clay and heat to brick, or water and wind to wave; yet for the reasons given, it is permissible and useful to discriminate between the two aspects. It is sound biology to say of some particular peculiarity in an organism that it is due (*a*) to the loss of some item in the natural or germ-plasmic inheritance, or (*b*) to some nurtural defect which inhibited the developmental expression of items that were certainly present in the inheritance, as subsequent breeding shows. Similarly, on the positive side, it makes a difference if the development organism has received factors for a particular character from both parents; and it makes a difference if the nurture is unusually stimulating as regards the expression of a particular character.

Environment and Inheritance

Some biologists are so sensitive to the abstractness of all the biological pigeon-holing, that they have seriously proposed to include the normal appropriate environment of the young organism as part of its "heredity," for, as they say, what does the inheritance amount to if the appropriate environment is wanting—a bundle of cheques but no bank. Perhaps, however, this is unnecessarily pedantic, after it has been agreed that these various "aspects" are devices for scientific analysis. Every living creature must have its surroundings; every embryo must have its nurture; function is only the unending sequence of actions and reactions between organism and the environment. All this may be granted, and yet it is useful and necessary to try to distinguish in development the respective influences of "nature" and "nurture"—including in the latter three sets of conditions: environmental, nutritional and functional.

Up to a certain point the fertilised ovum of a mammal may be induced to develop outside the mother, or an isolated neuron of a chick-embryo will grow in a droplet under the microscope, thus illustrating the hereditary inertia. Yet if the larval proteus be reared under red light in the laboratory, the minute primordium of the eye, which in the normal cave-environment remains arrested and buried, increases in size and in the differentiation of optic structures. It may actually grow to meet the skin and become a seeing eye, thus illustrating the potency of altered environment as a liberating stimulus. No doubt there are nurtural limits outside which normal development will not occur, but the majority of organisms in natural conditions find this minimum environment at least. This will be agreed to by all. What is more interesting is the question how far changes in the nurture, such as are of frequent occurrence in natural conditions, will serve as inhibitants and stimulants. The same kind of sponge may grow into a dwarf that lives in a hole excavated in an oyster-shell, or in conditions of greater freedom it may grow into a large vase. If a bonellia larva rests for a while on the proboscis of the adult and absorbs inhibitant nutritive material from the skin, it develops into a pygmy male; but if, after the free-swimming stage, it settles down in the mud, and not on a proboscis, it develops into a large and vigorous female.

Function and Heredity.—Along with the environmental and nutritional influences, those of active functioning must be included, though it is of course evident that the activity or inactivity, the restlessness or sluggishness of the developing organism is an expression of its particular inheritance. The free-swimming tunicate larva has in ordinary cases no alternative to becoming sedentary; the collapse is an expression of the inheritance. Yet in some cases the individuals of a family, clutch or litter, vary demonstrably in their heritable constitutional bias in the direction of greater or less activity—perhaps the commonest of all variations—and thus there arise differences in development which afford raw material for natural selection. Especially in relatively less stereotyped forms, *e.g.*, in fishes compared with mammals, the importance of active functioning in the course of development is momentous, for it is on the active functioning that the detailed expression of hereditary characters depends. A

vicious circle must be avoided, but not so timorously that we thereby miss a great truth.

The degree of development, *i.e.*, the expression of hereditary characters, depends in part on surroundings and food, but it also depends on the activity of the young creature such as the fish-larva, and on the action of part on part. The degree of this activity depends largely on the inherited constitution (and partly on food and environment), therefore we are not suggesting that it is a separate entity or anything of that sort. We are only emphasising a commonplace that is often missed: The differentiation of characters in development depends in part on the functioning of the young organism, and changes in the intensity of the functioning will result in changes in the evocation of structure. The changes in intensity of functioning may be of the nature of germinal variations, or they may be reactions to environmental stimulus. If the environmental stimulus should become constant, a modificational specific character might arise.

It is possible that many constant characters of a species are really of the nature of constantly re-impressed modifications. As Dr. Harry M. Kyle puts it: "The constancy of a species depends upon the persistence of a normal environment." From this point of view we get a useful new light on heredity. To some extent, especially in the lower grades of life, the inherited material may be moulded this way or that way if the nurture is changeful, or it may find a deceptively stereotyped expression when the nurture is very constant from generation to generation. Between inheritance and environment comes the activity of the individual. Dr. Kyle's *Biology of Fishes* (1926) may be cited for its many illustrations of this important thesis.

Heredity and Disease

For biological purposes a disease may be defined as a deteriorative process which tends to disintegrate the unity of the organism. The associated pathological changes cannot be separated off in any hard and fast way from ordinary vital changes, and what is a disease in one animal may be normalised in another type—let us think of the growth and decay of the stag's antlers. Yet disease implies that certain processes of metabolism have got out of place, out of time and out of tune.

For biological rather than medical purposes, again, we may distinguish four kinds of disease:—(1) There are environmental diseases, such as debilities due to lack of light or to deficiency in certain constituents of the food. Perhaps rickets may serve as an example. (2) There are functional diseases, which are due to overwork, lack of exercise or to some deteriorative factor in the occupation. Some kinds of heart strain, certain forms of obesity and lead poisoning may serve as examples. (3) There are the familiar microbic and parasitic diseases, due to the poisonings, lesions, blockings and so forth that are produced by intruding organisms of a hostile character; as in plague, tuberculosis, sleeping-sickness, malaria, and the disturbance brought about by hookworm, bilharzia, and other non-microbic invaders of man's body. It has to be recognised that part of what is, for practical purposes, called the disease in such cases, is the organism's defensive or even offensive reaction to the intruder, as in the phagocytosis associated with inflammation. (4) On a different plane are organic or constitutional diseases, which are due to some very early germinal or embryonic disturbance or defect.

A deteriorative peculiarity in the metabolism associated with excretion may find expression in kidney disease; or some defect in the inheritance may express itself later in one of the forms of epilepsy; or some inborn and at present inexplicable lack of balance in the functioning of the endocrinal glands may lead to one of the forms of diabetes. Apart from parasites, there is almost no disease in wild nature, where it is speedily nipped in the bud if it shows itself; in mankind and in his stock, where selection for health is less searching and insistent, where the struggle for existence is rarely with the gloves off, and where the conditions of life are often very artificial, disease is rife. In the case of organic or constitutional diseases, the organism starts with an inherited handicap, to which ill-advised nurture may add. In the other kinds of disease, the immediate cause is in great part extrinsic, though less so in occupational diseases, but the extrinsic influence may have its deteriorative effect increased by some hereditary predisposition on the organism's part, which has then to fight a battle with two fronts.

A few general statements may be made in regard to heredity and disease. There is no proof that modification-diseases (environmental, occupational or habitudinal) can be transmitted from parent to offspring, but they may bring about a general weakening of the germ-plasm, and they may influence the child prejudicially through the mother. Microbic diseases are not transmissible, though a susceptibility to them may be, and though very early—ante-natal—infection may bring about a semblance of heritability. As a disease is a process, there are few instances of hereditary disease in the strict sense; but there are many instances of definite heritable taints, that is to say, constitutional predispositions or susceptibilities that render the organism peculiarly liable to deteriorative influences in surroundings, in nutrition and in functioning, or to the assaults of intruding microbes. If a hereditary taint is a recessive Mendelian character it will be masked by the corresponding dominant character, that is by normality. Thus it will not find individual expression, though it remains part of the inheritance. It is possible that a pathological feature, *e.g.*, a nervous disturbance, may find expression earlier and earlier in development, until it becomes fatal at a very early stage (Sir F. W. Mott's "law of anticipation").

Heredity and Consanguinity

The older view that consanguinity is necessarily of itself deteriorative has not been confirmed experimentally. Leaving man's case apart, where psychological and social considerations complicate the issue, there is abundant evidence that the inbreeding or endogamy of healthy stock may go far without any deteriorative results. In the early chapters of the establishment of some of the famous stocks of domesticated animals there has been very close inbreeding. If there is a well-defined taint of some sort, it is plain that inbreeding will increase it if it is exhibited by both the parents. If a given character exhibits Mendelian inheritance, the result of inbreeding must always be the isolation of homozygous types—pure as regards the character in question. It matters not whether the character is advantageous or detrimental, except that in the latter case it may soon cross the limit of viability. If we suppose that a herd includes a percentage of individuals with a recessive taint, this will tend to become less conspicuous in conditions of outbreeding or exogamy, since the offspring of recessive tainted and dominant normal will appear normal.

But in conditions of inbreeding or endogamy, the taint will become more and more conspicuous, since the chances of two tainted parents coming together will be greater, and the offspring will be homozygous recessives. Thus there will come about an isolation of a homozygous tainted type (or, in more complex cases, types), and the rapidity of the isolation will be in proportion to the intensity of the inbreeding. When the taints interest the breeder practically he fixes his attention on them, and thus, in the past, consanguinity has been blamed for causing what it merely discloses. It should be noted that there may be remarkable combinations of deteriorative recessive characters, previously hidden by their dominant allelomorphs, and that there may be a general reduction in the vigour of the herd as taints diffuse. We cannot wonder, then, that inbreeding has come to have a bad name. But the facts all point to the conclusion that what the inbreeding itself does is to expose undesirable characters that already existed, but have been masked by their dominants. It follows that inbreeding can be used as a sieve for the radical improvement of a stock, since the exposed abnormalities, deficiencies and undesirabilities can be artificially eliminated.

A subsequent outbreeding with good stock will re-invigorate the purified inbred stock, for there will be a pooling of good qualities comparable to the previous accentuation of bad ones. Moreover, there may be a useful outcrop of fresh variations, for

this often follows the introduction of fresh blood. It may be definitely concluded, then, that inbreeding is not injurious because of the consanguinity, and that if the breeder understands what is happening, it may be made highly beneficial. The experimental evidence will be found conveniently in *Inbreeding and Outbreeding*, by E. M. East and D. F. Jones (1919). There seems to be no biological reason for objecting to the marriage of two thoroughly healthy cousins; and it would appear that the alternation of periods of inbreeding and outbreeding has counted for much in the history of human stocks and tribes and races.

Conclusion.—One cannot turn from this survey without referring to the fatalistic impression that the study of heredity is apt to produce: the hand of the past has such a heavy grip. Yet "the other side of heredity" must also be emphasised—the persistence of the stable, the conservation of advantageous qualities, the continual emergence of the new, the influence of nurture in determining the degree of development to which the hereditary nature attains, and, in man's case, the dominant importance of the extra-organismal or social heritage. A man cannot alter the number of his separate hereditary "talents," to use the phraseology of the immortal parable, but he can trade with what he has, and he is thus not only born, but made.

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HERGESHEIMER, JOSEPH (1880–), American author, was born at Philadelphia, Pa., Feb. 15 1880, and was educated at a Quaker school in Philadelphia. As a writer of fiction he is distinguished by the warmth and colour of his descriptive passages and by his psychological insight.

His publications include: *The Lay Anthony* (1914); *Mountain Blood* (1915); *The Three Black Pennys* (1917); *Gold and Iron* (1918); *Java Head* (1919); *The Happy End* (1919); *Linda Condon* (1919); *San Cristóbal de la Habana* (1920); *Cytherea* (1922); *The Bright Shawl* (1922); *The Presbyterian Child* (1923); *Balisand* (1924); *From an Old House* (1925); *Tampico* (1926).

HERKOMER, SIR HUBERT VON (1849–1914), British painter (*see* 13.364), died at Budleigh Salterton, Devon, March 31 1914.

HERMANT, ABEL (1862–), French author and dramatist, was born in Paris Feb. 3 1862. A brilliant wit and an exquisite stylist, he consistently devoted his abundant talents to describing the lighter side of life. His most characteristic works are those grouped under the general title, *Mémoires pour servir à l'histoire de la société* (1905), wherein, with unfaltering gaiety and a humour saved only by the delicacy of its expression from appearing scabrous, he mocks the aristocracy and wealthy bourgeoisie of France. He excels, too, in long series of amusing dialogues. *Le Caravansérail* (1917), a study of rich foreigners plunged into the cosmopolitan circles of Paris, is perhaps his best-known work, but the series of *Scènes de la vie des cours et des ambassades*, which includes *La carrière* (1894) and *Le sceptre*, (1900), no less pungently portrays the complications of diplomacy in a dignified Central European court. Among his plays may be noted *La meute* (1896), a comedy of parasites, and *Sylvie, ou la curieuse d'amour* (1900), which with infinite grace displays the reactions of a light-headed woman to the successive phases of revolutionary and imperial France.

HERRICK, ROBERT (1868–), American author, was born at Cambridge, Mass., April 26 1868. He was educated at the Cambridge Latin School and at Harvard University where he graduated in 1890. He was appointed instructor in rhetoric at the Massachusetts Institute of Technology in 1890 and three years later accepted a similar position at the University of Chicago, where he became professor of English in 1905. His novels and short stories deal with the complicated problems of modern life in realistic fashion. They include *The Man Who Wins* (1895); *The Gospel of Freedom* (1898); *The Web of Life* (1900); *The Real World* (1901); *The Common Lot* (1904); *The Memoirs of an American Citizen* (1905); *The Healer* (1911); *One Woman's Life* (1913); *The Conscript Mother* (1916); *Homely Lilla* (1923); *Waste* (1924); *Wanderings* (1924): and *Chimes* (1926).

HERRIOT, EDOUARD (1872–), French politician, was born at Troyes, in Champagne, July 5 1872, the son of an officer. He was sent first to the Lycée of La Roche-sur-Yon, and afterwards to that of Louis-le-Grand, which bore the reputation of being the best school in France. He then entered the École Normale Supérieure, which included many eminent teachers such as Brunetière and Gaston Boissier, both of whom were men of authority and unquestioned reputation. Here he remained working assiduously for several years, and while delighting in the pursuit of learning thoroughly enjoyed the interchange of ideas with his fellow-students, on whom he left an unforgettable impression. In 1894 he graduated with high honours. Whilst undergoing his military service at Nancy, his favourite relaxation was the study of Greek literature. His book *Philon le Juif* (1897) was crowned by the Académie Française.

Having been appointed a professor at the Lycée of Nantes, he was entrusted the following year first with the Chair of rhetoric, and then of higher rhetoric at the Lycée of Lyon. He imparted to his pupils not merely the principles of knowledge but also the love of it for its own sake; a scholar of great refinement, he possessed the gift of stimulating others, and his discourses were so lucid and attractive that all who heard them were captivated. On relinquishing his Chair he became a popular lecturer, as well as journalist and propagandist, and his book, *Madame Récamier et ses Amis* (1905), achieved widespread popularity. His *Précis de l'histoire des lettres françaises* (1905) shows that his literary criticism was based on a minute study of the text.

A man of M. Herriot's wide sympathy could not fail to be drawn into public life. In May 1904 he was made a municipal councillor and deputy Mayor of Lyons and the following year became Mayor. Thenceforward, with the exception of three months, he guided the destinies of Lyons; for at each successive election of the Municipal Council he resumed office. In 1910 he became a member of the conseil général and in 1912 senator for the department of the Rhône. From Dec. 1916 to March 1917 he occupied the post of Minister of Public Works, Transport and Supplies in the Cabinet of M. Briand. During this time he inaugurated a policy of restriction which enabled France to economise her resources, while at the same time lessening the drain on them caused by the World War, and enabling her to gain a more speedy victory. Having to a large extent solved the problem of supplies, he proceeded to bring order into the transport service. Stations, railway lines and ports were cleared and an efficient service was maintained.

M. Herriot now felt that by entering the Chamber, he would be better able to carry out his cherished ideas. He therefore renounced his office as senator, and was elected in Nov. 1919 deputy for the Rhône department. He was then appointed a member of the Finance Commission and reporter-general of the Budget of Public Instruction. The Radical party now chose him as their leader, and as a defender of the principles of democracy he soon reached the front rank of French statesmen. As an orator he showed subtlety and versatility, combined with a vivid imagination, while his delivery was pleasing and impressive. At times he was a man of the people, then at other times his eloquence was that of the scholar soaring into metaphysics. Both in speaking as well as writing M. Herriot always approached his subject from the loftiest standpoint—the result of his wide knowledge,

culture and absolute integrity. His chief qualities might be summed up in three words: logic, wisdom and conviction; and it was the combination of these which enabled him to draw up a formula for an experimental policy.

Even before hostilities had ceased, M. Herriot turned his attention to post-War problems. By his actions as well as in the Press he insisted on the necessity for the reconstruction and economic development of his country. In 1916, at the moment when the victory of Jan. seemed imminent, he organised the Lyons Fair, that magnificent international market which not only promoted the economic interests of the town and district, but at the same time contributed in a remarkable degree to national prosperity. This exhibition, though it cost the inhabitants of Lyons nothing, possessed a great palace to which each successive year new pavilions were added. That it proved a formidable rival to the Leipzig Fair, and had an ever-increasing success, was a striking testimony to M. Herriot's robust optimism. In 1917 he published *Agir*, a book which at a time when the fate of France was so uncertain, bore the character of an unflinching act of faith; for in it M. Herriot maintained that the culture and civilisation of France were too deep-rooted and too strong to be overcome. This gospel of action soon inspired the faint-hearted with fresh hope.

After the victory, M. Herriot brought out a work in two volumes, *Crêer* (1919), dedicated to the youth of France. It contained his programme of reconstruction, and gave his compatriots a fine example of resolution, fearlessness and patriotism. A similar example emerged from his visits to Russia, the U.S.A. and Canada. He was soon confronted with an even harder task than before, for as head of the Radical party the eyes of all French democrats were turned towards him. It was he who inspired the opposition and acted as its mouthpiece, yet he remained faithful to his original ideals, and even in the heat of conflict never allowed himself to forget that one day the responsibility of office might fall to him again. After the elections of May 1924 he became Premier and Minister of Foreign Affairs and immediately set to work to reform the policy of France. During the London conferences, in the application of the Dawes plan and finally over the Geneva protocol, he displayed a rare combination of idealism and common sense, and outlined those great aims, in pursuit of which the nations of the world should unite to avoid war. By these efforts he gained the confidence of all men of good will, not only in Europe but over the whole world. Germany in consequence offered to draw up a security pact destined to be signed eight months later at Locarno.

This admirable achievement, however, by no means disarmed M. Herriot's adversaries. The financial problems which he had to face were the occasion of innumerable attacks upon him and finally a hostile vote of the Senate obliged him to resign in April 1925. A few days later, he was elected president of the Assembly by the deputies who desired to testify to the courage, zeal for work and talents of the leader of the Left. The office of President gained an added lustre through the tact, good humour and timely exercise of his authority shown by M. Herriot, and everyone cheerfully submitted to his arbitration. During the many critical moments in the history of contemporary French politics, M. Herriot, with his idealism, practical wisdom and patriotism, proved a guiding light. He devoted his few leisure hours to writing *Dans la forêt Normande*, a book worthy not only of a great writer, but also of a philosopher. (L. Ri.)

HERTLING, GEORG, Count von (1843–1919), German statesman, was born in Darmstadt Aug. 31 1843. In 1882 he was appointed professor of philosophy in the University of Munich. From 1875 to 1890 and again from 1893 to 1912 he was a member of the Reichstag, from 1909 being for a short time the leader of the Centre (Catholic) party. In 1912 he was appointed president of the Bavarian ministry and minister for foreign affairs, and in 1914 was elevated to the rank of count by King Ludwig III. On Nov. 1 1917 he accepted the chancellorship of the Reich, which he had refused in July of that year; and for 12 months he strove against the encroachments of the military authorities upon the political affairs of the Empire. The failure of the German offensives in 1918 finally destroyed his hopes of being able to negotiate with the Allies on anything like equal terms and feeling at last unequal to the struggle against the introduction of real parliamentary Government, he resigned Sept. 30 1918, and returned to his home at Ruhpolding in Upper Bavaria, where he died Jan. 4 1919. His reminiscences were published in 1919 under the title of *Erinnerungen aus meinem Leben*. See also Karl Hertling, *Ein Jahr in der Reichskanzlei* (1919).

HERTZ, JOSEPH HERMAN (1872–), Chief Rabbi of the United Hebrew Congregations of the British Empire, was born in Rebrin, Czechoslovakia, Sept. 25 1872. Emigrating to America as a child, he was educated at New York City College, Columbia University, where he took the degree of Ph.D., and the Jewish Theological Seminary of America. He was a Rabbi in Johannesburg, South Africa, from 1898 to 1911 and, during the Boer War, was expelled by President Kruger for pro-British sympathies and for advocating the removal of religious disabilities from Jews and Catholics in the South African Republic. From 1906 to 1908 he was professor of philosophy at Transvaal University College. Dr. Hertz was elected to the Chief Rabbinate in succession to Dr. Hermann Adler, in 1913. In 1920–1 he undertook an extensive pastoral tour, visiting the Jewish communities in South Africa, Australia, New Zealand and Canada. He became President of Jews' College, London, in 1914. In 1925 he was made one of the board of governors of the University of Jerusalem and chairman of the administrative board of its institute of Jewish studies. He also became vice-president of the Anglo-Jewish Association, the London Hospital and the League of Nations Union. Among other Jewish writings, he published an anthology *A Book of Jewish Thoughts* (1917), of which 17 editions had appeared in 1926. He was a member of the original board of translators of the Jewish Bible Version, 1896–1903.

HERTZOG, JAMES BARRY MUNNIK (1866–), South African politician, was born at Wellington, Cape Colony, April 3 1866. Educated at Victoria College, Stellenbosch and Amsterdam University, he became a judge in the Orange Free State in 1895, and served through the South African War of 1899–02. He voted against peace at Vereeniging and, frankly hostile to the British connection, he helped to keep alive this anti-British feeling after the War. On the grant of responsible government in 1907, he became attorney general and minister of education in Fischer's ministry, and forthwith began to undo the work of the Crown Colony Administration. He tried to force upon the schools a system of compulsory bi-lingualism—Dutch and English—which was crude and impracticable. The director of education resigned, and one of the three inspectors, dismissed without enquiry, won an action for libel against Hertzog in a *cause célèbre*.

In the first Union Cabinet, in 1910, Hertzog became minister of justice under Botha, but his attitude made the position untenable. Botha resigned in 1912, took office again, reconstructed his Cabinet and left Hertzog out. The latter then formed an opposition party with complete independence of Britain as its goal, and his perfervid nationalism gained him much influence among the old Republican Boers. After the World War he continued his separatist policy but finally formed a "pact" with the Labour party. In 1924 this Coalition came to power with Hertzog as prime minister, whereupon he disclaimed any practical application of his republican policy. In 1925 he brought the native question into the forefront of the political arena, thus rendering a great service to the future of the country owing to the increasing gravity of the problem in its relation to the continued supremacy of a comparatively small white population. (H. Gn.)

HERVIEU, PAUL (1857–1915), French dramatist and novelist (*see* 13.405), produced his last play, *Le Destin est maître*, in 1914. He died in Paris Oct. 25 1915. See A. Binet, *Portrait psychologique de Paul Hervieu* (1914); H. Burckhardt, *Studien zu Paul Hervieu* (1917).

HEWART, GORDON HEWART, 1st Baron (1870–), British lawyer, was born Jan. 7 1870 at Bury, Lancashire.

Having graduated as a scholar of University College, Oxford, he was called to the Bar in 1902 and practised on the northern circuit. After an unsuccessful contest in Northwest Manchester in 1912, in which year he took silk, he was elected as a Liberal for Leicester in 1913, and after the rearrangement of constituencies in 1918 represented the eastern division of that city from 1918 till his retirement from Parliament. In Dec. 1916 he was appointed solicitor-general in Mr. Lloyd George's Coalition Government. Having afforded useful support to the administration by his talents as a debater, he was made attorney-general in Jan. 1919, and was admitted to the Cabinet in 1921. He gave material assistance in the conduct of reconstructive legislation, and took an active part in the final phase of the negotiations with the Sinn Feiners, being one of the signatories of the so-called Irish Treaty. He acted as president of the War Compensation Court from 1922. He had been knighted in 1916; on Jan. 16 1918 he was sworn of the privy council, and on March 24 1922 was appointed lord chief justice, being at the same time created Baron Hewart of Bury.

HEWLETT, MAURICE HENRY (1861–1923), British man of letters (*see* 13.417). The best of his later works are *Mrs. Lancelot* (1912); *Bendish* (1913); and *Mainwaring* (1921). His main interest, however, was directed from fiction to verse. *The Song of the Plow* (1916) has been recognised as one of the most considerable narrative poems of the century; it describes the fortunes of the English farm labourer from the earliest times to the World War, and though occasionally the imaginative beauty is obscured by necessarily prosaic detail, contains numerous passages of a fine masculine vigour. *The Village Wife's Lament* (1918) is a more uniform and but slightly inferior poem. In *Lore of Proserpine* (1913), Hewlett attempted, with some success, to hint in delicate prose at the mystical semblances of nature, and his essays, *In a Green Shade* (1920), were warmly received. His translations and imitations of the sagas, including *Thorgils of Treadholt* (1917), also deserve mention. The popularity of his earlier fiction concealed from many of his contemporaries the strength and originality of his later work. He died at Broadchalke, near Salisbury, June 15 1923.

HEYSE, PAUL JOHANN LUDWIG (1830–1914), German novelist, dramatist and poet (*see* 13.438), received the Nobel prize for literature in 1910. His later works include *Helldunkles Leben* (1909); *Italienische Volksmärchen* (1914) and *Letzte Novellen* (1914). He died at Munich April 2 1914. Several volumes of his letters have appeared (1916, 1917, 1919). See also H. Raff, *Paul Heyse* (1910).

HIBBEN, JOHN GRIER (1861–), American educationist, was born at Peoria, Ill., April 19 1861. He graduated from Princeton University in 1882; was a student at Princeton Theological Seminary from 1883 to 1886; and later studied at Berlin. In 1887 he was ordained a minister in the Presbyterian Church and was a pastor for four years at Chambersburg, Pennsylvania. In 1891 he returned to Princeton, where he taught logic as an instructor (receiving the degree of Ph.D. in 1893), assistant professor, and from 1907 professor. In 1912 he succeeded Woodrow Wilson as president of the university.

His works include *Inductive Logic* (1896); *The Problems of Philosophy* (1898); *Hegel's Logic* (1902); *Logic Deductive and Inductive* (1905); *The Philosophy of the Enlightenment* (1910, contributed to the *Epochs of Philosophy*); *A Defence of Prejudice and Other Essays* (1911) and *The Higher Patriotism* (1915).

HIGGINSON, HENRY LEE (1834–1919), American banker, was born in New York City Nov. 18 1834. At the age of 17 he entered Harvard University, but before finishing his course entered the banking house of S. and E. Austin, of Boston. He later went to Vienna for a year, where he studied music. In the Civil War he served as a volunteer officer. In 1863 he was severely wounded at Aldie, Va., and in the following year was honourably discharged. In 1868 he joined the banking firm of Lee, Higginson and Co., of Boston, with whom he remained until his death. His interest in music led to his founding the Boston Symphony Orchestra in 1881. A long line of distinguished directors placed this organisation in the first rank. It was a stimulating source of musical education in America and won full recognition abroad. In 1891, as a memorial to certain friends who died in the Civil War, he presented Soldiers' Field to Harvard University; and in it the stadium was built. In 1899 he erected the Harvard Union as a general meeting-place for all undergraduates. For many years a fellow of Harvard University, he died in Boston, Mass., Nov. 14 1919. See Bliss Perry, *The Life and Letters of Henry Lee Higginson* (1921).

HIGGINSON, THOMAS WENTWORTH (1823–1911), American author (*see* 13.455), died in Cambridge, Mass., May 9 1911. See *T. W. Higginson: The Story of His Life* (1914), by his wife, Mary Potter Higginson.

HILDEBRANDSSEN, HUGO HILDEBRAND (1838–1925), Swedish meteorologist, was professor of meteorology and director of the Meterological Institute at Upsala from 1878 to 1906. He was an associate member of the Comité Permanent International Météorologique from 1882 to 1885, ordinary member from 1891 and general secretary from 1900 to 1907. In 1886 he undertook, in conjunction with the Hon. Ralph Abercromby, the classification of cloud forms, and he published in 1896 his *Atlas international des nuages*, (with Riggenbach and L. Teisserenc de Bort), together with *Les bases de la météorologie dynamique* (1898–1907), in collaboration with Teisserenc de Bort. Hildebrandssen became an honorary member of the Royal Meteorological Society of London in 1888, which awarded him the Symons Gold Medal in 1921, and also a member of the Royal Institution of Great Britain. He died in 1925.

HILL, DAVID JAYNE (1850–), American diplomat, was born at Plainfield, N.J., June 10 1850. After graduating in 1874 from the University of Lewisburg, Pa. (later known as Bucknell University), he became instructor in Greek and Latin there and from 1877 professor of rhetoric. In 1879 he was elected president of Bucknell, and in 1888 of the University of Rochester. In 1896 he resigned and went abroad to study public law. In 1898 he was appointed assistant secretary of state by President McKinley. While in Washington he was also professor of European diplomacy in the school of comparative jurisprudence and diplomacy. In 1903 he was appointed minister to Switzerland, being in 1905 transferred to Holland. He was a delegate to the Second Peace Conference at the Hague in 1907. From 1908 to 1911 he was ambassador to Germany. In 1914 he was proposed as a candidate for the Republican nomination for the U.S. Senate from New York to succeed Elihu Root.

Hill's best known work is his *History of Diplomacy in the International Development of Europe*, embracing *A Struggle for Universal Empire* (1905); *The Establishment of Territorial Sovereignty* (1906) and *The Diplomacy of the Age of Absolutism* (1914). His other writings include *World Organisation as Affected by the Nature of the Modern State* (1911, lectures delivered at Columbia University); *Impressions of the Kaiser* (1918); *Present Problems in Foreign Policy* (1919); and *American World Policies* (1920).

HILL, JAMES JEROME (1838–1916), American capitalist (*see* 13.464), died at St. Paul, Minn., May 29 1916. He resigned the chairmanship of the board of directors of the Great Northern Railway in 1912. He had long thought that the farmers and millers of the north-west needed a large financial institution near at hand to which they could easily turn for aid. Accordingly in 1913 he secured control of the First and Second National banks of St. Paul and merged them, thereby increasing local facilities for loans. On learning in 1914 that friends had raised $125,000 for establishing as a tribute to him a chair of transportation at Harvard he added a like amount. During his later years he gave much attention to the Hill Reference Library, in St. Paul, to which he contributed liberally. He was the owner of a remarkable collection of modern French paintings, including fine examples of Puvis de Chavannes, Corot, Delacrois, Millet and others. He was the author of *Highways of Progress* (1910), a work dealing with the subject to which he had dedicated his life.

HILL, OCTAVIA (1838–1912), British philanthropist (*see* 13.465), died in London Aug. 13 1912.

HINDENBURG, PAUL VON (1847–), German soldier. Paul Ludwig Hans von Beneckendorff und von Hindenburg was born in Posen Oct. 2 1847, the son of a Prussian officer. His childhood was spent in his parents' house, and later in Pinne and Glogau. In 1858 he entered the cadet school at Wahlstatt in Silesia, afterwards joining the chief cadet academy in Berlin. At an early age the severity of the training in the Prussian cadet corps lent a note of inflexibility to his character, and developed in him strength of will, resolution and cool-headedness. Intellectually, he developed relatively late, owing to early illnesses and to his too rapid physical growth. Ambition awoke in him slowly; but as success crowned his efforts it grew unceasingly, and won him the reputation of a particularly gifted pupil. At the age of 18 he entered the 3rd Foot Guards at Danzig as a second-lieutenant in 1866, and soon after made his first appearance on the battlefield. At the battle of Königgrätz he stormed with his squadron an Austrian battery under fire. He took part in the war of 1870–1 as adjutant to a battalion, and after gaining distinction at St. Privat, became adjutant to the regiment.

After three years at the staff college in Berlin, he served with the general staff in 1877, and was soon promoted to the rank of captain. The next years were spent as company commander and chief of battalion and in various posts on the general staff. In 1883 he became an instructor at the Staff College in Berlin; and later, on the general staff under Count Schlieffen, he was the spiritual pupil and assistant of that strategist of genius. Several years' labour in the Prussian War Office developed his talent for organisation. After serving from 1893 to 1896 as commander of the 91st infantry regiment (Oldenburg), he was promoted major-general, and for four years served as chief of the general staff of the VIII. Army Corps at Coblenz, subsequently commanding the 28th Div. at Karlsruhe for three years. In 1903 he became general in command of the IV. Army Corps at Magdeburg. In 1911, being 65 years old, he was placed on the retired list.

The Outbreak of War.—The outbreak of the World War found him leading a life of seclusion in Hanover. It was in response to the threatening development of the opening campaign in the East against the Russians that on Aug. 22 1914 he was appointed commander-in-chief of the VIII. German Army, and had assigned to him Maj.-Gen. Ludendorff as chief of staff. Though hardly acquainted with one another previously, a reciprocal confidence soon resulted, which, despite divergence of character, led to a unity of thought and deed without analogy in history. Hindenburg has given a detailed account of his relations with Ludendorff in his memoirs. When, in Germany, after the War, from personal and political motives, attempts were made to make a scapegoat of Ludendorff, the marshal denied these accusations, saying: " We belong to one another till death. Gen. Ludendorff acted in constant accord with me. He who strikes at him strikes at me." General Ludendorff, too, in his war memoirs, fully reciprocates this attitude of complete trust and confidence.

It must be recognised that the disposition of Ludendorff was the more active, that a demonic spirit resided in him which was responsible for those decisive acts which changed the course of the world's history. His memoirs of the War and his demeanour in German politics after the War are instinct with the vehement passions of one who has been subjected to many attacks, just or unjust. During the War it was only the presence of the marshal's authority that prevented the vivid, sensitive and at times well-nigh fanatical temperament of his colleague from losing self-control. The character of Ludendorff was the harder, that of Hindenburg the greater. Their processes of thought ran upon separate lines, but each tested his own conclusions and completed them by reference to the other. Ludendorff bore the whole burden of the technical execution of the decisions, a task which he carried through with titanic strength. Hindenburg remained predominantly in the sphere of pure thought, supplying rather the static element in leadership, and leaving the dynamic side in the other's hands.

Hindenburg possessed a gift of inestimable value, and Ludendorff enabled him to develop it—that of economising his own mental energy and guarding it against strain and premature exhaustion. He was thus enabled to retain his nerve force until the end of the War, when he was then able to assume a heavier and more thankless task, that of saving his fellow-countrymen from the whirlpool of the revolution. In the political sphere, Gen. Ludendorff's vigorous intervention frequently involved the marshal in spite of all his distaste for political activities, in questions which he would probably have otherwise avoided. Hindenburg as a soldier was hampered by mistrust of his own political ability. Ludendorff frequently had to convince the chief of the general staff of the necessity for taking political decisions. Only the constraint of conscience and the sense of moral responsibility caused Hindenburg and Ludendorff to intervene at all in political questions.

Tannenberg.—The battle of Tannenberg, which lasted from Aug. 26 to 31 1914, found its origin in the dispositions, involving the assembly of strong forces on the southwest flank, adopted by the superseded Gen. von Prittwitz after breaking off the engagement at Stallupönen (Gumbinnen). Hindenburg's merit lay in converting the possibility thus acquired of a successful defence against Samsonov's Russian Army of the Narew into a victory, whereby despite the numerical inferiority of the Germans the enemy were twice encircled and practically annihilated. The most brilliant feature of the operations was the concentration of all available forces in order to overwhelm this enemy, despite the threats to Hindenburg's rear, first by Rennenkampf in the north and later by new Russian forces which were approaching from the south. In the subsequent battle of the Masurian Lakes, Sept. 7–12, the Niemen army under Rennenkampf was so thoroughly dispersed in the wood and marsh lands as to be unfit for further operations for weeks. In the opening of his campaign in East Prussia Hindenburg showed consummate mastery in the employment of interior lines and in using a central position to prevent hostile forces which were advancing from different directions from uniting on the battlefield. His plan was to overwhelm the first of these with lightning swiftness, and then to turn with all his strength upon the others.

Hindenburg was unable to follow up his victories in East Prussia by advancing across the Lower Narew; the Austro-Hungarian allies had suffered a heavy defeat in Galicia, and the German commander was compelled to hasten to their immediate aid with the bulk of the German forces available in the East. This led to the combined offensive of the German IX. Army through Southern Poland towards the Vistula and of the Austrians in Galicia across the San. The German advance met with little resistance, but the roads were mere morasses. On Oct. 8 the Vistula was reached between Jozefoff and Deblin (Iwangerod) after an advance along the Opatow-Radom line. The attempt to cross the river failed, and the Austrian allies, too, came to a standstill. Finally, the German offensive drew upon itself greatly superior Russian forces which, advancing past Warsaw, assailed its left flank. In this way the ally was relieved. Hindenburg himself succeeded in escaping the threatened envelopment from the north by a timely withdrawal upon Upper Silesia. With the vision of genius he grouped the great bulk of his forces about the railway line running to West Prussia, and at the beginning of Nov. advanced in a surprise attack from the Wrzesnía-Thorn line upon the right flank of the main Russian forces lying in southern Poland. He succeeded at the battle of Lódź in bringing the " Russian steamroller " to a standstill, and eventually compelled the enemy to withdraw behind the Bzura and Rawka.

Further Operations in the East.—Hindenburg in the meantime had been appointed marshal and commander-in-chief of all the German forces in the East. His next blow was in Masuria in Feb. 1915 against the northern wing of the Russian Army on the Upper Bobr, and led to the annihilation of the X. Russian Army. But the attempt to advance across the Narew to Bialystok failed, owing to a powerful Russian counter-offensive at Prazasnysz. The general eastern campaign, directed by Gen. von Falkenhayn, was now concentrated upon Galicia, where on May 8 the break-through at Gorlice-Tarnow initiated a promising offensive. The front line of the army group of Hindenburg, stretching from the upper Vistula as far as Courland, remained

stationary throughout this period, except for local offensives and a large scale cavalry raid. Not until the middle of July was Hindenburg's front-line set in motion, in co-operation with the victorious progress of the offensive in Galicia and southern Poland. But Gen. von Falkenhayn and the Marshal differed fundamentally in their attitude towards the cardinal problem of the War. Hindenburg's conviction, founded on the teaching of Clausewitz, was that the salvation of the Central Powers depended on the destruction of the Russian colossus. He believed that a great " Cannae " was attainable in the East, and that with such a victory all political and military considerations which fettered the commander in his power of decision would vanish.

Falkenhayn, on the other hand, held that it was sufficient by means of a " campaign with limited objectives " to keep the Russian Army at bay and to cripple its offensive power. Hindenburg's proposal was to take the offensive on his extreme left flank on the Niemen northwards past Kovno in the direction of Wilna and beyond, and thus to sever the northern arteries of the Russian Army—namely, the railways. This plan was rejected by Falkenhayn in favour of the advance across the lower Narew, which proved successful, for in conjunction with the successes of Mackensen and of the Austrians in southern Poland it caused the whole Russian front line to waver. Yet it was only gradually and in consequence of continual front-line engagements that the enemy allowed themselves to be driven back upon their rearguard communications towards the East. Several times during the operations Hindenburg brought up the question of his original project; he also carried out unaided the attack upon the fortress of Kovno, which fell on Aug. 18. Eventually, early in Sept., Falkenhayn gave way ostensibly, without, however, placing at Hindenburg's disposal the strength requisite for carrying out his plans. The offensive upon Wilna, begun too late, encountered powerful Russian forces, and it was only possible to press back the Russian front line, no decisive encounter having taken place.

From the autumn of 1915 onwards Gen. von Falkenhayn treated the East as a merely subsidiary seat of war; for while he was striving to wear down the French forces at Verdun the German eastern front was condemned to inactivity. This facilitated the great Russian successes in June and July against the Austro-Hungarian front, which was broken through and almost shattered at Luck. In Aug. when the danger was at its greatest, the whole of the eastern front from the Gulf of Riga to Galicia was united under Hindenburg. He brought order where chaos had reigned. On the upper Sereth, at Brody and on the Styr a new rampart arose, which, however, proved tenable only where German troops stiffened their allies' resistance. Meanwhile the struggle for Verdun continued to rage, and the battle on the Somme reached its culminating point.

At Headquarters.—When in Aug. Rumania joined the Entente, the Marshal, who was now the national hero, was appointed chief of the general staff in place of Falkenhayn, while Gen. Ludendorff remained with him as quartermaster-general. The new German High Command found itself confronted with innumerable heavy tasks. While the campaign against Rumania had to be improvised, it was necessary to stand on the defensive in the West. The offensive against Verdun was abandoned, not without the French having gained numerous local successes towards the end of the year. Hindenburg expressed his final aim in the words: " We intend, not to hold out to the end, but to conquer." An intensive submarine campaign was carried out as a reply to England's hunger blockade.

In the East every nerve had to be strained to force Russia to make a separate peace, while in the West the defensive campaign continued. The end of 1917 found the Quadruple Alliance, despite the tremendous demands made upon their strength—nay, despite the fact that they were almost exhausted—considerably nearer to their objective. The U-boat warfare was slowly but surely producing its effect. The Italians had in a brief but powerful offensive been, not indeed annihilated, but decisively defeated. In the East the German hammerblows at Tarnopol, Riga and Osel (Saaremma) had broken the fighting spirit of the new Russian ruler Kerensky, and carried the Bolsheviks into power. Peace was negotiated with them and with Rumania at Brest-Litovsk and Bucharest and, under military pressure, was finally attained in the winter of 1918. There remained the last and hardest task, the reckoning with France and England in the West, before America should be in a position to intervene as a military factor in the War on land.

In the spring of 1918 Hindenburg set himself to place the cornerstone upon the structure of his military achievements. All available effectives were utilised for this decisive conflict. The great offensive on both sides of St. Quentin was to break through the front line of the French and British on the southern flank of the latter, to roll them up towards the north and drive them towards the coast. From the tactical point of view the first blow in the direction of Amiens was a brilliant success. But it led to no practical advantage, and was supplemented by the attack upon the Lys front. But, here, too, the operations for a break-through miscarried, resulting only in a second massive concentration on the enemy front. Hindenburg, notwithstanding, clung to his resolve to deal the British a decisive blow in Flanders.

It was necessary, however, to effect a diversion in order to draw off the French reserves and to occupy them elsewhere. This led to loss of time, from which the enemy derived advantage. For the intervention of America loomed threateningly near. The first diversion at the Chemin des Dames gained considerable ground and drew in a large number of the French reserves, but not enough to pave the way for the decisive blow in Flanders. A new diverting attack on both sides of Rheims failed, whereupon Marshal Foch seized the initiative and from Villers Cotterêts attacked the German Marne position on the flank with strong forces. The Americans now appeared in the capacity of attacking troops. Hindenburg abandoned the Marne salient and held up the break-through on the Vesle. But from henceforth the initiative remained steadily in the hands of the French generalissimo, while the German reserves melted steadily away.

From a military standpoint the War was lost with the reverse of Aug. 8. Yet Hindenburg still hoped to cripple the fighting spirit of the enemy by a strategic defensive and to secure a peace compatible with the dignity of the German people. But Bulgaria's defection caused the complete collapse of the Macedonian front, and Hindenburg realised that an immediate armistice was necessary to give the army breathing space. With a just appreciation of their prospects of victory, the enemy took their time over granting an armistice, and summoning the full strength of their tremendous material superiority proceeded to force the German Army to throw in its last reserves. Meanwhile Turkey and Austria abandoned their rôles as allies of Germany, who found herself flung entirely upon her own resources in the final struggle. Hindenburg and Ludendorff wished to rouse the people to a final heroic effort of exertion; but the Cabinet of Prince Max of Baden lacked the capacity to check the revolution, and Germany was handed over unconditionally to the dictates of the enemy.

The marshal, victor in countless battles, had to return home, therefore, not as supreme war-lord but as a beaten general. Yet even in misfortune and profound humiliation his spirit remained unbroken, and he succeeded in extricating his country from the disorder of the revolution. On April 26 1925, the German people elected him President of the Reich.

Hindenburg stands out as the typical German, a personality of classic mould, unbroken by the tragedy of his life. He had a profound understanding of all human affairs, and he was thus enabled to pursue a steady line of conduct and to adhere to it during the appalling downfall of his country.

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(W. F.)

HINDUISM (*see* 13.501).—In Hinduism we may discern four main elements: religion, race, country and social organisation. They may not be separated. They are inextricably interwoven.

The life of each is bound up and is an integral factor in the life of the others. It is a living whole forged by the organic stresses of history and a long past, from diverse sources from various materials and it is still a living vigorous whole.

Its diversity is appalling. Uniformity could not be expected as a feature of the religious experience of 232,000,000 people of different racial origins, of different history, of different environment, tradition and social structure. Yet there is a true Hindu polity: there are features common to North and South, to East and West. Much of it belongs obviously to the universal pattern for the agelong problems, whose presentations, at various times, in differing modes, constitute the stimulus to religious activity, are based ultimately on certain definite universal experiences and facts. Man is born of woman, grows and withers like the grass. Whence and whither and why? The debate of fate, foreknowledge, freewill follows inevitably certain lines, and the solutions to these problems conform to type because they are universal problems, wherever, as is markedly the case in India, thought has turned to the scrutiny and analysis of experience.

What of unity is there in all this? Where is it to be found? What is the factor or force that transcends this welter of diversity and binds it into a whole? Not community of origin, not community of speech. A clue may be found in the view that " Though Hinduism has no one creed, yet there are at least two doctrines held by nearly all who call themselves Hindus. One may be described as polytheistic pantheism . . . the second doctrine is commonly known as metempsychosis, the transmigration of souls or reincarnation, the last-named being the most correct." Here most certainly are elements which Hinduism shares with and derives from lowlier cults. From these very elements and beliefs, the social fabric draws its strength. The new-born child is no stranger, dropped from the skies: he is one of the community returning for a brief while to the world to which again and again he will come till liberation shall have been won. These beliefs we now know to be part and parcel of the socio-religious manifestations of many so-called savage tribes. They make for the stability of social structure. They validate morality. They have a survival value.

The Hindu does not admit that a belief in reincarnation expresses pessimism. By judicious and timely expenditure a sinner may escape hell, but he cannot escape a disadvantageous rebirth—a belief which establishes a closer and more vital and socially valuable connection between morality and religion, which he cannot discover in other types of religion. What gives perennial force to these beliefs is their practical relation with the structure and rules of Hindu society and their ethical value.

In another aspect this belief lays emphasis upon the continuity of life while recognising to the full that change is ceaseless. The continuity of the Universe, which to a materialistic world is enshrined in the scientific dogmas of the indestructibility of matter and the conservation of energy, is a real doctrine of perpetual validity and practical ethical import in Hinduism, which recognises a material law in the spiritual world, as well as a spiritual law in the material world.

The charge is brought that Hinduism exhibits both intellectual and moral extravagance, yet the value of truth and of progressive revelation in religion is rated high. The moral extravagance, as the West judges morals, which exists in Hinduism, is in large part the result of the intellectual extravagance whereby logic is exalted to perilous heights unchecked by reason.

Is it absurd to affirm that Deity cannot be fettered, must be free in all respects, may act when and where and as it will? If this be true of the Divine, then in like measure as some men are the vessels of divinity, so will they be set free from the trammels and conventions that bind the ordinary lesser man. Such at least would seem to be the argument. The consequences drawn from it justify the criticism that what may be true of the Divinity is in practical reason inapplicable to humanity.

The sense of mystery, the recognition of power, the apprehension of an order dimly seen but always felt, are there. Hinduism provides a mode of life as well as a religion, a guide to and an interpretation of the relations between man and man, between one group and another, between humanity and divinity. To regulate these relations, to secure safety for all, there are minute observances and ordinances which seem to be, but at deeper view are not, incongruous with the philosophic subtlety characteristic of Hinduism at its highest and best.

Hindu polity is aristocratic, not egalitarian. It recognises and utilises and explains the inequalities of individuals and of groups of individuals. It is based on a sense of duty and of reciprocal obligation permeating the whole society from the King to the peasant. *Dharma* is duty. In the caste system, with its hierarchical gradations, its complex relations, its jealous endogamy, its fissiparous nature, it expresses an exclusiveness which at first sight seems to create a rigid barrier, but its process of proselytisation is by the absorption of whole communities, and that process is still active. The groups find a place, and some in course of time are known to have risen high by use of political and other circumstances. The highest height is still reserved for the Brahmin who, when a long view is taken of Indian history, has often proved himself worthy of the trust he has inherited.

Times are changing. The printing press is active. The schoolmaster is in the land. There is talk, loose talk, much talk of rights. Democracy and the ballot box constitute the court of final appeal. Ideas spread fast, faster than exact knowledge, and wisdom lingers. Yet appeals to the old ideals are heard and heeded by millions. Saintliness and character are recognised for what they are, great social forces. An emotional need awakened and created by the stirring political events of this period was satisfied by the worship of *Bande Mataram*, the symbolic identification of a religious entity with a racial and political ideal.

The old spirit lives and exerts its influence in countless ways. The development of industrialism in India has already made vast alterations in the mode of life of millions by changing the distribution of wealth and by augmenting the range of human and social ambitions. Those who but yesterday were poor and without honour, today are prosperous and seek for esteem and recognition. Hindu polity in the social order is based on the principle of " attaching more importance to the differences between social groups than to that which they have in common." Wealth is power and power is worshipful always. Wisdom, too, is power and still has its meed of respect, though perhaps not as fully as in the golden days, when great was the " influence exercised by Indian philosophers in every grade of society, from the highest to the lowest, solely by reason of their superior intellectual qualities and personal virtues."

Much has been, much yet remains to be, learnt by the serious student of religious and social problems from the vast array of Indian religious experience in which, daily, fresh contacts are established between Hinduism, Islam, Christianity and Primitive Culture. The diversity, polytheism, philosophic monotheism, practical henotheism, of Hinduism affect profoundly and intimately all it touches, and it assumes fresh forms and provokes change and reaction within the religious communities it touches. The census records display losses and gains and analyse them fairly. Within it the cement of philosophy which binds together the aboriginal beliefs, its prime material, is still strong as are the reforming movements like the Brahmo Samaj which, judged by numerical standards, is weak, even declining but is ever gaining fresh hold on the intelligentsia, especially of Bengal. The Arya Samaj in the Punjab has gained greatly in recent years. It has developed the practice of *Shuddhi:* (*a*) the conversion to Hinduism of persons belonging to foreign religions; (*b*) the reconversion of those who have recently or at a remote period adopted one of the foreign religions; and (*c*) reclamation of the so-called Depressed Classes. In conservative Southern India whence great movements have originated in the past, so much so that " it would be more correct to describe Indian religion as Dravidian religion stimulated and modified by the ideas of Aryan invaders," many forces are at work which are

destined surely to find expression in religious modes, perhaps as before, in a development of an emotional theism founded on the belief that "every man by his own efforts can come into immediate contact with the Great Being whom he worships."

Hinduism needs no apology. As Sir Charles Eliot has finely said: "If Hinduism were really bad, so many great thoughts, so many good men would not have grown up in its atmosphere. More than any other religion it is a quest of truth and not a creed . . . it is truly dynamic and in the past, whenever it has seemed in danger of withering, it has never failed to bud with new life and put forth new flowers. More than any other religion Hinduism appeals to the soul's immediate knowledge and experience of God. It has sacred books innumerable, but they agree in little but this, that the soul can come into contact and intimacy with its God, whatever name be given Him and even if He be superpersonal . . . the task of religion is . . . not to promote the welfare of tribes and states, but to effect the enlightenment and salvation of souls." Purified from within, Hinduism in its highest expression by which it, as any other religion, has a right to be judged, with its great vitality, its power of adaptation, its philosophic tradition, its insistence on the development of the powers that are latent in man and are in jeopardy of being atrophied by modern dependence on machinery, may yet serve humanity by correcting the stress laid by other schools of thought upon the material to the neglect of the spiritual.

BIBLIOGRAPHY.—The Census reports for 1911 and 1921 contain valuable data and critical examination of the statistical evidence collected. The Provincial reports are also full of matter. The publication of *The Tribes and Castes of Bombay*, 3 vol. (1920), completes a series of most important books so far as the main part of continental India is concerned. The religions of the Lower Culture are dealt with in the *Birhors*, by Sarat Chandra Roy (1925) and the monographs of the Assam and Burma Ethnographical Surveys.

Sir Charles Eliot's *Hinduism and Buddhism* (1921) is a fine presentment of facts based on personal knowledge and a critical investigation of the texts. Such works as *The Crown of Hinduism* by J. N. Farquhar (1913), *The Chamars* by G. W. Briggs (1920) and *The Village Gods of Southern India* (1921) by the Rt. Rev. Henry Whitehead, D.D., may also be consulted.

HINES, WALKER DOWNER (1870–), American lawyer, was born at Russelville, Ky., Feb. 2 1870. He was educated at Ogden College and the University of Virginia. From 1893 to 1904 he was with the Louisville and Nashville Railway in the legal department and, after 1901, as first vice-president. He practised law in Louisville, Ky., 1904–6 and in New York City 1906–16, becoming specially versed in questions of interstate commerce. In 1906 he became general counsel for the Atchison, Topeka and Santa Fé Railway, later becoming also chairman of the executive committee, and then chairman of the board of directors. In Feb. 1918, after the U.S. Govt. had assumed control of the railways as a war measure, he was appointed assistant director-general, and in Jan. of the following year director-general. He resigned in May 1920, and was designated by President Wilson as arbitrator in the distribution of German, Austrian and Hungarian inland shipping under the Peace Treaties. In Oct. 1921 he resumed the practice of the law in New York City. In 1925 he made an investigation and report of navigation on the Rhine and Danube for the League of Nations.

HIPPIUS, ZINAIDA (1869–), Russian poet and prose writer, was born Nov. 8 1869 at Belev, in the Tula province. She married Dmitry Mereshkovsky in 1889 and went to live in St. Petersburg (Leningrad). Later she went to live in Paris. Hippius was one of the leading poets of the Russian symbolist movement of the 'nineties and her poetry bears the usual character of the movement: the cult of beauty, mysticism and individualism. The influence of Nietzsche's philosophy is also apparent as in the famous line "I love myself as I love God" which became the slogan of the Russian "decadents." Her later poetry shows the influence of the neo-Christian theories of Mereshkovsky but at the same time reveals deep individual and emotional power. Her prose works were much inferior to her poetry, but under the pseudonym of "Anton Krainy" she was known as a trenchant literary critic.

HITCHCOCK, GEORGE (1850–1913), American painter (*see* 13.533), died on the island of Marken, Netherlands, Aug. 2 1913.

HITCHCOCK, GILBERT MONELL (1859–), American politician, was born at Omaha, Neb., Sept. 18 1859. He was educated at Omaha and Baden-Baden (Germany), and the law school of the University of Michigan. He was admitted to the bar in 1881 and practised law in Omaha for four years. In 1885 he founded the Omaha *Evening World*, and four years later bought the Omaha *Morning Herald*, combining the two papers into *The World-Herald*. He was representative in Congress 1903–5 and 1907–11. He was elected U.S. Senator for the terms 1911–7 and 1917–23. After the sinking of the "Lusitania" in 1915, he believed that action on the part of America should be limited to a demand for reparation. In 1917, however, he supported the resolution for a declaration of war against Germany, and in 1918 became chairman of the Senate committee on foreign relations. When the President submitted to the Senate the Treaty of Versailles, Senator Hitchcock led the administration forces by virtue of his office, giving strong support to the League of Nations.

HOBART, Tasmania (*see* 13.544), the capital of Tasmania, is the political and social, but not the commercial or trade centre, as it is reached from the north coast by a slow railway journey. Since electric power has been available from generating works at Great Lake, which began to give a large output in 1921, zinc works, a chocolate and sweet factory, and carbide manufacturing works, have been started near the town. A large number of summer visitors from the Australian mainland provide a livelihood for many inhabitants of Hobart, which had a population of 53,132 in 1921 (including suburbs), representing a quarter of the population of Tasmania. The magnificent sheltered harbour in the river Derwent, which is 2½ m. wide at Hobart, has some 2½ m. of wharfage, with depths of 45 to 65 ft. alongside the pier.

HOBHOUSE, LEONARD TRELAWNEY (1864–), British sociologist, was educated at Oxford; he became fellow of Merton College in 1887, and of Corpus Christi in 1890. Engaging at first in journalism, he served for five years on the staff of *The Manchester Guardian*. An active Liberal, he was secretary of the Free Trade Union in 1903–5 and published several political works, notably *The Labour Movement* (1893; 2nd ed., 1898) and *Democracy and Reaction* (1904), showing strong sympathy with collectivism, which he maintained to be not inconsistent with Liberalism. But in 1907 he was appointed Martin White professor of sociology in the University of London, and next year became editor of *The Sociological Review*. Thenceforth, except for a few war publications, he devoted his energies to writing and lecturing on ethical, psychological and sociological subjects. His principal works are *The Theory of Knowledge*, 3rd ed. (1921); *Mind in Evolution*, 2nd ed. (1915); *Morals in Evolution*, 2 vol., 3rd ed. (1915); *Development and Purpose* (1913); and *Principles of Sociology* in four separate sections (1918–24); the social application of ethical principles; in collaboration with G. C. Wheeler and M. Ginsberg, *The Material Culture and Social Institutions of the Simpler Peoples* (1915); and with J. L. Hammond, *Lord Hobhouse; a Memoir* (1905).

HOCKEY (*see* 13.554).—Since the World War, hockey has definitely established itself in Great Britain as a very popular game. During the years immediately before 1914 there was a steady increase in the number of clubs affiliating to the various county associations, and also in the number of teams put into the field. To-day there are about 1,000 clubs in England alone. In Ireland, the game more than held its own, but in Scotland and Wales there was little or no progress, due in some measure to lack of suitable grounds. In the services and at the universities, however, every year saw new adherents to the game, and since 1908 Cambridge has given a "full blue" for hockey. In 1910 the foreign countries in which hockey was played were France, Germany, Belgium, Denmark and the Netherlands. An annual match was instituted between England and France in 1907 and in 1913 Germany was also met. Turning to British dependencies, we find associations flourishing in Australia, New Zealand, South Africa and India.

The post-War period in Great Britain is noteworthy for the fact that the game is rapidly becoming more democratic. This is largely due to the initiative of the large banks, insurance companies and business houses in providing larger and better grounds for their employees. A newcomer to the ranks in the services is the Royal Air Force, which has some 30 affiliated stations. This arm of the services, together with the navy and the army, form the Combined Services Hockey Assn., which plays annual matches with one or other of the five divisions into which the English counties are grouped. The number of public schools playing hockey is now considerable.

The Game throughout the World.—It is, however, in foreign countries and, in a less degree, in the Dominions, that hockey has made a large stride forward since the World War. Taking Europe first of all, Spain, Austria, Switzerland and Czechoslovakia, have many flourishing clubs. The French have taken to the game with enthusiasm, and they hold inter-regional matches, corresponding to the divisional matches held in England. The Belgians are forging ahead and the Germans have a large number of players, Hamburg being the chief centre.

Turning to the Dominions, Australia and New Zealand are making headway. In South Africa, too, the game is increasing in popularity, with the result that in 1925 a South African Federation was formed. But so far as numbers are concerned, India is the biggest hockey country in the world. It is roughly computed that there are about 3,000 teams in India and recently an All-India Federation was formed to include the 24 provinces. The game in India is generally played all the year round; the natives are very fast and amongst them are many clever players. Japan is a newcomer to hockey and has formed an association to which some 50 clubs are affiliated. The Japanese Army and Navy have also included the game in their athletic curriculum and there are several service teams. In China a few of the more educated Chinese prefer hockey to association football, and it is extensively played in China by foreigners of various nationalities, principally in Hongkong, Shanghai, Pekin and Tientsin.

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United States and Canada.—The game of Ice Hockey is native to Canada and was first played in an organised way in the cities of Kingston, Quebec and Montreal and before many years it was the acknowledged national winter game of the country. The game was introduced into the United States in the early 90's, when Canadian teams played in New York City and Baltimore. To-day it is a recognised winter sport throughout many of the northern states.

Although in Canada and the United States the game is very generally played on open-air rinks, all organised club or league hockey is played in covered rinks. Practically all the covered hockey rinks in the United States and a considerable number of those in Canada have artificially frozen ice surfaces, which give assurance of a good sheet of ice, no matter how the weather conditions may vary during the ice hockey season. In Canada and the United States, organised hockey is played under the jurisdiction of leagues or associations—the professionals, the amateurs, the colleges and the schools having their respective leagues or associations. The playing rules and the laws of the game are fundamentally the same in all leagues or associations. There is some variation in the rules pertaining to off-side play, penalty for fouls, and other minor points.

The principles of the game are quite simple. An ice hockey team is composed of six players, each one having a designated position. There are the goal guard, the right and left defence, and the three forwards—right-wing, left-wing and centre. A stated number of substitute or relief players are allowed each team—not more than six. The game requires steadiness and speed on the skates, dexterity and agility, the capacity to think and act quickly, and physical fitness. The hockey stick is made of elm wood, except for some of the lower grades that may be made from ash. It is with the stick alone that the player manipulates the object called the puck, which is a disc made of rubber, one inch thick and three inches in diameter. The objective point in the game is to score by driving, pushing or sliding the puck through the opponents' goal. Present-day rinks are laid out to give an ice surface of anywhere from 180 to 210 ft. long by 80 to 85 ft. wide. A goal post with nets attached is fixed at each end of the ice surface about 10 to 15 ft. from the end board. The goals are four feet high and six feet wide. (T. Ho.)

HODGES, FRANK (1887–), British politician, was born at Woolaston, Gloucestershire. At the age of 14 he entered the Vivian Colliery at Abertillery, S. Wales. His fellow miners provided him with a scholarship to Ruskin College, Oxford, in 1909, and he later went to France. Returning to the mines, he also conducted classes in economics and French. In 1912 he became a miners' agent and six years later secretary of the Miners' Federation of Great Britain. In 1921 he was made joint secretary of the National Wages Board. Elected to Parliament in 1923 as member for Lichfield, he resigned his post as Secretary of the Miners' Federation. He became a Civil Lord of the Admiralty in the Labour Ministry of 1924. He lost his seat at the election of that year; and in 1925 was made General Secretary of the International Miners' Federation. He is the author of *My Adventures as a Labour Leader* (1925).

HODGKIN, THOMAS (1831–1913), British historian (*see* 13.557), died at Falmouth March 2 1913.

HODLER, FERDINAND (1853–1918), Swiss painter, was born at Gurzelen in the canton of Berne March 14 1853. He received his early education in drawing from a Swiss landscape painter at Thun, but his artistic career began at Geneva in 1872, where he worked under Barthelémy Menn, at the same time studying at the university. In 1874 he won the Calame prize for a landscape. After various journeys, notably in Spain, which explains the Spanish influence in much of his earlier work, he settled down in Geneva where, with a few intervals, he remained until his death. Among his most important pictures are the "Cortège des Lutteurs" (1887), "La Nuit" (1891), "L'Elu" (1894), "Eurythmie" (1895), "L'Émotion," "La Vérité" (1905), "Le Jour," "L'Amour" (1908). He also painted humorous portraits and landscapes, together with many water colours and lithographs. He received many commissions for decorations from official bodies, notably the large-scale decoration on the wall of the Hall of Arms in the National Museum of Zürich called "La retraite de Marignan" (1900). In 1907 he was entrusted with the decoration of the University of Jena, and in 1911 he painted his "Unanimité" for the town hall at Hanover. He died at Geneva May 19 1918.

HÖFFDING, HARALD (1843–), Danish philosopher (*see* 13.561), resigned his professorship at the University of Copenhagen in 1915. Among his later works are: *Moderne Filosoffer* (1904, English version 1915); *Spinoza's Ethica* (1906, etc.); *Henri Bergson's Filosofi* (1914, English version 1915); *Den store Humor* (1916, English version 1924); *Totalitet som Kategori* (1917); *Oplevelse og Tydning* (1918); *Ledende Tanker i det 19de Aarhundrede* (1920); *Relation som Kategori* (1921).

HOFFMAN, MALVINA (1887–), American sculptor, was born in New York City June 13 1887. She studied sculpture in New York with Herbert Adams and Gutzon Borglum, and in Paris with Auguste Rodin. After obtaining recognition in Paris, where she was awarded a first prize at the Salon in 1911 for "Russian Dancers," she settled in New York. Her memorial group, "The Sacrifice," presented to Harvard University by Mrs. Robert Bacon, but placed temporarily in the Cathedral of St. John the Divine, New York City, is considered the finest of her works. Three portraits by her of Paderewski, when exhibited in New York in 1920, attracted great admiration. Other works of hers are "John Muir" in the American Museum of Natural History, New York City; "Modern Crusader" in the Metropolitan Museum of Art, New York City; "Bacchanale Russe" in the Luxembourg Musé, Paris, and "Gervase Elwes" in Queen's Hall, London. One of her latest commissions was a

heroic size stone group over the entrance of Bush House, Strand, London. Miss Hoffman was married to Mr. S. B. Grimson June 6 1924 in New York City.

HOFMANNSTHAL, HUGO VON (1874–), Austrian poet, was born in Vienna Feb. 1 1874. He took the degree of Ph.D. at the University of Vienna and when still a schoolboy originated the Romantic School in Austria by his lyric and semi-dramatic poetry, which aroused much controversy at the time. He was not uninfluenced by Stefan George's example and Hermann Bahr's criticism, but the melody and colour of his language, and the art with which he gave poetic expression to complicated spiritual moods, in particular, were entirely new. A genius for appreciating bygone cultures and a sensitive understanding of the beautiful in art and in nature, characterised both the youth and the man. Hofmannsthal is little indebted to contemporary realism, but his almost too susceptible personality is tinged by innumerable literary influences from the Attic tragedians down to Victor Hugo, Swinburne, Browning and D'Annunzio. This lack of originality is especially noticeable in his dramatic poems, not a few of which are simply old plays of Sophocles, for example, of Calderon, Molière and Otway cloaked in modern form and spirit. Nevertheless he has an abiding place in the history of literature as founder of the whole German neo-romantic drama. A few of his dramas became known outside Austria through the music of his friend Richard Strauss, others through Reinhardt's Festival at Salzburg. His collected poems appeared in 1911. In later years he turned his attention to society comedy. The most characteristic of his dramas are: *Gestern* (1892); *Der Abenteurer und die Sängerin* (1899); *Der Tor und der Tod* (1900); *Der Tod des Tizian* (1901); *Oedipus und die Sphinx* (1906); *Cristinas Heimkehr* (1922); *Das Salzburger grosse Welttheatre* (1922); and his libretti: *Elektra* (1903) and *Der Rosenkavalier* (1911). See monograph by Sulger-Gebing (1905).

HOGG, SIR DOUGLAS McGAREL (1872–), British lawyer and politician, was born Feb. 28 1872, the son of Quintin Hogg, founder of the Polytechnic, London. He was originally intended for a business career, and on leaving Eton spent eight years with his father's firm of West India merchants. After serving in the South African War (1899–1902), on his return to England he abandoned commerce for the law. Called to the bar in 1902 he forthwith took a leading position as a junior, and when he became K.C. in 1917, immediately came to the front. His deadly power of cross-examination, easy mastery of facts and figures and persuasive speech made him formidable in every kind of case.

In 1922, on entering Parliament as Conservative Member for Marylebone, he became Attorney General and a Privy Councillor in Mr. Bonar Law's Government, receiving the usual knighthood given to a law officer. In opposition, or in office he showed himself a powerful debater, his vigorous speech on the Campbell prosecution (*see* ENGLISH HISTORY) had not a little to do with the defeat of Mr. Mac Donald's Labour Government. When the Conservatives returned to power in 1924, Sir Douglas Hogg was reappointed Attorney General, with a seat in the Cabinet.

(R. S–D.)

HOLLAND, HENRY SCOTT (1847–1918), English divine, was born at Ledbury, Hereford, Jan. 27 1847. He was educated at Eton and Balliol College, Oxford; in 1872 he was ordained, becoming the same year a tutor at Christ Church. In 1882 he was senior proctor of the university, and the same year was made a canon of Truro and examining chaplain to its bishop. He was appointed a canon of St. Paul's in 1884, and in 1886 precentor. He refused the offer of the see of Norwich in 1893, but in 1910 was appointed regius professor of divinity at Oxford. He died at Oxford March 17 1918. Scott Holland was closely associated with the Christian Social Union for many years. He was a successful tutor and a popular professor; but it is as a preacher that he is most vividly remembered. In 1905 his *Personal Studies*, which first appeared in *The Commonwealth*, were published in book form. He also wrote a notable essay on *Faith*, several volumes of sermons and a life of the singer, Jenny Lind. See *Life*, by Stephen Paget (1921).

HOLLAND, JOHN PHILIP (1841–1914), American inventor, was born at Liscannor, County Clare, Ireland, in 1841. He was educated at Limerick, and was a school teacher in Ireland prior to migrating to the United States. He was teaching in New Jersey when the Civil War broke out and the conflict between the "Merrimac" and the "Monitor" suggested to him the idea of a submarine. He became a pioneer in this field and one of the most successful designers of submarine craft. The first boat, built in 1875, was a failure and it was not until his ninth attempt in 1898 that he produced a serviceable submarine from the practical standpoint. This boat was commissioned for the U.S. Navy and orders for others were placed with Holland. His great achievement was the furnishing of the submarine with two methods of propulsion, a 50 H.P. gasolene engine to be used when on the surface and electric storage batteries when submerged. The British Admiralty acquired all the patents for Great Britain, although his avowed purpose had been to invent a craft that would overcome the British naval supremacy. Holland then turned his attention to the construction of submarines for sea-going purposes, constantly improving upon his original model, and all his subsequent boats were built for the U.S. Navy, the types tending constantly to become larger. He died at Newark, N.J., Aug. 12 1914.

HOLLAND: *see* DUTCH LITERATURE; NETHERLANDS.

HOLLYWOOD, Cal., U.S.A., the principal seat of the motion-picture industry, was annexed to Los Angeles (*q.v.*) in 1910.

HOLMES, OLIVER WENDELL (1841–), American jurist, was born at Boston March 8 1841, the son of Oliver Wendell Holmes, the poet and essayist (*see* 13.616). He graduated from Harvard in 1861. On the outbreak of the Civil War in that year he enlisted and served three years in the 20th Mass. Volunteers, rising to the rank of lieutenant-colonel. He was wounded three times—at Ball's Bluff, Antietam and Fredericksburg. He concluded his military career as aide-de-camp on the staff of the 6th Div., retiring in July 1864. In that year he commenced the study of law at Harvard, obtaining his LL.B. in 1866, and was admitted to the Suffolk (Mass.) bar March 4 1867. He practised law in Boston, and in 1870 was appointed instructor in constitutional law at Harvard, at the same time becoming editor of *The American Law Review*, which latter position he held for three years. In 1871–2 he was university lecturer in jurisprudence. In 1873 he edited the 12th edition of Kent's *Commentaries*, since recognised as the standard edition. In the same year he became a member of the firm of Shattuck, Holmes & Munroe and engaged in an active practice.

In 1880 Holmes was appointed lecturer on common law at the Lowell Institute. His articles in *The American Law Review* contained the germs of the lectures which he delivered before the institute, and these in turn, in an amplified form, were published in 1881 under the title *The Common Law*. The object of the work was to present a general view of the common law, and this was done with a wealth of illustration, a charm of language and a clarity of reasoning which, apart from the erudition displayed, gave Mr. Holmes an international reputation. In 1882 he was appointed professor of law at the Harvard Law School, but resigned to accept an appointment on Dec. 8 of the same year as associate justice of the Supreme Judicial Court of Massachusetts. This position he occupied for 17 years, becoming Chief Justice on Aug. 2 1899. On Dec. 4 1902 he became an associate justice of the Supreme Court of the United States. As a judge his opinions are conspicuous for their literary style and epigrammatic force. In 1924 he was awarded the Roosevelt Memorial Association Medal for the development of public law. In addition to the works already mentioned he published in 1891 a small volume of *Speeches*, re-issued with additions in 1913 and *Collected Legal Papers* (1920).

HOLROYD, SIR CHARLES (1861–1917), British painter-etcher (*see* 13.618), died at Weybridge, Surrey, Nov. 17 1917. He arranged for the transference of a large portion of the Turner bequest to the Tate Gallery, London.

HOLTZMANN, HEINRICH JULIUS (1832–1910), German theologian (*see* 13.620), died at Baden-Baden Germany Aug. 6 1910.

HONDURAS (*see* 13.649).—A republic of Central America and an original member of the League of Nations. On Nov. 15 1922 Honduras notified the League of its intention to withdraw because of the onerous annual contribution. The area is estimated at 36,000 square miles. The population in 1914 was estimated at 562,000; official figures gave the population in 1923 as 773,408. The capital, Tegucigalpa, had an estimated population in 1923 of 40,000; the population of La Esperanza was 11,453; and that of Santa Rosa 10,574. The inhabitants are mostly Indians and mixed races: there are a few Spaniards and a large proportion of negroes. Honduras broke off diplomatic relations with Germany on May 17 1917, and on July 19 1918 war was formally declared. The constitution of Honduras was remodelled and proclaimed in a new charter on Oct. 3 1924, which gave the legislative power to a congress of 43 deputies in the ratio of one member for every 15,000 inhabitants.

I. POLITICAL HISTORY

In 1910 Miguel R. Dávila (the creature of President Zelaya of Nicaragua), who was elected president of Honduras for four years in 1906, was eliminated in a rapid campaign by Manuel Bonilla, the former president. Dr. Francisco Bertrand, who had been chosen provisional president at a peace conference brought about by the United States, served as vice-president until the death of Bonilla in 1913, when he succeeded to the presidency and was elected to a second term of office in 1915. In the campaign of 1919 a Liberal revolt forced Bertrand to resign office and flee the country. Gen. López Gutierrez, who led the revolt, caused himself to be declared dictator, and was elected president in October.

An attempt to overthrow the President was made by revolutionists from Nicaragua in Aug. 1922; and when, in May 1923, war material of the 1922 movement was discovered near the boundary, new civil disturbances were foreseen. By June many of the citizens had been driven into exile by the warring factions. Further violence marked the presidential campaign in Oct. when Gen. Tiburcio Carias, a Conservative, was opposed to two Liberal candidates. The returns of the election indicated that Carias was the popular choice, although he was a confirmed revolutionist and opposed by the Government. Early in 1924 conflicts between the three presidential candidates, Dr. Arias, Dr. Bonilla and General Carias, caused American casualties, and marines were sent to the Nicaraguan boundary and to Tegucigalpa. In April 1924 Mr. Sumner Welles was sent by President Coolidge to arrange a conference between the contestants and the neighbouring republics at Amapala. The conference was successful, and Gen. Vicente Tosta was elected president with the moral support of the United States, superseding Gen. Fausto Dávila, the provisional president.

At the beginning of July, as no arrangement could be made regarding the future president, serious disaffection was manifested and political disturbances again broke out. Both the political leaders and the revolutionists accepted Dr. José María Caseo and Ramón Alcero Vastro as president and vice-president respectively. The election at which a successor to provisional president Tosta was to be chosen was postponed from Nov. 25 to Dec. 28–30. The elections were held on the postponed date without any disorder, and Dr. Miguel Paz Baraona was elected president, with Presentación Quesada as vice-president. The new president was inaugurated on Feb. 1 1925. In March diplomatic relations with the United States, which had been severed in Feb. 1924 were resumed. In 1925 political disturbances were recurrent: Tegucigalpa was held in a state of siege in May by revolutionists, and in the west Gen. Gregorio Terrera had been actively in rebellion since February. Nicaraguan and Honduran officials prevented revolutionists from Nicaragua entering the country. Martial law prevailed. In Aug. General Tosta, as Minister of War and Marine, announced at Tegucigalpa that peace had once more been restored. Honduras ratified the first three of the Washington conventions of 1922–3, and the 13th, providing for international commissions of inquiry (*see* CENTRAL AMERICAN UNION). In Aug. 1925 eight of the agreements were awaiting the final approval of the republic.

Defence.—Military service is compulsory for all citizens of Honduras on attaining the age of 21. Under the convention signed at Washington on Feb. 7 1923 the standing army of the republic was limited to 2,500. A congressional decree of April 9 1923 fixed the strength of the regular army at 3,036 of all ranks.

Education.—Primary education, which is secular, is free and compulsory from seven to 15 years of age. The number of children who do not receive instruction is high, estimated at 57%. Of 79,199 children of school age in 1922 it was estimated that 32,976 attended school. In 1922 there were 850 public schools with 1,127 teachers. There were five public secondary schools and four training colleges. The National University at Tegucigalpa was staffed in 1922 with 36 professors and attended by 107 students. Military and aviation schools have been established at the capital, and a school of jurisprudence at Comayagua. The Government offers two exchange scholarships with the United States. Expenditure on education in 1919 was 384,980 pesos.

II. FINANCIAL AND ECONOMIC HISTORY

Finance.—The budget of 1923–4 was adopted by Congress as the budget for 1924–5 owing to political disturbances in 1924. Revenue and expenditure were estimated to balance at 9,204,244 silver pesos; the budget for 1925–6 was estimated at 10,832,439 pesos. The fiscal years 1914–5 to 1920–1 showed a deficit; surpluses occurred in the years 1921–2 to 1924–5. Recent political warfare has, however, eliminated all surpluses. Military expenditure was the largest item in the budget, constituting in the fiscal year 1920–1 45% of all government expenditure. The foreign debt, as reported by the Corporation of Foreign Bondholders, amounted in Oct. 1924 to £29,114,775. The contract for the adjustment of the external debt was approved by the Council of Bondholders and forwarded to the National Congress for sanction. This ratification had not been given by Feb. 1926. The basis of the arrangement took the sum of £452,000 as the representative value of the external debt incurred in the wars of 1867, 1869 and 1870, and interest on this sum at 8·86% was allowed for the period of the new agreement. The total payment was to consist of £1,200,000 in semi-annual instalments of £20,000 for 30 years.

Production and Industry.—Business prosperity was depressed in 1923 and 1924 by wars. In the early part of 1925 complete stagnation followed bad political conditions, banditry on the frontiers and floods in the fruit districts. The principal culture is that of bananas and coconuts. In 1920 the export of bananas was 11,524,149 bunches; in 1923 the exports were 12,520,495. Coconuts dropped from 12,647,508 in 1920 to 8,360,720 in 1922. The 1924 sugar production in the Puerto Cortes district, 30,532,950 lb., was twice that of 1923 and four times that of 1922. The prospect was that the 1925 production would show a further increase. Silver production increased in 1924, when more than 2,000,000 oz. were produced. Bananas rank first in order of importance amongst the exports, and next in order are sugar, silver, coconuts, hides, cattle, gold. Imports, in order of importance, are manufactured products, foodstuffs, raw materials and lumber. The United States has 90% of the trade. The chief figures for trade totals of three years were:—

	1924	1925
All countries		
Imports	11,137,917	12,752,761
Exports	7,897,046	11,983,051
United Kingdom		
Imports	401,218	295,921
Exports	658,320	203,888
Germany		
Imports	198,792	308,197
Exports	10,485	28,170
United States		
Imports	9,783,811	10,252,257
Exports	7,186,045	11,072,463

Communications.—The national railway of 66 m., which was taken over by the Government in 1912, was in 1920 placed in the

control of the Compañía Agrícola, which in 1924 was reconstituted as the Cortes Development Company. The line has been overhauled to meet the demands for transporting the banana crops. Four other railroads are owned by fruit companies. In 1924 the mileage of the railways was 934. Telegraph lines in 1922 totalled 4,662 and telephone lines 873 miles.

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HONDURAS, BRITISH (*see* 4.615).—A British Crown colony in Central America. Its area is 8,598 sq. m. and the estimated population (1923) is 45,527; the birth rate was 37·91 per 1,000 and the death rate 20·50. Belize, the chief town, had a population in 1921 of 12,661. In 1923 there were 65 primary schools with 6,774 pupils on the registers. The Government expenditure on public education in 1923 was £10,615. There were five private schools conducted by religious institutions, with 499 pupils.

Finance and Commerce.—The chief sources of revenue were customs duties, excise and land tax and the sale and letting of Crown lands. Revenue and expenditure for the four years 1921–4 were:—

	1920–1	1921–2	1922–3	1923–4
Revenue	£232,496	£227,409	£234,059	£224,928
Expenditure	191,114	290,284	226,114	247,576

Customs duties levied on the majority of imports were, in 1923–4, £115,969; preferential treatment is accorded to goods of British origin, 10% *ad valorem* being accorded to manufactured goods.

Forestry products are the chief source of the colony's wealth, but agriculture has tended to engage the population. The forest area was estimated at 4,000,000 ac., or nearly one-half of the entire area; and 9,967,186 superficial ft. of mahogany were exported in 1923, as well as 663,437 superficial ft. of cedar wood. Primitive methods of cultivation employed have prevented the development of banana cultivation: in 1923, 332,500 bunches of bananas were exported, and 5,964,706 coconuts. The chief imports were, in order of importance, clothing and articles of apparel, foodstuffs, cotton goods, hardware and machinery. The balance of trade was adverse during the years 1922–4. The total trade figures were:—

	1921–2	1922–3	1923–4
Imports	£688,000	£692,716	£830,594
Exports	627,000	593,178	657,794

In 1922, 71% of the export trade was with the United States and 19·38% with Great Britain.

The United States gold dollar is the monetary unit, and British and United States gold coin are legal tender. In 1912 banking business was taken over by the Royal Bank of Canada. Deposits in the six Government savings banks were in March 1924 $164,236.

See A. B. Dillon, *Geography of British Honduras* (1923); *Colonial Office Reports*, annual series, London.

HONGKONG or HIANG-KIANG (*see* 13.657) is an island off the southeast coast of China, 11 m. long and from 2 to 5 m. broad. It is a British Crown Colony and was ceded to Great Britain by the Chinese Govt. in 1841. The total population of Hongkong and the leased territory of Kowloon was estimated (1923) 681,000, of whom the majority are Chinese British subjects. At the Washington Conference the Chinese delegates asked (Dec. 3. 1921) for the surrender of all the leases of Chinese territory, including Kowloon, to foreign Powers, but Mr. (Lord) Balfour declared that Great Britain could not contemplate the surrender of Kowloon, as without it Hongkong would be strategically untenable. He also pointed out that Hongkong ranks "easily first among the ports of the world," was a free port and therefore that its preservation was not only a British but a world interest.

Shipping and Trade.—The total shipping entering and clearing at Hongkong in 1924 was 764,492 vessels of 56,731,077 tons; barely more than one-third of the tonnage of ocean going ships was British. Hongkong's annual turnover of trade aggregates nearly 150 million sterling a year. Her import of opium remains important, amounting in 1923 to 550 chests uncertificated Indian opium and 216 chests Persian opium. The Persian opium went to Formosa; of the Indian opium 290 chests were for the Macao opium farmers and 186 for the Government monopoly. The total imports of all goods in 1924 (including bullion) were valued at £75,155,000, of which 13·1% came from the United Kingdom; the total exports at £63,675,000 of which only 1·2% were consigned to the United Kingdom. There are no duties upon imports and exports except on liquors and tobacco and a light due on shipping of 2 cents per ton for each call. Hongkong itself produces little and is principally a port of trans-shipment for goods. Some of her chief exports are rice, tin, tea, tobacco, etc.

Revenue and Expenditure.—The budgets for the three years 1924–6 are as follows:—

	Revenue Hongkong dollars	Expenditure Hongkong dollars
1924	24,209,638	26,726,426
1925 (revised estimate)	22,279,855	30,032,127
1926 (estimate)	23,790,615	21,367,743

In spite of apparent deficits the Colony's credit balance was expected to be over $5,000,000 at the end of 1925 and about $2,500,000 at the end of 1926 as the Government, in view of large balances in the Treasury from previous years deliberately budgeted for deficits.

Industries.—The four leading industries are shipbuilding, rope-making and the manufacture of sugar and cement. Other industries are glass blowing, soapmaking and toy manufacture, etc. In 1921 Hongkong's shipbuilding yards launched more vessels than the rest of the British Empire, outside the United Kingdom, together.

The Boycott of 1925.—For 80 years Hongkong progressed in mutually advantageous trade relationships with Amoy, Foochow and Canton and Swatow in South China, but in June 1925, an anti-foreign boycott began in China which interrupted commercial intercourse. The circumstances leading to this boycott were mainly the discontent of "young China" with foreigners' extra-territorial rights and with foreign concessions, and the impotence of the Central Government in Peking to enforce its own mandates. At the beginning this anti-foreign feeling was mainly directed against Japan and led to various strikes in Japanese cotton mills in Shanghai in the early part of 1925. On May 30 1925 the famous "Shanghai incident" occurred when a meeting was held by Chinese students to protest against the action of Japanese mill-owners who a fortnight before had fired in self-defence on Chinese strikers. Ordered to disperse the students resisted and attacked the police station. The police fired on the mob, killing four outright and wounding several, five fatally. This incident was the signal for a violent anti-foreign outbreak. As British interests predominate in China British firms were the main objects of attack by means of a commercial boycott and Hongkong, as the exemplification of the British Empire, was an obvious target.

The first serious manifestation was the withdrawal of ships' crews on June 19, followed by a general exodus of workers. Regulations were promulgated by the "All China General Labour Union" and the "Canton-Hongkong Strike Committee," the main points of which *vis-a-vis* Hongkong were that goods exported from or imported to Kwangtung should not pass through Hongkong and that foreign vessels passing through Hongkong should not discharge cargo in Kwangtung. In consequence of this boycott serious damage has been done to Hong-

kong's trade. The policy adopted by the British Govt. has been that of patience, *i.e.*, allowing the Chinese merchants to discover for themselves that Hongkong is not the only sufferer by the suspension of trade relations. (*See* CHINA.)

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HOOKWORM (*see* 2.58), parasitism caused by the hookworms *Necator americanus*, *Ankylostoma duodenale*, and, more rarely, *Ankylostoma braziliense*, which inhabit a relatively small portion of man's small intestine. A single healthy female hookworm passes daily several hundred eggs which leave man in his excrement. Under favourable conditions, such as its deposit on suitable soil, larvae form therein, hatch, develop to an infective stage, and enter the soil. Infection ordinarily occurs through the piercing by infective larvae of the skin, commonly of one who walks barefoot over infected soil. Carried by the circulation from the skin to the lungs, larvae reach the air passages and, like all foreign bodies, are driven up these to the throat, are swallowed, and so finally reach the small intestine. Man's normal mechanisms are thus subverted to the hookworm's use.

The treatment of ankylostome infestation involves, firstly, disinfestation by a vermifuge or anthelmintic, and, secondly, neutralisation of ill effects consequent on infection. To increase their concentration in the bowel, and presumably their efficacy, anthelmintics have customarily been preceded by purging and fasting. Accumulating evidence however suggests that purging lessens effectiveness. Starvation, beyond the ordinary nightly fast, increases, for some drugs, risk of poisoning the host. Anthelmintics are best given in the early morning. The ideal vermifuge, with a dosage which poisons all hookworms without endangering the host, is non-existent. The dosage employed for any drug should give the greatest efficiency compatible with safety, and may be termed the optimum dose. Attainment of increased safety is attempted by dividing the optimum dose into fractions, usually 3 or 4, given with intervals of one or two hours, by which means treatment can be stopped at any stage should ill effects appear, while efficacy is apparently increased; nevertheless supervising costs of mass treatment are thereby increased. Subsequent removal of the drug by purgation lessens risk of poisoning.

The many millions of persons infected throughout the tropics necessitates mass treatment, the essentials of which, namely safety, efficacy, cheapness, and palatability are varyingly combined in the five anthelmintics in present or recent use. These are eucalyptus-chloroform, betanaphthol, thymol, oil of chenopodium, and carbon tetrachloride. By some they have been administered promiscuously to whole communities in which examination of a few individuals has shown a high rate of infection.

Eucalyptus-chloroform has been almost completely abandoned as inefficient. Pure betanaphthol, in optimum dosage of two grammes, is inefficient; in larger doses it has caused deaths in India and Brazil. Thymol and oil of chenopodium, in their respective optimum doses of 4 grammes and 1·2 cubic-centimetres or mils (the latter dose equalling 48 drops or 20 minims) have for *N. americanus* equal efficiency and minimal risk; contrary statements emanate from the use of oil of chenopodium in excessive dosage of 3 mils, due apparently to considering a drop of this liquid as equivalent to a minim. For *A. duodenale* chenopodium appears the better drug, and is, in London, the cheaper. Its active principle is ascaridol. Unfortunately the oil contains markedly varying quantities of this substance, and its amount lessens on keeping. Ascaridol, extracted and administered in place of the whole oil, is effective but relatively costly. Carbon tetrachloride, recently introduced, has been taken by many thousands of persons in dosage of three mils, and has proved most efficient. The medicinally pure drug produces in large doses, in dogs, extensive fatty degeneration, followed by necrosis of the liver, and, apparently, of the kidneys; changes aggravated by starvation and fatty food, and lessened by glucose. Extensive similar change has been present in man when death has followed the 3-mil dose. A number of such deaths are now recorded. Clearly this dose requires reduction, so that the efficacy of carbon tetrachloride under optimum dosage has still to be ascertained. It is the cheapest of all advocated treatments. A combination of this drug with ascaridol is being tested.

Hygienically viewed, treatment of whole unsanitated communities lessens the risk of further infections; since destruction of female worms diminishes the seeding of egg-containing material upon the soil, and, on the whole, the number of infective larvae originating therefrom. Nevertheless, an imperfectly treated, and still lightly infected, person, seeding a favourable spot, is a danger to the community.

Individually viewed, disinfestation, by treatment, of the obviously ill and presumably heavily infected, restores health, always provided damaged tissues be still repairable. In the case of apparently healthy, but infected, persons, comparison of their condition of general health, wage-earning capacity, blood state and, in children, development of body and mind, before, and again a sufficient period after, disinfestation shows that they are often markedly improved by disinfestation; so that a light infection definitely handicaps the apparently healthy. Whether the lightest infections do, or may, penalise the individual is questioned. If, as now appears likely, we can detect infection by a single female worm, treatment producing complete disinfestation of such cases, combined with critical observation of conditions before and after effecting this, will doubtless shortly settle this point, so vital to the individual and community.

Iron and arsenic, ineffective before, may be essential for combating anaemia after disinfestation. Treatment of skin lesions at the site of infection varies with the condition present. (*See* PARASITOLOGY; TROPICAL MEDICINE.)

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(C. LA.)

HOOKER, SIR JOSEPH DALTON (1817–1911), British botanist (*see* 13.671), died at Sunningdale, Berks., Dec. 10 1911.

HOOPER, HORACE EVERETT (1859–1922), publisher of *The Encyclopædia Britannica*, was born in Worcester, Mass., Dec. 8 1859. He was of English descent, his father's family having settled in New England about 1650, while his mother was a descendant of John Leverett, Governor of Massachusetts, 1672–9. Having been educated in the public schools of Worcester and of Washington, D.C., he started in business in early life at Denver, Colo., but a few years later removed to Chicago, where with others, he organised the Western Book & Stationery Company, with book stores in a number of the large western cities. In 1895 he moved to New York and joined a company for the sale of *The Century Dictionary*, and his success in this enterprise led to wider fields. In 1897 he went to London and arranged with A. & C. Black, publishers of *The Encyclopædia Britannica*, for a reprint of the 9th Edition of that work, and with *The Times* for its sale through that paper. Later he purchased the copyright. By reducing the price and by providing for payments in small monthly instalments the sale of the work was revolutionised, 70,000 sets being sold in the next five years.

The success of this enterprise led Mr. Hooper to have prepared, in 1902, a large supplement in 11 volumes (under the editorship of Sir Donald Mackenzie Wallace, President Arthur T. Hadley of Yale, and Mr. Hugh Chisholm) which, added to the volumes of the 9th Edition, formed the 10th Edition. For this also there was a large sale. His next enterprise was *The Historians' History of the World*, 1904, a work in 25 volumes. Meanwhile Mr. Hooper's relation with *The Times* grew more close. He took an intimate part in the business management, and it was at his suggestion and under his personal direction that *The Times Book Club* was formed. In 1908 when the proprietorship of *The*

Times passed into the late Lord Northcliffe's hands, Mr. Hooper's connection with that paper came to an end.

In 1903 Mr. Hooper entered upon a larger enterprise than any yet attempted, the preparation of an entirely new edition, the 11th, of *The Encyclopædia Britannica*, under the editorship of Mr. Hugh Chisholm. This was published in the closing months of 1910 and the first of 1911 under an arrangement with the Cambridge University Press. Hitherto all large works of reference had been issued volume by volume over a period of years. By his energy and the liberal expenditure of money, Mr. Hooper arranged that the 11th Edition of *The Encyclopædia Britannica* should all be published at the same time, thus greatly enhancing the usefulness of the work. Of this edition 75,000 sets were sold in the next few years, the use of India paper being one factor in its success. In 1915 Mr. Hooper published the work in a smaller and cheaper form known as the Handy Volume Issue, the contents being identical with the original issue. In this form nearly 200,000 sets were sold within a few years. The last enterprise in which Mr. Hooper was engaged was the publication in 1922 of the Three War Volumes of *The Encyclopædia Britannica*, which supplemented the 11th Edition, and with the 29 volumes of that edition constituted the 12th Edition.

Mr. Hooper's success in publishing and distributing so widely the important works mentioned above lay partly in the originality, boldness and brilliance of his operations, but chiefly in his faith in the intelligence and ambition of the great masses of the people. He believed in the educational value of good books, and that the people would order such books and use them if the matter were properly placed before them. The ideals he set before himself were the maintenance in *The Encyclopædia Britannica* of the highest standard of scholarship and the placing of the work as an educational aid in the greatest number of homes. Many professional educationalists of note have done less than he toward popular enlightenment. For a number of years Mr. Hooper lived in England. He was a strong believer in the unity of the English-speaking peoples, and exerted his influence toward the removal of causes of friction between England and America and the establishment of cordial feeling and a mutual understanding. He died at Bedford Hills, N.Y., June 13 1922.

HOOVER, HERBERT CLARK (1874–), American engineer and public official, was born of Quaker parentage on a farm at West Branch, Ia., Aug. 10 1874. After the death of his father in 1878 and of his mother three years later, he was brought up in the farm homes of Quaker relatives in Iowa and Oregon. At the age of 13, while attending night school at Salem, Ore., he began to earn his own living, working in truck gardens and as an office boy. When Leland Stanford, Jr. University was opened in 1891 he entered with the first class and specialised in engineering. Graduating in 1895, he worked for a time with the U.S. Geological Survey, in California mines, and as a junior engineer in California, Colorado and New Mexico. In 1897 he went to Australia as mining engineer; returned to the United States in 1899; and subsequently accepted the post of chief engineer of the newly established Dept. of Mines at Peking, China. In China he made extensive surveys, which, however, were interrupted by the Boxer outbreak. He returned to California in 1900 and thereafter was engaged as an engineer in the United States, China, Australia, Burma and elsewhere. When the War brought this phase of his career to a close in 1914, the companies for which he was directing engineer employed upward of 175,000 men.

Mr. Hoover was in Europe in 1914 on a mission for the projected Panama-Pacific Exposition, and so happened to be in London at the outbreak of the World War. At that time thousands of Americans in Europe found their funds shut off, and Mr. Hoover organised a committee for their relief, facilitating the return of over 100,000. The sudden invasion of Belgium by the Germans rendered a large part of the Belgian civilian population destitute, and on Oct. 22 1914, the Commission for Relief in Belgium was organised and Mr. Hoover appointed chairman. (*see* RELIEF). Its activities were later extended to devastated Northern France. This organisation administered over $950,000,000, provisioning some 10,000,000 people—a task requiring the most rigorously economical system of food distribution. The commission operated a fleet of about 200 ships. Mr. Hoover's services were rewarded by King Albert I. of Belgium, who, as a unique distinction, ordained him " Citizen of the Belgian Nation and Friend of the Belgian People."

In Aug. 1917, after the entry of the United States into the War, President Wilson appointed Mr. Hoover U.S. Food Administrator. He at once established an organisation throughout the United States for stimulating production, preventing speculation and hoarding, and conserving food supplies. Exports of food were increased from a pre-War rate of 6,000,000 tons per annum to a rate of 20,000,000 tons per annum. He established the U.S. Grain Corp. and the Sugar Equalisation Board, which, together with the Food Purchase Board under his direction, purchased and delivered all army, navy and foreign supplies, the total turnover amounting to over $11,000,000,000. Mr. Hoover also served as chairman of the Interallied Food Council. After the Armistice, which at his suggestion provided for the furnishing of food supplies to enemy countries, he became chief executive officer of the joint Allied committee which later developed into the Supreme Economic Council. He also established the American Relief Administration, which, together with the U.S. Food Administration and U.S. Grain Corp., was instrumental in alleviating the food situation of Europe, separate food administrations being formed in 23 different countries. By the autumn of 1919 these organisations had handled some $700,000,000 worth of supplies. As a result the great typhus epidemic in Poland and Rumania was successfully resisted. Six million outcast and ill-fed children were cared for through a special fund. After the Armistice Mr. Hoover raised a fund of over $50,000,000 with which to continue child-feeding in eastern and central Europe during 1920 and 1921. In 1922, he superintended the systematic distribution of food to 12,000,000 persons in the famine-stricken districts of Russia, a task requiring over 1,000,000 tons of food and an expenditure of over $65,000,000.

In 1920 Mr. Hoover's friends conducted an unsuccessful campaign to secure his nomination for the presidency on the Republican ticket. After Harding's election as president, Mr. Hoover entered his Cabinet as Secretary of Commerce. He signalised his assumption of office by a complete reorganisation of the department, his object being to change the attitude of government toward business from that of interference to that of co-operation. He sought the aid and advice of prominent men engaged in industry, agriculture and commerce, and, with their co-operation, co-ordinated the various bureaux of his department, in order that it might serve most effectively the interests of producers, manufacturers and distributors. Noteworthy among the means employed was the encouragement, through a Division of Simplified Practice, of a general reduction in the number of different varieties and sizes in which articles of commerce were manufactured. (*See* STANDARDISATION.) Both as a means of stabilising credit and production and as an aid in the expansion of foreign trade, the statistical services of his department were widely expanded and made promptly available. The Patent Office and the Bureau of Mines were transferred to Mr. Hoover's department in 1925. Legislation pending in 1926 for the placing of civil aviation and wireless telegraphy under its supervision failed.

Early in 1923 Mr. Hoover had aroused interest by pointing out the danger of a foreign monopoly of raw materials and urged a world-wide search for new sources and increased supplies of rubber. This action was directed chiefly against the alleged monopoly of rubber by Great Britain, the government of which had passed legislation affecting the price of rubber, the United States being the chief consumer of this commodity. His other important activities included the chairmanship of the St. Lawrence river and Colorado river commissions and of the Northeastern Super-power committee. He presided over a number of national radio conferences and served on the World War Foreign Debt commission. At the Republican National Convention of 1924 he was put forward, against his protest, for the Vice-Presidency, and received 334½ votes, Gen. Dawes being nominated

with 682½. He was at different times offered the Secretaryship of the Interior and of Agriculture, but he preferred to remain at the head of the Dept. of Commerce.

Outside his official activities Mr. Hoover organised in 1922 the American Child Health Assn. and became its first president. He also served as trustee of Stanford University, where he founded the Hoover War Library. In 1925 he accepted the chairmanship of the National Research Endowment, which undertook to raise $20,000,000 for research in pure science.

He wrote *Economics in Mining* (1906); *Principles of Mining* (1909), and, jointly with his wife, Lou Henry, a translation (1912) of Agricola's *De Re Metallica*, a Latin treatise on mining and metallurgy which had remained the standard textbook for almost 200 years after its appearance in 1550. He published *American Individualism* in 1922. (J. W. T.)

HORNADAY, WILLIAM TEMPLE (1854–), American zoologist, was born at Plainfield, Ind., Dec. 1 1854. He was educated at the Iowa State College. Having made a special study of zoology, he travelled extensively to collect specimens, visiting (1874–9) Florida, Cuba, the West Indies, South America, India, Ceylon, the Malay Peninsula and Borneo. From 1882 to 1890 he was chief taxidermist at the U.S. National Museum, Washington, D. C. In 1896 he became director of the N.Y. Zoological Park at the Bronx, New York City, from which position he retired in 1926. He was active in promoting game preserves and instigating legislation for the protection of wild life, having been instrumental in founding the Permanent Wild Life Protection Fund ($105,000). It was largely due to his action that the bison was saved from extinction on the American continent.

Hornaday wrote a number of fascinating works on animal life, among which may be mentioned *Two Years in the Jungle* (1885); *American Natural History* (1904); *Camp-fires in the Canadian Rockies* (1906); *Our Vanishing Wild Life* (1913); *Minds and Manners of Wild Animals* (1922); *A Wild Animal Round Up* (1925).

HORNE, HENRY SINCLAIR HORNE, 1ST BARON (1861–), British general, was born Feb. 1 1861. He joined the Royal Artillery in 1880 and served on the staff throughout the South African War (1899–1902). In 1912 he became inspector of artillery, and in Aug. 1914 he went to France in command of the artillery of the I. Army Corps. At the end of 1915 he was given charge of the XV. Army Corps in Egypt and he took this to France in April 1916, and commanded it during the opening phases of the battle of the Somme. His method of employing his guns during these operations attracted much attention and was signally successful, as was recognised by his being chosen in Sept. to succeed Sir C. Monro as leader of the I. Army. His troops took a prominent part in the battle of Arras, 1917, and when the enemy, in March and April 1918, made his great effort they repulsed all attacks that were made upon their front. Then, when the Allies' counter-offensive developed in the late summer, their part in the final victories was conspicuous. For his services he was raised to the peerage as Baron Horne of Stirkoke, and received a grant of £30,000.

HORNE, SIR ROBERT STEVENSON (1871–), British politician, was born at Slamannan Manse, Stirlingshire, Feb. 28 1871. Educated at George Watson's College, Edinburgh, and the University of Glasgow where he graduated as M.A. and LL.B. he took first-class honours in philosophy in 1893 and in 1895 became lecturer in philosophy at University College, Bangor. Called to the Scottish bar in 1896, in 1910 he became a K.C., and stood unsuccessfully as a Unionist for Stirlingshire in both the general elections of that year. In the course of the War he was appointed assistant inspector-general of transportation. In 1917 he was made director of the Admiralty Dept. of Materials and Priority. In 1918 he became director of the Admiralty Labour Dept., being also made Third Civil Lord of the Admiralty and created K.B.E. Later in the same year he was elected Unionist member for the Hillhead Division of Glasgow. In 1919 he became Minister of Labour and as such presided over the National Industrial Conference of February and April 1919. In 1920 he became President of the Board of Trade and received the G.B.E. In 1921 he was appointed Chancellor of the Exchequer in succession to Mr. Austen Chamberlain, in Mr. Lloyd George's Coalition Ministry, but he did not accept office under Mr. Bonar Law or Mr. Baldwin. Instead he associated himself with the management of two or three large commercial undertakings, including one of the leading English banks and became an important figure in business circles. He was elected lord rector of Aberdeen University in 1921.

HORNIMAN, ANNIE ELIZABETH FREDERICKA (1860–), British theatrical manager, was born at Forest Hill, London, on Oct. 3 1860. Educated privately, she studied art for a period at the Slade School under Prof. Legros. At an early age she became interested in the theatre, and to the furtherance of this cause most of her subsequent life was devoted. Her first theatrical enterprise at the Avenue Theatre, London, in 1894 was a failure. In 1904 she became associated with the Abbey Theatre, Dublin, and subsidised the Irish National Theatre Society, which presented a series of plays by Irish dramatists dealing with various phases of Irish life. She will be chiefly remembered, however, for her institution in 1907 of the Repertory Theatre movement in Manchester. She acquired the Gaiety Theatre, Manchester, in 1908 and converted it into a repertory house in which some of the best known plays of modern times were originally produced. In 1921 she relinquished her control as owner and conductor of this enterprise, after 14 years of unbroken success.

HORSE-RACING (*see* 13.726).—During the World War horse-racing and the breeding of thoroughbreds were beset with unprecedented difficulties. The latter was quietly carried on in spite of the scarcity of forage. As for the former some owners of racehorses went out of business altogether, but many carried on with the restricted racing permitted by the Government.

Racing Before the War

In 1910 the colts that gained classic distinction were Neil Gow (Two Thousand Guineas), Lemberg (The Derby) and Swynford (St. Leger). When both colts were really well there was little or nothing between Lord Roseberry's Neil Gow, a son of Marco, and Mr. A. W. Cox's Lemberg by Cyllene. Though Lemberg was beaten by a few inches by Neil Gow for the Guineas, revenge came in the Derby. Lemberg won; Neil Gow, who had developed curb trouble a day or two before the race, was unplaced. Yet, when Neil Gow was right again, the pair ran a memorable race for the Eclipse Stakes and a dead heat resulted. Swynford came on the scene rather late in the season. Lord Derby's big colt, a son of John O'Gaunt, matured late, and was never heard of until he won the Liverpool Summer Cup under a low weight. There was a big gap to be bridged between that achievement and the winning of the St. Leger, but Swynford was a colt right out of the ordinary. He developed with amazing sureness and rapidity, and, ridden by Frank Wootton, then a boy jockey of rare skill and understanding, he won; though Maher, who had the mount on Lemberg, was much blamed at the time for riding with poor judgment, which, it was alleged, robbed the Derby winner of the honours. Lemberg was Cyllene's third Derby winner. His fourth, Tagalie, came only two seasons later. The two earlier ones had been Cicero (1905) and Minoru (1909). Both Lemberg and Swynford were destined to achieve fame at the stud. It is interesting to recall that in 1910 the highest priced yearling among the Sledmere lot made only 1,900 guineas. In 1920 Lord Glanely gave 14,500 guineas for Blue Ensign from the same stud.

In 1911 the Derby winner, Sunstar, bred and owned by Mr. J. B. Joel, was above the average. This brown son of Sundridge and Doris won both the Two Thousand Guineas and the Derby in addition to the Newmarket Stakes. He could not be trained again through breaking down in the Derby, which he won by three lengths. This explains his absence from the field for the St. Leger, which that year was won by Prince Palatine, a bay son of Persimmon. There was nothing in Sunstar's two-year-old career to suggest such distinguished classic honours, though he was a smart colt. His dam, Doris, was an insignificant little mare by Loved One that could win only a paltry selling race.

Mated with Sundridge, who was no more than a brilliant sprinter when in training, Doris produced the high class Sunstar, whose real worth was disclosed when he came through a great trial in private for the Two Thousand Guineas. He proved to be an astonishing foal getter, and included in his progeny were some of the highest class horses of their day, *e.g.*, Buchan (twice the winner of the Eclipse Stakes), Craig an Eran (winner of the Two Thousand Guineas in 1921), Galloper Light (winner of the Grand Prix), Sunny Jane (winner of the New Oaks), Somme Kiss, Blink, Skyrocket and Zambo. It was the owner of Sunstar, who, in the following year, gave £40,000 for Prince Palatine after that horse had won the Ascot Gold Cup in addition to taking St. Leger honours in 1911. Prince Palatine was bought primarily for stud purposes, but he was not a success, and after a few seasons was sold to France, and later, was located in America.

The year 1912 was not a good year for three-year-olds. There was no outstanding horse unless it was Tracery, who was late in maturing, and on that account was only "half" a horse when on the occasion of his debut, he was able to run third for the Derby to the grey filly Tagalie and Jaeger. It said something for the poverty of the colts when Sweeper II., owned by Mr. Duryea, who bred the colt in France from American parents, won the Two Thousand Guineas. Sweeper II. was trained in Great Britain and ridden by Maher. It was believed that he could win the Derby, but he proved to be sadly deficient in stamina. It was in the One Thousand Guineas, the classic race for fillies, that Tagalie forced herself on public notice. The rather mean-looking daughter of Cyllene could stay, as well as go fast, and the combination of virtues enabled her to win the Derby. Greys were sufficiently rare on our racecourses at that time to attract special notice. Then she was a filly, and though Signorinetta had won the Derby as well as the Oaks only four years before, the instances of fillies winning the Derby were still very few indeed.

When Tracery won the St. Leger he was a different horse. Instead of being lacking in strength and development generally he was now "made up," though still leaving further scope for improvement as a four-year-old. He won the St. Leger by five lengths and among his victims far down the course was the grey Derby winner. Tracery was destined to become noted as a sire. He did well in Great Britain and was sold to the Argentine breeder, Señor Unzue, for the unprecedented sum of £53,000. He left behind him a Derby winner in Papyrus (1923), and subsequent to that event he was repatriated for a big sum, but did not live for more than one covering season.

The Derby of 1913 was a drama of thrills. There was the hot favourite, Craganour, belonging to Mr. Bower Ismay, who had paid between 3,000 and 4,000 guineas for the son of Desmond and Veneration II. as a yearling. Craganour was a high class two-year-old, and grew into a medium-sized colt, of a light bay colour. Onlookers said he won the Two Thousand Guineas; the judge said he did not beat Mr. Walter Raphael's Louvois, who had a clear margin to spare. Craganour made no mistake about winning the Newmarket Stakes, and came to Epsom an outstanding favourite for the Derby. He was ridden by the American, Reiff, who for some years had been riding in France. The unknown Aboyeur, in the colours of Mr. A. P. Cunliffe, led the favourite into the straight. They raced close together, and just as the favourite had appeared to get the better of a somewhat rough argument the outsider left the rails and bored and probably bumped Craganour. They passed the winning post with Craganour's head in front. The stewards held an inquiry, the outcome of which was that they disqualified Craganour and awarded the race to Aboyeur. Craganour within a few days was sold by his owner for £30,000 to Mr. Martinez de Hoz for stud purposes in the Argentine, where he proved to be a valuable stallion. Mention may be made of the St.Leger success of Night Hawk, an unconsidered outsider, bred and owned by Colonel Hall Walker, afterwards Lord Wavertree. This again was a non-vintage year.

The Tetrarch.—In 1913 a horse appeared that was destined to make remarkable history, both on the racecourse and at the stud, that wonder, The Tetrarch, the weirdly marked grey with big irregular white splotches, something after the manner of the nursery rocking horse. He was a well developed colt by Roi Herode, a French-bred stallion that had been located at the Straffan Station Stud in Ireland, and, mated with Vahren, produced The Tetrarch, who as a yearling found his way into the sale ring and at 1,300 guineas passed into the possession of Major Dermot McCalmont. He ran seven times as a two-year-old and was never beaten. He was a prodigy, and it is a pity that through injuring a leg while galloping, he could not be trained as a three-year-old. As a sire he became an immediate success. His progeny showed themselves to be possessed of remarkable speed, and the outcome was that there was immense competition for his stock in the sale rings, while breeders keenly sought his services for their mares. He did not sire a Derby winner, but he is represented in the records by no fewer than three winners of the St. Leger in Caligula (1920), Polemarch (1921) and Salmon Trout (1924).

The classic winners of 1914 were Kennymore (Two Thousand Guineas), Princess Dorrie (One Thousand Guineas and Oaks), Durbar II. (Derby) and Black Jester (St. Leger). They did not possess much distinction; in fact the Derby winner, who belonged to Mr. Duryea and was brought from France, was probably the worst Derby winner of the century. Princess Dorrie was a daughter of the St. Leger winner Black Jester (who went to the Argentine), but though such a fine stake winner, she did little of note as a matron at the stud. Black Jester was a son of Polymelus, one of the greatest sires of the period under review, for in several years he headed the list of winning sires. Black Jester only did fairly well at the stud, though he had many moderate winners to score for him.

Racing During the War.—It was not long before the effects of the War on racing were noted. Agitation against racing of any kind so far influenced the Government that representations were made by the Cabinet to the Jockey Club, the outcome of which was the cancellation, in 1915, of horse racing at all places except Newmarket. This took effect on the eve of what should have been the Derby meeting at Epsom. Thereafter for that year racing was restricted to Newmarket, and so that those concerned should not be hit too hard the Jockey Club instituted a series of extra meetings. It was at one of these that special races took place for the three-year-old colts and fillies, an arrangement lasting till 1918. There was a New Derby and a New Oaks.

It is extraordinary that while Rock Sand in 1903 was the last horse to win the triple crown, the Two Thousand Guineas, Derby and St. Leger, yet three horses in four years were each capable of winning the Two Thousand Guineas and the substitute races for the Derby and St. Leger known as the New Derby and the September Stakes. The explanation does not wholly lie in the fact that Pommern (1915), Gay Crusader (1917) and Gainsborough (1918) were above the average of Derby winners. In peace times horses must visit Epsom and Doncaster in search of classic honours as well as Newmarket. The mere variation of ground and the possibility of flukes, such as the splendid fairness of Newmarket must reduce to a minimum, have doubtless been contributing to the strange fact that Rock Sand in 1903 was the last horse to win all three classic races.

Pommern, who was by Polymelus from Merry Agnes, was bred by his owner, Mr. S. B. Joel, and from the manner of winning his races was a worthy holder of the highest honours on the turf. Not improbably the best three-year-old of 1916 was Hurry On, an unusually big and powerful chestnut colt by Marcovil from Tout de Suite, bought for less than 1,000 guineas by Lord Woolavington as a yearling and never beaten during his three-year-old season. It was the only year of racing he had, and before it was over he had disposed of all brought against him, including Clarissimus, who had won the Two Thousand Guineas for Lord Falmouth. Fifinella, a filly by Polymelus from Silver Fowl, bred and owned by Sir Edward Hulton, was unquestionably the classic heroine of the year, for in the same week she won

both the New Derby and the New Oaks. She was no doubt a brilliant filly.

It is a pity that such a horse as Gay Crusader, by Bayardo from Gay Laura, should not have lived in times when he could have been tested at Epsom and Doncaster. All we know is that he was an exceptional colt as a three-year-old, carrying all before him and causing his great trainer, Alec Taylor, to regard him as the best horse he has ever trained, not excepting Bayardo himself. Gay Crusader was the first foal of his dam, and was a light fleshed horse with plenty of size and simply perfect action. He was equally brilliant, according to his trainer, at five furlongs or two miles, and it was a great regret to him that he could not train him as a four-year-old. From the same stable came Gainsborough to win the Guineas and the two substituted classics at Newmarket in 1918. He was a son of Bayardo from Rosedrop, who ranks as the winner of the Oaks in 1910. He was of a different type and possessed of more substance. Both he and Gay Crusader, have made their mark as sires, and Gainsborough has the distinction of siring Solario, the St. Leger winner of 1925.

Racing After the War

After the War racing at once entered upon a period of great prosperity. Attendances increased by many thousands at all racecourses, and the prices of bloodstock soared to astonishing heights. It was in 1919 after winning the Derby with Grand Parade, a son of Orby, and a number of big races at Ascot, that Lord Glanely spent money lavishly on young bloodstock. When he gave 11,500 guineas for a yearling by Swynford from Blue Tit, bred at Sledmere, he established a new record for a yearling, hitherto held by Sceptre, who had cost 10,000 guineas. In 1920 Lord Glanely gave 14,500 guineas for a yearling by The Tetrarch from Blue Tit. Prices remained high to the end of 1925, which was associated with the wonderful dispersal sale of Sir Edward Hulton's bloodstock.

Among classic winners Grand Parade was rather less than the average height of racehorses, and this has been true of more than one other Derby winner since the War, *e.g.*, Papyrus and Manna, while Humorist was not by any means a big horse. On the other hand Captain Cuttle (1922) and Spion Kop (1920) were undoubtedly big horses, especially Captain Cuttle, who was a son of Hurry On. Grand Parade was just an average Derby winner, neither more nor less. Spion Kop was a son of Spearmint, who won the Derby as far back as 1906. With his four white legs Spion Kop, who belonged to Major Giles Loder, was a conspicuous horse. He certainly won in fine style, though, like Sansovino, the hero in 1924 in Lord Derby's colours, he was not destined to do much afterwards. This has been a feature of the post-War Derby winners. Grand Parade went to Ascot, where he had great difficulty in beating a single opponent. He went forthwith to the stud. Spion Kop was kept in training until he was four years old, but he was a disappointment.

Then came the ill-fated Humorist in 1921. Donoghue, who rode Captain Cuttle, Papyrus and Manna to victory, in addition to Pommern and Gay Crusader, rode one of his most brilliant races on him, and within a month the horse died. He was found in his box dead from internal haemorrhage. Humorist had been sired by Polymelus, and was the foal of Jest, a delightful little mare that had won both the One Thousand Guineas and the Oaks for her owner and breeder, Mr. J. B. Joel. Captain Cuttle by a very easy victory stamped himself as a high-class colt, but he did not stand much further training, though he won afterwards. Papyrus, as a yearling, cost Mr. Ben Irish, a farmer, who had won an Ascot Gold Cup with Periosteum, 3,500 guineas. He was a Derby winner well up to the average, a medium-sized dark brown son of Tracery, with marked quality and a beautiful temperament. After finishing second to Lord Derby's filly, Tranquil, for the St. Leger, he was sent to New York to run a match against America's champion, Zev. With only a month in that country, on strange going, and after a trip across the Atlantic, the Derby winner had little or no chance, and he was beaten. Papyrus was unlucky as a four-year-old, for when giving away much weight he was second for the Eclipse Stakes and for the Jockey Club Stakes. At least he did train on better than the others.

Sansovino won the Derby in heavy going in 1924, and when the weather was about as bad as it could be. He was twice asked to race at Ascot, and though he won the first time he seemed to go all to pieces afterwards. He won once as a four-year-old and then went to the stud, after breaking down during the race for the Jockey Club Cup. The three-year-olds of 1925 were above the average. Manna, a charming colt by Phalaris that cost 6,000 odd guineas as a yearling, won both the Two Thousand Guineas and the Derby for Mr. H. E. Morriss. He broke down at the start of the St. Leger won by Solario, and that was the last of him on a racecourse. It is true, therefore, that the post-War classic winners have not trained on as they should have done. The last Derby winner to win an Ascot Gold Cup was Persimmon, and that was in 1897. In 1926 the Derby was won by Coronach owned by Lord Woolavington.

The Bloodstock Market

It was after the War that the Aga Khan took up ownership and then breeding in Great Britain on a large scale. His investments, chiefly in yearlings, for two or three years must have run well into six figures, and he had many horses in training and one of the finest studs in Ireland. He won the Two Thousand Guineas (Diophon) and the St. Leger (Salmon Trout). He was second for the Derby to Manna with Zionist, a colt that was good enough to win the Irish Derby. With Mumtaz Mahal, a daughter of The Tetrarch, for which he paid 9,700 guineas as a yearling, he had a remarkably fast two-year-old. By his enterprises he had much to do with the flourishing state of the bloodstock market. At Doncaster in 1925 Sir Victor Sassoon gave 12,000 guineas for a yearling filly by Tetratema from Confey, and the Aga Khan paid 10,500 guineas for a filly by Gay Crusader from Tête-à-Tête, both being greys. At Sir Edward Hulton's wonderful sale a total of 288,380 guineas was realised. The highest price was 17,000 guineas paid on behalf of an American buyer for the Oaks winner, Straitlace, a daughter of Son-in-Law. Other mares made respectively 12,000 and 12,500 guineas, a two-year-old filly, Silvretta, 13,000, and a two-year-old colt, Legatee, that had never seen a racecourse, 9,100 guineas. In 1926 racing in England was flourishing, with apparently more wealthy owners than ever, even though the old race of patrician owners would appear to have died out. The breeding industry is in a healthy state, with all the countries of the world coming to Great Britain for replenishment.

The story of racing and breeding in England during the period under review would not be complete without some reference to the demonstration made in England by French-bred horses, and to the steadily ascending values of the high-class British thoroughbred in what is unquestionably a world-wide market. The latter may be said to embrace every country in the world in which racing takes place, and which must periodically come to England for the replenishment of its studs and stables. In particular, reference is made to North and South America. First, however, as to the successes of the French horses in England, even though for the most part the blood of well-known strains emanating from England can be found in their pedigrees.

Racing in Foreign Countries

France.—France, even more than England, neglected racing and breeding during the war. The result was that for about three years after the War, matters were at a low ebb in France. Several successful raids were made on the Grand Prix de Paris when it came to be re-established. This race is open to all, unlike the French classic races, which are strictly confined to horses bred in France, whereas the English classic races are open to the world. The first English post-War Grand Prix winner was Mr. Anthony de Rothschild's Galloper Light, a son of Sunstar, and undoubtedly a high-class horse. Next came the undistinguished-looking black horse, Comrade, owned by M. de St. Alary, but

bred in Ireland and trained in England. His was a most romantic case if only for the reason that he was actually bought for only 25 guineas in the sale ring as a yearling by Mr. P. P. Gilpin, who trained him. Such a low-priced horse was not entered in the English classic races, but luckily he was put in the Grand Prix to triumph in it. Then a third year did England triumph in France's big race at Longchamps. The hero this time was Lemonora, a chestnut son of Lemberg, that had been purchased as a yearling for several thousand guineas on behalf of Lord Manton. Lemonora won the Newmarket Stakes and was placed third in the Derby won by Humorist. Two or three weeks later he was in France, and there won the Grand Prix.

The position was destined to alter most abruptly. England had not won the Grand Prix since up to 1925, perhaps because no first-class horse has endeavoured to do so. On the other hand the French have failed in England's classic races, but they achieved a signal success in 1924 when their fine stayers, Massine and Filbert de Savoie (the latter a Grand Prix winner), finished first and second respectively for the Ascot Gold Cup. In the same year the fastest horse in France up to a mile, Épinard, came over to win the Stewards Cup of six furlongs at Goodwood. This the brilliant horse did under a big weight for a three-year-old. Later in the year he was beaten only by a neck for the Cambridgeshire when his weight was the very big one for a three-year-old of 9 stone 2 pounds.

It was in 1924, too, that Sir Galahad III., a French classic winner, was exploited at Lincoln and won the Lincolnshire Handicap. A year later another French classic winner in Tapin was similarly successful in the same race, but history will always tell that the most notable achievement of horses sent from France was when Forseti won the Cesarewitch and Masked Marvel the Cambridgeshire of 1925. Both these horses were owned by the same man, Mr. A. K. Macomber, who for some years past has maintained elaborate breeding and racing establishments in France.

Argentina.—Argentine breeders, as has been already stated, purchased Tracery for £53,000 and Craganour for £30,000. They have bought freely since, but the really big business since the War has been with the United States, in which country there has been rapid development of breeding and racing. The boom was doubtless encouraged by the visits of the English Derby winner Papyrus, and of Épinard, but their breeders have not been afraid to pay large sums for some notable horses. High-class sires that have gone there include Stefan the Great (by The Tetrarch), Royal Canopy (by Roi Herode), Bright Knight (by Gay Crusader) and St. Germans (by Swynford). It is said that £20,000 was paid for St. Germans. The others also cost sums runnir g well into five figures. High-priced yearlings and mares have found their way there, including Straitlace, as stated, for 17,000 guineas, and Sunny Jane, a New Oaks winner in England during the War.

India.—India has not bought so freely since the War as just before, but the reason is economic and is not concerned with any falling off in appreciation. She has simply been outbid by other countries. South Africa, Australia, Egypt and the Far East are regular customers. To Germany went Caligula, a winner of the St. Leger since the War. Austria and Hungary are countries that are rapidly regaining ground, their breeders having purchased for large sums the sires Light Hand, by Sunstar (declared by Lord Astor to be the best colt he has ever bred) and Tamar, by Tracery, second in the Derby and also bred by Lord Astor. Italy is well in the market, while France is at all times a buyer. These facts explain why the value of the British thoroughbred in a general sense has never been so high in history as since the War. Moreover, this is true after making due allowance for the depreciation in money values and the fluctuations in the exchanges.

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Racing in the United States

United States.—There is the greatest possible difference between the surroundings of racing in Europe and in the United States. "Time" is the great factor in the States, instead of varying weights, in determining the speed and endurance of a horse, and training methods are totally distinct. There is no one representative body governing racing, but the states of New York, Maryland, Illinois and Kentucky have each its own body, so that punishments and penalties are limited to the individual area; this is not good for the sport. Jockeys, after passing their apprenticeship, are totally beyond control, except when riding; and, owing to a foolish emasculation of the Scale of Weights, most of the good riders of the United States are obliged to migrate to Europe almost as soon as they become really competent. The card of any day—exclusive of fixed weight stake events—will average 20 lb. below the scale for each horse started, irrespective of age or distance.

Until the jockey passes from his apprenticeship and is eligible to a contract to ride, good care is taken of him. In a number of Associations or Jockey Clubs there are churches, nightschools, gymnasiums and hospitals; for the horses there are ambulances to remove injured animals from the course, and hospitals. As for racing proper, the Westchester Racing Assn., near the City of New York, is probably the most beautiful and the most perfectly equipped course in the world. Its grandstand covers and seats 30,000, and its lawns and tree-studded, flower-bedded paddocks cover several acres.

The famous "Ten Thousand Pounder" races of Europe were balanced in U.S. racing, in 1925, by the £11,700 Futurity, the £11,500 Coffroth Derby, the £10,700 Pimlico Futurity, the £10,600 Preakness, the £10,600 Kentucky Derby, with a great probability of the Belmont and the Hopeful Stakes far exceeding these figures in 1926. All of these amounts have been built since the crucial year of 1911, when Charles S. Hughes (later Secretary of State) was Governor of the State of New York and was responsible for the passage into law of the Agnew-Hart bill, and for the drastic enforcement which caused the arrest of more than 300 well-known people only to have them discharged later for lack of evidence, and which frightened the six important associations in the state into ceasing racing for two years and caused the exportation of animals of the best blood in the country to the value of about £400,000. Racing would probably have been killed utterly in the state but for the courageous amateur sportsmen of the United Hunts Racing Assn., who laughed the law to scorn, declined to be intimidated, asked for arrest and went on racing. Two years later the important associations found courage to open their gates, and, by the underwriting of expenses by certain prominent lovers of the sport, racing was resumed at a minimum scale, and under the same, unamended law which closed the courses has prospered like the proverbial green bay tree.

In 1925 17 states accounted for 1,656 days of sport with 11,579 races decided; the stakes alone represented a value of £460,000 as against £132,700 in 1910; and the yearling sales in 1925 had a total value of £373,360, with an average of £640, as against the 1910 record of a gross value of £36,000 and an average of £65. In 1925 a new record price for a yearling was reached, this being the £10,000 paid for the colt by Man O'War, out of Tuscan Red by William Rufus. During 1925 £2,515,450 was distributed in stakes and purses, as against £600,000 in 1910.

As to the really great horses appearing since 1910, personal opinions vary widely, all depending on the quality of competition met. The interesting high-lights on the question are that Luke McLuke proved that the famous Domino strain could go a distance if properly prepared; Hourless, by Negofol, was a great performer in 1917; and in 1920 came Man O'War (whose one scandalous defeat must not be reckoned against him). He defeated every rival, and this son of Fair Play out of Mahuba, by Rock Sand, proved a remarkable sire, for all of his dozen or so progeny have won good races. Regarding the visits of foreign horses, Papyrus never had a chance, as he was shod for a fast course and raced in mud, but his conqueror, Zev, has been

useless since the contest. Épinard, the French horse, was unlucky, and should have won at least one of his three races. Neither race proved anything or threw any light upon the excellences of U.S. horses bred mainly from English blood, as against the British home-bred product. (W. P. P.*)

HORTHY DE NAGYBANYA, NICHOLAS (1868-), Hungarian admiral and regent, was born June 18 1868 at Kenderes, in the family mansion in the county of Szolnok (Eastern Hungary). His family belonged to the landed gentry, and from 1635 ranked amongst the nobility. After studying at the naval academy at Fiume he entered the navy of the Dual Monarchy. After considerable sea service he was appointed A.D.C. to the Emperor Francis Joseph, and served in the naval department of the War Ministry in Vienna. At the outbreak of the World War he was appointed to command the cruiser "Novara." After Italy joined the Allies Horthy distinguished himself in the naval raids on Porto Corsini and San Giovanni di Medua, and particularly at Otranto, where on May 14 1917, with the cruisers "Novara," "Saida" and "Helgoland," he broke through the ship cordon blockading the Straits of Otranto. Horthy, although severely wounded, remained on deck and continued the fight until he succeeded in returning safely with his ships to his home port, despite the enemy's heavy fire. He was awarded the Military cross of Maria Theresa. Near the end of the War Horthy was appointed commander-in-chief of the Austro-Hungarian fleet.

After the collapse of the Monarchy and when revolution broke out in Hungary Admiral Horthy returned to the home of his ancestors and began to organise the counter-revolutionary forces in southeastern Hungary. Thanks to his popularity as a war hero, Admiral Horthy added considerably to the influence of the informal counter-revolutionary Government of Count Julius Károlyi, which in Hungarian territory occupied by French troops endeavoured to form a nucleus for all partisans of law and order. When it became obvious that the fall of Bolshevism was imminent, the second "Szeged Government" appointed Horthy to be commander-in-chief of the national army, which, after the flight of the people's commissioners (Aug. 1919), entered Transdanubia and succeeded in restoring order in territories where law and discipline had been upset by the Red Terror of Bela Kun. When the Rumanians finally withdrew their troops from the centre of Hungary the new national army, with Horthy at its head, entered Budapest on Nov. 16 1919 amidst the cheers of the population.

The restoration of order was no light job, and it was done with no light hand by a sailor who regarded the spirit of discipline in his ship as more important than the praise of kings or the blame of politicians. Horthy has been frequently attacked for failing to restrain retaliatory outrages of those who suffered under the Red Terror, and who themselves created what has generally been termed the White Terror. It must be remembered, however, that all the normal forces for maintaining order had previously been dispersed, and that without such forces it was practically impossible to control what was a natural reaction, however regrettable. When in Feb. 1920 the national assembly of Hungary was elected, Admiral Horthy, still commander-in-chief of the army, was practically the only possible candidate for the regency. Consequently he was elected to this office on March 1 1920.

As regent or governor, as the office is variably termed, Admiral Horthy had the bitter duty of ratifying the Treaty of Trianon, which his second Government, that of Count Paul Teleki, carried through in Nov. 1920. The gravest responsibilities, however, which the regent was called upon to meet were the two attempts of the late King Charles to regain the throne of Hungary. The regent of Hungary was then in a desperate conflict between an allegiance sworn as admiral and privy councillor to his king and the oath taken as regent to the Hungarian national assembly. First, in April 1921, he refused to obey the summons to hand over the Government to King Charles when the latter came to Hungary unarmed. On that occasion the Hungarian Govt. succeeded by peaceful means in getting the king to leave the country. At his second venture, in Oct. 1921, King Charles came with troops against the capital. The regent and Count Bethlen's Government had no alternative but to fight him, as the Allied Powers and the states surrounding Hungary were definitely opposed to the restoration of a Habsburg monarchy. It was a poignant task for the regent to disarm and hand over to the former enemy powers the anointed bearer of St. Stephen's crown.

As the disturbances inevitable after revolution, Bolshevism and monarchical "putsches" died down, and the life of the country became more normal, the personality and actions of the regent ceased to have such critical importance. Representative government, exercised through the national assembly, resumed its ordinary sway, and Admiral Horthy performed his duties with constitutional correctness, supporting the efforts of Count Bethlen's Government towards the economic reconstruction of the country. He had to lead his country through difficulties which few men in history have had to face, and it is small wonder that in doing it he had to take drastic measures and has made many enemies. It is doubtful, however, if Hungary could have found a regent more energetic in times of peril or equally constitutional in times of peace. Horthy may be described as a typical sailor, frank and simple and direct in manner, with no suspicion of diplomacy, and devoted to sport, but in official life a strict observer of the ceremonies which appertain to the head of a state that is still a monarchy.

(W. Go.*)

HOSPITALS (*see* 13.791) (1912–25).—At the beginning of the period under review two special points should be noted in connection with the general development of hospitals:—

1. The development of operating and clinical methods led to an increasing specialisation in the departments of general medicine and surgery in hospitals.

2. From the architectural point of view, simplicity and comfort were being increasingly sought, and buildings and hospital premises were being to an increasing extent adapted to the necessities of sanitation and hygiene.

General Features.—Attempts to create large hospitals outside urban centres and in favourable climatic conditions have been to a large extent successful. In the case of old hospitals, where it was difficult to make rapid changes, the various services have been installed in special buildings and annexes, divided one from another, each dealing with a special subject, *e.g.*, surgery, clinical work, ophthalmic work, otolaryngology, children's diseases, gynaecology, epidemics, etc. Whereas in Anglo-Saxon hospitals the principle of placing hospitals under independent management maintained by voluntary aid has been adhered to, in continental countries there has been an increasing tendency to centralise hospitals by placing them under municipal, local or national authority. The former method tends to encourage individual initiative and the desire to make each hospital as perfect as possible. The latter allows of the most practical and economical distribution of the various services between the departments concerned.

Statistics.—Hospitals were more frequented in 1912 than in previous years. This fact must be attributed not to the increase in the tendency to disease, but to the addition of a large number of buildings and wards which allowed of a larger number of patients being received. The dissemination of the principles of hygiene has familiarised the public with medical methods and has caused a marked increase in the number of patients under treatment. Various statistics show the movements of patients in hospitals during the years preceding the War. In 1913, 106 hospitals in London (general hospitals, children's clinics, gynaecological hospitals, anti-tubercular hospitals, etc.), with 9,171 beds, dealt with 134,749 patients, and were attended by 1,329,567 persons.

In 1912, the Paris Department of Public Relief (*l'administration générale de l'assistance publique*) admitted to its general hospitals (Andral, Beaujon, Boucicaut, Broussais, Charité, Cochin, Hôtel-Dieu, Laennec, Lariboisière, Necker, Pitié St. Antoine, St. Louis and Tenon) 147,828 patients, and 46,601 patients to the special hospitals (St. Louis, Maternité, Broca,

etc.). Germany, in 1912, had 9,054 hospitals with 535,579 beds. This figure includes general hospitals, military and naval hospitals, lunatic asylums, sanatoria, maternity homes, special clinics, children's hospitals, homes for the blind, etc. In 1912, the medical institutes of Vienna dealt in all with 82,939 patients. In the United States there was a noticeable increase in the number of hospitals and clinics, and there was a considerable development of the specialisation of medical and surgical departments.

War Conditions.—The World War of 1914 compelled hospitals to adapt themselves rapidly to new requirements, *e.g.*, assistance for the wounded, ambulance work, mobile hospitals in the army zones, medical staff, additional nurses, etc. Existing hospitals were transformed to meet the new requirements. In addition, a large number of extra establishments were improvised.

Military and naval hospitals are directly dependent on the military medical service and are divided as follows:—

(*a*) Permanent military hospitals, already existing in time of peace, were specially adapted for the reception of sick and wounded soldiers;

(*b*) Civil hospitals were placed, together with their staff, under the direction of the military authorities;

(*c*) Hospitals were installed in public or private buildings, such as hotels, schools, private houses, etc., to receive and deal with the flow of wounded from the front;

(*d*) Hospitals in the zone of military operations were carried on in permanent premises or under canvas, even underground, nursing posts and relief posts dealing with first aid to the wounded before their evacuation to the rear.

(*e*) As described in the article MEDICAL SERVICE (ARMY), ambulances of every type were employed. Aeroplanes, trains, barges and liners, specially converted and equipped, were used for the transport of sick and wounded to base and home hospitals.

(*f*) Special hospitals for orthopaedic, for tuberculous, neurasthenic, paralysed and gassed cases were organised. Electro-therapeutical, hydro-therapeutic, helio-therapeutic massage and special sections were also developed.

(*g*) Convalescent homes were set up and many private mansions were used for this purpose.

(*h*) Temporary hospitals were erected to receive influenza patients, and malaria camps were organised.

Neutral Countries.—In non-belligerent countries there was no very considerable change in the organisation of hospitals between 1914–9. By the force of circumstances, the construction of new buildings was slowed up, technical methods remained more or less stationary, and the nursing staff tended to diminish, in view of the large number of volunteers serving in the belligerent countries. In 1917–8, statistics of the movement of disease and mortality remained more or less equal to those of 1914. Anti-epidemic hospitals were organised in large numbers in Poland, Russia, Hungary, Rumania and the Baltic countries.

Quarantine Stations.—Quarantine stations, which before the War were limited to maritime ports, were, after the War, set up on the borders of Poland, Czechoslovakia, Rumania, Hungary and the Baltic States, for the supervision of travellers arriving from countries contaminated by exanthematic typhus and relapsing fever. Three model stations, set up by the International Red Cross Committee at Narwa in Estonia, Riga in Latvia, and Iniö in Finland, dealt with the reception, supervision and disinfection of thousands of prisoners arriving from Russia on the convoys of repatriated prisoners between 1919–22.

Special Hospitals.—The Italian Red Cross has been most active in districts affected by malaria, and with this end in view has organised the anti-malaria sanatorium of Massalubrense, together with a number of motor ambulances. In Georgia, the tropical institute of Tiflis is engaged in centralising the work of the various clinics and hospital stations. In 1913 12,500 malaria patients were treated in the hospitals of Tiflis. In Oriental countries may be mentioned the leper hospitals (the Indies and Siam), hospitals for the treatment of snake-bites (Siamese Red Cross at Bangkok), and the anti-epidemic and summer hospitals of the Chinese Red Cross at Shanghai. Hospitals have been supplemented by dispensaries, preventive homes, consulting offices, convalescent homes and mountain sanatoria and seaside hospitals. Venereal disease and dermatological hospitals have considerably developed. Cancer hospitals have been improved and perfected, especially as regards radio-therapeutic services, anatomo-pathological laboratories and radio-therapeutical, photo-therapeutical and radiological work.

Developments.—In 1924, the number of hospitals in London was 118 (as against 106 in 1913), the number of beds 13,460 (as against 11,840 in 1913), the number of patients treated 177,300 (as against 145,600 in 1913) and the number of consultations 6,677,000 (as against 5,020,000 in 1913). Among the principal hospitals included in these general figures, St. Thomas's Hospital alone received 10,139 in-patients and gave 488,600 consultations; St. Bartholomew's Hospital received 8,648 in-patients and had 344,226 out-patients, the London Hospital 17,331 in-patients and 553,965 out-patients, Guy's Hospital 9,495 in-patients and 487,452 out-patients. In Paris, the number of sick persons received was 238,912 in 1923, of whom 153,794 were in the general hospitals, 43,403 in the special hospitals, 29,329 in the children's hospitals, 2,071 in the mental hospitals and 10,315 in various homes and asylums.

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United States.—During the period from 1912, and more particularly from 1914 to 1925, the development of hospitals in the United States has been unprecedented. This development may be considered under the heads of (*a*) the present trend of hospitals as a social factor, (*b*) the present day construction, (*c*) specific examples and (*d*) statistics of 1925 and the increase during the period in question.

Hospitals as a Social Factor.—While there is a continued development and refinement of the care of the sick in the hospital to-day, the conception of the function of this institution has materially broadened, with a rapidly increasing tendency to regard it as a community health centre from which to radiate all health activities, particular emphasis being placed upon the development of out-patient departments (this as a means of teaching and practising preventive medicine and thereby obviating the necessity of the hospital bed), district nursing and social service. In the larger cities medical centres are being developed, in which case the foregoing community functions are associated with the instruction of student bodies in various branches, including medicine, nursing, public-health work, social service, and, in many instances, dentistry.

The tendency to develop isolated speciality hospitals is being replaced by provisions for the specialities as departments of the general hospital or by the affiliation of already existing speciality hospitals with existing general hospitals. The different types of schools teaching health work, with the various hospitals, form these medical centre groups, in which are included convalescent homes as an integral or co-ordinated part.

Present-Day Construction.—While in the earlier period hospital development in the United States was largely patterned after the developments in Europe, the present trend of large institutions is toward the "skyscraper hospital"—as St. Luke's Hospital Annex, in Chicago, with 19 stories; the Jefferson Hospital, in Philadelphia, with 17 stories; and the new Presbyterian Hospital of the Medical Centre of New York City, now under construction, with 22 stories. This tendency is extending even into the country districts where the value of land is not a factor—the University Hospital at Ann Arbor, Mich., with its nine stories, being an example.

Economy and effectiveness of administration is claimed by the promoters of the multi-story hospital movement. The newest developments lay emphasis upon small wards with a maximum of 10 or 12 beds, numerous single rooms for patients of all types, and elaborate facilities for private patients. In this type of construction it is quite common to find the kitchen, laundry and all essential services provided for in a single building along with the housing for the patients. This type of construction and administration, which is distinctly American, is not at this writing being followed in the United States to the entire exclusion of the methods commonly pursued in Europe.

Specific Examples.—A typical example of the hospital movement in the large American cities is to be found in the Medical Centre in the City of New York, in which the Columbia University College of Physicians and Surgeons, Presbyterian Hospital, Sloane Hospital for Women, Vanderbilt Clinic, The Babies' Hospital, Neurological Institute, State Psychiatric Institute and Hospital, Presbyterian School of Nursing and certain other schools and hospitals are reconstructing their institutions on a single plot of ground, having jointly undertaken all the branches of medical teaching, research and care of the sick, their simultaneous constructional programmes involving $20,000,000.

Increase in Recent Years.—At the close of the year 1925 a complete census of all the hospital facilities in the United States, however owned and controlled and for whatever type of patient, showed that there were 8,695 hospitals—a figure somewhat in excess of 50% of the number of institutions of this character in the world. These hospitals provided a total of 836,576 beds, of which 34,511 were bassinets. This compares with 5,037 hospitals, with 532,481 beds, in 1914. Of the total number specified, 341,480 beds are devoted to the care of mental and nervous diseases.

While the development of the large institutions has made unusual progress, yet the growth of the small institutions in the smaller communities seems to have a special significance and to be indicative of the popularisation of the hospital in the public mind. While in 1920 44% of the 3,027 counties in the United States had community hospitals, the record of 1925 shows an increase to 56%; 52% of all the hospitals in the United States being of 40 beds or less. The close of the period finds recorded 1,117 new buildings planned, with $309,000,000 involved in a year's construction; the total value of hospital properties being variously estimated between $4,000,000,000 and $5,000,000,000.

In the year 1925 the 56 privately owned hospitals of all types in New York City receiving partial support from the United Hospital Fund reported 12,022 hospital beds, 230,988 cases, and 3,456,111 days of hospital care—this being independent of the state and municipal hospitals in New York City. All types of hospitals in New York City, excepting those for the insane, provided 32,167 beds, treated 510,859 patients and gave 8,813,721 days of hospital care; treated 1,028,347 cases in out-patient departments and had a total of 3,595,261 out-patient department visits.

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HOUGHTON, ALANSON BIGELOW (1863–), American diplomat, was born at Cambridge, Mass., Oct. 10 1863. He was educated at Harvard (B.A. 1886), subsequently studying at Göttingen, Berlin and Paris. He associated himself with the Corning Glass Works N. Y., in 1889, becoming successively vice-president and president, and, in 1918, chairman of the board of directors. He was elected a member of Congress in 1919 and re-elected in 1921, resigning in 1922 on his appointment by President Harding as U.S. ambassador to Germany, a position which he held until 1925, when he was appointed ambassador to Great Britain in succession to F. B. Kellogg.

HOUGHTON, WILLIAM STANLEY (1881–1913), British playwright, was born at Manchester Feb. 1881, and educated at Manchester grammar school. He became a cotton broker, but employed his leisure in dramatic criticism for *The Manchester Guardian* and in the writing of plays. *The Dear Departed* (1910) was produced by Miss Horniman at the Gaiety Theatre, Manchester, in 1908 and afterwards in London. With *Hindle Wakes* (1912) he leapt into fame. It had a long run in London and later in the same year *The Younger Generation* (written and played in Manchester in 1910, 2nd ed. 1913) was successfully produced at the Haymarket Theatre, London, with *Trust the People* (1913) the following year at the Garrick and *The Perfect Cure* (1912) at the Apollo. His early death in Manchester, Dec. 10 1913, cut short a career of much promise.

HOURS OF LABOUR (*see* LABOUR LEGISLATION, 16.7).—The position in regard to hours of labour reached in the years immediately following the Armistice of 1918 was further consolidated during the succeeding years and in some directions a movement was made towards a further reduction of the daily and weekly working hours, in practice as well as by legislation. The European economic crisis, however, particularly that occasioned by the fall of the German mark, the abnormal unemployment in Great Britain, in Switzerland and later in Germany reacted on the national and international position in regard to working hours and tended to check the movement towards general reduction. The weight of the reparations burden upon Germany weakened the campaign of the trade unions there towards shorter hours, and Germany's rivals felt the influence of the longer hours (" Mehrarbeit ") which were instituted, with the consent of the German trade unions, in certain branches of industry in 1924.

Many workers during this period showed themselves ready to undertake overtime work whenever possible, or even to work a " second eight "—in another factory or workshop at the conclusion of their normal day's labour. This latter case was made, on grounds of social policy, a statutory offence in some countries, and was frequently used as an argument in favour of the short working day. These phenomena contradict the experience of the pre-War period; they are explained in certain countries with depreciating currency by the failure of wages to keep pace with rises in the cost of living, in others by the prevalence of unemployment, which has given the employer a powerful weapon against the worker whose chance of obtaining new employment, once thrown out of work, is very slight. In either case the force of the temptation upon the worker to earn as much as possible is obvious, and the trade unions have sometimes (notably in France and Italy) had to abandon their traditional opposition towards overtime, or even moderate their insistence upon increased rates of pay for overtime work. In Germany the trade unions ceded for a time their demand for overtime pay in regard to the " Mehrarbeit " hours, whilst retaining it for any further hours. In Great Britain, the overtime rates were almost universally maintained owing to the strength of organised labour.

I. THE GENERAL INDUSTRIAL STANDARD

Standard Day and Week.—But these weakenings of the general movement were everywhere recognised as exceptional and as due to temporary factors. Public opinion in general as reflected in the various legislatures supported the trade unions in their resistance to any demand for extension of hours, and the " standard " working day or working week has successfully maintained itself. In Great Britain collective agreements showed no tendency towards an extension of hours; successive parliamentary attacks on the Belgian 8-hour Act of 1919 were easily repulsed; in the Netherlands, though the 45-hour week established by law became 48 hours for certain branches of industry and commerce (and thus was brought to the international normal) exceptions to the latter were permitted only temporarily and to meet special emergencies. The ceding of the " Mehrarbeit " in Germany, whereby the workers in certain industries agreed to work additional hours, usually four to six per week, without demanding an increased rate of pay for these hours, was their contribution towards improving the situation brought about by the necessity of reparations payments. It led directly to a corresponding extension of hours in the neighbouring and competing heavy iron industry of Polish Silesia (declared by the Government to be temporary and dependent on the German situation), and

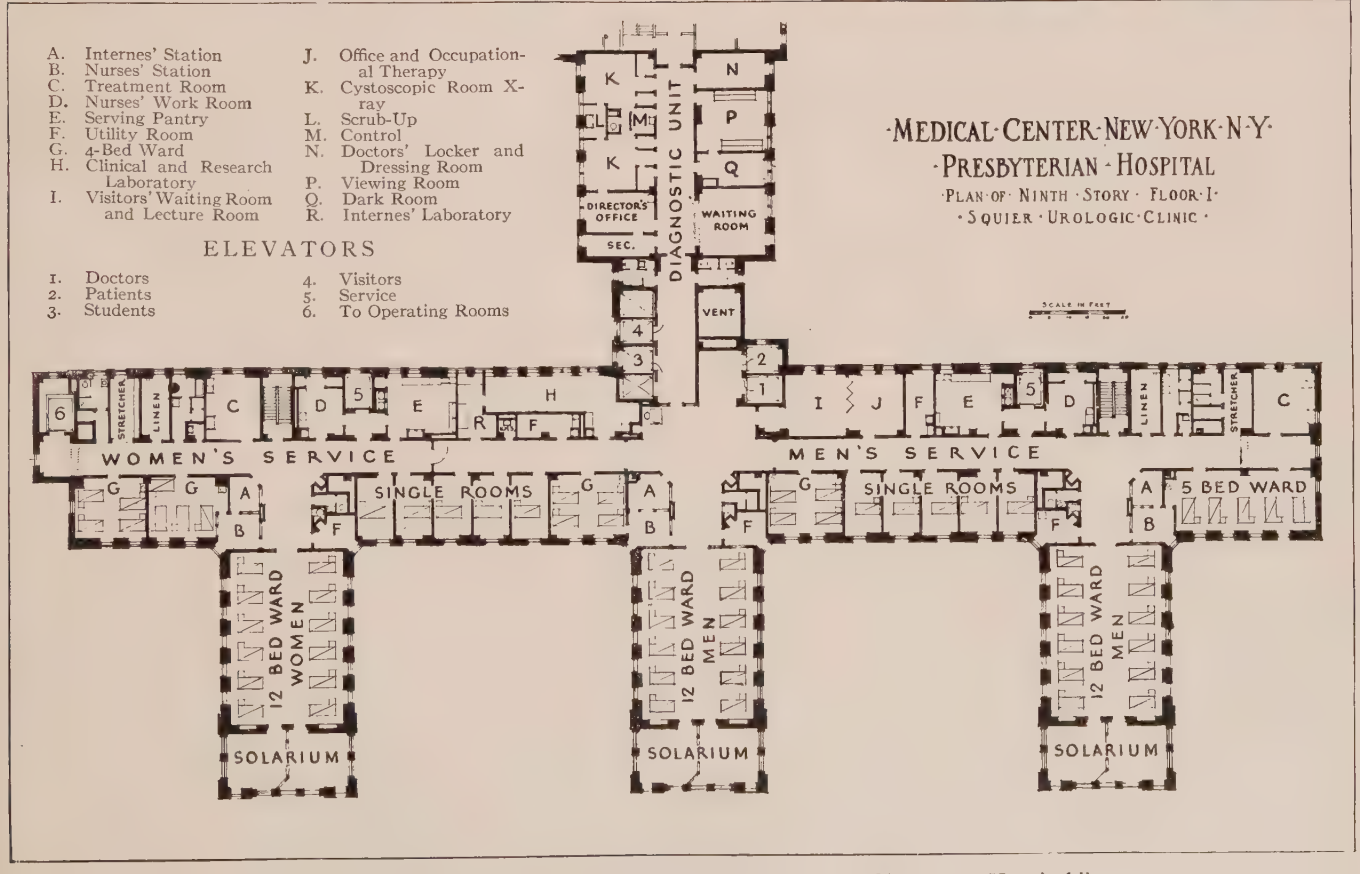


FIG. 1. Sketch Perspective:—typical example of American "Skyscraper Hospital."
FIG. 2. Floor plan of the same.

caused difficulties, without however actually bringing about an extension of hours, in Czechoslovakia. The " Mehrarbeit " was only temporary: a statement of the German Minister of Labour in March 1926 showed that less than 500,000 industrial workers out of a total of 12,000,000 workers covered by collective agreements worked normally more than the 48-hour week. The position in Poland was amended *pari passu* with the improvement in Germany. From Aug. 1925 the extensions permitted, which allowed in certain branches of industry a 10 instead of an 8-hour day, were gradually withdrawn, and the situation at the end of 1925 was nearly normal.

The " 8 and 48 " rule maintained itself as a " standard," and in some quarters was even held to have the demerit of many standards, since movement towards it may be from below 48 as well as from above it. The Netherlands 45-hour week became in effect a 48-hour week; the Polish 46 was in the same danger.

A working week of less than 48 hours is not uncommon. Rigid application of the 8-hour day in combination with the " English week-end " leads to a 44-hour week, which became the legal industrial limit in New South Wales and Queensland from Jan. 1926. West Australia, however, rejected a bill to this effect. In Great Britain working hours (except in regard to women and children, mine-workers and employees in certain " sweated " trades) are not regulated by law, but by collective agreements. Very many such agreements provide for a week shorter than 48 hours. In the metal trades, wood-working and furniture, and the engineering and shipbuilding it is 47; in building generally 44; in textiles, whilst most agreements provide for 48, the frequent practice is to work 45 or 46. A proposal by the engineering employers in July 1925 to extend the working week from 47 to 50 in view of foreign competition met with no success, and a similar proposal made for the same reason to extend the miners' working day from seven to eight hours was not supported by the Commission which enquired into the conditions of the coal industry in 1926. Attacks in 1924 and 1925 on the Polish 46-hour week similarly failed, though their basis was the opportuneness of a return to the " normal " 48.

It would seem fairly clear that the rule is to be maintained, and not merely as a standard, but as a maximum. It seems to be a stage definitely gained, from which further advances in social progress may be made as conditions permit.

Application of the " 8 and 48 " rule.—In fact the " 8 and 48 " rule is now very generally established for industry throughout Europe, including Soviet Russia, either by law or by collective agreement. The details of its application vary. It is not universally applied to all factories and workshops; in Sweden and Switzerland it is not applied to very small establishments. Nor is it equally rigidly enforced: factory inspection, which is very efficient in Germany, the Netherlands, Belgium, Great Britain, Czechoslovakia and the Scandinavian countries, is much less efficient in France and Italy and virtually non-existent in certain other countries. Its application depends, too, upon the vigilance and consciousness of the trade unions. Where they are strong, law or collective agreement is valid in practice; where weak, both employers and workers can often offend against either with comparative impunity. Nevertheless, such dependable statistics as are available show a high degree of uniformity in the average hours actually worked in corresponding industries in the various European countries; and, at least in the great industrial states, arguments concerning unfair competition based on alleged differences in hours—except in rare and unusual cases—should be very carefully examined before being accepted.

The rule holds too in the British Dominions generally, though again with differences of application, and has recently made much progress in the United States, where however it tends to take the form less of a fixed maximum than of a " basic " rule for the determination of wages. A decision (1925) of the Railroad Board, for example, provides that all hours worked over eight in the day shall be paid for at increased rates; thus the 8-hour day is accepted as the normal whilst the working of additional hours is not prohibited. This is in agreement with the International Convention of Washington, which makes no attempt to restrict overtime internationally further than to insist on an overtime rate of 25% above the normal. In South America, wherever legislation on the subject exists, the " 8 and 48 " rule prevails.

In the important industrial states of Asia the working day and week are normally longer than in the countries hitherto mentioned. Progress in the reduction of hours except in India has been slow. The reluctance of Japan to reduce her working hours is probably the main factor in the situation. A second is the confused state of China, where factories working 12 and 14 hours a day exist side by side with others which have introduced and 8- or 9-hour day. An attempt to reduce hours by general agreement in certain Chinese cities, notably Shanghai, met with partial success only. Persia has not many industries susceptible of regulation in this matter; in her carpet industry, which employs numbers of children, sometimes of tender years, hours are restricted to eight daily. In Palestine, although legislation was lacking, the immigrant Jewish population, which brought with it the industrial concepts of Europe, secured for itself by agreement with the employers the almost complete application of the " 8 and 48 " rule, which it endeavoured to extend to the Arab workers. In 1925 Turkey adopted legislation providing for a 60-hour week—the first limit imposed by statute—to include the time necessary for prayer and for the cleaning of work-places and machines. Miners work a 6-hour day.

Hours of Labour in Asia and Africa.—Recently increased attention has been paid to the question of the working hours of native races not yet accustomed to the regularity demanded by modern conditions and now forced upon them in the rapid development of many hitherto untouched areas. Plantations, mines, road and railway construction and even factories are making enormous demands upon the native populations of, for example, Central Africa, and the transition to modern industrial conditions appears to be very difficult. Many experts in colonial affairs hold that an 8-hour day for many of these natives is much too arduous; yet much longer hours are often exacted. The mortality rates among native workers are disquieting; in recent years rates of 8 and 10% per annum have been recorded in Africa, and these in areas where supervision is better than the average. Some attempts have been made to meet the situation; hours are limited to eight in certain African mining areas; the immigrant Chinese workers in Samoa (under mandate to New Zealand) have an 8-hour day, and it is becoming regular both in Asia and in Africa that, where workers are engaged under indenture or contract, the number of daily working hours (usually eight) shall be inscribed in the indenture. In the more important islands of the Dutch East Indies hours are regulated by law, or are prescribed in indenture. It is clear, however, that the problem of the utilisation of the labour of these peoples without injury to their physique and their numbers is far from being solved, and that the question of their working hours has not yet been sufficiently examined.

Exceptions to the " 8 and 48 " rule.—The " 8 and 48 " rule clearly cannot be and is not applied to all industrial occupations indifferently, and some have been excepted from its application both in national and international legislation. Among the difficulties of application is the redoubtable scourge of the 12-hour day in certain continuous processes, and in some seasonal industries. The two-shift system in continuous processes is replaced, in the International Convention on hours, by that of three shifts: the 12-hour day and 84-hour week thus becoming the 8-hour day and 56-hour week. This change, which involves a large increase of staff, has been strongly resisted, and has not yet been inscribed in all national legislations; but the old system is disappearing, even in the United States, where the two-shift system and the 12-hour day were specially prevalent. In some seasonal occupations, notably in the sugar beet industry in Europe, the great difficulty of bringing more temporary workers and accommodating them near their work for the 10 or 12 weeks of the " season " has prevented the reform in some areas; in others where conditions are more favourable, it has been carried out in spite of the handicap in competition involved; the social advantages have triumphed over the economic disadvantage.

The distribution of work over the days of the week implied in the " 8 and 48 " rule may not always correspond, not only to the economic needs of a particular case, but to general changes of opinion on these matters. The English week-end (short Saturday), for example, has become much more general over the continent of Europe; it is the rule in the British Dominions and in the United States and spreading elsewhere. It is not consonant with a strict application of the 8-hour day and the 48-hour week, and has led sometimes to the institution of a 44-hour week, sometimes to the working of more than eight hours on some days to compensate for the shortened Saturday.

A relatively new development—the five-day working week—shows signs of becoming popular. In certain industries it has long been the practice, in Great Britain, France and other countries, to complete the working week in five days, since the overhead expenses made it uneconomic to work a short Saturday of four or five hours. In Great Britain, especially since the War, with the consent of employers and workers, the practice extended, notably in boot and shoe factories and chocolate works where it is almost the normal, and it appears to be favourably received even where the economic argument is not perhaps so powerful as in the industries (*e.g.*, dyeing) to which it was first applied. The social attractions of the five-day week begin to outweigh the disadvantages involved of a 9- or 10-hour working day.

II. IN COMMERCE, AT SEA AND IN AGRICULTURE

Hours of Labour in Commerce.—In commerce, legislation on hours of labour generally belongs to the post-War period. The increasing development of the large departmental store has changed fundamentally the position in the shop-keeping world and has forced the regulation of working hours, either by legislation or by collective agreement.

In Great Britain both methods have been used, but the Shops Act of 1912 affects only the labour of young persons under 18 and provides for a maximum working week of 72 hours (including rest periods). Collective agreements and general practice have largely superseded the provisions of the Act. Few employees of large urban establishments now work 72 hours in the week, some only 43. The agitation of the organisations of shop-assistants for reduction has been generally successful. The obstacles to progress are the numerous small establishments which are frequently managed by their owners and have few or no paid workers in the ordinary sense; it is considered unjust to compel establishments which have employees to close whilst leaving open the small shops of the owner-workers. There is also the difficulty of changing the shopping habits of the general population.

Certain British regulations on closing hours adopted during the War period have not given general satisfaction. Nevertheless, many European countries have introduced legislation: Austria (1919), Czechoslovakia (1918), Finland (1917), France (1919), Germany (1923), Italy (1923), Poland (1919), Portugal (1919) and Russia (1922) have each adopted Acts which fix the normal working week in commercial establishments at 48 hours. In the Netherlands, the law of 1922 imposes 10 hours per day and 55 per week as maxima. In the other cases the 48-hour week seems to be rather the principle than the practice. The legislation itself provides for numerous exceptions and in a very much more elastic manner than is general in industry.

In Germany the hours may be lengthened by collective agreement between workers and employers, or by the judgment of an arbitration court, and the 48-hour week in commercial establishments is probably rather the exception than the rule. In Czechoslovakia, the law is seldom strictly applied. The French Act of 1919 permitted the application by decree of the 8-hour day and 48-hour week not only to industry but also to workers in shops and offices. A number of decrees have been issued, affecting for example employees in banks and public offices, and shop-assistants. Most of these decrees are regional in their application: it has been found easier to regulate hours in the larger towns. The decrees affecting industry (now covering all but very minor branches) cover the commercial workers attached to the industry (clerks and employees in the offices) also. In Italy a similar system of regulation is in effect in the larger towns.

A vast amount of local legislation, by-laws, etc., govern this matter, shop-keepers themselves very often fixing closing hours through their associations. Very little of this form of regulation however is definitely based on the notion of restricting working hours for employees; other factors enter into account.

Hours of Labour at Sea.—The seafarers' hours are still more difficult to regulate and relatively little national legislation on the question exists. The different categories of workers employed on a modern vessel, and the difference in the effort demanded of them is one cause of difficulty; another is found in the risk attached to the sea-service and the necessity of abandoning all regulation in time of stress. Yet a third arises, curiously enough, in the seaman's problem of what to do with himself on board ship when he is neither at work nor asleep. This latter is gradually being overcome by the more satisfactory conditions now insisted upon by many states in regard to living accommodation on board.

The vast majority of seamen, including the British, have obtained regulation of hours by means of collective agreements, but in many cases the legislatures have intervened. The most interesting, and probably the most successful interventions, are the Acts of Finland (1924), Norway (1919) and Sweden (1919). These divide the personnel of a vessel according to the nature of its work: the engine-room staff is required to do not more than 16 hours work in two consecutive days, whilst the ordinary seaman works not more than 24 hours in the same period. Other arrangements are made for small vessels, for cases where the crew is not divided into watches, for coastal traders and for work whilst in port. These Acts seem to have been fairly satisfactory in application, though the seamen concerned demand a reduction of the hours prescribed. A French decree of 1925 extending the application of the 1919 general Act to the sea service provides alternative methods, either an 8-hour day may be worked, or a 48-hour week, irregularly divided as regards the daily limit or an averaging of hours over a month, the 8-hour average being conserved. These hours are subject to exceptions to meet sea emergencies. Greece in 1923 extended her general labour legislation by decree to cover sea workers, but it does not appear that her hours legislation, which is somewhat special and not applied as yet to all land industries, has been adopted at sea. In Portugal working hours are regulated by a decree of 1923; whilst in port the 48-hour week is maintained, at sea the hours for the deck staff and for stewards and pursers are 84, and for the engine-room 56. A Spanish decree of 1919 lays down as maxima a 10-hour day for officers, 12 for ordinary seamen, and 8 for the engine-room crew. In Yugoslavia a decree of 1924 provides a 10-hour day and 60-hour week. Uruguay has applied the 48-hour week and Argentina has under consideration the question of the regulation of hours at sea by legislation. Denmark is revising her maritime legislation upon the lines of the Finnish, Norwegian and Swedish Acts.

The French decree above mentioned makes an important new departure in defining " hours of *effective* work," An Act of 1919 on which this and earlier decrees were based had stipulated the 8-hour day, but in practice and by a decree of 192 it had been construed that 12 hours of presence were held to constitute eight hours of *effective* work. In 1925 the Council of State found this to be abusive and defined " hours of effective work " as " the time during which the crew are, in consequence of an order given, at the disposition of the captain and away from their ordinary living quarters." This very important and far-reaching decision will have its effects on other national legislation and agreements, including probably the projected legislation under consideration in Germany and the Netherlands. In both these cases the proposed reforms are stated to be based upon the principle of the 8-hour day.

In Great Britain the matter is dealt with solely by collective agreements, which are exceedingly complicated and not universally applicable. They are not so much intended to limit the hours of labour directly as to secure that overtime rates are paid after a daily " normal " has been reached, and thus to penalise employers who exact the longer day. Emergency cases (of which the master of the vessel is sole judge, and which may be cases of salvage, fog, fire, stranding or other circumstances affecting the safety of the vessel) are not usually affected by these overtime pay arrangements. In general, the agreements provide for overtime rates when the working day in port exceeds eight hours, with special arrangements for Saturday (five or six hours) and Sunday (ordinary necessary routine work up to four hours), and for days of arrival and sailing. At sea the ordinary system of watches results in a longer day being worked, except for the categories known as day-workers (*i.e.*, those who normally work only during the day) who have similar hours to those detailed above.

This may be taken as fairly typical of the terms arranged by collective agreement, not only in Great Britain but elsewhere in countries where legislation has not been adopted. The Australian and New Zealand seamen however have secured better terms. By agreement they have a strict 8-hour system which is probably the most favourable to the workers yet obtained anywhere; the question of its consecration in legislation is stated to be under consideration.

Hours in Agriculture.—The attempt to apply the regulation of hours of labour to agriculture has aroused keen controversy. Legislation on the subject is still experimental, and a perfect system has yet to be devised. Little or no legislative regulations existed before 1918, though Ecuador in 1916 passed an Act that " No labourer . . . engaged in agriculture shall be compelled to labour more than eight hours daily, six days per week." Information as to the successful application or otherwise of this law is lacking. Where so much depends upon the seasons and the weather, and where the care of animals and crops makes demands that have often little reference to a time-table, the regulation of hours is complicated and difficult. Nevertheless it has been more or less scientifically attempted by law in several countries, and has come into practice by agreement in others.

The German regulations, issued under the provisional Agricultural Labour Act of 1919, make a serious attempt to deal with the question of seasonal variation of work, prescribing daily maxima of

8, 10 and 11 hours during three four-monthly periods into which the year was divided for this purpose. Time spent in travelling to and from the farm is calculated as working time—another point which has caused much difficulty in agriculture and in other occupations.

In Czechoslovakia, the Act of 1918, which introduced the 8-hour day very generally, seems to have become in practice an Act for increasing wages, so far as agriculture is concerned. There does not appear to be in fact any limit upon the hours worked, but overtime rates must be paid for hours worked beyond an average of eight per day. Portugal (1922) prescribed a maximum working day. Estonia (1921) prescribed a maximum yearly average of nine hours daily, Austria an average of 10 in Lower Austria; in Upper Austria, nine consecutive hours of rest and two hours for meals are provided for, the possible working hours being thus limited. An Estonian Act of 1921 created district joint commissions which were empowered to agree upon hours, with a maximum of nine daily on a yearly average; it is stated however that these commissions do not work well, and that the hours situation is confused. The Spanish decree of 1919 does not appear to be rigidly applied, and little information is available as to the working of a Costa Rican decree of 1920. In both cases the 8-hour day was the basis of the systems laid down.

In Italy collective agreements from 1900 onward specified generally "from sunrise to sunset" as the limit of working hours, with rest periods of from three to four hours during the summer day and shorter ones in spring, autumn and winter. In April 1919 an agreement was made in regard to day-workers (mostly the seasonal workers employed in rice cultivation) providing an 8-hour day, with higher rates for overtime. The collective agreements made between 1900 and 1923 secured progressively favourable conditions for agricultural workers; the advent of Fascism however changed the system fundamentally and the rural custom of collective bargaining seems virtually over. Alongside the system of agreements in Italy a legislative code governs hours in agriculture. The migratory workers in the rice areas, who are mostly women, were the subject of legislation as early as 1866, and their hours are now determined (apart from the results of collective agreements) by regulations of 1908 issued under the Public Health Code of 1907, which prescribe a 10-hour day for workers resident on the rice estates and a 9-hour day for others. Other agricultural workers (day-workers and those with a fixed annual salary) are further covered by a Royal decree of 1923, issued in pursuance of a Legislative decree of the same year, which lays down the 8-hour principle but permits a 10-hour day during a period not exceeding three months in the year.

In England and Wales legislation does not directly affect hours, but the Agricultural Wages (Regulation) Act of Aug. 7 1924 regulates them indirectly and indeed has given the best results of legislation in any country. The District Committees set up under the Act have the power of fixing weekly wage rates, and in so doing they have based the rates upon a certain number of hours of work per week, in general between 48 and 52, but in some cases extending to 62. Longer hours than these are indeed worked, but must be paid for as overtime, and are thus avoided or reduced to a minimum wherever possible with suitable arrangement of hours. The agricultural worker here further enjoys the "guaranteed week"; he is guaranteed the full minimum week's pay even though weather or other conditions make it impossible to work the total number of hours. This guarantee of pay in occupations where irregularity of hours is a feature, may prove a solution of much difficulty. It exists on the British railways, and in a modified form at the docks. Excepted from the guarantee in agriculture are, in general, female workers, whose wages are usually fixed on a casual hourly basis.

Collective agreements are not ruled out by the British legislation quoted, and in fact play a large part, within the framework provided by the work of the District Joint Committees, in the fixing of hours.

III. INTERNATIONAL ACTION

The Washington Convention.—The standard "8 and 48" rule was consecrated in the Convention on Hours in industry adopted by the first session of the International Labour Conference, held at Washington in 1919. Its adoption was based upon general practice at the end of the War and upon the resolutions of many international congresses and conferences of previous years, as well as upon the opinions of governments expressed in the documents prepared for this session. The Convention provides, in brief, for an 8-hour day and a 48-hour week in industrial establishments of all sizes except in workshops where only members of the same family are employed. It makes special provision (eight hours daily and 56 weekly) for continuous processes; it permits more than eight hours daily where a short Saturday is worked; it allows exceptions of a permanent nature for workers whose duty it is to prepare beforehand for the general running of the establishment, as for example enginemen in a factory, or who must be employed for a time after the general work of the establishment has ceased, and for intermittent work; it provides also for exceptions of a temporary nature to meet unusual pressure of work. By a special and very elastic Article it permits the 48-hour week to be exceeded, provided the average of 48 is maintained over a period of three weeks or more, where the ordinary rule is not capable of application. It leaves overtime to be regulated by the states themselves, stipulating only that employers and workers shall be consulted, and that an overtime rate of not less than one and a quarter times the normal rate shall be paid.

Since 1919 the question of the ratification of this Convention by the State Members of the International Labour Organisation has been the predominant issue in international labour affairs. By March 1926 Bulgaria, Chili, Czechoslovakia, Greece, India and Rumania had ratified it unconditionally and Austria, Italy and Latvia conditionally upon the ratification of certain other countries. In Brazil, Denmark, Estonia, France, Germany, Lithuania, the Netherlands, Poland, Spain and Uruguay the governments concerned had recommended its ratification to their Parliaments, but the latter had not yet signified their approval. The great European industrial states were still holding back, as was Japan. In India, which had ratified the Convention and materially reduced her working hours in consequence, employers and workers alike continued to protest that, with Japan refusing to reduce her working hours, amelioration in India and China was impossible. The great European states were reluctant to bind themselves unless assured that their industrial competitors would be equally bound. At first some governments held that the provisions of the Convention were too rigid; then, that they were too elastic, and that their ratification and application would not necessarily, owing to different interpretations of their terms, lead to uniformity of action. Hence the conditional nature of the ratifications of Austria, Italy and Latvia and hence also similar conditions inscribed in the bills for ratification submitted to the parliaments of certain other countries.

In Great Britain, difficulties of another nature hindered the progress of a bill for regulating hours and making possible the ratification of the Convention which was introduced by the Government of Mr. MacDonald. It was held in some quarters that the existing agreements regulating the hours of work on railways could not be brought into accord with the Convention; the railway employees were reluctant to change these agreements, and the Government therefore hesitated to take action which might, it was thought, precipitate a crisis. Differences of interpretation were possible also on various other points and consequently, in order if possible to arrive at agreement upon them before ratification, a meeting of the Ministers of Labour of Great Britain, Belgium, France and Germany was held at Berne in 1925. The meeting was partially successful, but the British Govt. decided to convoke the same ministers, with a representative of the Italian Govt. in addition, to a conference in London in March 1926.

The London Agreement, 1926.—At this meeting, which was prepared for by the circulation to the governments concerned of a memorandum on the points at issue, to which all replied, complete agreement was reached on all the issues raised, with one exception mentioned below. This agreement, signed by all the Ministers present, is likely, to have far-reaching effects on the fate of the Washington Convention and on the question of industrial working hours in general. It covers the following points:—

Working hours are defined as those during which the workers are at the disposal of the employer; deductions for rest pauses and breaks, except scheduled breaks for meals, are therefore not possible, and this decision disposes of much controversy on the question of "effective" working time and the system of grading occupations in accordance with a scale. This is made even clearer by the agreement upon a definition of "intermittent work," the effect of which is to confine the application of this term to such occupations as those of doorkeepers and watchmen which "are not concerned with production properly so-called and which, by their nature, are interrupted by long periods of inaction during which these workers have to display neither physical activity nor sustained attention, and remain at their post only to reply to possible calls."

The Conference further agreed upon matters concerning the five-day week (see above) the regulation of overtime, and overtime pay (with the agreed minimum of 25%), the working of railways (thus removing an important British difficulty), and the recuperation

of time lost by holidays. On all these questions opinion was unanimous, but on one last point—the possibility of the suspension of the application of the Convention " in the event of war or other emergency endangering the national safety "—the British Minister reserved approval pending consultation with his Government.

The conclusion of this agreement removed many important difficulties in the way of ratification of the Convention by the European industrial powers. The ministers undertook to report to their Governments, which could then proceed with their consideration of the question of ratification. In the cases of Great Britain and Germany, at least among these Powers, it would be necessary to secure the adoption by the parliaments of new legislation, and in France and Italy new administrative measures would be required. If these difficulties could be overcome, and the ratifications of the five countries registered (simultaneously or otherwise) the international position of the " 8 and 48 " rule would be secured.

Protection.—The Berne and London Conferences of Ministers of Labour were reflections of the preoccupations of the governments and of the employers more directly than of the workers, who meanwhile formulated and discussed other policies in regard to the Washington Convention. In British trade union circles, for example, the revival by the Safeguarding of Industries Act of the policy of protection gave rise to the proposition that what workers should be more precisely protected against is that form of unfair competition which consists in exploiting their fellow workers abroad, and that the only form of " protection " acceptable to the workers as a whole would be one which would differentiate against goods produced by such methods and, in particular, by the exaction of excessive working hours. The adoption of such a policy, it is claimed, would give a powerful weapon to the more advanced states and enable them to insist on social progress in other countries whose backwardness retards the general advance in welfare. Similar ideas inspired the Austrian Social Democrats who carried in the Lower Chamber a resolution to increase import duties by one-third in the case of goods coming from countries where the conditions of employment, particularly in the matter of hours, were not satisfactory.

In the international field the same ideas appear to be gaining ground. In 1925 a joint committee of the International Socialist Congress and of the International Trade Union Congress decided to examine the possibility of a system of boycott applied to goods manufactured in countries where the Hours Convention is not observed. Later on in the same year a committee of the British Labour party published a report recommending such a boycott, which, it was stated, was not without precedent. Books which contravened the law on copyrights, and goods manufactured in foreign prisons cannot be imported into Great Britain; the great chocolate manufacturers have agreed not to purchase slave-grown cocoa. On the same principle, goods produced under conditions inimical to the worker should, it was argued, be refused admission. These proposals indicate a tendency which may develop as Labour or Socialist Govts. become more general and as the interdependence of states one upon another in the matter of social amelioration becomes more widely recognised. The Washington Convention affects industry only; hours in commerce, agriculture and employment at sea are not as yet regulated by any international convention.

Commercial, Maritime and Agricultural Hours.—The International Labour Conference has not yet considered the question of working hours in commercial undertakings. In 1920 a draft Convention instituting the 8-hour day, with suitable modifications, for seafarers was lost at the Conference of Genoa by a fraction of a vote. Since then the question has been the subject of constant negotiation between seamen and shipowners, and the organisations of the former, national and international, have decided (1926) to urge that the subject be placed again on the agenda of the Conference. The Conference at Geneva in 1921 held the moment not ripe for the regulation of hours in agriculture. Indeed no proposal to limit working hours in agriculture in the precise way which is possible in industry was ever put forward. Agricultural conditions do not lend themselves so readily as do those of industry to the fixation and limitation of hours, but it seems probable that international action in the matter cannot be long delayed; the hours exacted from agricultural labourers in many countries are unconscionable and are a powerful factor in bringing about the very active migration to the towns, which is a troublesome social problem in almost all modern states.

Charter for Native Labour.—Equally pressing is the need for international action in regard to the hours of labour exacted from subject populations in colonial areas. Here again the increasing force of competition makes it difficult for one country to advance in this as in other social matters unless neighbouring areas move forward also; yet it is probably true that the suffering entailed by delay is more intense and the economic waste and loss is relatively greater in these areas than in the countries where the population is capable of defending itself. As has been said above, local legislation has made a beginning and on the basis thus provided it seems possible that international action may be early called upon to build. The discussions on the Draft Convention on Slavery adopted by the Assembly of the League of Nations in 1925, though it did not enter into the details of the regulation of native labour, showed clearly enough that there was a widespread feeling that a " Labour Charter " for native peoples was an urgent necessity. The resolution of the Assembly which called the attention of the International Labour Organisation to this necessity will not, it is to be supposed, remain without effect, and undoubtedly the hours question must be one of the first, as it is one of the most important, to be dealt with by the members of the League of Nations.

References.—The texts in English, French and German of most of the Acts cited above, and in general of Acts relating to Hours of Labour, are published by the International Labour Office in its " Legislative Series." Monographs on the hours situation in a number of important countries have been issued from the same source. For the general situation in regard to the Convention of Washington, see the Directors' Reports to the successive sessions of the International Labour Conference since 1919. The text of the conclusions of the London Conference of March 1926 was published in the *Times* of March 20. For hours of work in agriculture (England and Wales) see Report of Proceedings under the Agricultural Wages (Regulation) Act, 1924, issued by the Ministry of Agriculture and Fisheries. (H. A. G.*)

HOUSE, EDWARD MANDELL (1858–), American statesman and diplomat, was born at Houston, Tex., July 26 1858, the seventh son of Thomas William House and Mary Elizabeth Shearn. His father, who had left England as a boy, came to Texas when it formed part of Mexico, joined the revolution, and helped to free it and bring it into the Union. The younger House was educated at the Hopkins Grammar School and Cornell University, and returned to Texas in 1880, where he lived for more than 30 years as planter. His chief interest, however, was public affairs. He took an influential part in the successful campaigns of Governors Hogg, Culberson, Sayers and Lanham, and during the period 1894–1904 his political influence in Texas was regarded as decisive.

He refused invariably to become a candidate for office himself, but he acted as the intimate adviser of the several governors named. Although frequently urged to participate in national politics he remained aloof from the disastrous Democratic campaigns that followed the Bryan candidacy of 1896; but in 1912 he played a major rôle in securing the nomination of Woodrow Wilson, and at the time of the election Wilson had come to put full trust in him, offering him a choice of Cabinet positions. Following his custom, House refused any office, but politically as well as personally he remained closer to the President than any member of the official family. It was upon his recommendation that Wilson chose a number of his Cabinet; after the inauguration both President and Cabinet utilised his wide knowledge of men and his shrewd estimate of political effects to help them in meeting legislative and administrative problems; he exercised a great influence in the framing of the Federal Reserve Act and also played an important part in the organisation of the original Federal Reserve Board. Wilson spoke of him as his " independent self."

House's chief interest lay in foreign affairs, and through close contact with American ambassadors abroad and his intimacy with European statesmen, as well as the confidence of the President, he was able to influence the course of American foreign policy. In 1913 he helped to tide over the crisis in relations with Great Britain over the Panama tolls exemption until Wilson secured the repeal of the exemption. In 1914 he undertook formal negotiations with the diplomatic representatives of Argentina, Brazil and Chile, which led to the drafting of a pan-American pact designed to guarantee peace in the Western Hemisphere. The proposed pact was never translated into a formal treaty, but it was of historical significance as marking an initial step in the development of Wilson's policy of creating a League of Nations. In the spring of 1914 House, apprehensive lest war should break out in Europe, sailed for Germany to offer the assistance of the United States in reaching some arrangement between England and Germany which might avoid war. He talked with high officials of the civil Government, the army and navy, and had a conference with the Kaiser, in which he received some encouragement. William II. later said:— " The visit of Colonel House to Berlin and London in the spring of 1914 almost prevented the World War." At London he found Sir Edward Grey ready to entertain any feasible plan to preserve peace. This, House wrote to the Kaiser on July 7 1914. The murder of the Archduke Francis Ferdinand, however, precipitated war before the plan could be developed.

Returning to the United States, House maintained close intimacy with the British and German ambassadors and thus helped to smooth American relations with the belligerents. In Jan. 1915 Wilson sent him abroad to study the possibility of American mediation. He suggested the principle of the " Freedom of the Seas," after visits to London, Berlin and Paris, as a possible step towards a compromise; but the sinking of the " Lusitania " ruined all chances of success. In the autumn, House proposed that Wilson suggest to the Allies that a peace conference should be summoned; if Germany refused the conference or rejected terms calculated to ensure a just settlement, the United States would enter the War on the side of the Allies to enforce such terms. House left for Europe again in Dec. 1915, visited England, Germany and France, and finally made the aforesaid offer to the British, the substance of which was incorporated in a memorandum drafted by Grey and himself. The Allies, however, refused to take advantage of it.

In the summer and autumn of 1916 House took an influential part in the campaign which led to Wilson's re-election. At the time of the " Sussex " crisis and the German Peace Note of Dec. 1916, his private negotiations with Bernstorff were of high importance. After the United States entered the War, he kept in close touch with the chiefs of the war-making agencies, and was in consultation with the special envoys of the Allies: Balfour, Northcliffe, Tardieu, Reading. In the autumn of 1917 Wilson named him chief of the special American mission designed to co-ordinate Allied war needs, especially the problems of finance, supply, tonnage and man-power. The conferences in London and Paris which he attended proved to be the turn of the tide. After his return he was intimately concerned in Wilson's drafting of the Fourteen Points, and at the request of the President he drafted a tentative covenant for a League of Nations, which formed the basis of Wilson's later plan. In Oct. 1918 Wilson sent him to Paris to represent the United States at the Allied Council which granted an armistice to Germany.

After some difficulty, House succeeded in pledging the Allies to Wilson's Fourteen Points as a programme for peace. He had previously organised " the Inquiry," a body of experts for collecting authentic data for the use of the Peace Conference. House was one of the U.S. Peace Commissioners signing the Treaty of Versailles, and although ill at the opening of the conference he played an important rôle by reason of his intimacy with European statesmen. He was a member of the commission that drafted the League of Nations' Covenant, and ultimately most of the details connected with the formation of the League were settled with his co-operation. In July and Aug. 1919 he represented the United States in the organisation of the Mandates system. After his return to the United States he urged President Wilson, by letter, to compromise with the Senate so as to secure ratification of the Versailles Treaty and the entrance of the United States into the League. A serious illness, coming at the same time as the physical breakdown of Wilson, combined with other factors to interrupt the close relations between the two men which had persisted since 1911.

Col. House had won a reputation for such sagacity and disinterestedness that his advice was continually sought by political leaders even after the overthrow of the Democratic party in 1920. Arthur Griffiths asked that he be named arbiter in the Anglo-Irish dispute. He continued his interest in international questions and maintained close relations with the ruling statesmen of Europe.

In 1912 House published, anonymously, a political romance, *Philip Dru;* in 1921 he edited (with Charles Seymour) *What Really Happened at Paris*, a series of essays on the Peace Conference written by members of the American Delegation. He also wrote, after 1920, a number of articles upon contemporary politics and political leaders for *The Philadelphia Public Ledger*, *Foreign Affairs*, *Harper's* and *The Encyclopædia Britannica.*

BIBLIOGRAPHY.—*The Real Colonel House*, by A. D. Howden Smith (1918), a brief but accurate biography covering House's career to 1918; *The Intimate Papers of Colonel House*, arranged as a narrative by Charles Seymour (1926). (C. SEY.)

HOUSEHOLD APPLIANCES.—The working equipment for the household has achieved a new importance in recent years. In the 19th century, labour-saving machinery was adopted in industry; the 20th century has witnessed a progressive application of such machinery to the work of the household, the most important advances falling within the period following 1910. This change is little indebted to the initiative of the housekeeper herself, although a growing desire for the elimination of drudgery, together with a scarcity of domestic help, has provided an incentive to the engineer and manufacturer to meet this need with numerous mechanical devices.

The wide adoption of such appliances has owed much to the increasing availability of electricity for power and to the development of automatic machinery and standardised methods of production. A large part in their distribution has been played also by advertising, demonstrations in stores and the home and similar methods employed by manufacturers to make known their products. A number of manufacturing and distributing plants, including gas and electric-light companies, especially in the United States, are now maintaining home-service departments directed by women trained in home economics.

Schools and colleges, and also government departments, have been giving attention to the subject of household appliances during recent years in the United States, Canada, Great Britain and, to some extent, in other countries. A significant factor in this development of household devices, in some of the English-speaking countries, has been the work accomplished by enterprising home magazines that have established service bureaux, and also laboratories for the testing and investigation of household appliances.

ELECTRICITY IN THE HOME

The outstanding feature in the development of household appliances, during the period under review, 1910–26, has been the greatly extended use of those operated electrically. This fact in turn has had an important bearing on one aspect of house construction, namely, the wiring, which is increasingly ordered with a view to the use of electrical appliances. This involves the installation of a large number of appliance outlets, properly placed, instead of a limited number of lamp sockets. In districts where electricity is very cheap, houses are being wired with circuits of high current capacity to provide for electric ranges and certain other cooking devices which cannot be used on ordinary circuits. There has been a general improvement in the fittings or fixtures, such as switches, sockets, plugs, etc., the restrictions of regulatory bodies having helped to main-

tain minimum standards which in practice have been exceeded by the better manufacturers. Attachment plugs have largely been standardised, thereby ensuring the same interchangeability in appliance connections as appertain to incandescent lamps. In the United States the parallel blade plug is superseding all others.

The electric curling iron is reputed to be one of the oldest, if not the oldest, of electrical appliances. In 1926, however, the electric flat iron had a far greater sale than any other electrical appliance. The electric toaster leads in the field of small table devices, but there are many others which find a place in the kitchen or dining-room, such as percolators, table-stoves, grills, hot plates and waffle irons. The general use of nickel chromium resistance wires, introduced about the year 1910, assured the practicability and therefore the beginning of a really extensive use of electric heating appliances. These alloys can be heated to redness in the air without oxidation and the physical properties of ductility and malleability they possess permit the fabrication of heating units in a wide variety of designs. The popularity of electrical heating devices owes much to the ease with which the heat may be regulated, and this is often automatically accomplished, notably in ranges, flat irons, warming pads and percolators, by means of thermostats, which may either limit the temperatures or keep them at the desired level. In some cases additional controls are provided to start and stop the current at predetermined times. In certain central house-heating plants an electric motor controlled by a thermostat operates dampers and drafts. If the fuel used is oil or gas the heating becomes, by this device, entirely automatic, but if coal is burned, refuelling is necessary. (*See* HEATING AND VENTILATION.)

Small Motors.—Among the more important factors in the wider application of electricity to household appliances has been the perfection of light-weight, efficient motors. The motor of small size and light weight has made possible portable electric vacuum cleaners, electrically driven mixers, floor-polishers, coffee-grinders, knife-sharpeners, sewing-machines, etc. Sewing-machines designed for the incorporation of a motor are portable, light in weight and easy to operate. In motor design the important problem is lubrication, because, in the household, motors frequently go unoiled for relatively long periods and their use is intermittent, often being confined to an hour or two each week. It is now customary to provide oil-wells of relatively large capacity, which do not need replenishing for long periods. In many instances ball bearings are provided, packed in grease, so that lubrication will not be required, perhaps for the life of the device, or at least until some other parts need attention or replacement, when the ball bearings can be repacked.

The tremendous increase in the use of electrical appliances in the United States during recent years has been due, in no small degree, to the almost complete standardisation of the type of current furnished for consumer supply, namely, 110 or 120 volt 60-cycle alternating. Direct current is mainly confined to a few large centres, where its use is economically feasible. In many other countries a lack of a standardised current has placed almost insurmountable obstacles in the way of a general use of electrical appliances in the household. An indication of the rapidity with which they have been adopted in the United States is afforded by the fact that the number of electric vacuum cleaners in use rose from an estimated figure of 18,000 in 1910 to 5,000,000 in 1925. In the same period the number of electric washers increased from 3,000 to 3,500,000. The number of houses wired for the use of electric current rose from 2,934,900 in 1910 to 13,406,777 in 1925. Incidentally those equipped for the use of gas increased from about 5,000,000 in 1910 to 10,720,646 in 1925.

THE EQUIPMENT OF THE KITCHEN

As regards the kitchen the present trend is in the direction of a smaller kitchen, used only for the preparation of food. In the smaller modern apartments the kitchen has become a kitchenette, with more wall space than floor space. This fact as well as the desire to obviate unnecessary motions, has led to careful planning in the arrangement of the refrigerator, work-cabinet, range and sink. The working surfaces at sink, range, work-table and kitchen cabinet have been raised to a height better adapted to the worker, that found most generally suitable for the sink being 34 in. from working bottom to the floor. The kitchen cabinet, as a valuable space saver, is growing steadily in favour in the United States, Canada and possibly in a few other countries. More recently these cabinets have been supplemented with additional storage units, a cupboard and a broom unit. Thus equipped, the cabinet really brings the storage pantry to the work-table and provides compact and convenient storage space. While it would be sounder engineering practice, as applied to the kitchen, to have in sight all tools and materials needed for daily use, popular taste apparently objects to having utensils hanging uncovered on hooks beside the proper working centre, or to seeing food containers on open shelves. Kitchen cabinets are, therefore, all provided with doors, behind which equipment and food materials are stored. These cabinets are available in so-called built-in units, which may include a refrigerator, storage and broom cupboard and may be installed to form part of the permanent fittings of the kitchen. Cabinet cases and their accompanying units are usually finished in either white or grey enamel, and nearly all cabinets have porcelain-enamelled iron table-tops, usually so constructed as to permit being drawn out for use and pushed back within the general body of the cabinet when not required.

Porcelain-enamelled iron linings have become very common for refrigerators. The most noteworthy development in domestic refrigeration has been the increasing use of mechanical units to supplant ice. In the United States and Canada up to the present time the actuating part of the unit has been almost exclusively of the compressor type operated by an electric motor. In some European countries machines operating on the so-called expansion principle are coming into use. In these machines there is no motor, the compression of the gas refrigerant being accomplished in closed vessels through the application of heat. The source of heat is usually gas or electricity. Sinks are usually provided with drainboards frequently cast in one piece with the sink, the material used being porcelain-enamelled iron, porcelain or vitreous china. Combination faucets for hot and cold water have proved very convenient. As steps toward making the precision of the laboratory possible in the kitchen, the capacity of kitchen measuring cups has been standardised and thermometers have been specially designed for registering the temperature of the oven, of the fat in deep frying and of syrups in home candy-making.

Ranges.—Ranges are frequently equipped with thermostats for the automatic control of oven temperatures. In both gas and kerosene ranges, there has been a marked improvement in the construction of the burners, making possible better combustion. In England the "all-gas" kitchen, in which gas is used for cooking, heating and water-heating, is a development of the years 1915–26. The cabinet type of gas cooker or range, in which the oven is located adjacent to the cooking top, has become common in England and in the United States. Some electric and gas ovens have been constructed to utilise the principle of the fireless cooker, by which baking is done on retained heat. Another development is the improved insulated gas-range oven, designed for the greater conservation of fuel. Porcelain-enamelled iron is used for the exterior of gas ranges, and some have oven linings of this material.

Fireless cookers have been improved by the use of aluminium linings and by the employment of heated radiators producing oven temperatures for baking, the latter innovation necessitating a safety valve in the cover of the cooker to provide for the escape of steam, thereby avoiding danger of explosion. A later development was the electrically-heated cooker. The pressure cooker is employed for canning and for high-altitude cookery. In this device, the steam generated is confined within the cooking utensil and, by the increased pressure, raises the boiling point of the liquid. Cooking, therefore, takes place more rapidly and with a consequent economy of fuel.

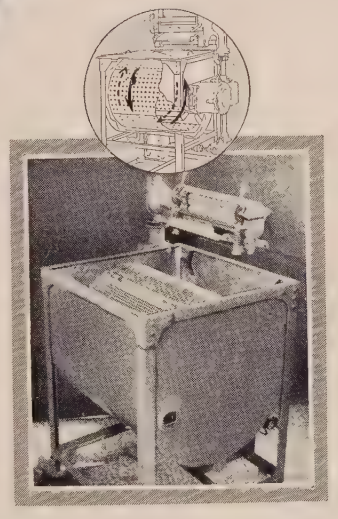
Laundry and Cleaning Equipment

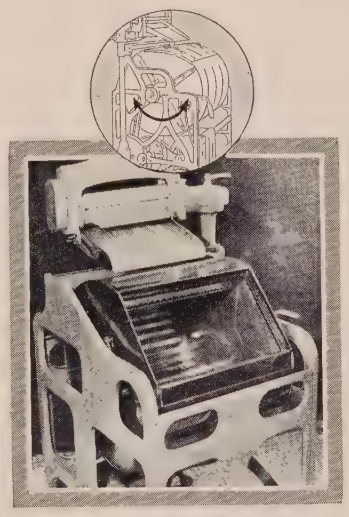
This ironing-machine has an electrically heated shoe and the padded roll is revolved by a small motor. The operator's right hand is on the lever controlling the mechanism that moves the shoe away from or up to the roll. Mechanically operated ironers are rapidly superseding the older types of machines which require considerable exertion on the part of the operator in order to bring the roll and shoe together against the action of the springs which maintain the pressure. Similar household ironing-machines use gas for heating the shoe instead of electricity.

The floor scrubbing and polishing-machine above has a ¼ horsepower motor mounted on a circular base. The motion of the motor shaft is transmitted by gears and a chain drive to a brush or polishing pad under the base.

In electric suction cleaners air, moved by a motor-driven fan, enters the floor nozzle carrying dirt into a fabric bag which retains the dirt as the air passes through the pores of the bag. Generally a tractor or a stationary brush is fitted to the nozzle. Other cleaners have a brush in the nozzle revolved by the motor. Another type has a combination agitator and brush which taps the floor covering to loosen the dirt.

Obviously there are many ways to produce the relative motion between clothes and water necessary to flush the dirt out of the fabrics and in this way wash them. As a natural result many different types of washing machines have been developed. The machine at the right represents the cylinder type, in which clothes are placed in a cylindrical container having perforated sides or ends and transverse baffles to lift the clothes as the cylinder revolves. The cylinder is revolved about its axis in another container holding water to a depth about half way between the bottom of the cylinder and the axis. The motion of the cylinder usually is arranged to reverse periodically to prevent tangling of the clothes.

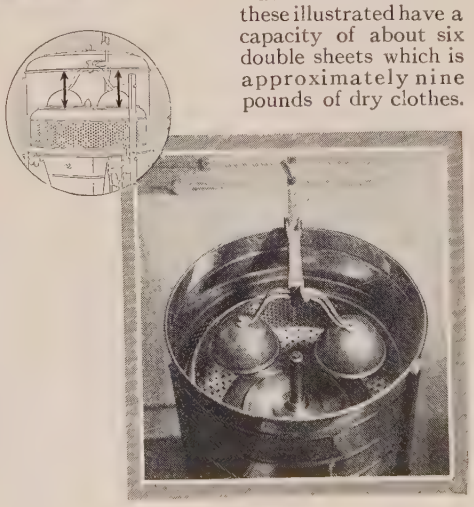




The machine illustrated at the left is an oscillator washer. In machines of this type the clothes are placed directly in the water in a tub that generally is shaped somewhat like a cube with two of the ends rounded. The tub is rocked or oscillated on its transverse axis so that the water and clothes are tumbled about in the washing process. Both machines at the left have power-driven wringers, the direction of rotation of the rolls being reversible and the wringer being movable about the support so that it may be used in any one of several positions, such as wringing from tub to basket. Washing-machines similar to these illustrated have a capacity of about six double sheets which is approximately nine pounds of dry clothes.

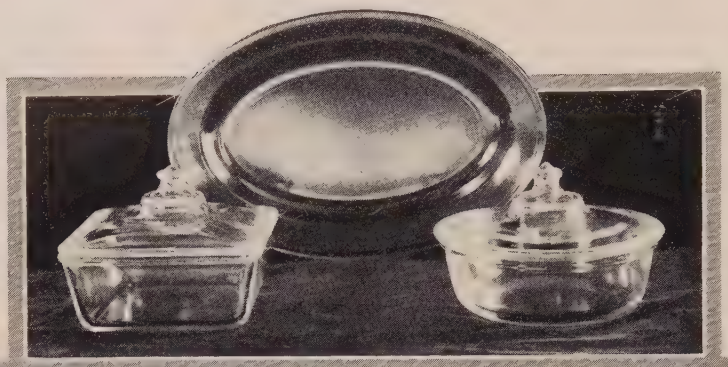
The washer, at left, has a tub of square cross section with rounded corners. The washing action is produced by a dasher or gyrator, a circular plate having vertical vanes or paddles. The clothes are dragged back and forth through the water, and the water is rather violently agitated by the gyrator as it rotates around the vertical axis. This machine has a power wringer.

In the machine at the right, the inverted hollow hemispheres are moved up and down in the clothes and water contained in the cylindrical tub. This action is typical of so-called vacuum cup washers. The one illustrated has no wringer, the drying being accomplished by centrifugal extraction. During the drying operation the inner basket is spun about the vertical axis at high speed.

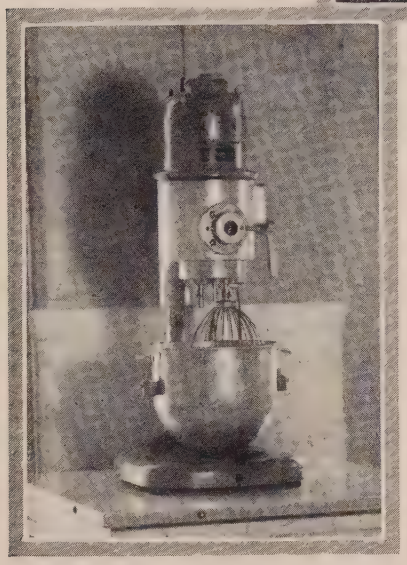


Kitchen Equipment

A lighting fixture, adapted to kitchen or laundry, designed to give proper diffusion and distribution of light with a high brilliancy incandescent lamp.

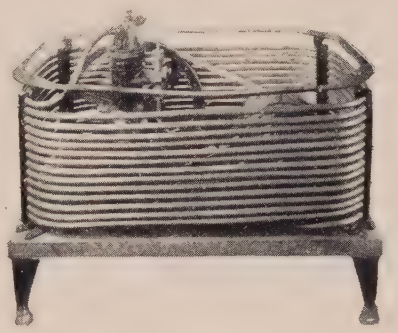


Advantages of the steam pressure cooker are economy in time and fuel. It has important applications in cooking at high altitudes, and for canning.

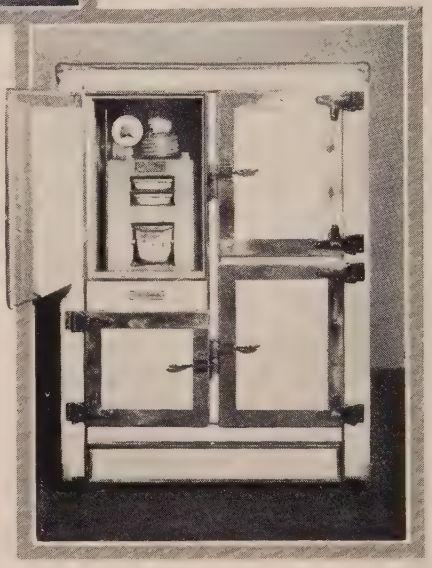


This beater and mixer is operated by the motor at the top which, through gears, drives two vertical spindles below, to which whips or beaters may be attached. A horizontal shaft drives other attachments such as coffee grinder, food grinders, ice chopper and ice-cream freezer. Three speeds are available.

Glass of special composition which will withstand oven temperatures is being used extensively for oven cookery in casseroles, baking cups, platters and other suitable forms.



The motor-driven compressor compresses a gas refrigerant that becomes liquid in the condenser coil. The liquid is expanded in a coil in the refrigerator absorbing heat from surroundings. Expanded gas passes to intake of compressor and cycle is repeated.

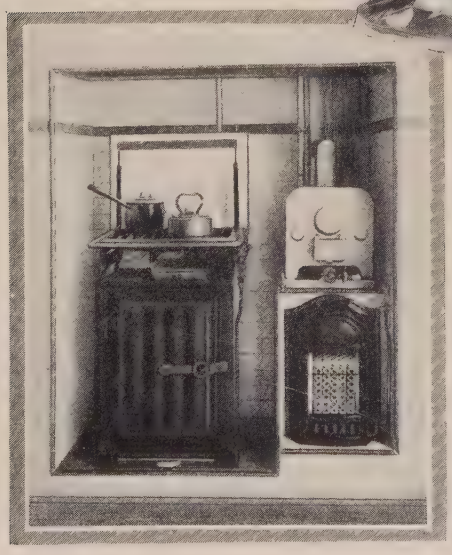


The tank in this refrigerator is the portion of the refrigerating unit which takes the place of ice. In it is a coil through which passes the refrigerant, such as sulphur dioxide, methylchloride, ethyl chloride, propane or isobutane. Outside of the coil is brine or other liquid having a low freezing point.

The appliances shown above include, from left to right, table stove, waffle iron, insulated cooker, toaster, and coffee percolator urn. All of these are electrically heated.

To the left is an English "all gas" kitchen having a cooker or range, a gas fire or room heater and a boiler or water heater.

The dishwasher at right is motor-operated and part of a kitchen sink. The motor is connected with a vertical shaft which projects through the bottom of the tank. On top of the shaft is a dasher to splash water over the dishes held in suitable racks. A cover is provided to reflect the splashed water over the dishes. There is a valve-controlled drain to the house waste pipe.



The dish-washer, both non-electric and electric, although available for some years, has been slow to meet with popularity. It depends on the action of a spray of hot water over the dishes, the motive force being provided either by water pressure from a faucet or by an electrically-driven agitator immersed in water. A metal dish-drier, valuable in the saving of time and in the possibilities for sanitary dish-washing, has not yet come into as general use as it deserves. A machine of many uses in the kitchen is the electric beating and mixing machine. It has a variety of attachments for various types of work. Among the minor devices of value should be mentioned stainless steel cutlery, first developed in England (*see* RUSTLESS STEEL); oven-proof glass; and a foot-lever attached to garbage cans, by which the cover may be operated without the necessity of any stooping on the part of the user.

CLEANING AND LAUNDRY WORK

The scrubbing brush is being eliminated partly through changes in floor coverings and surface finishes, which lend themselves to easier cleaning methods, and partly through improvements in cleaning devices. The push-broom has come into wide use, the brooms with stout, heavy fibre being largely replaced by vacuum sweepers for cleaning carpets and rugs. Brushes of specialised design and material have been adapted to a large number of different uses, the bristles varying in stiffness, size and arrangement and the shape and handle being adjusted to the function for which the brush is intended. There is a tendency to replace wood by metal for the backing of such brushes. An important labour-saving device is a scrubbing-brush rotated by an electric motor, which may be used for polishing waxed floors.

Vacuum Cleaners.—The first vacuum cleaners were hand-operated and were of the pump type. An electric cleaner, introduced a little before 1910, was made by attaching a motor to one of these hand-machines. In other machines a centrifugal fan, directly attached to the motor shaft, replaced the suction pump. Increased efficiency of the motor and fan has permitted a great reduction in the size and weight of the cleaner. There are two general classes of cleaners: those relying on suction and those depending mainly on a motor-driven brush. Those of the first class clean by creating, through and across a floor covering, a current of air, which is carried through the cleaner by revolving fan and takes the particles of dust with it to be deposited inside a bag provided for the purpose. Some of these so-called "vacuum cleaners" are provided also with fixed brushes inside or outside the nozzle or with revolving brushes within the nozzle, the motion of the brush being transmitted by the wheels on which the machine travels. These machines are distinguished from the second type by the fact that the action of the brush is secondary in importance to that of the air current. In the second type, called "suction sweepers," the brush itself, revolved by motor, does the major part of the work, agitating the floor covering in such a way as to loosen the dirt. The suction produced by a fan raises the floor covering to the mouth of the nozzle and carries the dirt into the bag. Various attachments may be used with electric cleaners for cleaning cushions, upholstered furniture, draperies and other surfaces.

Laundry Equipment.—Although primitive equipment and methods of laundering are still widely used, modern laundry methods are gradually driving out those century-old pieces of equipment—the washboard and the boiler. These are not necessary in machine-washing, when there is available a supply of hot water and soaps in flake and chip form or in cakes. The use of stationary tubs, made of glazed porcelain or porcelain-enamelled iron, is becoming more common and, as in kitchen equipment, tubs and ironing boards are being raised to a more comfortable minimum working height. The use of the combination faucet for hot and cold water is increasing. Washing-machines, both hand and power-operated, are to a considerable extent supplementing the stationary tubs. The electric washing-machine was first used a little before 1910, and by 1926 was in rather general use in the United States and Canada.

The purpose of all washing-machines is to drive the soapy water through the soiled clothes with sufficient force to wash out the dirt. In the so-called "dolly," one of the earliest types, the clothes are dragged back and forth through the water in a tub by means of prongs or pegs projecting into the tub from a base that is moved first in one direction and then in the other around its vertical axis. The sides and bottom of the tub are generally corrugated, so that there is something like a wash-board action as the clothes are dragged back and forth by the prongs. A second type might be called the "pump circulating type." It consists of a tub in which a water-pump operated by an electric motor maintains the circulation of water, and the clothes are carried around and kept continuously in motion by the circulating stream. Another type has several paddles mounted on a plate in the bottom of the tub. It moves first in one direction and then in the other around its vertical axis, swirling the clothes and water back and forth.

The vacuum-cup, or suction, washer has two, sometimes three, cups shaped like inverted funnels or hollow hemispheres, which move up and down so as to plunge down into the clothes and water and force the water through the clothes. There is a constant shifting of the relative position of cups and clothes to ensure thorough washing. The oscillating type of washer consists of a tub generally shaped somewhat like a cube with rounded ends, in which a rocking action keeps the clothes in motion.

In the cylinder, or rotary-type, washer the clothes are placed in a perforated cylinder supported in a tub containing water. The cylinder revolves in one direction and then reverses, repeating this regularly, thereby keeping the clothes in a backward and forward motion over strips of wood or metal along the inner surface. Washing-machines often have power-driven wringers attached. Among the improvements introduced into the wringer is the use of semi-hard rolls, to prevent breaking of buttons and serious injury to the fingers of the operator if accidentally caught between the rolls. There is also a type of washer fitted with a centrifugal drier instead of a wringer in the form of an inner perforated container, which revolves rapidly, throwing the water out of the clothes. For filling these power-machines and emptying them there are fillers and drainers, working with a syphon action. Labour is saved, however, by having a supply of hot and cold water piped directly to the machine with a piped outlet for waste water. This arrangement involves having the machine permanently installed in the house. Clothes driers heated by gas are available for indoor drying, and indoor clothes racks have been ingeniously designed with a view to economy of space.

Ironing Machines.—The ironing-machine (formerly called mangle) was first operated by hand and, not being heated, accomplished its work entirely by pressure. The power-driven heated ironing-machine was developed in the United States about 1910. Both gas and electricity may be used for supplying heat, and mechanical control is, in some cases, now substituted for manual control. The larger machines have a roll length of about 48 in. and the smaller ones of about 28 inches. Water-softening plants are sometimes installed for use with household laundries to meet the problem of softening hard water.

HEATING AND VENTILATING

In a large number of homes electrically-driven fans have long been used to give a cooling breeze in the summer. It is becoming more generally recognised that fans may be advantageously used in winter to improve the circulation of air in a closed room or to assist in direct ventilation to outdoors, thereby ridding the air of smoke or vapour. A specialised fan has been designed for attachment in window frames of kitchens for the purpose of ridding the room of cooking odours.

Auxiliary room-heaters, utilising the easily controlled fuels, are in common use. Gas heaters, of the so-called radiant type, have been making big strides in this field. They were first used in England, where they were practically always placed in front of a coal fireplace. Later "built-in" gas grates were introduced,

and these have greatly increased in use. These grates take up less floor space and require a much smaller flue than the coal fireplace. Kerosene heaters, mainly taking the form of a large kerosene burner set in a suitable case having a steel drum for radiating heat, find frequent use in the autumn and spring to take the chill from one or more rooms and to help the main heating plant in periods of extremely cold weather. Electric-heaters of the radiant type are in general use, but more extensive development in electric house-heating appliances has been prevented through the relatively high cost of electricity in comparison with other available fuels.

Water-heaters.—In assuring a supply of hot water for household uses water-heaters play an important part as labour-saving appliances. One of the older methods for obtaining hot water where plumbing was installed was the provision of a hollow cast-iron section or water-back for one side of the fire-box of the kitchen range, this section communicating with a tank for storing the hot water. A similar method uses a coil or pipe inserted in the fire-box of the house-heating furnace or boiler and communicating with a storage tank. These methods of heating water suffer from the disadvantage that they cease to function when the furnace is not being used and when some other fuel is used instead of coal in the kitchen range. One of the cheapest methods of obtaining an abundant supply of hot water in the coal-burning regions of the United States is a small stove especially designed for the purpose of communicating with a water-storage tank. Gas is used extensively for heating water, sometimes in addition to a water-heating attachment to the house furnace. There are several types of gas water-heaters, the simplest consisting of a gas burner placed below a coiled pipe or cast-iron water-container attached to a tank by two pipes to permit circulation of water through the coil or container. This type of heater is frequently known as the side-arm heater. It is generally designed to be operated whenever hot water is desired, but attachments are made so that it can be converted into a thermostatically controlled heater to maintain a constant temperature in the storage tank. Another type of control is of the clock variety, so arranged that the gas flame will be extinguished after the burner has been in operation for a definite time, which can be varied as required. Another type of gas water-heater is simply a combination of gas burner and storage tank with automatic temperature control, known in the United States as the automatic-storage type. To avoid loss of heat during idle periods the tanks of these heaters are heavily insulated with such materials as corrugated asbestos paper, in layers sometimes 1½ to 2 in. thick, mineral wool, ground cork, etc. An adjustable thermostat controls the burner, which has a pilot light burning continuously.

The so-called instantaneous type of gas water-heater is controlled by the opening and closing of any hot-water faucet on the pipe line attached to the heater. This control is effected by means of a hydrostatic valve, which operates through differences in pressure. When all the faucets on the hot-water line are closed the conditions of pressure on both sides of the hydrostatic valve are such that the latter remains closed, but when any faucet is opened, the release of the pressure operates the valve, which in turn opens the gas valve supplying the burner.

Kerosene or coal-oil water-heaters are in use in districts where gas is not available. The majority of these heaters are practically identical in principle with the side-arm gas water-heater already described. Some kerosene water-heaters, however, consist of a complete unit of tank and burner. This unit has a thermostatic control, which extinguishes the burner when the water in the tank reaches a certain maximum temperature. Electric water-heaters have not come into very general use because they are comparatively expensive to operate, unless electricity is very cheap. They are easy to control, the heating elements do not require oxygen as do the burners of any device depending upon combustion, and there are no products of combustion to pollute the air. The efficiency, also, can be made relatively high, because the heating elements may be immersed directly in the water.

HOUSING (*see* 13.814).—Even before the outbreak of War the problem of sanitary and suitable housing deeply engaged the attention of all persons interested in promoting the welfare of the population, especially of the working classes. The population of modern large towns had risen very rapidly through influx from outside, and the working classes in particular were crowded together in narrow, over-populated quarters. Thus a chief aim of pre-War housing reform was the construction of cheap workmen's accommodation, together with the clearing of the city slums. The methods of this reform hardly went beyond the provision of easy building credits and cheap sites, the reduction of building costs, the systematic planning of new residential districts, and the encouragement of co-operative building activity. The ideal form of dwelling, the so-called garden city, which aims at giving every family a beautiful and healthy home surrounded by a garden, could only be realised in a few model examples.

I. A GENERAL SURVEY

Apart from the so-called "public utility building," which aimed at no profit beyond a normal and fixed return on capital, almost all building activity before the War was conducted by private enterprise. The margin of profit was arrived at by estimating the difference between the sum necessary for amortisation of the capital invested and the proceeds of the annual rent, after deduction of all taxation and costs of repairs, upkeep and administration. This margin was not as a rule very high, but represented a secure income for the landlord-proprietor; experience had shown this to be one of the safest of all forms of investment.

Changes During the War.—The World War brought first a falling-off of demand, followed later by a very rapid increase in the costs of building, which reduced and finally abolished altogether the return on capital in new buildings. Moreover the economic weakness of states and individuals made it impossible to allow rents to rise at the same rate as building costs. The raising of rents on this basis was almost always countered by the state with restrictive legislation, partly out of consideration for the families of the soldiers called up for active service and partly in the belief that the universal and increasing rise of prices was only a temporary phenomenon. It seemed advisable, therefore, to let rents form an exception to this rise; this was achieved by prohibiting the raising of rents, either in all dwellings or in particular categories of them. This prohibition was regularly supplemented by other restrictions, such as prohibition of notice to quit. Thus there arose in almost all European countries a special tenant protection legislation, which imposed artificial restraints on the natural development of prices on the housing market.

Thus arose the difference between the rent paid for old dwellings and the economic rent of new dwellings, a difference so great that tenants could not pay for dwellings in new buildings. But at the same time rents, kept stationary at the pre-War level, had lost so much purchasing power in view of the general rise of prices that they often barely sufficed to cover the costs of the most necessary repairs. In most cases they no longer counted as a source of income for the landlord-proprietor. Thus private capital withdrew from building activity, as it could find much more profitable application in many other branches of production.

Housing Shortage.—Therefore a demand for housing accommodation, which grew suddenly and rapidly, especially after the War, was confronted with a complete lack of supply of free dwellings. Moreover, the housing accommodation to hand was on the decrease, since little or no renovating or repairs had been carried through for several years. Since it was impossible in most countries suddenly to let rents rise at one bound to a level which would make the construction of new dwellings completely economic, there was no resource but to draw the necessary building capital out of national resources through other channels than those of free initiative.

State and Municipal Assistance.—States and municipalities were forced to spend on this object, under various headings and in various degrees, in part even by an actual subsidy of building activity. They took over the payment or guaranteed payment for interest, redemption charges, amortisations and repay-

ment of advances for building purposes, granted loans from public funds, either free of interest or on easy terms; and granted non-repayable building subsidies (in the form of premiums, subsidies *à fonds perdus*, etc.), either to cover the annual interest and redemption charges or to cover the so-called " non-recoverable building costs," *i.e.*, that part of the capital invested in building on which interest and amortisation cannot be obtained.

Social Aspects of State Assistance.—This far-reaching financial assistance of building activity enabled the public authorities to fulfil certain social requirements in the dwelling houses which they helped to erect. Public assistance in building was as a rule confined to the construction of small dwellings and workmen's houses, subject to the fulfilment of certain minimum conditions of a social, hygienic and ethical nature and usually assistance was only given to the " public utility " building activity of the local authorities and co-operative societies. Only in its later stages was this public assistance extended to include private building activity, and then mostly on the pre-War lines of remission of taxation and of credit facilities. As, however, the resources which could thus be applied to the construction of new dwellings were, even so, usually insufficient to meet the actual demand, it seemed imperative to supplement them by measures controlling existing housing accommodation.

Post-War Housing Policy.—Post-War housing policy may thus be divided into three groups of measures, under the headings: " tenant protection," " distributive " and " productive housing policy." Rents in existing dwellings should only be raised to a degree justified by the general economic situation and the general ability of the population to meet them. This ideal can only be realised when the conditions governing notice to quit can be regulated at the same time (tenant protection). Since low rents encourage an uneconomic utilisation of existing accommodation and, combined with the restrictions on notice, make an adjustment of the housing market difficult, it is necessary to ensure proper utilisation and just distribution of existing dwelling accommodation through official supervision (distributive housing policy). The systematic encouragement of direct building activity becomes a task for legislation and administration, as explained above (productive housing policy). Although tenant protection and distributive housing policy are essentially exceptional measures which infringe on the liberty of the individual to dispose of his property, they have nevertheless lent a characteristic stamp to the housing policy of almost all European states.

Tenant Protection.—Tenant protection assumed different forms in different legal systems. In countries where fixed-period leases are customary (France, Belgium, Italy, Rumania, the Canton of Geneva), the extension of the period of lease was secured by law in some cases, in others left to the decision of special rent conciliation offices or tenant protection commissions composed of landlords' and tenants' representatives in equal numbers. In countries where leases are regularly contracted for indefinite periods and are terminable by notice (Central and North Europe) the right of giving notice is legally restricted, subject to the legitimate interest of the landlord (personal requirement), on condition that the tenant can find another suitable dwelling; offences committed by the tenant (arrears in payment of rent, disturbance of the peace, sub-letting without approval, etc.); or considerations of public interest (alteration of the house, official requirement of accommodation, etc.). In Germany, the right to give notice has been abolished altogether and replaced by application to a court of law for termination of the lease. Tenant protection has also often been extended to the increasingly common case of sub-tenancies. Special provisions for periods of grace in case of notices to quit are designed to eliminate, where possible, compulsory evictions, which are undesirable if only in the interest of public peace.

Restriction of Rents.—Measures for the protection of tenants and sub-tenants against increases of rent have varied widely in different countries according to the intensity of the housing shortage. In many of the neutral countries (*e.g.*, Holland, Spain) commissions were set up, usually giving equal representation to landlords and tenants, to consider whether a disputed increase of rent was justified. Other countries (England, France, Belgium, Italy, the Scandinavian countries, etc.) went further, introducing legislation or regulations by which certain categories of tenants or dwellings where such protection seemed advisable were liable to increases of rent only on a fixed graduated scale. In determining the percentage of increase, the taxable value of the house, the average expenditure necessary for its upkeep, etc., were taken into consideration. According to the country's general housing policy, the tendency was apparent, in greater or lesser degree, to bring rent gradually into line with the general level of prices and thus clear the way for the removal of rent restrictions.

The countries most severely affected by the housing shortage, especially those of Central and Eastern Europe, sometimes even reached the stage of making every increase of rent illegal, on the principle of placing the whole question of fixing rents on an exactly defined legal basis and thus abolishing freedom of contract in rent questions. As these were the very countries where the devaluation of currency with its devastating economic consequences appeared in its acutest form, the adaptation of the real rent, which had often sunk to a minute sum, to the new monetary conditions, formed a particularly difficult problem.

Allocation of Existing Dwellings.—These are the countries which were forced to take the most drastic measures in their distributive housing policy. In western countries, the authorities generally confined themselves to prohibiting the demolition of dwelling-houses, the utilisation of dwelling-space for other than dwelling purposes, the use of two or more dwellings by one occupant, etc. In many cases, too, permits to enter and settle in a district were introduced to restrict the liberty of moving (especially in Switzerland and Czechoslovakia) in order to secure the available dwelling-space for the native population. In some cases strangers were excluded from the benefits of tenant protection.

In the countries of Central and Eastern Europe, where the housing shortage was worst, housing policy even resorted to the radical measures of official requisitioning and allocation of available dwelling-space. Here again the interpretation of the word " available " varied sensibly. In some cases only dwelling-room which was actually empty or easily dispensable was subject to these measures, in others the dwelling-space allowed per head, or rather, the number of heads allowed per dwelling-room was fixed by law, and every dwelling-room beyond this was requisitioned and allocated to persons requiring accommodation (Germany, Austria, Czechoslovakia). Such measures were not far from the socialisation of dwelling-space, as actually practised in Hungary under the Communist régime and in Soviet Russia, where the Govt. carried its principle of " condensing " housing so far, that not only dwelling-rooms, but also unused corners of rooms were requisitioned and officially occupied. Even so, the housing crisis in Russia surpassed that of the worst-situated of the European countries.

Economic Effects of Rent Restriction.—The allocation of requisitioned dwelling-space presupposed a just and rigorous classification of the applicants according to the urgency of their needs. An entirely new and very responsible administrative branch was therefore created in public, especially municipal administration, which created an expensive and intricate apparatus (housing offices). The economic consequences of the restriction of rents in comparison with those of before the War was a far-reaching alteration in the utilisation of the national income. Of the enormous sums which had formerly been employed in the form of rent to pay interest and amortisation of the capital invested in dwelling-houses and to maintain the stock of dwelling-houses, only a small fraction was now applied to the same end. In this way the capital invested in dwelling-houses was partly consumed without any compensation being received. How far this was the case in the different countries is best seen from the table on the next page, which shows the percentage expenditure on rent in the total cudget of a workman's family before and after the War.

But a closer observation of the consequences of rent restrictions seems to show that the alteration in the distribution of the national income goes far deeper than is apparent at first sight,

Percentage Expenditure on Rent in the Total Budget

Country	Pre-War	July 1922	July 1924
Denmark	14·2	11·14	11·22
Norway	15·7	11·40	11·30
Sweden	11·9	11·2	12·38
Switzerland	10·4	9·9	9·88
Great Britain	16·0	13·7	13·76
Finland	11·8	10·3	11·92
France	12·0	7·2	6·60
Italy	11·4	4·34	6·84
Germany	18·0	0·34	10·62
Austria	14·6	0·66	1·18
Poland	18·1	3·44	5·07
Hungary	18·0	0·22	0·77

and that the relative expenditure on different objects of the working population in particular has been deeply influenced by the fall in rents. For it became the almost universal practice to determine wages by reference to the general level of prices, so that the real wage of the workman, that is the purchasing power of his wage measured in commodities, should remain essentially stable. In reckoning the general level of prices, rent was considered as a factor. The workman who only paid in real value half as much or less for his dwelling as before the War, could therefore be content with a proportionately smaller real wage without impairing his general standard of life.

In view of the fall of the national income in many countries, this reduction of the workman's real wage, while not perceptible to himself, was perhaps actually necessary, at any rate advisable as making cheaper production possible. In any case, similar consequences of the rent restrictions also had their effect on the income and relative expenditure of other classes of the population. It became impossible to find paying tenants, especially for new working-class dwellings erected at greatly increased cost. They could not therefore be built with any prospect of a return on the capital invested, and were not built at all except where the state or the municipality intervened with assistance from public funds. But even this fund was modest in comparison with the capital which had been employed before the War in erecting dwelling-houses. A further consequence of this rent policy has been therefore a change in the application of the available national capital.

Modification of Restrictions.—Under these circumstances, all countries which did not aim at complete destruction of the value of housing property as a step towards socialism began to feel the need of restoring normal economic conditions in the housing market and of gradually raising rents into line with the general price level. The legislative methods adopted, the so-called "modification of rent restrictions," varied greatly in different countries; it was a general rule that the dwellings of the poorer classes were affected last by the rise in rents, and only quite gradually. Some governments found it expedient not to restore to the house owners that part of the national income which the increases of rent had rediverted into its former channels, but, after covering the expenses of repairs, upkeep and administration, to reserve the remainder as "rent duties" for public ends, either the construction of new dwellings for the most necessitous classes of the population, or else (as, for example, in Germany) for the general financial reconstruction of the state. In any case, since the raising of rents, if severe shocks to the economic system are to be avoided, must almost always be distributed over a long period, the capital necessary for new building had to be drawn from other sources than private capital seeking investment.

Other Methods of Financing Building.—The application of public money to housing is generally confined within as narrow limits as possible. Attempts have often been made to induce employers to help in raising the necessary means. Building subsidies from public funds have often been made conditional on the employers' providing subsidies of an equal amount. Some countries (*e.g.*, Yugoslavia) have even imposed a legal compulsion to build, on well-to-do individuals and firms who have been obliged at their own expense to provide by building for the accommodation of themselves, their families and their employees.

Reduction in Costs.—Another important way of bringing the rent of new dwellings into correspondence with the means of tenants is by reducing the cost of building. This can be done by using less expensive forms of construction, employing cheaper materials, standardising and typifying certain elements of the house. In almost all countries architects, engineers and contractors have been occupied with these questions. In England, the Govt. has made elaborate enquiries in this direction, and has recommended certain useful new types of building. Attempts have been made to reduce building costs by co-operative methods. Encouraged by many municipal authorities and by the trade unions, guilds, building organisations and social building enterprises have sought to solve the financial problem by eliminating profit and increasing output. But surrounded as they are by a world organised on non co-operative lines, they have achieved no more than partial successes. No new method, no new system has been fully successful in combating the housing crisis. The qualitative elements in housing—the improvement of hygienic, ethical and social standards—have to be considered under the head of CITY PLANNING.

II. HOUSING IN VARIOUS COUNTRIES

The neutral states of Europe naturally suffered least from the housing crisis consequent on the World War. Nevertheless, they did not wholly escape it, and, in fact, the Scandinavian states, Holland and Switzerland all adopted a more or less extensive tenant protection policy. These countries, however, suffered very much less than the belligerents from the stoppage of building; in none of them did building cease altogether. Therefore they could set about filling up their gaps much sooner. Holland is the only country besides Spain in which extensive building activity since the War has already brought the end of the housing shortage in sight.

Countries of Western Europe.—Those victorious states which found wide stretches of their country in ruins at the end of the War had to reconstruct many thousands of ruined houses. This gave a welcome opportunity within the narrow limits of financial possibility of realising as far as possible the ideas of the housing reformers by building small family houses in garden settlements. Remarkable successes have been achieved on these lines in the reconstructed districts of Northern France, Belgium and Italy. Poland and Yugoslavia have also carried through the work of reconstructing their devastated districts with much success. In Belgium, the *Société Nationale des Habitations à Bon Marché*, with its wide network of local organisations, has done excellent work in public utility housing construction, and financial assistance has been given by the State.

In Italy legislation for the *case popolare ed economiche* has been of great importance, whereas the French housing action based on the legislation *pour les habitations à bon marché* does not appear to have given really satisfactory results, although considerable financial assistance has been given and a great apparatus of offices and *sociétés d'habitations à bon marché* established. Great Britain has attacked her housing problem with much greater energy and correspondingly greater success, as will be seen in the article on the following page.

Germany and Austria.—Most states of this group have been compelled to requisition housing accommodation. The methods adopted were often influenced by political tendencies. Their degree of success depended mainly on the economic capabilities of the different countries. Germany suffered a severe housing crisis as an effect of the depreciation of her currency, though she spent large sums from public funds and inaugurated a most successful housing policy in many industrial districts, *e.g.*, in the Ruhr. The particular character of her housing problems was met by the organisation of housing offices, official control of the exchange of dwellings, the assistance of rural building from the funds of the so-called "productive unemployment relief," the construction of miners' homes out of the proceeds of a duty on coal, self-help associations such as the Lüneburg "Notgemeinschaft," building guilds, state-assisted limited companies for erecting dwellings for dismissed employees, etc. Germany's rent

policy aimed at raising rents in comparatively rapid stages to their pre-War level; the landlord-proprietor receives, however, only so much of this increase as will correspond to the revaluation of mortgages in progress in 1925.

The housing shortage in Austria brought with it a strict tenant protection policy. In Vienna, rents were kept down in a way which amounted to expropriation of the landlords in favour of the tenants. The municipality of Vienna then itself took over the building activity for the city, covering the deficit which it incurred out of general and special taxation (rent tax).

Other Countries.—The more favourable financial situation of the other succession states enabled Czechoslovakia and Yugoslavia especially, both to undertake state-assisted building activity on a much larger scale and to resume private enterprise. The reduction of war and emergency measures dealing with tenant protection and distributive housing policy is already far advanced in these countries, as also in Hungary, Poland, Rumania, Bulgaria and Greece.

In Russia, the change of system in general economic policy in 1923 brought a return to more fruitful methods of housing policy after the original epoch of municipalisation and socialisation without, however, bringing noticeable relief. The European housing shortage thus presents a problem of such extent that, in view of the continuous increase of the population, it will be long before it vanishes from the order of the day. (K. P.)

NOTE.—The above sketch is based chiefly on the volume *European Housing Problems since the War*, published by the International Labour Office, Geneva (1924).

United States.—Housing conditions in the United States closely parallel those of European countries. The conflagration risk, however, is greater, due to the large use of wood in the construction of dwellings. On the other hand, the much more general use of modern systems of plumbing, heating and lighting makes for greater comfort. The relative newness of American cities means that they are less harassed by the survival of obsolete types of dwellings. The problem of slum demolition is therefore not as acute or as prevalent as in Europe.

The National Housing Assn., established in 1910, and directed by Mr. Lawrence Veiller, has promoted the study of local housing conditions and the framing of state housing laws and city housing ordinances. Approximately 100 local housing surveys have been made in the last 20 years, most of them resulting in improvements of local housing conditions. State-wide surveys made in California by the State Commission of Immigration and Housing and in New York State by the Commission of Housing and Regional Planning are especially noteworthy.

Legislation.—The revised edition of Lawrence Veiller's Model Housing law has been used as the basis of housing acts in a large number of states and cities. The Recommended Minimum Requirements for Small House Construction of the United States Dept. of Commerce, prepared by a special committee with the co-operation of Dr. John M. Gries, Chief of the Division of Building and Housing, are widely used as the basis for building codes, and that division has played an important rôle in promoting building, housing and zoning legislation and in providing general information on these and kindred subjects.

Agencies of Improved Construction.—Among the scores of limited dividend companies for improved housing, the City and Suburban Homes Co. of New York City is conspicuous for the extensiveness of its building operations. The Metropolitan Life Insurance Co. and the Bayonne Housing Corp., with the aid of Andrew J. Thomas, architect, have made notable advances in tenement house architecture, especially in planning for sunlight. The most striking of recent developments in row and group housing have been made by the City Housing Corp. of New York City in their Sunnyside development and by the Bridgeport Housing Assn. at Bridgeport, Conn., and the Octavia Hill Assn. in Philadelphia. The garden community designed by John Nolen at Mariemont, near Cincinnati, O., although not designed for wage-earning families, is the best recent example of community planning with detached housing.

Co-operative Housing.—A movement for co-operative ownership of apartments has been cultivated by the National Assn. of Real Estate Boards. The only important recent venture in co-operative suburban housing is that of the Garden Homes Co., near Milwaukee.

Industrial Housing.—Several hundred American industrial corporations have provided industrial villages or extensive improved housing developments for their employees. Among these should be mentioned the U.S. Steel Corp., which has built in scores of communities; the General Motors Co. at Flint, Mich.; the Goodyear Tire and Rubber Co. at Akron, O.; Norton Co. at Worcester, Mass.; the Mount Union Refractories Co. at Kistler, Pennsylvania and the Ford Co. at Detroit.

Governmental Housing.—In the United States the building of houses is left to private enterprise. During the World War the Federal Govt., through the U.S. Housing Corp., the Emergency Fleet Corp. and the War Dept. built many thousands of houses in well-planned communities, as an emergency measure. These projects have since been disposed of by sale to individuals or corporations. They have, however, served to interest many leading architects and town planners in the problem of industrial and suburban housing, and thus have led to improvement in general standards of industrial housing.

Housing Finance.—There is no provision by the Federal or state governments for public loans for small-house construction. The recent attempt by the state of North Dakota to provide such loans has been pronounced unsuccessful. The construction of private dwellings is largely financed through building and loan associations, which are semi co-operative in their organisation and methods. In 1924 there were 11,844 associations of this character, with a membership of over 8,500,000 persons, and total assets amounting to over $4,700,000,000.

Educational Agencies.—In 1922 Better Homes in America, Inc., was established by Mrs. William B. Meloney to organise local committees to study and improve local conditions of housing and home-life. Under the leadership of its president, Herbert Hoover, Secretary of Commerce, this organisation in 1926 formed 2,937 committees in cities, towns and villages throughout the United States. These committees have arranged lecture and discussion programmes, contests for home improvement and demonstrations of the better types of small house architecture, furnishing and landscaping.

The Architects' Small House Service Bureau, established by the American Institute of Architects, has contributed greatly to the improvement of prevailing standards in small house planning and design by issuing hundreds of plans of single-family houses of from three to six rooms. Such plans, with specifications and quantity surveys, are sold at nominal cost to families throughout the United States who are interested in building homes of their own. (J. F.)

III. HOUSING IN GREAT BRITAIN

Despite legislation during the preceding 50 years or thereabouts, housing of the working classes throughout England and Wales in the census year of 1911 was far from satisfactory. Economic facts mainly account for the paradox of surplus accommodation (5·6%) existing in conjunction with some 250,000 families surplus to structurally separate dwellings; 405,010 tenements of four rooms and less were occupied by more than two persons in one room. Insanitary areas and unfit houses abounded. The conditions in Scotland were worse. Local authorities, even later than 1890, with few exceptions, did not consider that housing the people fell within the essentials of their activities, and up to 1909 a legal obligation existed to sell, within 10 years, houses erected in discharge of rehousing obligations.

Unregulated and speculative individual effort dominated this branch of the building industry to the extent that some 95% of pre-War working-class accommodation was built by private enterprise. Increasing cost of production operated to diminish output until fear, inculcated by the taxation of land, produced by the Finance (1909–10) Act, dried up the sources of

speculative house building. The dangers due to increasing population cribbed by inadequate and wasting accommodation failed to secure national recognition, although private bills to stimulate production by subsidy were introduced unsuccessfully from 1911 to 1914.

Thus the outbreak of the World War in Aug. 1914 found housing in arrear. War conditions, causing large migrations and increased marriages, rapidly absorbed vacant accommodation in the cities. Rent Restriction Acts controlling rents and preventing evictions, but aggravating slum conditions, followed. Normal upkeep of houses was checked, and new construction was suspended by military requirements. Production and import of building materials ceased, and the ranks of skilled labour became depleted. The end of the War revealed a deplorable condition. The perpetual housing problem due to poverty had been intensified, and accommodation was lacking for many whose capacity to pay was undoubted. It was estimated (1918), possibly in excess of the immediate effective demand, that a deficiency of approximately 500,000 houses existed, of which 109,000 were needed in Scotland.

The census of 1921 later revealed 760,543 families in England and Wales surplus to structurally separate dwellings. The replacement of unfit dwellings to an approximate amount of 205,000 was not included. In addition, the London County Council required 29,000 new dwellings and immediate clearance of insanitary areas involving rehousing of 40,000 persons. It is noteworthy that nevertheless health statistics were good.

The problem presented was incapable of rapid solution. Skilled operatives were reduced by 50% as compared with 1908, and the remainder absorbed in maintenance and by contract builders. Material was scarcely procurable. An unparalleled financial stringency prevailed, with cost of living of wages and of material increased by over 100% on pre-War figures. The working classes, which constitute about three-fourths of the population, mainly require houses let at weekly rents. Even if building for sale were feasible, to let at an economic rent was impossible.

The Act of 1919.—In these circumstances the Coalition Govt., stimulated by the slogan "Homes for Heroes," rapidly passed the Housing, Town Planning, etc., Act 1919. This epochal Act embodied three principles: an obligation on local authorities to effect housing schemes, a State subsidy to housing and stringent penal clauses relating to compensation payable for insanitary property. The State shouldered all liability on approved schemes exceeding a 1d. rate borne by the local authority. The standard of housing was raised, but the incentive to local extravagance, countered by paralysing departmental centralisation, combined with exclusion of private enterprise, marred the Act. Prices soared until an annual loss per house of £50, to be met throughout the loan period of 60 years, was not uncommon. The average cost, exclusive of London, in 1920 was £860 for non-parlour and £972 parlour type. Nearly £100 must be added to building prices for land, roads and sewers. In London it cost as a minimum £158 per person housed as compared with £43 per person pre-War, and the average per habitable room in a tenement block attained £375 comparable with less than £100 pre-War. A total of 174,540 houses excluding some 3,000 temporary huts was the result of the Act at a (Treasury) cost of about £175,000,000, exclusive of the 1d. rate borne by the local authorities.

The Act of 1919.—The Housing (Additional Powers) Act 1919 remedied the exclusion of private builders, to whom a lump sum subsidy averaging about £240 a house was given, which provided nearly 40,000 houses at a total cost to the Government of £9,493,155; it forbade conversion or demolition of dwelling houses, and, to conserve labour for dwellings, attempted prevention of "luxury" building; the latter prohibition proved more injurious generally than beneficial. Both output and cost were seriously affected by the trade unions of this sheltered industry, which defeated all attempts to increase production by a dilution with ex-service men or otherwise. The results attained by the 1919 Act were not commensurate with the cost. Therefore in June 1921 the Government curtailed the scheme to "the number built, building or for which tenders have been approved," and notified a contribution not exceeding £200,000 a year for the improvement of insanitary areas in England and Wales. The suspension of the Act led to a fall in prices, and a vain hope of abolishing subsidy was entertained in some quarters. The average cost (excluding London) in 1922 for non-parlour type was £362 and with parlour £393. By 1925 prices had reached £440 and £495 respectively, but in 1923 it was deemed expedient to enact a limited subsidy (£6 a year for 20 years) for houses or flats of specified dimensions and containing a bath. The (Chamberlain) Act successfully aimed at promoting private enterprise and owner-occupiers both by subsidy and loan. The Small Dwellings Acquisition Act 1899 was extended and co-operation with public utility and building societies sought. Up to the end of 1925 over 278,484 houses had been arranged for under the Acts of 1923 and 1924, of which 151,102 were completed.

Acts of 1923 and 1924.—Before the 1923 Act could become operative the advent of a Labour Govt. led to fresh legislation, to run *pari passu* with the 1923 Act. After conferring with the building industry and the local authorities a financial basis was agreed as between taxpayer and ratepayer. The former was to pay twice as much as the latter, viz.: £9 and £4 10s. respectively, for 40 years, and any remaining gap between cost of production and income should be filled by rent from the tenant. Heretofore rent fixation had proceeded on the basis of comparable accommodation in the neighbourhood: now special conditions were attached on the basis of pre-War rents as amended by Rent Restriction Acts. This would diminish rent where production costs were low. In agricultural parishes, of defined limits, the subsidy was raised to £12 10s. because of the special difficulties of rural conditions. The Housing (Financial Provisions) Act 1924 propounded a fifteen years' programme, subject to biennial revision of contributions, under which 2,500,000 houses should be provided; an apprenticeship scheme, under which the ratio to craftsmen was increased to one in three, instead of the unattained permitted maximum of from one in four to one in seven, was an essential adjunct of the Act. But an apprenticeship scheme requires several years before fruition, and augmentation of craftsmen was overdue.

The continuing shortage of skilled labour led to investigation of new methods and materials for cottage construction. Concrete speedily established itself as a substitute for brick, but the necessity of eliminating plasterers' and bricklayers' work evolved novel types, notably the factory-made "steel" house. Progress in such types has been hindered by the hostility of the building industry and the timidity of local authorities.

Consolidating Act of 1925.—The permanent law relating to housing was consolidated into the Housing Act 1925, and the attached table shows progress up to the end of that year. In the London area progress was retarded by special difficulties, mainly due to London's magnitude, the population being eight times that of Birmingham, the next largest city (excluding Scotland), and the inaccessibility of housing sites.

The housing problem is not solved, and the economic position, now as ever, refutes the idealistic standard of one dwelling one family, every family a dwelling. It will take much expenditure and many years of persistent national endeavour to achieve a practical standard enabling all capable of paying a moderate rent to occupy a structurally separate dwelling, to establish a margin of surplus accommodation, to suppress overcrowding and to abolish insanitary areas and unfit houses. But a postulate lies in an adequate supply of skilled labour, and a measure of town planning applied to built-up areas is indicated as a corollary.

Pre-War Number of houses provided	Greater London	England and Wales	Scotland
Average per year in five-year periods ended—		(including Greater London)	
1904	25,500	116,370	14,553
1909	17,860	102,706	9,120
1914	9,330	60,648	2,850
Post-War.			
To end of 1920	2,642		
1921	12,921	221,000[1]	
1922	16,913		35,000*
1923	10,229	71,934	
1924	17,339	125,762	
1925	23,000[1]	166,952	

[1] Estimated.

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HOUSMAN, ALFRED EDWARD (1859–), British poet and scholar, was born March 26 1859 and educated at Bromsgrove School and St. John's College, Oxford. From 1882–92 he held a post in the Patent Office, and then became professor of Latin at University College, London, until 1911. He filled the Kennedy Chair of Latin at Cambridge from 1911 onwards, being also elected fellow of Trinity College. His editions of Manilius (1903–20) and of Juvenal (1905) are well known to classical scholars, but he is most widely famed as the author of the lyric sequence, *The Shropshire Lad* (1896), a work with few rivals of its kind in the language. His only other published volume of poetry was *Last Poems* (1922), which showed a command of delicate cadence and a fine sensibility no less distinguished than those of his early work.

HOUSSAYE, HENRY (1848–1911), French historian (*see* 13.828), died in Paris Sept. 23 1911. After his death were published *Iéna et la campagne de 1806* (1912), and *La patrie guerrière* (1913). See L. Sonolet, *Henry Houssaye* (1905).

HOUSTON, Texas, U.S.A. (*see* 13.828).—A few years after the World War, Houston became a world port, with 33 steamship lines in 1925 operating regularly to the principal ports of North and South America, Europe and the Orient. Its total tonnage of exports, imports and coastwise traffic (1924) was 5,343,598 tons, valued at $294,796,871. The first bale of cotton was exported in Nov. 1919; shipments for the season 1924–5 were 1,821,828 bales. The 25-ft. ship channel, completed in 1914, was deepened to 30 ft. and widened between 1919–25. Under an enabling Act, passed in 1921, the navigation district of Harris co. assumed operation of the port and made extensive improvements in port facilities. The projected intracoastal canal from the Mississippi river to the Houston Ship Channel will connect the port with 6,000 m. of inland waterways. The value of manufactures within the city limits was $23,015,000 in 1909; $86,874,000 in 1919; $89,133,777 in 1923. The area was increased from 17·4 sq. m. in 1910 to 36·5 sq. m. in 1920 and to 41 sq. m. in 1925. The population in 1920 was 138,278, of whom 33,960 were negroes and 12,088 foreign-born; in 1925 it was estimated at 164,954; the local estimate for the metropolitan district was 250,000. Between 1920 and 1925 great progress was made in paving and widening streets, constructing sewers and bridges, improving the fire department, building driveways along the bayous, adding parks and beautiful public buildings and transforming the business section with modern office buildings and hotels. Rice Institute opened for its first academic year on Sept. 23 1912 in buildings on its 300-ac. campus.

HOWARD, LELAND OSSIAN (1857–), American entomologist, was born at Rockford, Ill., June 11 1857. He graduated from Cornell University, becoming B.S. in 1877 and M.S. in 1883. After serving as assistant entomologist at the U.S. Dept. of Agriculture, Washington, D.C., in 1878, he was made chief of the Bureau of Entomology in 1894. From 1904 he was consulting entomologist in the U.S. Public Health Service, and from 1895 honorary curator of the U.S. National Museum. He was in 1917 a member of the committee on agriculture and chairman of the sub-committee on medical entomology of the National Council of Defence.

Howard wrote *Mosquitoes—How They Live* (1901); *The Insect Book* (1902); *The House Fly—Disease Carrier* (1911); a monograph on mosquitoes for the Carnegie Institution (1912); and many government bulletins.

HOWELLS, WILLIAM DEAN (1837–1920), American novelist (*see* 13.839), died in New York May 11, 1920. In 1915 he received the gold medal of the National Institute of Arts and Letters for his work in fiction. To within a short time before his death he continued to contribute to the "Editor's Easy Chair" of *Harper's Monthly*. His later works included *My Mark Twain* (1910); *Imaginary Interviews* (1910); *Parting Friends: a Farce* (1911); *Familiar Spanish Travels* (1913); *New Leaf Mills: a Chronicle* (1913); *The Seen and Unseen at Stratford-on-Avon: a Fantasy* (1914); *The Daughter of the Storage and Other Things in Prose and Verse* (1916); *The Leatherwood God* (1916); and *Years of My Youth* (1916). In 1920 he edited with an introduction *The Great Modern American Stories*. He left unfinished *Years of My Middle Life*.

HRDLIČKA, ALĚS (1869–), American anthropologist, was born at Hampoletz, Bohemia, March 29 1869. His early education was received in Bohemia. He studied at the New York Eclectic College becoming M.D. in 1892. In 1894 he joined the New York State service, investigating the insane and other defective classes, and became in 1896 associate in anthropology in the State Pathological Institute. He was a member of the Hyde expeditions to Mexico and the southwestern United States in charge of physical anthropology, 1898–1903. In the latter year he was appointed assistant curator in charge of the division of physical anthropology at the U.S. National Museum, Washington, D.C., becoming curator in 1910. As a member of various anthropological expeditions he made researches in many parts of the globe. He became a leading exponent of the theory that the North American Indian is of Asiatic origin. Among his works are *The Eskimo Brain* (1901); *Ancient Man in North America* (1907); *Ancient Man in South America* (1912); *Anthropological Work in Peru* (1914).

HROZNY, BEDRICH (1879–), Czech orientalist and archaeologist, studied in Prague, Vienna, Berlin and London. In 1904 he took part in the Seelin excavations in Ta'anuk (north Palestine), on the basis of which he wrote *Die Keilschrifttexte von Ta'annek* (1904) and *Die neugefundenen Keilschrifttexte von Ta'annek* (1906). In 1905 he was appointed professor at the University of Vienna, and in 1919 became professor of cuneiform research and ancient Oriental history at the Charles University of Prague. Hrozny's name became known chiefly in connection with the study of the ancient Hittites. He left the solution of the Hittite hieroglyphics to chance, proceeded to work on the basis of Hittite documents from the Boghazkoi archives written in cuneiform script, and in 1915 thus succeeded in deciphering the Hittite language, which he proved to be an Indo-European tongue, closely akin to the Iranian, Celtic, Italic and Slavonic families of speech. His solution was attacked from many quarters, but he substantiated his claim by the success with which he read and translated a number of documents, among others a Hittite legal code (published in Paris, 1922, under the title: *Code Hittite provenant de l'Asie Mineure, I. Partie: Transcription, traduction française*). In 1925 excavations for the purpose of further research were made under his direction by a Czech scientific expedition to Asia Minor.

HUBAY, EUGENE DE (1858–), Hungarian composer and violinist, was born at Budapest Sept. 15 1858. His first teacher was his father, who was a professor of the violin, as well as a composer and conductor. From 1871–5 he studied in Berlin under Joachim, and later, on the recommendation of Liszt, gave successful violin recitals in different countries including England. While in Paris he was associated with Vieuxtemps and Massenet. In 1882 he succeeded Wieniawski as professor of the violin at the Brussels Conservatoire, and in 1886 was appointed to a similar post at the Budapest Academy, of which he has been the director since 1919. His pupils include many eminent violinists, among them Vecsey, Jelly d'Aranyi and Szigeti. Hubay has written the following operas: *The Violin Maker of Cremona; Anna Karenina; Alienor; Die Maske; Moosröschen; Lavottas Liebe*, etc. His other compositions include symphonies, violin concertos, and solos and songs. His early works, based on Hungarian and French elements, were exclusively lyrical, while his later compositions show more dramatic rhythm as well as more modern tone-colouring.

HUBER, MAX (1874–), Swiss lawyer, was born Dec. 28 1874 at Zürich. He became doctor of law at Berlin University in 1897 and, on the conclusion of his studies, travelled extensively and made a prolonged sojourn in the Far East. From 1902 to 1921 he held a law professorship—first extraordinary and subsequently ordinary—at the University of Zürich. In 1921 he resigned his chair and became honorary professor. The Swiss Federal Council on many occasions consulted him as an expert in international questions and he was a Swiss representative at the Hague Conference in 1907. During the World War he was

legal adviser to the Swiss Political Department. In this capacity he was entrusted with several missions to the Peace Conference, to the League of Nations and to various governments. In 1920 and 1921 he was deputy delegate to the Assembly of the League of Nations. He was a member of the Jurists' Committee of the Council of the League of Nations dealing with the Aaland Islands question and of the International Blockade Commission. He became both a judge of the Permanent Court of International Justice and a member of the Permanent Court of Arbitration.

HÜCH, RICARDA (1864–), German poet, was born in Brunswick July 18 1864 and educated there. Later she studied in Zürich, where she took her degree. She was appointed secretary of the library in Zürich and married first Dr. Ceconi, and later Dr. Richard Hüch, a lawyer. She wrote a number of romantic and imaginative novels, among which may be mentioned *Aus der Triumphgasse* (1902); *Vita Somnium Breve, Ein Roman* (1903); *Der grosse Krieg in Deutschland* (1912–4); and *Der wiederkehrende Christus* (1925). Her most important historical works are *Blüthezeit der Romantik* (1899); *Ausbreitung und Verfall der Romantik* (1902); *Das Risorgimento* (1908). In 1919 appeared a volume of reflections, *Der Sinn der heiligen Schrift*, which reveal a profound knowledge of psychology.

HUDSON, WILLIAM HENRY (1841–1922), British naturalist and writer, was the son of Daniel Hudson (1804–68), who was himself born of English parentage at Marblehead, Massachusetts. W. H. Hudson, Daniel's third son, was born at Quilmes, near Buenos Aires, Aug. 4 1841, and remained with his family on the pampas until about the age of 29, when he came to England. From then the greater part of his life was spent in poverty, and his difficulties were accentuated by frequent ill-health. His wife, Emily, long kept a boarding-house in London, where Hudson too lived, known to only a small circle of appreciative friends. A civil list pension granted in 1901 aided him somewhat, but he voluntarily relinquished this in later years when belated success reached him. He died in London Aug. 18 1922 and was buried at Broadwater, Sussex. His writings include the memorable pictures of the South America of his youth, such as *The Purple Land* (1885); *A Crystal Age* (1887); *El Ombú* (1902); *Green Mansions* (1904); *Far Away and Long Ago* (1918); of the English countryside, such as *A Shepherd's Life* (1910); *Dead Man's Plack* (1920); and the posthumous *A Hind in Richmond Park* (1922); ornithological works, as his collaboration with P. L. Schlater in *Argentine Ornithology* (1888–9); and his own *British Birds* (1895); and *Birds of La Plata* (1920); and many pamphlets for the Society for Protection of Birds. A bird sanctuary with a decoration by Jacob Epstein was erected to his memory in Hyde Park, London, in 1925.

See H. J. Massingham, *Untrodden Ways: Adventures among the Works of Hudson, etc.* (1923); Morley Roberts, *W. H. Hudson* (1924).

HUGEL, FRIEDRICH VON, Baron (1852–1925), Catholic theologian, was the son of Karl von Hugel (1775–1870), Baron of the Holy Roman Empire, a German by birth, an Austrian subject, and Austrian minister to the grand ducal court of Tuscany at Florence where on May 5 1852 Friedrich was born. Baron Karl had married Elizabeth Farquharson, a convert from Presbyterianism to the Catholic Church. In 1867 the family went to England and made their home at Torquay.

Friedrich von Hugel's education was curiously miscellaneous: brought up a Catholic, he was early made acquainted with Anglican forms and doctrines; from 8 to 15 he had a Rhenish Prussian Lutheran tutor, whom he loved, the Catholic historian Alfred von Reumont meantime supervising the course of the teaching; to his father perhaps he owed a turn for science, studying geology and entomology. Hebrew he learnt from a Rabbi and from the Catholic priest—Professor Gustav Bickell, the Biblical critic and commentator on Job. This singular upbringing, his mixed ancestry and his knowledge of languages, together with his natural gifts helped him to become one of the most sympathetic, resourceful and persuasive religious teachers of his age, and won him many friends in many lands. He took into his purview all history, all races, all religions, all philosophies, all literature. But while he possessed a generous sympathy for all seekers after truth, he held the Catholic Church to possess in its creeds, worship, history and institutions, the fullest, richest and deepest realisation of religion. He accepted the Papacy and the principle "*ubi Petrus ibi ecclesia*," but at the same time he thought that the government of the Church was overcentralised, and he believed that the bureaucratic tendency could be counteracted by the healthy interaction of energy between the head and the members of the whole body of believers.

His Biblical scholarship led him into relations with the Higher Criticism and he accepted what he regarded as the assured results of such studies. This association with modernist Biblical critics led him to be classed with Modernists. When the crisis of Modernism was over, he made it more and more clear that friendly and sympathetic as he was to them, as to all others who were troubled by doubts, he could not follow the Modernists who revolted from Rome and that he rejected altogether their theory of belief. He wrote that the main spiritual influence, dating from 1886, which had strengthened his faith, had been the teaching and the example of the Abbé Huvelin, a remarkable French priest, who wrote no books but "wrote in souls." Baron von Hugel himself brought out no book until he was fifty-eight. A letter in The *Times Literary Supplement* of May 25 1922 on Louis Duchesne is of value for its treatment of the subject, but also as an apologia for the Baron's own religious belief.

In 1873 the Baron married Lady Mary Herbert, a daughter of Sydney Herbert (Lord Herbert of Lea). He died in London Jan. 27 1925 and by his own wish was buried in Downside Abbey, Bath, Somersetshire. He asked that his library should be given to St. Andrews University. In his will are the words "I desire to die as I have striven to live, a devoted member of the Catholic and Roman Church."

His works include: *The Mystical Element of Religion as studied in St. Catherine of Genoa and her Friends* (1908, new and rev. ed. 1923); *Eternal Life, a Study of its Implications and Applications* (1912, 2nd ed. rev. 1913); *The German Soul in its Attitude towards Ethics and Christianity*; *The State and War* (1916); *Essays and Addresses on the Philosophy of Religion* (1921).

HUGGINS, MARGARET LINDSAY, Lady (1848–1915), British astronomer (*see* 13.857), died in London March 24 1915.

HUGHES, CHARLES EVANS (1862–), American lawyer and statesman, was born at Glen Falls, N.Y., April 11 1862. He attended Colgate University from 1876 to 1878, whence he proceeded to Brown University (B.A., 1881; M.A., 1884). He studied law at Columbia University, taking his LL.B. degree in 1884 and obtaining a prize fellowship at the Columbia law school. In the same year he was admitted to the New York bar, and engaged in practice till his appointment as professor of law at Cornell University in 1891, a position which he relinquished in 1893 in order to resume practice. He continued, however, to maintain his connection with Cornell in the capacity of special lecturer, and, in addition, was a special lecturer at the New York law school from 1893 to 1900.

In 1895 he was retained as counsel for the Stevens Gas Commission, appointed by the New York State Legislature to investigate the cost of gas; and in the same and following years was counsel for a committee of the New York State Legislature, known as the Armstrong Insurance Commission, formed for the purpose of investigating life insurance companies. In 1905 he was nominated for mayor of New York City by the Republican convention, but declined to stand. In the coal investigation of 1906 he acted as special assistant to the Attorney-General of the United States. In the same year he was elected Governor of the State of New York, defeating William Randolph Hearst, and was re-elected in 1908. He resigned Oct. 6 1910, on being appointed Associate Justice of the Supreme Court of the United States by President Taft.

Candidate for the Presidency.—In 1916 he resigned from the Supreme Court on being nominated for the presidency by the Republicans, but was narrowly defeated by President Woodrow Wilson, who had been renominated by the Democrats. Hughes's election was considered assured when the campaign began; but though he "stumped" the country widely he disappointed the

people because he took no definite position on any of the specific questions involving the stand of America in the World War, and especially as regards the sinking of the "Lusitania." The result of the election was doubtful until a full count had been made, and eventually hinged upon Minnesota and California, normally Republican states. Hughes carried Minnesota by a few hundred votes, but lost California by a few thousand. The electoral vote was 277 for Wilson against 254 for Hughes. The popular vote was 9,129,606 for Wilson against 8,538,221 for Hughes. The following year he again entered upon the practice of law in New York City. In 1917 he was appointed chairman of the Draft Appeals Board of New York City by Governor Whitman, and in 1918 he acted as special assistant to the U.S. Attorney-General in charge of the investigation of alleged waste and delay in the construction of aircraft. He was president of the New York Bar Association in 1917–8, and of the Legal Aid Society 1917–9. He was the leader of the New York Bar Association in its opposition to the expulsion of the Socialists from the New York State Legislature in 1920.

As Secretary of State.—On the inauguration of President Harding, March 4 1921, he became Secretary of State. One of his first steps was to intervene in the Panama-Costa Rica dispute respecting their boundaries. The two states had drifted into actual hostilities, but on March 18 1921 Mr. Hughes advised them, in terms which practically amounted to an ultimatum, to arrange for a peaceful delimitation of their joint frontier—a suggestion which they ultimately accepted. The Soviet Govt. approached him in his first month of office asking that the United States should resume trade relations with Russia, but he promptly rejected the Soviet proposals. Later on M. Chicherin communicated with him with a view to the recognition by the United States of the Soviet Republic, but this also was refused, Dec. 19 1923.

In 1921 Mr. Hughes, under authorisation by President Harding, sent out invitations suggesting a conference on the limitation of armaments to be held at Washington. The conference was held—Mr. Hughes being chief U.S. delegate—with the result that seven treaties were negotiated relating to limitation of naval armaments, the fortification of islands in the Pacific and relations between China and other Powers (*see* WASHINGTON CONFERENCE).

In a speech at New Haven in Dec. 1922 Mr. Hughes dealt at length with the matter of German reparations, and unofficially suggested a committee of experts to investigate. This was the genesis of the committee which ultimately prepared what is known as the Dawes Plan (*see* REPARATIONS). The Tacna-Arica dispute afforded another instance of Mr. Hughes's intervention on behalf of peace (*see* TACNA-ARICA). It was largely due to Mr. Hughes's efforts also that a convention was signed between the U.S. and British governments by which the U.S. authorities were permitted to search British vessels on the high seas within a 12-mile limit from shore, the purpose being to prevent the smuggling of liquor into the United States. One of the last acts of Mr. Hughes before he retired from office was to suggest a solution of the controversies between Brazil, Colombia and Peru as to certain portions of their boundaries. A settlement was effected in March 1925.

Mr. Hughes's attitude in respect of foreign affairs during his term of office was well set forth in an address entitled "The Pathway of Peace," delivered by him before the Canadian Bar Association Sept. 4 1923. "The League of Nations," he said, "by its constitution presupposed that peace could be maintained by economic pressure and military force." He dissented from this, since he believed that there was no path to peace except as the will of peoples might open it. The way to peace was through agreement, not force. "There is no lawgiver for independent states; the outlawry of war necessarily implies a self-imposed restraint." Upon this hypothesis was consistently based his whole attitude towards world politics. He was, however, in favour of the adherence of the United States to the World Court of International Arbitration. The judicial impartiality of Mr. Hughes's character fitted him admirably to succeed in handling the international problems confronting him as Secretary of State, but he lacked the dramatic and popular qualities which might have led to his choice as chief executive of the nation.

He resigned office March 4 1924 and retired into private life. He was, in the April following, elected president of the American Society of International Law. In 1925 he acted as chairman of the New York State Reorganisation Commission, appointed to investigate the structure of the State Government. The commission reported March 1 1926, urging that the 180 state bureaux and departments be merged into 18, and that an executive budget system be introduced.

In addition to numerous addresses, most of which have been reproduced in pamphlet form, Mr. Hughes has published *Addresses and Papers* (1908); *Conditions of Progress in Democratic Government* (Yale Lectures, 1910); *Addresses 1906–16* (1916); *Foreign Relations* (1924); and *The Pathway of Peace* (1925).

(H. W. H. K.)

HUGHES, SIR SAMUEL (1853–1921), Canadian soldier and politician, was born at Darlington, Ont., Jan. 8 1853. In the Fenian raids of 1870 he served with the Canadian volunteer militia, and in 1873 he was gazetted to the 45th Regiment. Educated at Toronto University, he lectured at a Toronto collegiate institute until 1885, when he took up journalism, being editor and proprietor of the Lindsay *Warder* from 1885 to 1897. In 1892 Hughes was elected to the Dominion Parliament, but service in the South African War interrupted his political career. Returning to Canada after the coronation of King George V. in 1911, he became Minister of Militia and Defence, and was chiefly responsible for the creation of the overseas force which sailed for Europe in 1914. In 1915 Hughes was created K.C.B. and promoted major-general; but in the following year disagreements with Sir Robert Borden resulted in his resignation. Hughes criticised severely the strategy and leadership of Sir Arthur Currie. In July 1921 he announced his intention of retiring from Parliament, and he died at Lindsay, Ont., Aug. 24 1921.

HUGHES, WILLIAM MORRIS (1864–), Australian statesman, was born Sept. 25 1864 at Llansantffraid, Montgomeryshire, Wales, and received his early education at Llandudno Grammar School. Moving to London, he became a pupil teacher at the Burdett-Coutts schools, Westminster, where he attracted the attention of Matthew Arnold, then an inspector of schools; and at the age of 20 he emigrated to Australia. Here he began a period of picturesque wanderings, which it would be hard to parallel in the life of any statesman, ancient or modern. He drove sheep and cattle across the vast spaces of New South Wales and Queensland, worked on farms and cooked for harvesting gangs, became a sailor on coasting steamers, prospected for gold, tramped from station to station doing odd jobs, mended everything, from umbrellas to locks and from ovens to violins, taught children in remote settlements, walked hundreds of miles organising for the Australian Workers' Union, and in the end drifted back to Sydney and gravitated, as was only to be expected from the bent of his mind and character, to politics. He formed the Sydney waterside workers into a militant organisation, and entered the New South Wales Parliament in 1894 as member for the Lang division of Sydney.

As a member of the Opposition Mr. Hughes had no chance of showing administrative ability, but he became known as an effective debater, and devised the Labour party's caucus system of settling all internal dissensions outside the House and presenting a united front in Parliament. Then in 1901 came federation, and as member for West Sydney in the first House of Representatives Mr. Hughes found the wider scope that his political genius demanded. In 1904 Mr. J. C. Watson formed the first Labour Ministry, and Mr. Hughes, who in the midst of his industrial and political work had found time to qualify as a barrister, became Minister for External Affairs. The Ministry was short-lived, but thenceforth it was clear to friends and foes alike that a new force had entered Australian politics. During the years that followed Mr. Hughes went on developing until the hesitating, ineffective speaker of the 'nineties became one of the most brilliant and powerful orators in the Empire, and his

courage, energy, intellectual gifts and dominating personality made his succession to Mr. Fisher almost inevitable.

Mr. Hughes was attorney-general in the Fisher Ministry of 1908, and revealed not only a remarkable gift of eloquence and a mordant wit, but a breadth of view and a warm Imperialism hardly to be looked for in a party which, not so many years before, had toyed with the idea of "cutting the painter." He was largely responsible for the scheme of compulsory military service which later proved so valuable, and he was heart and soul with his leader when Mr. Fisher, who had returned to office after the Liberal defeat of 1913, made his historic offer in 1914 of Australia's last man and last shilling. In 1915 Mr. Fisher went to London as high commissioner, and Mr. Hughes, as his logical successor and the man to whom Australia looked for strong leadership in the dark days of war, succeeded him as Prime Minister. Thus this frail little man, who weighed only seven stone, who suffered increasingly from deafness and ill-health, and who had depended for higher education entirely on what reading he could find time for in the intervals of work ranging from the mending of kettles to the organising of strikes, had as his reward the highest honour that his countrymen could offer.

On the whole they were not disappointed. Mr. Hughes, by his driving force and faculty of kindling enthusiasm, gave an immense stimulus to the raising and maintenance of the Australian Expeditionary Forces; and with equal energy he devoted himself to the task of eradicating German commercial influence from Australia. Germany, he found, had almost a monopoly of the output of Australian mines, and German firms controlled even the supplies of metals needed by the British Govt. for munitions. By the end of 1915 he had brought forward legislation which annulled all German contracts, transferred control of output to the newly established Australian Metal Exchange, prevented trading with the enemy, and disinherited enemy shareholders in commercial enterprises of every kind. This was practical statesmanship of very real importance.

In the following year he visited England and attracted wide attention by preaching a renaissance of the British race based upon a greater development of the Empire's resources and a closer-knit economic system. Returning to Australia with the conviction that a stronger flow of reinforcements was needed, he attempted to introduce conscription. On this issue the Labour party split, and the result was that Mr. Hughes formed a coalition government composed of the Liberals and that section of the Labour party which followed him on the conscription issue. The conscription referendum, on which the Government was defeated, was marked by great bitterness, and there followed a period of industrial and political strife without parallel in Australia's history. Mr. Hughes was hotly attacked for his autocratic methods, for his excursions into state shipowning and shipbuilding, and for his policy of concentrating power in his own hands by means of the War Precautions Act, the establishment of boards to control industry, and the appointment of special tribunals to settle industrial disputes over the head of the Arbitration Courts. But so long as the War lasted there was no alternative leader acceptable to the people, and the Prime Minister left to attend the Peace Conference with his prestige higher than ever. His assertion of Australia's right to proclaim something rather like a Monroe Doctrine for the Pacific did a great deal to awaken Americans and the world to the importance of Australasia; and at Versailles his advocacy, as eloquent as it was dogged, of the Commonwealth's right to a mandate over the former German colony of Papua, helped to make history. His quarrel with President Wilson, embittered by mutual dislike, gave rise to some of the most piquant passages in the annals of the conference.

In Australia, on his return, Mr. Hughes found grave industrial troubles disturbing a country already weighed down by an immense load of debt and the problem of reabsorbing 400,000 men into civil life. In peace as in war he gave Australia a bold and brave lead, and a gift of £25,000, raised by private subscription, showed that some at least of his countrymen were not ungrateful. But he could not prevent discontent revealing itself in the secession of certain Liberal-Nationalists and the formation of a new Country party. As the conditions which had brought it into existence disappeared, the War party which he led began to crumble, and in Feb. 1923, after holding office as Prime Minister for eight years, he was forced by a Liberal-Country party coalition to resign in favour of the Treasurer, Mr. S. M. Bruce. Then, a leader without a party, he stood aside and awaited his chance. (G. C. D.)

HULL, England (*see* 13.870), with a city area of 11,854 ac., including 2,495 ac. of the river Humber, had a population in 1921 of 287,013. The port was enlarged in 1914 by the opening of King George's Dock, with an area of 53 ac. and provision for future extension to 85 ac., a large grain silo and fine equipment. The total water area of the docks is 236 ac. with 10 m. of quays. The extensive and varied traffic of Hull was much affected by the World War, as the city was in the area of the North Sea operations, but the volume of trade had almost recovered in 1926. The numerous industries include a large production of vegetable oil. There are some 300 steam trawlers in the fishing fleet, which did valuable service during the War. In 1914 the chief magistrate was created lord mayor.

New churches include St. Colomba's (1914), St. Mary's, Sculcoates (1916), St. Nicholas', Hessle Common (1915) and the German Lutheran church (1911). A Friends' meeting house was built in 1919, a synagogue in 1914 and a large Wesleyan-Methodist Hall in 1910. The City Hall and Municipal Art Galleries were opened in 1910, and the Guildhall enlarged in 1915; a statue of the 1st Baron Nunburnholme was placed in front of the latter in 1913. In 1912 a home for incurables was built and a new poor law hospital in 1914. During an air raid in that year some 40 houses were wrecked and 24 persons were killed. The council chamber at Trinity House, together with many art treasures, was destroyed by fire in 1924. The Rt. Hon. T. R. Ferens, a benefactor to the city in various directions, initiated in 1925 a fund for the establishment of a university college with a gift of £250,000. He had previously given land on Cottingham road, on the outskirts of the city, as the site of a new technical college, but this is to be made available for the university college.

HUMAN GEOGRAPHY.—Geography is defined (*see* 11.619) by Dr. Mill, as the exact and organised knowledge of the distribution of phenomena on the earth's surface. Human geography on this view would be the corresponding type of knowledge of phenomena relative to mankind. While it is possible to bring in a great deal under this heading of distributional study, yet this does not express the aim towards which many workers have striven from at least the time of Herodotus onwards.

Ratzel, Vidal de la Blache and Herbertson.—Space cannot be given for a historical survey, else we might discuss the standpoints of thinkers of many centuries and regions down to Montesquieu, Humboldt, Ritter, Le Play, Buckle and Reclus. Ratzel reacted against writers who overemphasised personality in interpretations of history. He urged that in treatises touching both history and geography the history was likely to expand unduly. His anthropogeographic studies discuss especially the human relations of natural features and his method has been developed by Miss Semple into that of a study of influences of geographic environment. Some workers on these lines have failed to see how much of an "environment" has been made by man's previous work. Vidal de la Blache made a special contribution to the clarification of thought on human geography. For him the study of place is the foundation and the place-relations of modern life are the centre of interest. Proceeding from description to interpretation, he was led to look upon those place-relations as stages in long courses of evolution from the past towards the future. Indeed the realisation of the time factor is a great feature in all his work.

He again has contributed markedly to the idea of man as an agent modifying the world about him, influenced by the stage of human action as he found it, but also doing much to make the setting wherein his successors are to act their parts. One of his typical statements may be rendered thus: "The personality of a country, its *genius loci*, is not a matter given beforehand by

inanimate nature, it is in large measure a product of the activity of man, of an activity which confers a unity on matters that would otherwise lack it," and again, " If a region has personality, it has been gained through the effort of its successive inhabitants." He saw, as did Herbertson, that the *genius loci* changes with the spirit of the time. In a sense, then, the student of human geography aims at picturing the settings of the stage of human activity at all places and at all times, even if he is primarily concerned with the present. If he limits himself by not looking back to the past out of which the present has come, he is not likely to be able to glimpse the future arising out of the present, and his work will be still-born.

Evolution and Human Geography.—It is obvious from what has been said here that human geography is a daughter of Darwinian thought, for Darwin brought to a head the problem of relations between organisms and environments and their influences upon one another, and for him also the present was but a stage in the succession from past to future. The application and modification where necessary, of the thought brought to fruition by Darwin, has occupied the minds of biologists ever since. The stages of conquest of the land by backboned animals from fish-like beginnings up to the varied orders of mammals are being worked out in ever increasing detail, and equally the dead-ends of evolution, the extinct orders, are followed to their disappearance.

The extension of Darwin's point of view to man has proceeded some distance, but, in the study of man's relations with his environment, that extension meets with difficulties largely because of the highly varied fields of study, which must necessarily come, whether directly or indirectly, into consideration. Outlines of the progress of men's relations with their environments from the earliest days of stone to the latest days of steel are being worked out in many ways, and also, just as in the study of animals, dead-ends, such as the jungle-covered cities of Ceylon, the monuments of Easter I., are receiving attention from many points of view, including that of the geographer. At the same time, it is well that one should guard against too ready acceptance of theories of determinist sequences in history such as those suggested by Flinders Petrie and Spengler.

Culture Origins.—It is unfortunately as easy as it is dangerous to argue, largely *a priori*, that a given environment produces certain results in human culture, and there have been thinkers who have argued that numbers of the more fundamental inventions such as metal tools, pottery, cultivated wheat, domestic cattle have been made independently in several regions as parallel responses to the influences of those environments. Enquiry has thrown doubt on several of these conclusions and many now think that food production had one localised origin, while probably the same conclusion is true for pottery (*see* ARCHAEOLOGY; SOCIAL ANTHROPOLOGY). The varying spreads of these main folk-inventions, probably quite as much by contacts as by migrations, have been important means of modifying men's relations with their surroundings far from their place of origin. Thus is introduced into the study of the setting of the scene of man's activity a cultural-historical element, and geography is brought into close relation with folk-history. Geography studies the scene, history the sequence of the action, but both need the sister science of anthropology in its widest sense, the science which analyses the types of man and of his forms of expression.

Geography, History and Anthropology.—In the study of men's life and work on earth there is thus special opportunity for co-operation of human geographer, historian and anthropologist, the first contributing his survey of the factors of place in men's work, the second elucidating the time-sequences, and the third helping to discriminate types of humanity and of human expression involved. It is on the increase of such co-operation rather than on more definite separation of studies that hopes for a great future advance of knowledge in human affairs depend.

The great man of history is often the man who has a special dynamic vision of the world about him, who sees whither the minds of multitudes are tending and what the work of contemporary pioneers will mean in the coming days, and he crystallises out inchoate thoughts. He thus depends very much upon the scene as he finds it. With Francis of Assisi and with Peter the Great, for example, we have the personal factor of vision, energy and initiative extraordinarily developed, yet even here the scene whereon they play their part has its influence upon that part, and the geographer, with his spatial discipline, his study of place, has his share to contribute towards the interpretation even of these mighty personalities and of their work.

If human geography works, especially at the analysis of place relations of mankind, it is deeply concerned both with the comparison and classification of the scenes of human work and with studies of distributions of human phenomena of every kind. For their interpretation it seeks to relate these distributions to one another in order to see how one influences another in the present, and how one in the present has been influenced by another from the past. The collection of data for maps, and the creation of maps which picture the data collected in the most useful way for study of their mutual relations is thus one of the tasks of the human geographer, a task as yet only begun (*see* FOLKLORE).

Culture Distributions.—Among the studies of cultural distributions made in order to get a picture of life in various environments and to suggest interpretations thereof, one may mention especially those of Clark Wissler in North America, and refer the reader to, *inter alia*, his study of *Man and Culture* (1923).

The discussions which followed, for example, the publication of Jovan Cvijic's *La Péninsule Balkanique* (1918) with its studies of cultural distributions show how much need there is for co-operation between students of types, be it of houses or other forms of human expression, and students whose aim is that of the human geographer, namely, the statement of the setting of the stage of human action.

The human geographer utilises, with understanding, the results of his colleagues' work, but concentrates on his own task, his study is the study of places, but in the idea of place are included the features of the place which are due to man's work. He needs that understanding of his colleagues' work, perhaps most of all as a protection for himself against the ascription to influences exerted by the place under discussion of features which may be imported or which may have arisen through other types of sociological influence such as those elaborated by Rivers (*v. inf.*). At the present stage of development, there is scope both for the human geographer, who will concentrate on the picturing of the scene and for the worker in the border zone, who may try both to make the morphological analysis of the facts discussed and to picture the setting of the stage as far as he can.

The anthropological student with his morphological discipline distinguishes types of men, of material objects or of customs or forms of expression in language, and he then seeks their relations with one another and is thereupon impelled to map their distribution in space. In this way, for example, he is led to see a great awakening of life near the western shores of Europe at or just before the dawn of the metal age. He sees the germ of that life developing in the west of the Iberian peninsula, according to some from local, according to others from imported, seeds. He follows the new life to the Garonne estuary, the south and west coasts of Brittany, Ireland and even farther. To make his story live he needs the help of the human geographical point of view accustomed to picture man's relation with environments. The study of copper objects and their successors in bronze must be far more than merely a classification of types.

Human geography can help archaeology (*see* ARCHAEOLOGY) to see the setting of the life of the bronze age. And on the other hand, the human geographer, who is trying to see the modern relations between man and environment in what we may call the Celtic fringe of Europe will miss a great deal unless he appreciates the early days of metal and has some notion of the inheritances those days have left to our own. With this equipment the human geographer is enabled to avoid the gross error of seeking to state the relations of particular men to their particular environment solely in terms of relations observable at present, as well as the other gross error of stating that such relations have come into existence on the spot at which they may now occur.

Culture Spreads and Contacts.—Few thinkers have done more in our day than the late W. H. R. Rivers, to show how spreads of culture have altered men's relations to their environments. He worked just outside the sociological frontier of geography and emphasised not only the apparent naturalisation of imported elements of culture, a naturalisation sometimes so marked that *a priori* arguments could easily be constructed to show that these elements of culture must be native, but he has also shown that there is much more in the matter. Importation of elements of culture has often led and still often leads to the weakening of local custom, that is to the removal or abrogation of ancient habits. He has shown that, in some cases, the weakening affects so much that the whole life of the people concerned is dislocated beyond repair and they die out (*see* ANTHROPOLOGY, APPLIED). Sometimes the weakening of old custom due to new contacts has avoided this catastrophe, but has been sufficient to set free a large amount of human initiative and effort. In such cases, new features have appeared that are the result of the play of this liberated initiative, but quite probably have no close relationship to the imported elements of culture. These last acted as the ferment; their direct part in the ultimate result may be small enough.

Especially following Rivers' work and that of the "Kulturhistorische" School in Germany, the study in cultural distributions has had its importance increasingly recognised. We see far more fully than heretofore some of the founts of human initiative, of human influence over environment. We appreciate in a deeper way the fact that men may knit widely differing relations with one and the same region, for we see how much will depend, for example, on the dominance of ancient custom in one case and the importation of cultural elements and associated liberation of initiative, or it may be its destruction, in another. The contrasts between native Patagonian huntsmen and Welsh agricultural immigrants at Chubut illustrate these points.

We see also the wide bearings of the principle illustrated, for example, by the commonplace fact that railways began by linking together places already in existence and then went on not only to modify them and their activities, but also to create new centres, in England new groups of factories, new suburbs, new watering places, in Canada new capital cities, new agricultural lands and the like.

Synthetic Regional Studies.—One of the most appropriate tasks of the human geographer is the study of a particular region, as the setting of human life, and multifarious have been the recent efforts in this direction. Vidal de la Blache wrote his classic *Tableau de la Géographie de la France* (1903) and his followers have written monographs on several of the "pays" or natural units of human life in that country. The monographs vary greatly in value, but on the whole avoid fairly well the errors in the argument of physical determinism. There cannot be said to be a physical predestination of the special developments of human activity in a particular region, the efforts of man, the contacts of autochthones and immigrants and their consequences, all need to be brought into the story. A distinguishing feature of the monographs of this school is the intimacy of the writers with the district about which each writes; that intimacy and attachment have been emphasised by Herbertson and by Younghusband as valuable aids in serious regional study. In several of the monographs in question, on the other hand, there is a lack of maps of cultural distributions especially as regards distributions giving clues to the local beginnings of civilisation; historic documents, however, are widely utilised. J. F. Baddeley's *Russia, Mongolia and China* (1919) and Sir M. A. Stein's *Serindia* (1921) are monumental works on their respective regions which have appeared recently, while Hilton Simpson has made studies of the people of the Aures massif. New works on regional planning for Dublin, Deeside, Doncaster and East Kent are valuable examples of applications of the regional study of human geography.

Scope of Human Geography.—In this province of study of a region and in that of study of cultural, including commercial distributions, the work of the human geographer is well recognised even if he be held to need for this work some systematic knowledge of allied sciences that his work must necessarily touch. The subject of general human geography is, on the other hand, still at such an early stage of development that its content and scheme are still subject to argument.

Huntington.—Ellsworth Huntington's attempt to give a scheme avoids a claim to be more than a sketch to help young students to form pictures of the world about them. He treats of men in relation to location, land forms, bodies of water, soil and minerals, climate, vegetation, animals and other men. For him the subject is a mass of problems of the relations between environment and human activity. In the course of the work, he touches upon the very deep problem of the relation of man to climate, of his varying energy and initiative in different environments and he thus introduces study of man along with study of place, with this justification, namely, that such study of man is essential if there is to be a reasonable picture of men in their various environments.

Schrader.—F. Schrader, towards the end of his life, sketched a characteristic policy for the development of human geography in the 20th century, suggesting that with the modern development of world-wide connections there was an immensely increased practical need for increase of our knowledge and our sense of the natural laws which rule material and spiritual exchanges of activity between man and the world. Geddes has long emphasised the need for correlated studies of place, work and folk, but without detaching from this wide general task the special part which the geographer should undertake, unless it be that of place.

Brunhes.—Brunhes has made an attempt to be more systematic and has suggested human geography as the study of all those facts of the surface of the earth in which human activity plays a part. He tries to work out first the facts of such occupation of the soil as is not directly productive, and treats especially houses and roads; then he takes up man's work with vegetable and animal material for productive purposes; next he takes up man's destructive influence on plants, animals and inanimate materials. Subsequently, after giving analyses of the social life of a number of natural units of humanity, he proceeds to study the bearings of his earlier pages on growth of human society and its organisation. The debt of this writer to the thought of the sociological school of Le Play seems to be considerable.

De la Blache.—Vidal de la Blache left at his death notes for a large work and these have been arranged for publication. Starting as do both Schrader and Brunhes with the idea of the world's effective unity, he makes the study of the distribution of population the first concern of human geographers, who must try to follow its forms of nucleation and its types of scattering, its migrations and oscillations. Following this, he considers in regional succession the great agglomerations of human population. In the second place, he includes study of the forms of civilisation to be pursued, especially regionally, but apparently to be discussed under subjects such as materials, food, constructions, sites, habitations and so on. In the third place, he proceeds to the study of the circulation of men the world over, roads, railways, sea-transport and so on. It was evidently his intention to proceed to survey the evolution of races and the dispersion of cultures, and he sketched maps of the distribution respectively of animal and of vegetable products used by man and of constructions which may be supposed to be autochthonous in different regions of the world.

Commercial and Political Geography.—G. G. Chisholm's encyclopaedic work, *Commercial Geography* (1889–) may be looked upon as a type of study of a special subdivision of human geography, which has a peculiar importance for practical life. Several other recent works have discussed commercial or economic geography with a considerable measure of success.

A few words on political geography may be added. Ratzel is here one of the chief pioneers and his followers in most countries make the state the unit of treatment, describing and sometimes seeking, to interpret the physical, demographic and economic facts of each state. A large body of material for political geog-

raphy has been published in the British Foreign Office and Admiralty handbooks designed to assist discussion of the treaties of recent years. This study is in a sense an applied development of general human geography; in another sense it is an alternative study. Human geography in the stricter sense could not at all generally accept state frontiers as natural boundaries for divisions of its discussions and might well seek, as in some recent studies of frontiers, the geographical interpretation of those boundaries which are in essence human facts.

Conclusion.—The contrasts between Huntington, Brunhes and Vidal de la Blache are evident. In Huntington's work we find the emphasis on man; in that of Brunhes the main emphasis is on work; in Vidal de la Blache, the repeated efforts towards serial consideration of regions gives emphasis to place. But all see that studies of forms of civilisation occurring in various environments, *i.e.*, that studies on a regional basis are a fundamental task; and all bring out the impossibility of the attempt to delimit at all strictly mutually exclusive spheres for what may be called human geography and anthropology. It is possible at present only to urge that, in the latter, the main object of study is man, his various physical, social and other forms, *i.e.*, primarily morphological.

In human geography, on the other hand, the main object of study is place relations of men of all kinds, and of any or all of their forms of expression the world over. The place relations of the present day are not the only legitimate objects of study. We need the study of these place relations in the past as well if we are to have an eye to the future, but it is the present that gives us the truest starting point, for it is here that we may observe most directly how man influences and is influenced by environment. From a study of the present, also, as from nothing else, we may be led to say that man and his surroundings are changing together, and that we cannot set man and environment in opposition to one another, save for convenience of discussion, and with the full consciousness that as we do this we deliberately sacrifice something of the concrete reality. We may accept these drawbacks for the sake of reaching generalisations of a manageable kind, but we must recognise the incompleteness that is a necessary consequence.

There is reason to hope that, on the one hand, regional studies will progress and that on the other hand studies of distribution of men and of their forms of expression, present and past, will be deepened. The first will need intimate acquaintance, loving familiarity, to use Herbertson's phrase, as its starting point, and, however much it may concentrate on the present, it will need to consider the past at every turn; it may well need also to bring into its purview some results of study of the differences between man and man; it must remember that the environment presents to man opportunities and difficulties, possibilities rather than compelling influences. The second will need increase of emphasis on the study of the places involved and the possibilities they offer or deny; that is to say, the student of place will be called upon to play an increasing part here, but it remains obvious that the student of the morphology of the forms of expression studied is equally important, and this is a field especially for a combined effort of students of place, time and type in relation to human beings and their forms of expression, both material and spiritual.

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HUMPERDINCK, ENGELBERT (1854–1921), German musician (*see* 13.891), died at Neu Strelitz Sept. 27 1921. His last opera, *Die Marketenderin*, was played at Cologne in 1914.

HUNEKER, JAMES GIBBONS (1860–1921), American musical critic, was born at Philadelphia Jan. 31 1860. He graduated at Roth's Military Academy, Philadelphia, and was a law student for a time, subsequently studying the piano in Philadelphia, Paris and New York. He was teacher of the piano at the National Conservatory, New York City, 1886–98, becoming musical and dramatic critic for the New York *Recorder* and *The Morning Advertiser*. From 1900 to 1912 he was musical and dramatic critic for the New York *Sun*. In 1912 he joined the New York *Times*, but returned to *The Sun* in 1919. He died in Brooklyn, N. Y., Feb. 9 1921. His writings on music, literature and art are notable for their style and popular appeal. His published works include *Chopin: the Man and his Music* (1900); *Overtones: Music and Literature* (1904); *Franz Liszt: a Study* (1911); *Ivory, Apes and Peacocks* (1915). He also supplied the text for Josefy's edition of Chopin's works.

HUNGARIAN LITERATURE (*see* 13.924).—Hungarian literature at the beginning of the 20th century was on the brink of a revolution. The intellectual life of the country was undergoing a crisis. After 1,000 years of a history sometimes glorious, but more often tragic, Hungary was faced by new difficulties which threatened her very life: the social question, the defence of her civilisation and her language against the Slav and Teutonic races, and the antagonism between the essentially rural nature of the Hungarian people and the Americanism and cosmopolitanism of the capital, Budapest.

Writers were divided into two camps: the traditionalists and the moderns. This division still persists. The older generation, inspired by Hungarian nationalism, had joined in the celebration of the country's 1,000th anniversary in 1896 and had accepted modern civilisation but remained firmly opposed to cosmopolitanism and radicalism. They still longed for the Hungarian steppes and the old folk songs. From this generation originated what is known as the Turanian movement, which draws its inspiration and its themes from the East and endeavours to arouse in the Hungarian people the consciousness of their non-European origin. The numbers of this older generation diminish year by year. The patriotic and classical poets, Joseph Lévay (1825–1918) and Alexander Endrödi (1850–1920), followers of Jean Arany, towards the end of their lives burst again into song. In 1910 Hungary lost the novelist Koloman Mikszáth, the most notable successor of Jókai, the immortal painter of the Slovak peasant and the aristocracy of Northern Hungary. Among contemporary writers of this school are the poets Jules Vargha and André Kozma, the novelist Ferencz Herczeg and the critic and essayist Eugene Rákosi, their organ being the review *Budapesti Szemle*, edited by Géza Voinovich.

In opposition to the older generation were the moderns, who hailed the advent of capitalism and industrialism in place of the old provincial spirit. These intellectual radicals wished to eliminate from literature all national characteristics, and to promote the cause of realism with its materialistic philosophy. They turned their faces towards the West, not the chauvinistic West, but the home of cosmopolitanism and anti-nationalism. The moderns gathered their forces in the early years of the 20th century, using as their rallying point a review with the symbolic title *Nyugat*, edited by Ignotus. Round it gathered the young poets of the symbolist and romantic school.

Chief among these men was André Ady, an original Magyar genius, whose primitive and prophetic gifts place him in the first rank of Hungarian poets. Influenced as he was by French symbolism as well as by the works of Zola, he drew inspiration also from the days before the school of Arany, from the melancholy, sometimes crudely expressed, Protestant hymns of the 16th century, from the songs of the rebels against the Austrians, from the archaic and primitive beauties of the Hungarian Bible. His robust language and brilliant vision illumine the depths of the soul. He tilts against conventional morality and describes love with all the voluptuousness of the realist: a trait which is, in fact, common to all the moderns. He is distinguished by a certain aristocracy of mind, as, for instance, in his attitude towards the Nietzschean cult of the Ego, but in his general outlook, and in his hedonistic glorification of blood and treasure, and above all, in his sympathy for the poor and despised, he inclines towards Socialism.

Compared with him, modern lyrical poets such as Michael Babits, Jules Juhász, Désiré Kosztolányi, Árpád Tóth, Gabriel Oláh, Ernö Szép have confined themselves to pure aestheticism, seeking to express the emotions of a cultivated, almost neurasthenic, minority. The realistic novelists found a successor in Sigismond Móricz, whose preoccupation with brutish peasants and corrupt petty tradesmen reflect his political tendencies. His work is the antithesis of that of idealistic novelists such as Géza Gárdonyi (d. 1923) and Cécile Tormay.

When the World War broke out, these two camps, the traditionalists and the moderns, were still divided by a great gulf. Cosmopolitan literature was silent for a time. The poets of tradition hailed the conflict with acclamation. One poet, a soldier, Géza Gyóni, in a language learnt from the moderns, turning his back on *l'art pour l'art*, succeeded in expressing the horrors and pathos of the War. The moderns were not long in making themselves heard, but, as might have been expected, their pacifist leanings were only accentuated by what had happened. Far from joining in the martial chorus which then predominated, their symbolist and decadent verse reflected the trouble in their souls, whilst glorifying man and life.

The final disaster, and the revolution of Oct. 1918 unmasked the political connections of *Nyugat;* its contributors joined hands with the rabble. In the intoxication of the first success the moderns threw off the mask. Their review declared itself to be definitely on the side of the revolution and of Count Karolyi. They looked forward to the end of the old feudal agricultural Hungary, the Hungary of officialdom, of the nobility and of the nationalist writers grouped around both.

During its four months' reign Bolshevism kept literature under strict control. Newspapers were suppressed and the right of publication withdrawn. A single publisher held all the world of thought in fee: the State printed nothing but propagandist papers and pamphlets. The socialised theatres were forced to produce plays in celebration of the revolution. Futurist and expressionist writers alone were protected and subsidised by the "literary directory." This upheaval brought no good to literature. Expressionism pushed to extremes led nowhere.

After the fall of communism, literature set itself to assist in the task of national regeneration. With no definite theories of art or literary programme it expressed the grief of the divided country and its longing for the lost provinces. Although historic Hungary was divided into five parts, Magyar literature kept its unity. In political Hungary the novel took the place of the lyrical poetry of the pre-War period. Désiré Szabó, in his loftily conceived work, describes the great cataclysm of the World War and the determined defence made by the Hungarians, in both the material and moral spheres, against the foreign invader.

Hungarian literature from this time onward endeavoured to break the bonds of torpid decadence and of anti-national radicalism, and to place before a people, struggling in the shadows of adversity, a new conception of the world which should be healthy, energetic and modern, thus again proving that Hungarian literature has always been something more than a mere exercise in aesthetics. Modern drama is striving to create new and lasting values, both poetic and philosophical. Romanticism has reappeared, and talented dramatists such as Ferencz Herczeg, Ferencz Molnár, Louis Biró and Melchior Lengyel have attained to well-deserved success in the theatres of Europe, and even in those of America. Realism and purely theatrical effects have, for the time, being quite vanished from the Hungarian stage.

In discussing Hungarian literature we must not forget that of the lost provinces of Hungary. In Transylvania in particular there has been a remarkable renaissance. The reawakening of a feeling for the mother country has also made itself felt in the Northern Carpathians. There, poets such as the Transylvanian Végvári often express under pseudonyms the sadness which, as Magyars, they cannot but feel.

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HUNGARY (MAGYARORSZÁG, *see* 13.894), an independent kingdom of Central Europe. Previous to 1918 Hungary formed part of the Austro-Hungarian Empire, whose monarch was Apostolic King of Hungary. The Lands of the Hungarian Crown had an area of 125,402 sq. m., of which Croatia and Slavonia, which were in political union with Hungary, occupied 16,420 sq. miles. The census of 1910 gave the population of Hungary as 20,886,487, including 10,050,575 Magyars (for racial statistics *see* AUSTRIA-HUNGARY). The Treaty of Trianon (*see* TRIANON) in 1920 deprived Hungary of all Croatia, Slavonia and Transylvania and much of Hungary proper. Her new frontier runs as follows:—

Starting from the junction of the Czechoslovak and Austrian frontiers near Bratislava, southeast to the mouth of the Ipel river, then along its course to a point 10 km. below Lučenec; hence southeast above Salgotarján, northeast up to a point lying 20 km. south of Košice, southeast above Sátoraljaújhely to Csap, thence along the Tisza to the junction of the Rumanian and Czechoslovak frontiers. After running west of the Satul Mare Oradia-Mare line, it turns west, and runs south of Makó to the Yugoslav frontier below Szeged; hence south of the junction of the Maros and Tisza southwest to a point on the Dráva south of Pécs; hence west and northwest along the Dráva to the mouth of the Mur; along the Mur, then north to Szentgotthard; hence north to Köszeg, then makes a loop to include Sopron, crosses Lake Neusiedler (Fertö), thence north to the Czechoslovak frontier.

The area comprised within these frontiers is 35,916 square miles. Population (1920), 7,989,143. Of these 7,147,530 were Magyars, 551,211 Germans, 141,882 Slovaks, 23,760 Rumanians, 36,858 Croats, 17,131 Serbs, 1,500 Ruthenians, 69,271 other races. Some 3,250,000 Magyars were living within the frontiers of Czechoslovakia, Rumania, Yugoslavia and Austria (*see* MINORITIES). The Treaty took from Hungary all her gold, silver, copper, salt and mercury mines; all but one of her iron mines; her largest and best collieries; and 86% of her forests. The only branch of productive territory of which she retained over half is viticulture (68%). The strongest social element left to her was her peasant class (4,449,105 persons were engaged in agriculture). There was a very large intellectual class, composed largely of ex-state employees formerly resident in the territory of the present Succession States, the settlement of which formed a grave problem.

I. POLITICAL HISTORY

At the fateful Crown Councils of July 7 and July 19 1914, the only person present who opposed the idea of an attack on Serbia or any measure beyond the formulation of severe but acceptable demands to Serbia was Count Stephen Tisza, then Hungarian Minister President. Thanks to his influence alone, a passage was entered in the minutes of the second council as follows:—

The Common Cabinet Council, on the motion of the Minister President of Hungary, decided that immediately after the commencement of hostilities the foreign Powers should be notified of the fact that the monarchy was not waging a war of conquest, and that it was not the object of the monarchy to annex the Kingdom of Serbia.

Tisza, however, made no statement on his conduct until Oct. 17 1918 when he mentioned it in the Lower Chamber of the

Hungarian Parliament, enumerating the documents in which it was recorded (*see* AUSTRIA-HUNGARY).

The Collapse of the Monarchy.—The causes of the catastrophe of 1918 were partly internal, partly international. After the death of Francis Joseph I. on Nov. 21 1916 the rule of the Dual Monarchy gradually lost its character of stability. Austria was already weak; and the dismissal of Tisza (May 22 1917) made Hungary, too, helpless. However, as the armies of the monarchy still occupied considerable enemy territories, few people thought of the possibility of its sudden collapse. The protracted war had become extremely and increasingly unpopular. The general desire for peace and the weak and irresolute policy of the Government contributed to encourage the defeatist agitation. The peace propaganda was furthered by the publication on Jan. 8 1918 of President Wilson's Fourteen Points, which were accepted with implicit faith by the Hungarian people, who have always shown a sincere enthusiasm for the great ideas of mankind. The return home of large numbers of soldiers released from Russian captivity after the Treaty of Brest-Litovsk (Mar. 3 1918) furthered the growth of communistic and anti-militarist ideas, which were enormously strengthened by the privations and suffering caused by the blockade. Only on the capitulation of Bulgaria (Sept. 29 1918) did the situation become quite clear. The revolutionary movement now ceased to be a merely sporadic phenomenon; foretokens of the coming upheaval became everyday occurrences.

The first signal of the process of upheaval was a demonstration of students on Oct. 25, the crowd being, however, dispersed by the police. The same day the so-called National Council was formed, with Károlyi as its president, together with a soldiers' council and a students' council. Lieut.-Gen. Baron Lukachich, who had been appointed military governor of Budapest, suggested that Károlyi and the members of the National Council be arrested; but the suggestion was not approved by the Government just resigned. Two days later the National Council issued a proclamation with the title "Amnesty and land for the soldiers," which foreshadowed the coming of Bolshevism. Now events succeeded one another with bewildering rapidity. Two companies ordered to the front mutinied and, joining the groups of demonstrators during the evening of Oct. 30, attacked and seized the headquarters of the commander of the garrison, the telephone exchange and the general post office. Gen. Lukachich telephoned to Vienna for instructions, but the King refused to consent to the employment of the armed forces at the Baron's disposal. By the morning of Oct. 31 the town was completely in the hands of the revolutionaries; Károlyi was appointed Prime Minister. His Cabinet included principally persons without seats in Parliament, Social Democrats and Radicals; of the parliamentary parties only the Independence party (Kossuth party) was represented in the Government, several of the ministers chosen by Károlyi belonging to it.

The same afternoon Count Stephen Tisza was murdered, probably by emissaries of the soldiers' council. His friends had repeatedly warned him; but he had remained in Budapest in a final effort to unite all the elements of order against the rabble. Tisza knew how critical was the situation and he knew that he was threatened by death. The followers of Károlyi ordained as a national holiday the very day on which they laid Tisza low. On the other hand, it appeared to Károlyi's opponents that with the disappearance of a formidable antagonist he lost his personal initiative and became little more than a puppet in the hands of Jászi, the Radical party and the Socialists.

The first measure taken by the new Government was to demobilise and scatter in all directions the soldiers pouring back from the front. The war minister—Béla Linder—declared that he "did not wish to see soldiers"; and Hungary was thus disarmed and rendered powerless both to stem the internal anarchy of the country and to resist occupation from without. The first result was universal looting and robbery; then followed the invasion of the Czechs, Rumanians and Yugoslavs. The Czechs were able to occupy the almost impregnable fortress of Komárom on the Danube without striking a blow, for the troops of occupation met not the slightest resistance anywhere. In vain did the inhabitants everywhere protest against the occupation; the Government was both unable and unwilling to do anything to lend weight to their protests.

On Nov. 1 the Austro-Hungarian delegates had met the Italian

generals Diaz and Badoglio to conclude an armistice. Point 3 of the conditions enunciated was that the Austro-Hungarian troops were to evacuate all enemy territory occupied in the War; a line of demarcation was drawn in the southwest; elsewhere it was to consist of the former political frontier. Gen. Weber, who was authorised by the Hungarian Govt. to negotiate for Hungary, accepted these conditions in the name of Hungary. Károlyi and a delegation of his Government, however, believing that he could get better terms from the Entente, called on Gen. Franchet d'Esperey in Belgrade, who concluded a separate "military convention" with them on Nov. 13. This fixed a line of demarcation well within the old political frontier (Bistrita-Nagy-Szamos-Marosfalli-Subotica-Baja-Pécs), the line of the Drava. Hungarian troops were to withdraw behind this line, but Hungarian police, gendarmerie and civilian control would continue to function. The Allies were entitled to occupy any towns or other points of strategic importance but would not interfere with the internal administration. Hungarian troops were to remain to secure the line of demarcation.

In fact, however, the occupying troops, backed by the inter-Allied missions in Budapest, denied Hungary any sovereign rights in the territory outside the line of demarcation; assumed the civilian administration, removing the Hungarian officials; disarmed the gendarmerie and police; set up an economic boundary; interrupted communications; forced inhabitants to take an oath of allegiance to themselves, and even pressed them into military service. It thus became abundantly clear that Károlyi could not obtain better terms from the Entente, and his popularity at once began to wane.

Proclamation of the Republic.—On Nov. 13 Charles IV. issued the Eckartsau manifesto, declaring that he "resigned all share in the conduct of state affairs and was prepared in advance to accept any decision to be taken by Government respecting the future form of government of Hungary." The Károlyi Govt., without consulting Parliament, at a mass meeting in Budapest proclaimed Hungary a republic (Nov. 16). Under pressure from the Government the House of Deputies proclaimed its dissolution; the only protest against this arbitrary measure was that contained in the declaration read by Baron Wlassich, president of the Upper House (House of Magnates), who at the same time announced that the Upper House had adjourned its sittings for an indefinite period. The counter-revolution received legal sanction from the illegality of the proclamation of the republic. William Böhm, who was Minister of War under Károlyi, writes that there were 50 cases of riot, most of them involving fatal consequences, while 14 different military formations were raised to deal with the counter-revolutionary movement. Complete anarchy prevailed in the administration. The Government admitted that the "national councils" of the provincial towns were daily guilty of grave abuses but alleged that it was powerless to prevent them. Jászi admitted that they had made a revolution without having any men to do the everyday work.

Not only did they fail to do anything to save the territorial integrity of Hungary, they were even incapable of achieving any radical reform. They were not satisfied with a mere republic, "it had to be a people's republic." The plebiscite promised by the National Council was never held by the Károlyi Govt., for their few months of power yet sufficed to make them not dare to appeal to that national public opinion in the name of which they consistently spoke and acted. Károlyi was proclaimed President of the Republic on Jan. 11 1919 and on Jan. 19 formed a Cabinet under the presidency of Denis Berinkei, then Minister of Justice. It had no proper support either among the bourgeoisie or among the socialists; yet it created a whole series of laws and ordinances. Never had there been so rapid and so general a promotion of public employees, for the older employees were in general regarded as unreliable Following the precedent of the United States Károlyi as "provisional President of the Republic" took part in the Cabinet Councils and frequently spoke at these meetings.

There were two questions of first-rate importance: universal suffrage and land reform. A protracted discussion preceded the drafting of an ultra-modern suffrage bill (drafted and passed *intra muros*, without reference to Parliament, which did not exist). But the bourgeois parties were beginning to recover from their apathy. The suppression of individual liberty, the intimidation of the bourgeois press, and the policy of internment at last began to change their initial lethargy into a determination to rally their forces; and it was already clear that a very strong Catholic party would contest the elections; consequently, Government continually postponed the elections and finally manoeuvred them off altogether. Nor did Government materialise the promised scheme of land reform.

The Allied Powers meanwhile bombarded Hungary with ukases. Col. Vyx, their representative in Budapest, permitted the Czechs, Rumanians and Yugoslavs to pass at will beyond the line of demarcation. The Government still maintained that a "peace by agreement" would follow; shortly afterwards, however, the radicals and Jászi resigned from the Cabinet, which was now clearly lacking the support of public opinion.

The Soviet Republic.—The agents of the Russian Soviet had long since begun their work in Budapest. Béla Kun, who had been sent home from Russia to organise the Hungarian Soviet, had been in Budapest with some associates since Nov. 19. These men had money; they were daring and active and rapidly gained a following, not only in the organised proletariat but also among the socialists and the "intellectuals." They arranged demonstrations among the soldiers returned from the front; they demanded the payment to these men of immediate relief. Continuously increasing their demands, they gained larger and larger masses to the cause of revolution. On Feb. 20 1919 a mass meeting of unemployed yielded entirely to Communistic influence. To intimidate the Socialists they attacked the offices of their organ the *Népszava*, killing seven policemen and wounding 80. After protracted discussion the Government imprisoned Béla Kun and his followers. The funeral of the murdered policemen was a gigantic demonstration of the people against Bolshevism and in favour of Socialism. It seemed as if Bolshevism had been finally overthrown.

On the morning of March 20, Col. Vyx handed Károlyi a note establishing a new neutral zone between the Hungarian and Rumanian troops. This area comprised some 2,000 sq. m. of predominantly Magyar territory. Vyx afterwards stated that the zone was to be purely neutral, remaining under Hungarian administration. Károlyi contended that Vyx had stated that Rumanian troops would occupy this area. At a Cabinet Council the same evening Károlyi resigned as President of the Republic, and a resolution was passed that, as the Coalition Govt. saw no prospect of solving the political crisis or of ensuring production, the Social Democrats must take over the government. The Socialists, however, were too weak unless supported by the Communists. On March 21, at noon, the Socialists decided to come to terms with the Communists, undoubtedly at Károlyi's personal instance. It is true that the difficulties were numerous; but Károlyi and Jászi had been unequal to them. The hopes aroused by their promises had not been fulfilled and their phase of the revolution had ended in chaos.

The agreement between the Socialists and Béla Kun was made in the prison. The Communists dictated and the Socialists accepted everything. The whole Social Democratic party united *en bloc* with the Communists. Pending the decision of the Third International the new party was styled "the Socialist party of Hungary"; it was to take over the power at once in the name of the proletariat; the dictatorship was to be wielded by the Labourers, Peasants and Soldiers' Council; urgent steps were to be taken to organise a "class army" and completely disarm the bourgeoisie; a reign of terror was to be proclaimed to ensure the rule of the proletariat; a close military and spiritual alliance was to be made with the Russian Soviet.

By the evening (March 21 1919) the streets were in the hands of armed Communists; at 6 P.M. the public prosecutor visited the prisons to release the prisoners. At the head of the governing council was placed Alexander Garbai, a bricklayer. His asso-

ciates in the council of people's commissaries were Kun, Joseph Pogány, president of the Soldiers' Council and Sigismund Kunfi, a secondary school teacher who had been a member of Károlyi's Cabinet. The people's commissaries and practically all the leading persons were Jews, a fact which explains the anti-Jewish feeling which later prevailed in Hungary. Károlyi's revolution had been in part an imitation of that of Kerensky; Hungarian communism took Lenin as its model, though Lenin is said to have warned Béla Kun to take into due account the fact that conditions in Hungary were essentially different from those prevailing in Russia. As the majority of the people's commissaries had been prisoners of war in Russia, they often spoke Russian at their meetings. They ordained the " communisation " of the land, of industrial establishments, of houses and factories, of all undertakings and shops. Jewels of a value in excess of 2,000 crowns were to be surrendered; the deposits entrusted to the banks (both savings and current account deposits) were seized and communised.

From the outset there were two distinct currents of opinion in the Government: a moderate and an extremist. At first the socialist influence predominated and the action of the communists was more of a chicanery than a persecution. On April 4 Gen. Smuts arrived in Budapest to negotiate with Kun's Government on behalf of the Allies. He offered to recognise the disputed line, not as a political frontier, but as a line of demarcation only, to be bordered by a neutral zone. Kun insisted that the Bolshevik system must be introduced in the neutral zone. Smuts broke off negotiations. On April 16 the Rumanians advanced along the line of demarcation up to the Tisza (Theiss). As their position was now menaced by the danger of a counter-revolution, the Bolsheviks resorted to undisguised persecution. In Budapest alone they took 481 " hostages," and several thousands more throughout the country. The Red Army was organised, primarily to ensure the maintenance of the dictatorship. Later, when they saw that the national feeling and popular exasperation was growing even more formidable, and that terror, internment, torture and assassination could no longer keep passions in check, the Bolsheviks commenced an offensive campaign, defeated the Czechs, occupied Košice (Kaschau) and advanced up to the Polish frontier at Bardiov (Bartfa). But, after receiving Clemenceau's note of protest dated June 8, they withdrew their troops, and on June 13 were fixed the definitive frontiers which condemned Hungary to dismemberment and helplessness.

This catastrophe instilled fresh courage into the counter-revolutionaries. On June 24 the cadets and officers of the military academy, assisted by the Danube monitors, some of which were stationed in the winter harbour at Ó-Buda, assumed the offensive. On this occasion the Red Army suppressed the counter-revolution; but communism never recovered from the shock, and no one believed it could long maintain its position. As there had been counter-revolutionary movements in the provinces too, the Red Terror made its appearance. Indisputable official data have recorded the murder by the terrorists of 585 persons, including Louis de Navay, a former Speaker of the House of Deputies and one of the most distinguished Hungarians of his day; the number of persons of obscure origin who may also have fallen victims to Szamuely's thirst for blood is unknown. Throughout the Commune Budapest suffered from a disastrous shortage of provisions, due not only to the blockade, but still more to the passive resistance of the peasantry.

The Communists employed their money for propaganda purposes, particularly in Austria. Budapest lived mainly on pearl barley and vegetable marrow; anyone desirous of obtaining better food was compelled to go to the provinces and offer clothes or petroleum in exchange for meat or bread. Unrest and discontent were general; even the trade unions were beginning to turn in secret against the Soviet régime. There was a breach between Béla Kun and Haubrich, commander of Budapest and leader of the iron and metal workers. As an open rupture seemed imminent, it was proposed that the garrison of Budapest should be placed under Szamuely, the most bloodthirsty of all the Jack Ketches in the service of the dictatorship. Luckily, the Italian colonel, Romanelli—who had already collaborated with the American mission to save the lives of hostages and prisoners—prevented this baleful scheme.

On July 20 Béla Kun began hostilities against the Rumanians in the hope that his propaganda had demoralised their troops. The Rumanians defeated him easily and advanced on Budapest; whereupon the outbreak of internal discontent overthrew the Bolshevik régime. The Soviet Govt. resigned on Aug. 1. Most of its leaders fled to Austria. A Socialist Govt. under Peidl was formed, which guaranteed the sanctity of private property. On Aug. 4 the Rumanians entered Budapest. Two days later the organised bourgeoisie overthrew the Socialist Govt. in which they felt no confidence since its recent connection with the communists, and a Government was formed under the presidency of Stephen Friedrich.

The Counter-Revolution.—The restoration of a stable régime in Hungary proved extremely difficult. In May 1919 a counter-revolutionary Government had been formed at Arad—then already occupied by the Rumanians—under the presidency of Count Gyula (Julius) Károlyi, which endeavoured to act as the representative—as against the reign of terror of the Commune—of the ideas of bourgeois order, of the historical integrity of Hungary and of the principle of legal continuity. At first this was little more than a demonstration, since it lacked real power. After a few days the Rumanians sent this Government under military escort, first to the state estate at Mezöhegyes and then to Szeged which, was at that date occupied by French troops.

The Szeged Govt. began to organise a counter-revolutionary army out of a nucleus of volunteers who had distinguished themselves during the War and had fled to Szeged to escape the Bolshevik Terror. Its sphere of authority hardly extended beyond the inner confines of the town, but the authorities in occupation made many difficulties for both the military organisation and the civil administration. A certain success was achieved by the Szeged Govt. through its representatives in Vienna, under the guidance of Count Bethlen. This " detachment " kept in touch with foreign countries and informed public opinion of the West of the misdeeds of the Hungarian Soviet régime.

After the fall of the Commune the Szeged Govt. suspended its activity, and those detachments of the Hungarian national army which had been formed at and near Szeged moved their quarters to Siófok on Lake Balaton. The Government appointed Admiral Nicholas Horthy commander-in-chief of the national army.

In Budapest, meanwhile, the popular Archduke Joseph assumed the government, assisted by Stephen Friedrich as Prime Minister; but the Supreme Council in Paris refused to recognise any Habsburg in a position of authority in Hungary and sent four generals to Budapest to represent the four Principal Allied Powers. The Archduke Joseph was forced to resign. The four generals were fully occupied in thwarting the excesses of the Rumanian troops of occupation in Budapest, who plundered and destroyed property wholesale. According to the report dispatched by Col. Loree to Paris, the value of the goods requisitioned by the Rumanians exceeded 90,000,000 gold crowns (about £3,750,000). The Rumanians also aggravated the difficulty of the Friedrich Government. The Entente then deputed Sir George Clerk to negotiate as plenipotentiary delegate of the Supreme Council and pave the way for the constitution of a Coalition Government to include all the political parties with which the Entente could properly conclude peace. On Nov. 22 Friedrich resigned, and a Government, including representatives of all parties, was formed, Huszár being Minister President.

On Nov. 14 the Rumanians withdrew to the line of the Tisza (Theiss), and Horthy entered Budapest at the head of the small national army, amid the enthusiasm of his many adherents. General elections were held in Jan. 1920 on the basis of a suffrage (secret ballot) of a practically universal character. They gave a considerable majority for the parties of the Right which formed the Government alone. This was a natural reaction after nearly a year of excesses committed by the extreme Left. Those regrettable

acts of violence known and described abroad as the "atrocities of the White Terror" sprang from a similar revulsion. It is a fact that, immediately after the fall of the Commune, certain "detachments" were formed in various parts of the country, which arbitrarily executed Communists; however, such atrocities were nothing like as numerous as those committed by the Soviet régime. The victims of the period following the overthrow of Communist Dictatorship number, according to data compiled by the Hungarian Ministry of Justice:—

Victims of the White Terror	279
Killed while attempting armed resistance	9
Killed in flight	19
Total	307

By Act I. of 1920 the new National Assembly restored and once more put into force all that part of the ancient constitution which had been destroyed or eliminated by the revolutions. Act XLV. of 1921 proclaimed Hungary to be a monarchy (kingdom), the decision relative to the exercise of the kingly power being postponed to a later period. On March 1 1920 the National Assembly elected Horthy to the office of Regent unanimously and by acclamation. At the same time a law was passed defining the constitutional power of the Regent.

The Treaty of Trianon.—The Hungarian peace delegation, headed by Count Albert Apponyi, Count Paul Teleki and Count Bethlen, arrived in Paris Jan. 7 1920. On Jan. 15 it received the conditions of peace framed by the Allied Powers, to which it replied on Feb. 27 in the form of a long memorandum, which, together with Count Apponyi's speech made when handing it over to the representatives of the Allied Powers, took the view that the conditions were unjust and must lead to catastrophic results. But the leading members of the Peace Conference would not agree to a plebiscite. The delegation was, however, allowed to put its observations before the Peace Conference itself with better success. Thus, M. Millerand promised, in the name of the Allied Powers, that the boundary commissions should be instructed, where they found the new frontiers involved any economic or ethnical injustice, to appeal to the League of Nations. Unfortunately, the Conference of Ambassadors found that any alteration of the frontiers, however slight, would be equivalent to a breach of the Peace Treaty.

The Treaty of Peace was signed on June 4 1920 in the Trianon by the Hungarian delegates and ratified by the Hungarian Parliament on Nov. 15. M. Simonyi-Semadam, who had succeeded M. Huszár as Prime Minister in March 1920 with a transition Cabinet, resigned in July 1920. Count Paul Teleki, the new Prime Minister, carried through the first stages of Hungarian consolidation. There were only slight differences among the four Government parties. The orthodox Legitimists and Liberals formed the Opposition. On the monarchist question Legitimists and Free Electionists were found in Government and Opposition parties alike.

King Charles' Attempts at Restoration.—On March 27 1921 King Charles IV., misled by the general depression which followed the signature of the treaty, and ill-advised by his entourage, arrived at Szombathely, whence he motored to Budapest, driving straight to the residence of the Regent, whom he called upon to hand him over the power. Horthy replied that the nation was spiritually unprepared for so sudden a change, which might involve a grave upheaval. The Little Entente might use the restoration as a pretext to annihilate Hungary's independence. King Charles returned to Szombathely. Meanwhile the ministers of the Great Powers, of Yugoslavia and of Czechoslovakia declared that the continued residence of King Charles in Hungary might involve the most serious consequences.

On Oct. 20 of the same year King Charles and Queen Zita left Switzerland by aeroplane, landing at Dénesfa, near Sopron. The gendarme battalion stationed at Sopron joined the King, and its example was followed by other troops. The King appointed a Cabinet, with Stephen Rakovszky as Premier, and on Oct. 22 he started for Budapest, his soldiers following him. Telegraphic and telephonic communication with Budapest had been interrupted. As soon as the Government were informed of what had happened, they declared that, in view of the foreign political situation, the King was not entitled to exercise royal prerogatives in Hungary and called upon him to leave the territory of the country. The Regent sent a letter to the King explaining to him that, if he entered Budapest, this might result in the ruin of Hungary. His Majesty should come alone, unaccompanied by soldiers or by his Cabinet, and clear the situation in conference with the legal Government of Hungary and with the ministers of the Entente Powers. However, the King continued his journey, refusing all intervention. On the next morning, Oct. 23, a small skirmish took place between the King's troops and those of the Government, at Budaörs, near the capital. The King's troops retired and dispersed. The royal couple were taken to the abbey of Tihany, near Lake Balaton, there to await the decision of the Entente Powers. Yugoslavia and Czechoslovakia had already decreed mobilisation. On Oct. 31 the Conference of Ambassadors demanded the formal deposition of Charles and of the dynasty. On Nov. 3 the Hungarian Govt. introduced a bill abrogating Charles' sovereign rights, and on Nov. 5 declared that before proceeding to settle the question of the election of a future king, they will agree previously with the Great Powers represented on the Conference of Ambassadors, and will not act without their consent.[1] On Nov. 1 the King and Queen had left Hungary on the British monitor H.M.S. "Glowworm" for Funchal on the island of Madeira (*see* CHARLES).

Period of Depression.—In April 1921 Count Bethlen had succeeded Count Teleki as Premier. The international position of Hungary had been seriously shaken by the royal attempts at restoration. The tension only abated very gradually and the events at Budaörs were doubly unfortunate since they followed closely on the Venice Conference (Oct. 11 and 12 1921) by which, thanks to the intervention of Italy, an agreement had been reached with Austria that a plebiscite should decide the future of the town and environs of Sopron (Oedenburg). The plebiscite went in favour of Hungary (*see* BURGENLAND).

At the end of the Commune the Hungarian crown had still been quoted in Zurich at 20% of its pre-War value. Since then it had declined steadily. The chief cause of the financial catastrophe was naturally the historical and political collapse of Hungary, which had been followed very rapidly by a general economic crisis. From the occupied territories several hundreds of thousands of public employees and their families had been pouring into the country, and they had to be provided for by the Government. As there was a great dearth of housing accommodation in Budapest, most of the miserable refugees had to live in railway trucks, indeed, incidentally monopolising for years a considerable proportion of the rolling stock of the State railways, already grievously diminished by Rumanian requisitioning. The destitution and misery of the population was fearful; everybody everywhere demanded assistance from the state, which, despite its meagre revenue, was compelled to assist, unless thousands were to die of starvation. The state resorted to inflation and the currency soon became worthless. Business stagnated. The rate of interest at times reached 40–50% per month. Speculation was rife. No efforts of the successive finance ministers, neither the stamping of the currency notes—a measure taken to avoid a further inflation—nor the sequestration of 20% of the cash deposits, 15% of the shares and 17% of the larger estates, could remedy the situation. The rate of exchange in Zurich fell to 0·0003. One or two branches of industry—such as the textile industry—prospered, since they were protected by high tariffs and labour was cheap; but the state and a very large part of the population were faced with utter ruin.

Conditions at home required a strong Government and a working majority in the National Assembly, and such an issue could only be secured by new elections. On the expiration of the prescribed period of two years, in Feb. 1922, the National Assembly was dissolved, and the elections held in the spring gave the Government a big majority. There was, however, a strong opposition consisting of Liberals, Democrats, Kossuthites (independents), 24 Socialists and 20 "Neutrals." In order to secure the working capacity of the National Assembly, the standing orders of 1907 were revised with beneficial results. In the elections of June 1922 the Bethlen Government secured a great majority and formed the United party of smallholders, bourgeois, industrials and great landed proprietors. Out of 242 seats in the national assembly the United party secured 143,

[1] See letter from Bauffy to the Conference of Ambassadors, Nov. 5 1921, in *Engagements internationaux pris par la Hongrie en ce qui concerne la dynastie des Habsbourg.* (League of Nations, Doc. 132 and 160 of 1922.)

the Christian National United Party 32. The Social Democrats secured 24 mandates.

Count Bethlen now reconstructed his Cabinet with a programme of " the complete liquidation of the revolutionary spirit, the extension of civil rights and economic reconstruction." His main object was to ensure consolidation. The tide of extremist passion was on the ebb, and the policy of the golden mean proved most likely to achieve favourable results. The conditions of public safety were restored. The outrages perpetrated against the Elizabeth Ward Club (on April 2 1922) and against the Inn Csongrád (somewhat later) were the last attempts to subvert public order. It now became possible to set about realising the two most urgent reforms: agrarian reform and financial reconstruction.

Agrarian Reform.—The land reform question is inseparably connected with the name of the late Minister of Agriculture, Stephen Szabo de Nagyatad. To provide the landless with land a levy was raised upon the latifundia. Official figures for the period Jan. 1921 to Nov. 1925 show that 845,567 cadastral ac. (1 cadastral ac.=1·422 English ac.) were requisitioned and allotted respectively for 168,263 house sites and for the formation of " dwarf " and small holdings, while in 650 parishes 123,763 cadastral ac. were taken over for the formation of small leaseholds. Proceedings for the compulsory purchase of land for the purpose of grants to the landless have been instituted or applications for such institution filed in altogether 3,532 parishes. To carry through such proceedings, the national land distribution tribunal has dispatched judges to 3,526 parishes, and the tribunal has exercised its right of pre-emption in 300 cases, affecting altogether an area of 15,816 cadastral acres. Landed property has been parcelled out in 273 cases, the area involved being 62,328 cadastral acres.

The Reconstruction Plan.—As a result of the World War and the subsequent revolutions, the Hungarian state budget and balance of payments both showed a considerable deficit, while the unsettled reparations problem perpetuated grave uneasiness in Hungary which again made foreign capital adopt an attitude of absolute reserve. The Government was convinced that economic reconstruction was out of the question unless adequate capital was available to stabilise the crown until public finances were again balanced. The Government could only secure the necessary capital by means of a foreign loan, but there were grave obstacles in the way of a negotiation of such a loan, since, for the security of their reparation claims, the Allied States had the right to regard those claims as a charge on all the assets and revenue of the Hungarian State (". . . the first charge upon all the assets and revenues of Hungary shall be the cost of reparation and all other costs arising under the present treaty . . ." Art. 180 of the Treaty of Trianon). The loan which the Hungarian Government desired to take up through the intervention of the League of Nations could not be negotiated until the reparation commission had, with the consent of all the states claiming reparation, released the assets and revenues of Hungary from the general charge thus stipulated, and until Hungary, as a member of the League of Nations (she had been admitted Sept. 18 1922), had submitted a request to that effect.

On Oct. 17 1923 the reparation commission agreed in principle to suspend the priority of charges on the assets and revenues of Hungary and thus to approve of the negotiation of the foreign loan to be taken up under the aegis of the League of Nations. The Council of the League, at its session in Paris in Dec., was thus able to discuss the flotation of the loan, while the experts sent to Budapest by the Council elaborated—in conjunction with the Hungarian Government—a programme of reconstruction. By request of the Council the financial committee of the League—on the basis of negotiations carried on in respect of questions of detail with the parties concerned—drafted two protocols (*procès-verbals*), which were accepted by the parties concerned and adopted—*nem. con.*—at the meeting of the Council held on Dec. 20.

The first protocol was of political nature. Great Britain, France, Italy, Rumania, Yugoslavia and Czechoslovakia engaged to respect the territorial integrity, sovereignty and independence of Hungary, not to endeavour to obtain any economic advantages calculated to endanger that independence, and to abstain from all action likely to run counter to the spirit of the agreements to be concluded for the purpose of furthering the financial reconstruction of Hungary; Hungary engaged to meet her international obligations faithfully and punctually, and similarly to abstain from all action in defiance of the agreements to be concluded for the purpose of furthering her financial reconstruction. The protocol affirms Hungary's full liberty of action in respect of all questions affecting her own economic system and commercial relations, while requiring her not to put into force in her relations with any other state such special measures as might be calculated to endanger her independence.

The second protocol contains the detailed conditions relating to the floating of the loan:—

The Hungarian Government shall submit to the League the programme of reforms to be gradually materialised and of economic reconstruction; detailed statements being presented every six months during the period of reconstruction of the minimum revenue expected and the maximum expenditure which the country is able to undertake, and the measures proposed to decrease expenditure and increase revenue; the whole must comprise a scheme which shall provide for the restoration of the balance of the public budget by June 1926. The programme must preclude any recourse being had to any other loan, or to inflation. Hungary engages to endeavour to conclude commercial agreements, in particular with the neighbouring states, for the purpose of eliminating the obstacles impeding trade. The Hungarian Govt. undertakes to secure the approval of the scheme by the National Assembly. It is empowered—within the period required for the restoration of the balance of the budget—to take up a foreign loan of 250,000,000 gold crowns to secure surplus expenditure, the proceeds of such loan to be available only in accordance with the provisions of the protocol. Hungary consents to the League of Nations appointing a commissioner-general to be resident in Budapest, whose duty it shall be to control the execution of the reform programme. The commissioner-general shall submit to the council a monthly report on the results obtained during the working out of the programme. As security for the loan the Hungarian Government mortgages the gross revenue of the customs, the sugar tax and the tobacco régie, the net revenue of the salt régie, and where required such other special sources of revenue (mortgage rights) as that Government shall appoint by agreement with the commissioner-general, save only the revenue of the Hungarian state railways. The Hungarian Govt. engages not to take any such measures as in the opinion of the commissioner-general are calculated to prejudice the value of the charges thus stipulated. This protocol also contains a provision to the effect that the obligations devolving on the Hungarian Govt. shall only be in force in the event of the reparation commission taking a decision to that effect.

At its meeting held on Feb. 21 1924 the reparation commission released the state revenues acting as security for the loan, and agreed to the floating of a loan of 250,000,000 gold crowns. At the same time the reparation commission fixed the payments and deliveries to be made by Hungary in respect of reparation liability within the limits of a fixed schedule amounting to 200,000,000 gold kronen spread over 20 years. These payments and deliveries are graduated from 880 tons of coal or its equivalent in value from Jan. 1 1924 to Dec. 31 1926; then until Dec. 31 1928, annual payments of 5,000,000 gold kronen which increase by degrees until 14,000,000 per annum is reached in 1942 and 1943. This removed the last obstacle to the putting into force of the Geneva protocol which was formally signed at Geneva on March 14 1924. The commissioner-general appointed by the League of Nations, Mr. Jeremiah Smith, an American citizen, took up his duties on May 1 1924.

Connected with the reparation question are the liabilities undertaken by Italy and by the Succession States, viz.: Poland, Rumania, Czechoslovakia and the Serbo-Croat-Slovene State, to pay to the Reparation Commission the value of the state properties (railways, forests, public buildings, etc.) of the former Austro-Hungarian Monarchy situated in the territories ceded to them, and further a contribution to the expenses incurred by the Allies in liberating the people of the said territories. These liabilities, which in the aggregate would amount to a very large total, were to be paid off, with 5% interest, in 30 years from Jan. 1 1926, but no payment has hitherto been made. It should also be mentioned that Italy and the Succession States were, in accordance with a now generally accepted principle of international law, required to take over a share of the pre-War Austrian and Hungarian public debts proportionate to the Austrian and Hungarian territories they respectively acquired.

The reconstruction imposed heavy burdens on the Hungarian people. The state was obliged to exercise the utmost economy in order to balance its budget; it had to dismiss many thousands of public servants—25,000 had been dismisssed up to Dec. 1925—and withdraw the subsidies previously granted to numerous branches of production. All taxes had to be raised to the utmost point possible. Yet the reconstruction proved a decided success, and the balance of the public finances was restored at the very opening of the period appointed for the reconstruction. The League of Nations expressed great satisfaction at the success of the scheme; and both the Council (in September 1925) and the General Assembly, during its 1925 session, conveyed to the Hungarian Govt. and the commissioner-general its sincere appreciation, also expressing its admiration for the generosity and self-sacrifice of the Hungarian taxpayers.[1] During 1924–5 the Hungarian Govt. was actively engaged in an endeavour to settle the questions still pending with other states, and in particular with Hungary's immediate neighbours, and to develop the friendly character of Hungary's international relations.

[1] In June 1926 the Council of the League of Nations decided to terminate the control of Hungarian finance on June 30, the reconstruction having proceeded more rapidly than had been expected. Supervision was retained in two respects only—over the revenues assigned as security for the Reconstruction loans, and over the unspent balance of those loans.

A series of agreements were concluded with Austria, Rumania, Yugoslavia and Czechoslovakia, referring to legal questions and a general rapprochement in respect of economic and commercial questions and of financial and credit transactions. Hereby the Hungarian Govt. has shown indubitably that it is desirous to remain true to its own policy, the cardinal principles of which are consolidation and the solution of the fundamental problems of peace. These latter naturally include also the securing of the cultural, economic and political liberty of the Hungarian minorities living in the territories separated from Hungary by the Treaty of Peace.

(BE.)

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Defence.—Under Article 108 of the Treaty of Trianon the strength of the Hungarian Army (Royal Hungarian Honved) is limited to 1,750 officers, 2,334 N.C.O.'s and 30,916 other ranks —35,000 in all. Up to July 1 1922 the Honved officers had to be recruited exclusively from among former regular officers. The term of service for the rank and file is 12 consecutive years. Only voluntary recruiting is permitted. The army consists of seven mixed brigades; there are also four regiments of Hussars, four batteries, three battalions engineers. A mixed brigade consists of two regiments of infantry (each containing three battalions) one cyclist battalion, one squadron hussars, one artillery group of three batteries, one trench-mortar company, one signals company, one horse-transport detachment, one mechanical transport detachment. Heavy reductions were made on the application of the reconstruction scheme, and it is understood that the permanent establishment of the army in 1926 was much below strength. The police and gendarmerie consists of 2,100 officers and 9,900 men; the term of service is 20 years for the officers and 6 years for the men. See League of Nations, *Armaments Year Book* (1925–6). (X.)

II. ECONOMIC AND FINANCIAL HISTORY

Agriculture.—Of the population of Hungary in 1925 about 56% were engaged in agricultural work as compared with 30% in industry and commerce. Agricultural production was therefore the basis of the country's economic development.

In the five years which preceded the World War, Hungary's agricultural production showed a gradual but constant development in consequence of the draining of flooded areas and the extended use of agricultural machines and artificial manures. This development was arrested by the War, the succeeding revolutions, the occupation of the country by foreign Powers and by the provisions of the Peace Treaty. Owing to the scarcity of labour, draught animals and manure, the arable land, amounting to 5,600,000 hectares, could not be properly cultivated, and a considerable decrease of production resulted. The downward tendency reached its lowest level in the years 1919–20; from that time, progress, at first slow and later quicker, was visible, some crops showing in 1925 a yield which compared well with those of pre-War years.

The index numbers of the five principal crops showing favourable development (the average of the years 1911–5 being equal to 100) are as follows:—

Years	Wheat	Rye	Barley	Maize	Potatoes
1911–5 average	100	100	100	100	100
1920	52	64	66	84	106
1921	79	79	67	67	91
1922	75	79	67	82	68
1923	92	99	75	93	69
1924	70	70	45	125	79
1925	95	96	73	156	118

The following table shows the yield of seven principal crops:—

Crop	Average of the Years 1911–5	in 1920	Average of the Years 1921–4	in 1925
	(In metric quintals)			
Wheat	19,950,076	10,322,119	15,812,439	18,942,014
Rye	8,042,139	5,143,169	6,586,079	7,742,259
Barley	7,141,212	4,718,519	4,693,232	5,224,057
Oats	4,404,705	3,237,901	3,187,092	3,560,879
Maize	15,055,696	12,742,081	13,444,601	23,483,383
Potatoes	19,458,893	20,722,294	14,915,207	23,054,775
Sugar Beet	15,019,512	6,398,261	8,706,781	15,252,572

These results are due in part to favourable weather, but credit must also be given to the diligence and perseverance of the people of Hungary. The abolition in 1923 of export and other arbitrary restrictions on trading, and the subsequent stabilisation of the currency under the League of Nations reconstruction plan, also greatly contributed to increased production by assuring the farmer sure markets at stable and profitable prices.

The values in millions of pounds sterling of the seven principal crops mentioned above amounted in 1920 to 14·2, 1921 to 22·7, 1922 to 29·4, 1923 to 33·0, 1924 to 51·6 and in 1925 to 59·1 million sterling. Before the War the same seven crops produced in the territory of present Hungary (calculated on the basis of the prices of 1913) had a value of £48,400,000. The total value of the agricultural products for 1925 was approximately £80,000,000. There is no reason to think that the production of 1925 cannot be maintained or even improved, provided increased credit facilities for implements and plant are forthcoming.

Live stock, which in consequence of the War and occupations by the enemy had suffered serious losses, showed in 1925 an improvement both from the point of view of quantity and quality. Poultry farming also showed great advance after the War. While only £700,000 worth of poultry and poultry products (eggs, feathers, etc.) were exported by Hungary in 1922 these exports approximated to £2,900,000 in 1925. The production of wine also showed an increase over pre-War figures for the same territory, and there was steady development in fruit-growing, bee-farming and silk production.

Land mortgage loans granted by the principal financial institutions in Hungary amounted in 1913 to £167·7 million, or 41% of their capital. The land mortgage loans granted by the same concerns at the end of 1924 only amounted to £83,000 or 0·3% of their capital. In other words, the land in Hungary was practically free of all mortgage, owing to the depreciation of the currency. Towards the close of 1925 the 9·3 million hectares of land in Hungary were worth £582·2 million, of which the 5·6 million hectares of arable land were valued at £406·5 million.

Industry.—The total production of Hungarian industries (present territory) in 1913 amounted to 1,641·4 million gold crowns, and in 1924 only 1,531·12 million gold crowns, *i.e.*, 6·5% less. The average production for each factory was 790,000 gold crowns in 1913 and only 560,000 gold crowns in 1924, *i.e.*, a diminution of 29·1%. The value of the average working capacity of one worker was 7,485 gold crowns in 1913 and only 6,066 gold crowns in 1924 *i.e.*, a decrease of 19%.

In the various industries production figures were as follows:—

Industries	Value of Production in Millions of Gold Crowns	
	1913	1924
Iron and metal	252·49	193·58
Machines	251·30	160·49
Stone, pottery and glass	70·87	52·34
Wood and bone	41·42	36·14
Leather, hair and feathers	44·95	51·62
Spinning and weaving	82·24	193·44
Clothing	24·81	31·86
Paper	10·69	7·23
Foodstuffs	695·43	702·55
Chemicals	124·50	84·20
Printing	42·60	18·07

The larger industries showing the greatest progress since the War are sugar and textiles. In 1924–5 the sugar industry manufactured 1,770,000 and exported 892,000 quintals of refined sugar, as compared with an output of 1,500,000 quintals in 1923. Out of home requirements in textiles amounting to 447,000,000 gold crowns, home production in 1925 was able to supply textiles to the value of 260,000,000 gold crowns, as compared with only 82,400,000 pre-War. Next to Minneapolis, Budapest has probably the largest flour-milling capacity in the world, but only about 30% of the capacity was utilised in 1925, owing to lack of the grain that formerly came to Budapest from the southern territories now separated from Hungary.

Foreign Trade.—The foreign trade figures of Hungary for 1925 showed rapid improvement. For the first time since the War there was a favourable balance in August. The figures for the six years ending 1925 are as follows:—

Year	Import	Export	Excess of Import	Increase of	
				Import	Export
	In millions of pounds sterling			Expressed in Index Numbers	
1920	17·3	6·8	10·5	100	100
1921	21·6	10·5	11·1	125	155
1922	22·4	13·7	8·7	129	201
1923	17·6	14·1	3·5	101	206
1924	29·2	23·9	5·3	168	350
1925 [1]	30·9	29·2	1·7	179	429

[1] The figures for 1925 are provisional.

The increase of the unfavourable balance in 1924 may be explained by the fact that after the abolition of import restrictions a great number of goods were imported in a short period. The steady tendency of the commercial balance towards equilibrium was also shown by the decrease of the proportion of the unfavourable balance to total imports: 60·6% in 1920, 38·8% in 1922, 18·2% in 1924 and 5·5% in 1925.

The new international commercial free harbour on the Danube at Budapest, which was partly open in 1925 for traffic, is likely to be an important aid to increased trade between the Western States and the Balkans and the Levant.

Employment.—The unemployment returns compiled by the trade unions—the only available statistics—showed a reduction from over 36,000 in Jan. 1925 to about 26,000 in Nov. of the same year. The average wage level for full time was then over 100% of pre-War in gold and between 80% and 90% in home purchasing power.

Price.—The wholesale price index reached its peak at the beginning of 1925 at 159, and the retail index (Pester Lloyd) at 141, exclusive of rent. By Nov. of that year they had fallen to 129 and 123 respectively.

Trade Conventions.—The breaking up of the Austro-Hungarian Monarchy, with its single customs union, into seven independent customs territories naturally proved a handicap to close trade relations between Hungary and her neighbours. In the beginning of 1925 an autonomous customs tariff was brought into force. Although the new duties—partly for the protection of home industries and partly as a basis of bargaining—were relatively high, there was a marked increase of imports, indicating that the duties were by no means prohibitive. By the end of 1925 Hungary had concluded commercial agreements with 17 states on the basis of the most-favoured-nation clause, and definitive commercial treaties with five other states on the basis of special tariff concessions. Negotiations with other and particularly with neighbouring states were proceeding, though slowly, with a view to substituting the existing provisional agreements by definitive treaties. Among the many obstacles was the unwillingness of adjacent states to avail themselves of the direct transit facilities offered by the Hungarian railway lines. As a result of this diversion of traffic to more roundabout routes, encouraged by artificial rates, Hungary's ton-kilometre railway figures have fallen steadily—an instance of the problems that confront any solution of the economic difficulties in the Danubian basin.

The Country's Finances

Budget for 1924–5 and 1925–6.—The state budget for the fiscal year ending June 30 1925, as approved by the League of Nations, provided for a deficit of £4,200,000. Instead, there was a surplus of about £2,600,000. The budget for the year ending June 30 1926 estimated for a surplus of £1,200,000, although the League of Nations had originally estimated that in this year there would be a deficit of £2,100,000. The results of the first six months of the fiscal year 1925–6 indicated that the more favourable estimates were being borne out by actual results. The principal items of the budget for 1925–6 were as follows:—

Budget headings	Million pounds sterling
Expenditure for material	3·6
State debts	2·4
Treaty charges	0·3
Expenditure for personnel	8·0
Contribution to expenditure of autonomous bodies, comitats, etc.)	1·3
Pensions	3·1
Capital outlay	0·5
Total	19·2
Deficit of undertakings	0·4
Total of expenditure	19·6
Receipts from revenue, etc.	20·8
Surplus	1·2

Both expenditure and receipts showed increases over the League estimates, partly due to the rise of 17% in the value of the crown since the date of stabilisation.

In view of the satisfactory condition of the budget, the League of Nations in June 1925 released for productive capital expenditure 30,000,000 gold crowns from the reconstruction loan which had not been needed, as originally anticipated, to balance the budget, and also agreed that the budget surplus for 1924–5 should be applied similarly and for bringing the salaries of state employees nearer to the pre-War level. In Dec. 1925 the League released from the reconstruction loan a further sum of 20,000,000 gold crowns for capital expenditure in 1925–6; also, conditionally, 50,000,000 for 1926–7, leaving 82,000,000 out of the original loan of 250,000,000 gold crowns still to be released. As at Nov. 30 1925 the commissioner-general's account showed the available balance of reconstruction loan to be 152,000,000 gold crowns.

State Debt.—The total Hungarian state debt amounted to £329,800,000 sterling before the War, which represents a burden of £15·7 *per capita* of population. The debt of present Hungary, as constituted under the Peace Treaty, amounted to £57,600,000 sterling at the end of 1924, due allowance having been made for the allocation of the pre-War debt and of part of the War debt as provided by the Peace Treaty. Of this amount £2,000,000 represents the funded internal debt, £48,700,000 the funded foreign debt and £6,900,000 the floating debt. The burden *per capita* of the population amounts to £7, much less than the pre-War burden, mainly in consequence of the depreciation in the value of the obligations of the state.

Savings and Credit.—Coincidently with the stabilisation of the Hungarian currency on the £ sterling there was a marked increase in savings deposits. Figures from the postal savings banks and the 13 principal financial institutions in Budapest show that savings deposits steadily increased from £210,063 at Dec. 31 1923 to £5,012,500 in Nov. 1925, while current account deposits with the same institutions and over the same period increased from £4,876,952 to £13,029,166. The gross total of deposits is only about one-quarter of the pre-War amount.

The bank rate, which in March 1925 was 12½% was gradually lowered until in Oct. 1925 it reached 7%, credit and money conditions becoming correspondingly easier. This was facilitated by the introduction of foreign capital. In addition to relatively large short-term commodity credits for flour, sugar, etc., principally from England, and the participation of foreign capital in two of the leading Budapest banks, two long-term foreign loans were successfully floated towards the end of 1925, one of $10,000,000 in New York for 48 Hungarian municipalities, and another of £1,000,000 sterling in London against land mortgages.

Taxation.—Prior to the period of reconstruction in 1924 the Hungarian Govt. had recourse to many taxation expedients and drastic measures in their struggle to maintain revenue in the face of an ever-depreciating currency. The system of assessing taxation on the incomes and revenues of the previous year soon ceased to have any meaning. As a result of the War, the revolution and the Rumanian occupation there were also outstanding arrears due for some three or four years. In 1920 there was a forced loan by the stamping of notes amounting to 50% of the currency then in circulation, in 1921 a heavy capital levy, and in 1924 another forced loan based on the earned income and capital of each individual or firm

operating in Hungary. Consumption (excise) taxes were fixed at a proportion of the actual price of the articles consumed, and the "turn-over" tax, payable simultaneously with the purchase of all articles, was introduced. The latter tax was fixed originally at 1·5% and subsequently at 3% of the sale price of each article and on each handling, thus amounting in many instances to a tax of 12%. (In Aug. 1925 this tax was reduced to 2%.) Arrears of taxation were drastically compounded, and land taxes were made payable in wheat or wheat values. Finally, by the passage of Act IV. of 1924 the Government were empowered to levy all taxes in values of gold crowns.

In a report presented to the League of Nations in Oct. 1925, the League commissioner-general in Hungary estimated that on the Hungarian Budget for 1925–6 the taxes levied by the state, excluding local taxes, amounted to 60 gold crowns *per capita* of population. This compared with approximately 45 gold crowns *per capita* pre-War, which, after making allowance of 35% for the depreciation in the value of gold, also worked out at 60 gold crowns *per capita*. Adding local to state taxation, the commissioner-general estimated that the total *per capita* taxation was 72 gold crowns per head. Estimating the national income of Hungary at approximately 3,600 to 4,000 million gold crowns, the commissioner estimated that the total taxation of Hungary represented between 14 and 17% of the national income. This compared with between 13 and 14% pre-War. According to the same authority this taxation was by no means light for an agricultural country such as Hungary. From one-fifth to one-quarter of these taxes were raised in 1925 by direct and from three-quarters to four-fifths by indirect taxation.

On the basis of the Government assessment for the fiscal year ending June 30 1926 the direct taxes, according to Commissioner-General Smith, were divided as follows:—

	Millions of gold crowns
Land tax	42
House tax	24
State participation in house rents	23
Corporation tax	10
Income tax	41
Property tax	8·7
	148·7

The estimates of indirect taxation for the same period are as follows:—

Turnover tax	103·6
Stamp and other similar taxes	52·4
Tax on commodities	55·6
Customs	85·6
Salt monopoly (net)	11·2
Tobacco monopoly (gross)	97·6
Transport tax	9·2
	415·2

Currency.—During the existence of the Dual Monarchy, Hungary and Austria had a joint monetary system and a joint bank of issue. After the outbreak of the revolution the Austro-Hungarian Bank was able for some time to continue its work in Hungary, but the Bolshevik régime seized the entire stock of notes. When these began to run short the so-called soviet republic issued their own notes. After the collapse of soviet rule in 1919, the Hungarian Govt. issued the necessary decree to enable the Austro-Hungarian Bank to continue its statutory work as "Manager of the Hungarian business of the Austro-Hungarian Bank."

In March 1920 the Government ordered the stamping of the notes of the Austro-Hungarian Bank which were in circulation within the country, and requisitioned 50% of these notes as a forced loan in order to secure, so far as possible, the carrying on of the state administration without constant application to the note printing press. As the creation of a special issuing institution appeared to be inevitable in consequence of the liquidation under the Peace Treaties of the Austro-Hungarian Bank, the state itself provisionally established the Royal Hungarian State Note Institute (M. Kir. Allami Jegyintézet), which began its activities on Aug. 1 1921. The notes of the Austro-Hungarian Bank, which had been provided with the Hungarian stamp, were exchanged in the same year against state notes.

When the State Note Institute commenced its work, the financial and economic position was such as to compel the state to cover its budgetary requirements not from revenues but by means of the note printing press. This naturally resulted in the gradual depreciation of the crown. The forced loan raised by stamping notes had covered the budget deficit only for a short time. In 1921 the Government had recourse to a non-recurring capital levy, but by the time most of the proceeds reached the Treasury the value of the crown had so depreciated as to nullify these efforts. In the first half of 1921 the exchange rate of the crown rose temporarily in Zürich from 1·05 to 2·85 Swiss francs (100 crowns), owing to the impression created by the taxation and other plans of the then Minister of Finance, M. Hegedus. When it was seen that these plans were impossible of realisation, and as Hungary's balance of payments became more and more unfavourable, the crown continued to fall, until in March 1924 it reached 0·0085 Swiss francs for 100 crowns. As the result of long negotiations the League of Nations loan was raised, and the restoration of normal economic and currency conditions was thus made possible (*see* above, *Political History*). All restrictions in foreign exchange were abolished in Oct. 1925, when the currency was considered to be sufficiently stabilised to be left to fluctuate freely according to supply and demand.

Central Bank.—The re-establishment of an independent bank of issue was in the forefront of the programme of reconstruction. The Hungarian National Bank was founded, with a capital of 30,000,000 gold crowns, and commenced its activities on June 24 1924. From that day the state notes then in circulation were regarded as bank-notes. Under its statutes the bank is precluded from lending to the state, and is required to maintain against its note circulation a percentage of cover in precious metal and stable foreign exchanges, on an ascending scale, beginning at 20% during the first five years. The bank return of Dec. 31 1925 showed the proportion of cover to be 56·46 per cent. Since July 1924 the currency has been stable on a sterling basis. In Oct. 1925 the basis of stabilisation became gold, and all restrictions on dealings in foreign exchange were abolished.

The following table shows the development of the note circulation:—

Date	Issuing institution	Circulation in paper crowns
Dec. 31 1920	Hungarian management of Austro-Hungarian Bank	14,307,808,630
Aug. 1 1921	State Note Institute	15,787,175,750
Dec. 31 1921	State Note Institute	25,174,941,187
Dec. 31 1923	State Note Institute	931,337,334,630
June 24 1924	Hungarian National Bank	2,520,113,700,576
Dec. 31 1924	Hungarian National Bank	4,513,989,561,419
Dec. 31 1925	Hungarian National Bank	5,193,937,447,500 (415,514,995·79 pengös)

New Currency.—On Dec. 31 1925 the currency *per capita* of the population was approximately 43 gold crowns. In the latter part of 1925 the new monetary unit was chosen and named the pengö, divided into 100 fillér; 3,800 new units go to one kilogramme of fine gold, so that 1 pengö contains 0·26315789 grammes of fine gold. The Currency Reform Law passed on Nov. 6 1925 provides for the minting of gold coins for 20 and 10 pengös from an alloy consisting of 900 parts of gold to 100 of copper, so that 3,420 pengös will be struck from one kilogramme of this alloy. The National Bank is required to buy gold in bars at a fixed price without limit and on demand. Silver coins of one pengö will be put into circulation to a total nominal value of not more than 45,000,000 pengö.

From Jan. 1 1927 the pengö will be the obligatory unit of account in Hungary. The rate of conversion from the old to the new currency is 12,500 paper crowns to one pengö, or one gold crown = 1·1585365 pengö. 1 pengö is therefore equal to 0·0359388 pound sterling, or 0·1748985 dollar.

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(W. Go.*)

HUNTING: *see* FOX HUNTING: SHOOTING.

HUSAIN IBNA'LI (*c.* 1854–), Amir of Mecca from 1908 to 1916 and King of Hejaz from 1916 to 1924, was the second son of Muhamnad Ibn'Aun of the 'Abadila clan of Ashraf. He was brought up in Bedouin surroundings, but spent a great part of his life at Constantinople. Reputed to harbour Anglophil tendencies, he was deeply versed in the byways of Ottoman politics and his best trait was a profound knowledge of the desert, for which he always maintained a genuine affection. At the beginning of his Amirate he won golden opinions by his sagacity and modesty and set himself vigorously to forward Turkish interests in Arabia. In 1910 he subdued a rebellion in 'Asir and subsequently invaded Qasim without result, but in 1913 he began to show his true colours by opposing the extension of the Hejaz Railway to Mecca.

When the World War broke out he entered into negotiations with the British, which culminated in the Arab revolt in June 1916. In Oct. he proclaimed himself "King of the Arab Countries" though he was formally recognised only as King of Hejaz. At the Versailles Peace Conference (1919) he was represented by his third son, Faisal, but refused to ratify the treaty as a protest against the mandatory *régimes* imposed on Syria, Palestine and 'Iraq. Subsequently his domestic policy was marked by ever increasing avarice and reaction, while he

sowed the seeds of future trouble by deliberately courting the enmity of Ibn Sa'ud. In March 1924, while on a visit to Transjordan, he proclaimed himself Caliph, but war with Ibn Sa'ud was already imminent and the Wahhabi attack on Zaif in Sept. found him unprepared. On Oct. 5 he abdicated and proceeded to 'Aqaba, whence in July 1925 he was conveyed by a British warship to Cyprus, where he took up his residence.

By his first marriage Husain had three sons: 'Ali; 'Abdullah, Amir of Transjordan, and Faisal. The first of these, 'Ali Ibn Husain, who was born about 1880, took no conspicuous part in affairs during his father's Amirate. After the World War he became Amir of Medina and in that capacity did much useful work in connection with the reconstruction of the Hejaz Railway. In 1924 he was pressed to accept the Amirate of Transjordan but declined in favour of returning to Medina. He succeeded his father as second King of Hejaz on Oct. 3 1924, but abdicated on Dec. 19 of the following year (*see* HEJAZ) and returned to Baghdad to live as the guest of his brother Faisal.

HURGRONJE, CHRISTIAAN SNOUCK (1857–), Dutch orientalist, was born at Oosterhaut Feb. 8 1857. After completing his studies in theology and Oriental languages he went to Arabia, where he stayed for several years, and to other parts of the Near East. The result of these travels was his work *Mekka* (2 vol., 1888–9). He refused a nomination as professor of Arabic at Cambridge University in succession to Robertson Smith and also nominations in Germany and at Leyden, preferring to continue his studies on Islam in the Dutch East Indies (1889–1906) where for some years he was counsellor to the Government in Mahommedan affairs. In 1893–4 he published *De Atjehers*, which was translated into English in 1900. He returned to Holland in 1906, where he accepted the chair of Arabic at the University of Leyden; in 1907 he was nominated counsellor for Indian and Arabian affairs to the Dutch and the Dutch East Indies Government. Among his other works are *Nederland en de Islam* (1911); and *Verspreide Geschriften* (1923ff.).

HUTCHINSON, SIR JONATHAN (1828–1913), British surgeon (*see* 14.13), died at Haslemere, Surrey, June 23 1913.

HUTMENTS: *see* BARRACKS.

HUYSMANS, CAMILLE (1871–), Belgian politician, was born at Bilsen in Belgian Limbourg May 26 1871. After graduating in Germanic philology at Liége, he became a professor, first at the Collège Libéral at Ypres, and then at the Université Nouvelle, Brussels. He edited the *Petit bleu* and the *Peuple* and after the War started the *Volksgazet* in Antwerp. He entered the Chamber in 1910, first as deputy for Brussels and then for Antwerp, where he became an alderman of public instruction. In 1914 he was secretary of the Socialist International party and while in Holland endeavoured to organise a congress at Stockholm. Though he was severely criticised for this by his fellow socialists at the time, he completely regained their confidence later and became the chief organiser of the Socialist party in Antwerp. In June 1925 he became Minister of Science and Arts in M. Poullet's Government. His chief works are: *Limburgsch Jaarboek* (1891–5); *Zoponymische studie over Bilsen* (in conjunction with J. Cuvelin) 1897; *Stockholm* (1919); and numerous socialist brochures.

HWANG-HO (*see* 14.23).—A reconnaissance of the flood-stricken delta of the Hwang-Ho was undertaken by the American Red Cross in 1911 and 1914; a promising series of observations by the Kiang-Hwai engineers under H. E. Chang Chien was begun in 1911, and a critical review of these previous findings was made in the field in 1919–20 by John R. Freeman, partly in connection with his work for the Grand Canal Improvement Board.

Through the province of Shantung the Hwang-Ho's fall to the sea has been found to be about 1 in 5,000, a steep gradient for so large a river. The current is therefore very swift, and the river not only carries along great quantities of sediment, but the muddy bottom itself steadily works forward and the bed of the channel is raised. Measurements by Freeman's staff show that the river carries over 4% *by weight* of silt, and may even carry 13% in greatest flood. Naturally the stream drops a part of its heavy burden whenever its velocity decreases. Three types of deposit are to be considered: outside the outer dikes; between the dikes; and along the river bed within the main channel.

Deposits outside the Outer Dikes.—When the river overflows or breaches the outer dikes, it deposits over the land a sloping ridge of sediment which varies greatly in size, but probably during the past 1,000 years has not exceeded the equivalent of 10 ft. close to the main dike, tapering off to almost nothing at 5 or 10 m. away.

Deposits between the Inner and the Outer Dikes.—Whenever the river floods the space between the outer and inner dikes, the waters as they subside deposit their silt and a flood plain is formed. These flood plain deposits between the dikes, while varying from 12 to 20 ft., average 15 ft. above the low-water level. Probably they accumulate somewhat rapidly. It is this very action which can be utilised to form a permanent barrier of surpassing strength if the river be trained as Freeman suggests (*Proc. Amer. Soc. Civil Engineers*, May 1922, pp. 1113–67).

Deposits within the Main Channel.—When the summer floods subside, the river, in narrowing to its winter channel, slows up and deposits sediment on its own bed. Although much has been written about the Yellow river continually raising its bed, compelling the inhabitants constantly to build the dikes higher, there were no facts upon which to base such statements until the Red Cross in 1914, and the Grand Canal Improvement Board in 1919, gave cross sections, extending far beyond the dikes, showing broadly the relation of the elevation of the river bed to that of the adjacent country. These show that the river has done remarkably well in conveying nearly all of its silt to the sea, and that the rise of its bed has been extremely slow, in general not more than 15 ft. during the past 1,000 years, or perhaps 2,000 years—say a foot a century. Great as the river's land deposits have been, they are small in comparison with the total volume of sediment transported in 1,000 years, if the river during that time carried anything like the percentage of sediment recently observed. It appears that the Yellow river during all the historic period has carried to the sea 99% of the burden of silt gathered in the loess country.

The flow of the Yellow river varies much with the season, being ordinarily three times as great in flood as at low water. In the summer of 1919 a flood flow of 265,000 cu. ft. per sec. was measured (the highest for 10 years) with a minimum of 10,600 cu. ft. per second. This is remarkably small, considering the great extent of the drainage area; much of it, however, is a land of little rain, and the losses on the way are very large. Moreover, this river has no tributaries for some 300 m. from its mouth. Its only connections are with irrigation and navigation canals which serve during high-level periods to draw off water. Though practically useless for navigation, the Yellow river may, in spite of its relatively small discharge and variable flow, be a blessing in the way of drainage and irrigation if it is properly dealt with. (C. K. E.)

HYATT, ANNA VAUGHN (1876–), American sculptor, was born at Cambridge, Mass., March 10 1876. Educated at a private school at Cambridge, she commenced the study of art in Boston, proceeding later to New York City. There she studied a short while with H. A. MacNeil and Gutzon Borglum, under whose influence she acquired that knowledge of horses which is so signally exemplified in some of her works. She devoted herself chiefly to small bronzes. Her equestrian statue, "Jeanne d'Arc," was selected for Riverside Park, New York City, in 1915, and copies of it were erected at Gloucester, Mass., and Blois, France. This work, a "Saint Joan of Arc" in the Cathedral of St. John the Divine, New York City, and a "Diana" have been her chief figure compositions. Notable among her other works is a colossal "Lion on a Boulder" executed for the Dayton High School. In 1923 she married Archer Milton Huntington.

HYDE, DOUGLAS (1860–), Irish scholar and writer, was born at Frenchpark, Co. Roscommon, 1860, and was educated at Trinity College, Dublin. In 1891 he acted as interim professor of modern languages at the University of New Brunswick, Canada. He formed in 1893 the Gaelic League, for the preservation and extension of the Irish language, and was president of that body until 1915. In 1899 his production, before a vice-regal committee on education, of letters from leading Celtic scholars throughout Europe saved the Irish language on the intermediate board which regulated the curricula for Irish schools. During 1905 he toured America and raised £11,000 for the Gaelic League. On his return he was appointed a member of a royal commission on Irish university education. Dr. Hyde was made professor of Modern Irish at University College, Dublin, in

1909. He was co-opted by the Free State Senate in 1922, but failed to secure re-election in 1925. In the latter year he became editor of *Lia Fáil*. The movement created by him initiated an enthusiasm for the native language, which finally resulted in the teaching of the language being made compulsory in Irish schools.

Among Dr. Hyde's more important works are *A Literary History of Ireland* (1899); collections and translations of the *Love Songs of Connacht* (1893); *Raftery's Irish Songs* (1904); *The Religious Songs of Connacht* (1906). He also wrote several short plays in Irish.

HYDERABAD, SIR MIR OSMAN ALI KHAN, Nizam of (1886–), was born April 6 1886 and succeeded his father, Sir Mir Mahbub Ali Khan, on his death on Aug. 29 1911. His education had been under an English tutor, Sir Brian Egerton, and a nobleman of the state, of scholarly attainments, Imad ul Mulk (Saiyid Husain Bilgrami). Soon after accession he abandoned the traditional system of governing through a Diwan, and for five years was his own prime minister. In 1919 he constituted an executive council with a president and eight other members, each in charge of one or more departments. During the World War he enjoined on his subjects the duty of firm and steadfast devotion to the British cause and prohibited anti-British propaganda in his dominions. The War expenses of the state amounted to over three-fifths of the annual income. His Highness, already a G.C.S.I., was awarded the G.B.E., was promoted to hon. lieutenant-general in the British Army, and in 1918 King George V. conferred upon him the new and special title of Exalted Highness.

HYDROELECTRIC ENGINEERING.—The extent to which the water powers of the world have been investigated and developed during the past decade forms one of the striking engineering features of the period. Although falling or flowing water formed the earliest of the natural sources of energy to be utilised for providing power, some two-thirds of the water power at present in use has been developed since 1910.

The reasons for this are partly technical and partly economic. The technical development of electric generation and transmission has made it economically possible to utilise powers remote from any industrial centre, while the great developments in electrochemical, electrophysical and metallurgical processes have provided an outlet for such energy as could be cheaply developed. Most of these processes require relatively large amounts of energy, and all are economically dependent on the cheapness of this energy. They have created a demand for large blocks of cheap power which can, under favourable circumstances, be satisfied more readily from a water-power installation than from any other source.

Developments.—The urgent demand for energy to supply the abnormal requirements of the War period, combined with the increased cost of fuel, was responsible for an unprecedented rate of development in those countries having available water-power resources and normally dependent on imported fuel. Thus in France something like 2,500,000 of water-horsepower is now developed as compared with 750,000 H.P. in 1914. In Switzerland, the present output is 1,500,000 H.P. as compared with 880,000 H.P. in 1914. In Italy it is estimated that the total output will shortly amount to 3,000,000 horsepower. Japan, which only recently began to investigate her water-powers, has, since 1916, developed over 1,200,000 H.P., or about 20% of her available resources. Step by step with developments on the electrical side, advances have been made in the design of hydraulic turbines. These various developments have made it commercially possible to make use of large water-power at sites quite remote from any centre of industrial activity. In many cases industrial communities, attracted by the cheapness of the power, have grown up around such sites. In others the energy has been transmitted electrically for long distances, in some cases between 200 and 300 m., to some more convenient centre.

Available Water Power.—An estimate, based on papers presented to the World Power Conference at London in 1924, and on other sources, indicates that the amount of water-power, respectively available and developed in some of the chief countries of the world, is approximately as follows:—

Millions of Horsepower	Available	Developed
Great Britain	0·9	0·25
Canada	23·0	3·28
Remainder of British Empire including Australia, Africa (East), Africa (South), Africa (West), British Guiana, India and Ceylon, New Zealand, Papua	35·0	0·7
Austria	3·7	0·28
South America	54·0	0·42
Dutch East Indies	8·0	0·08
France	4·7	2·5
Germany	1·5	0·75
Italy	5·4	2·5
Japan	6·4	1·5
Norway	13·3	1·32
Russia	20·0	0·83
Spain	6·0	1·26
Sweden	8·8	1·42
Switzerland	4·0	1·49
United States	28·0	9·8

From these figures it appears that some 200,000,000 H.P. is available, of which approximately 27,000,000 is at present developed or in course of development.

Uses of Hydroelectric Energy

While a large proportion of the energy developed from water power is utilised for industrial purposes and for lighting and traction, an increasing proportion is being used for pulp and paper making and electrochemical and electrometallurgical processes; indeed the chief outlet for hydroelectric power in the near future is likely to be in connection with such processes and, probably, railroad electrification. The amount of power already used in electrochemistry is large. Thus the world's production of calcium carbide alone requires some 500,000 H.P. and when it is remembered that such products as aluminium, carborundum, chromium, cyanamide, caustic soda, chlorates, magnesium, phosphorus and silicon are only rendered commercially possible by such processes, it will be realised that the future demand for energy for their manufacture is certain to be large. Nitrogen fixation is also likely to make great demands. In Norway alone some 400,000 H.P. is available for this purpose, and in view of the rapid depletion of the natural nitrate deposits, from which four-fifths of the world's nitrogen consumption has hitherto been supplied, and of the diminution in fertility of many of the great wheat and cotton growing areas of the world, the production of artificial fertilisers by one or other system of nitrogen fixation must, in the near future, become a question of great importance.

Railroads.—The electrification of railroads has made rapid strides of recent years. In the United States some 3,300 m. of track have been electrified, while the Chicago, Milwaukee and St. Paul Railway has the longest electrified section in the world (850 m.), the power for operation being obtained from hydroelectric stations. In France, much of the track of the Compagnie du Midi in the region of the Pyrenees has been electrified with the aid of water power, and it is anticipated that the whole system of about 3,000 km. will be electrified within 10 years.

The hydroelectric stations supplying these lines have a capacity of close on 300,000 horsepower. The Orleans Co. has a scheme for electrifying 3,000 km. of its lines, part of which is to be supplied from hydroelectric stations having a capacity of about 210,000 horsepower. In Austria some 1,800 km. of line is in process of electrification for which 120,000 H.P. is available from hydroelectric stations. In Germany about 1,200 km. is now electrified, its electricity coming from hydroelectric schemes. Much of the Swiss Railway system has been electrified, and the electrification of further trunk lines in these and other countries

is at present under consideration. Such developments will open up a very large field for the utilisation of water-power where this is available. (*See* RAILWAYS, ELECTRIFICATION OF.)

Agriculture.—Much energy is now being utilised in the United States of America for purely agricultural purposes. In California, for example, there is in effect one vast system of electrical supply extending over a distance of 800 m. with 7,200 m. of high-tension transmission lines. This is fed from 75 hydroelectric stations interconnected with 47 steam plants, to give a total output of 785,000 horse-power. A further group of 13 hydroelectric schemes now under construction will add another 520,000 horse-power. A large proportion of this power is used in agriculture, and it is estimated that electric motors equivalent to over 500,000 h.p. are now installed on Californian farms. The Californian rice industry is almost wholly dependent on irrigation made possible by electric pumping, whilst most of the mechanical processes involved in farming are being performed by electric power.

The economic development of many of the tropical dependencies of the British Empire, whose latent wealth is practically untapped, is directly inter-connected with the development of their water-power resources. Not only would an abundant supply of such power enable railroads to be operated, irrigation schemes to be set on foot, and mineral deposits to be tapped and worked, but it would go far toward solving the labour problem which promises to be one of some difficulty in the future.

While those outlets for electrical energy which are now in sight promise to absorb all the energy which can be cheaply developed for many years to come, there are many other probable directions in which such energy might find a new and profitable outlet. Among these may be mentioned the purification of municipal water supplies; the dehydration of food products; and the preservation of timber.

LAY-OUT OF HYDROELECTRIC SCHEMES

High Head Schemes.—The layout of a hydroelectric scheme depends on the physical characteristics of the catchment area and site. High head schemes are of necessity located in mountainous country and are usually fed from streams of relatively small volume. Owing to this a comparatively small reservoir is often sufficient to provide sufficient storage of the head waters to give uniform output over a considerable portion of the year at a reasonable cost. The water may be brought directly from the reservoir to the power house through a pipe line or pressure tunnel if the gradient is suitable. Often, however, it is possible to bring it through an open canal at a very flat gradient, to a forebay on the hill-side above the power-house, whence a short pipe-line conveys it to the turbines.

Low Head Schemes.—Low head schemes are usually located on rivers where the gradient is small, the head being provided by a dam, or naturally by means of rapids or a waterfall. A river dam, by raising the natural level of the water, provides a certain amount of storage, but seldom more than is sufficient to store the night flow for use during the day. Such a scheme can therefore only give a continuous output equal to the dry weather capacity of the river, unless operated in conjunction with some steam station capable of equalising the output at such times.

Several types of low head layout are available. Where a dam is built, the power house is often constructed on one flank of the dam with a short head race or tail race as is most convenient, and the dam itself is used as a spillway over which excess water is discharged in times of flood. Where the river flows in a narrow and steep gorge the power-house may sometimes with advantage be constructed in the dam itself, which now consists of a hollow reinforced concrete structure. Where the river forms a long bend, it is often possible to cut across the neck of the bend and to utilise the head between the two points.

Medium Head Schemes.—In medium head schemes—utilising between 40 and 200 ft. head—the layout is usually similar in broad outline to those involving either high or low heads. Where such a scheme involves the use of a long closed supply pipe to the turbines, having only a small gradient, somewhat special treatment, however, becomes necessary. Owing to the large inertia of the column of water in the pipe line, any sudden demand for water caused by opening the turbine gates on an increasing load causes a relatively large drop of pressure at the turbines, which renders governing very difficult. To reduce this difficulty, a surge tank is fitted to the pipe-line at a point as near to the turbines as possible. This is a stand pipe surmounted by an open tank having a comparatively large surface area, whose upper level is slightly higher than that of the water in the reservoir. Any sudden demand is then supplied in part by flow down the stand pipe and the drop of pressure is greatly reduced. At the same time any rise in pressure caused by suddenly closing the turbine gates is also reduced.

In a low head station the available space is usually limited by the width of the dam on which it is built. In consequence, in such plants, there is a tendency to locate the switch gear and transformers either on floors above the machine-room, or, as is becoming more common, in an entirely separate building on the river bank. In some few cases all the transformers and high-

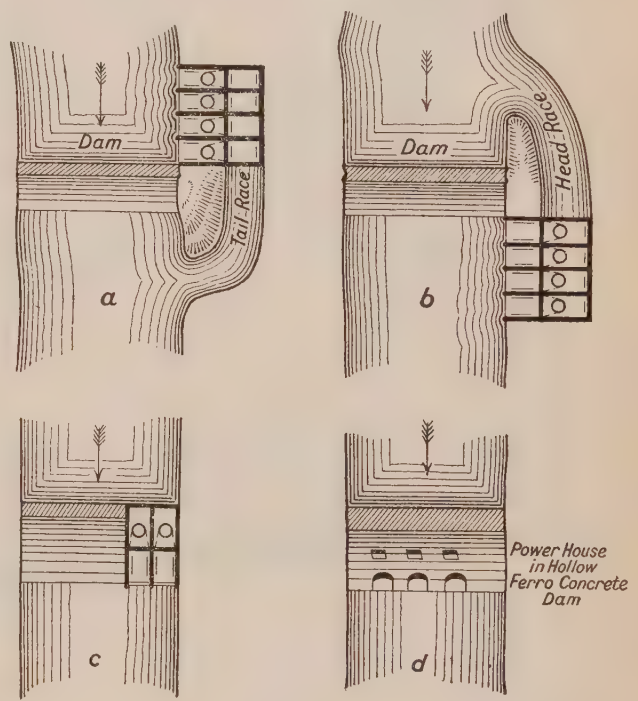

FIG. 1.—Types of Low-head Development.

tension switch gear are out of doors, and this will probably become standard practice in the future. It has even been proposed to place the whole generating plant outside, merely providing a portable cover for use during repair work. The recently planned Muscle Shoals development in Alabama was originally schemed along these lines. It has finally been decided to adopt the conventional type of station building, but the complete outdoor generating station will doubtless arrive in the near future.

Turbines.—The inward flow pressure turbine and the Pelton wheel are the only types of turbine used in modern hydroelectric schemes of any size. The type to be adopted depends largely on the available head. The Pelton wheel is a slower running machine than the pressure turbine and is therefore better fitted for very high heads. It has the further advantage for such heads, that since the water is discharged through one—or at the most two—nozzles, these may be of reasonable size when dealing with the small volumes of water normally available in high head schemes. The pressure turbine on the other hand with its full peripheral admission of water is well adapted to utilise the large volumes necessary in low head schemes, and its higher speed of rotation is also a great advantage in low and medium head plants, in enabling the cost of the electrical generators to be reduced Broadly speaking the Pelton wheel is more suitable for heads above about 700 ft.; the pressure turbine for heads below about 250 ft. in small units and below about 500 ft. in large units;

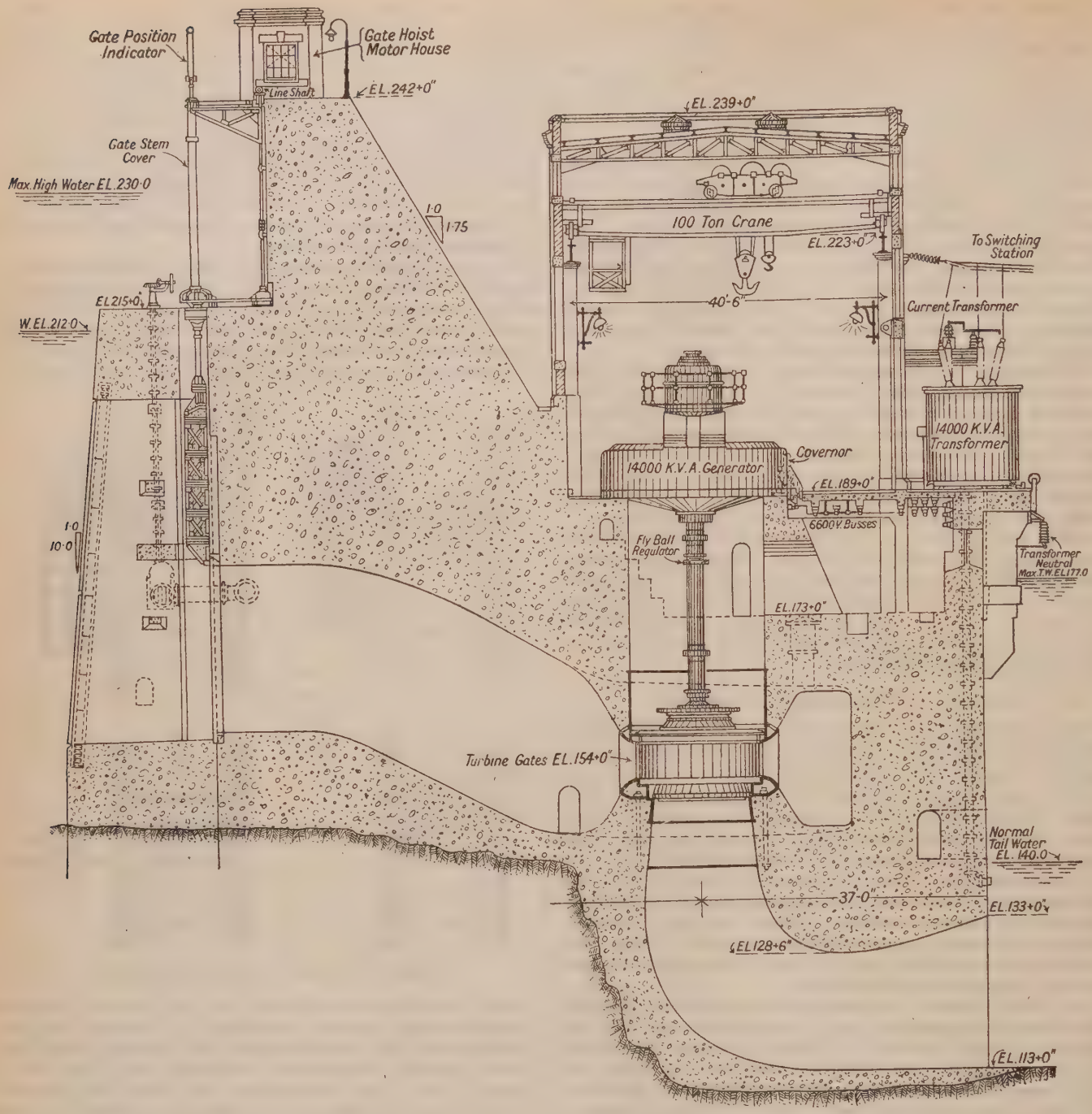

FIG. 2.—Hydroelectric station with outdoor transformers and high-tension switch gear. 14,000 K. V. A. under 80 ft. head.

while over the intermediate range of heads much depends upon the size of the units and the special circumstances.

All modern pressure turbines are of the mixed flow type, having inward radial flow through guide vanes surrounding the runner, and axial discharge. Pivoted guide vanes are universally used, speed regulation being attained by simultaneous rotation of these about their axes. Low head turbines—up to about 40 ft. head—are usually set in an open forebay. Either vertical or horizontal shaft machines may be used, but the former are becoming more common, especially for large units. For higher heads the water must be supplied through a pipe-line and the turbine is enclosed in a spiral casing so designed as to distribute the water evenly around the periphery of the guide vane ring. For heads up to about 120 ft. this casing may be moulded in concrete, but for higher heads and pressures a metal casing becomes necessary. This may be of cast iron, cast steel or of steel plate construction, and in order to give rigidity and increased safety in case of surges of pressure is sometimes embedded wholly or partially in the concrete of the substructure. Modern development is tending in the direction of units having a single runner and a vertical shaft on the top of which the electrical generator is mounted. The weight of the shaft, runner and generator is then carried from a single thrust bearing of the Michell or Kingsbury type. This type lends itself to a simple and efficient form of setting, while the friction losses are extremely low.

One of the great drawbacks of the low head turbine in the past has been its relatively slow speed of rotation, which necessitated either a slow speed and costly generator or expensive gearing. As a result of experiment it has, however, been possible so to modify the form of the runner as greatly to increase the speed of rotation under a given head without seriously reducing the efficiency.

Such runners are characterised by their small number of vanes—often not more than four being used—and approximate in form to that of a marine propeller. In one of the latest types,

the Kaplan, the vanes are capable of rotation about their own axes so as to enable the vane angles to be adjusted to suit the varying flow of water at part loads. Further developments in the direction of increasing the speed are in active progress and promise to give important results. At the present time, however, turbines are in existence which are capable of efficient operation at speeds at least three times as great as would have been thought possible 10 years ago.

The pressure turbine is now built in units capable of developing upwards of 70,000 H.P. under a head of 300 ft., and this size could readily be increased if necessary. If well-designed and installed in a suitable setting the efficiencies are remarkably high. Efficiencies of 93% have been obtained on tests of vertical shaft turbines at Niagara and values approximating 90% are quite common. In a medium head plant the following are typical values:—

Fraction of full load	·25	·5	·75	·90	1·0
Percentage efficiency	70	82	88	90	88

Pelton wheels are usually built as horizontal-shaft units with one or two nozzles, and in sizes up to about 30,000 horse power. Speed regulation is usually performed by a deflector which cuts off the jet from the wheel, acting in conjunction with a central needle or spear which slowly reduces the size of the jet while the deflector returns to its original position. The mechanism is operated by a relay cylinder supplied with pressure water or oil through a pilot valve actuated by the governor. In a well-designed plant the instantaneous speed variation corresponding to a sudden application of full load should not exceed 12 to 15%. The difference between the initial and final steady speeds should not exceed 2% between full load and no load, and should not exceed 5% with a load variation.

At constant speed the efficiency of a Pelton wheel falls off comparatively slowly as the load is diminished. A well-designed wheel should have approximately the following efficiencies:—

Fraction of full load	·25	·50	·75	·99	1·0
Percentage efficiency	77	83	85	86	83

The lack of a suitable pipe-line has, until recent years, tended to retard the development of plants for very high heads. Under such heads the necessary wall thickness, even with a moderate pipe diameter, becomes too great to permit of the use of riveted joints. Recent developments in electric welding and oxyacetylene welding have, however, rendered it possible to construct suitable welded pipes and by their aid, and by the use of solid drawn steel pipes in extreme cases, it has been found possible to harness some very high falls. The highest as yet utilised is at the Fully installation in Switzerland. Here the working head is 5,412 ft., corresponding to a working pressure of 2,360 lb. per sq. inch. The pipe-line is 19.7 in. in diameter and $1\frac{3}{4}$ in. thick at its lower end, and each of the three Pelton wheels in the power-house develops 3,000 horsepower.

Pipe-lines.—The pipe-line for a water-power plant may be constructed of steel, reinforced concrete or wood. Steel is the most usual, riveted pipes being suitable for all but the highest heads. For heads up to about 200 ft., reinforced concrete pipes are suitable and have the advantage of not deteriorating appreciably with age. As compared with steel pipes the materials are more easily transported and the friction losses are less. Large pipes are moulded in site, and as the bulk of the materials is usually obtained locally, only the cement and reinforcement require to be transported for any distance. For small diameters, pre-moulded concrete pipes with loose-sleeve or spigot-and-faucet joints are often used.

For moderate heads, wooden pipes are extensively used in countries where suitable timber is cheaply available, and under favourable conditions have a useful life of at least 25 to 30 years. They are built up of wooden staves about 6 in. wide, shaped to the correct radius and jointed end to end by thin metal plates driven into saw cuts on both the abutting ends, covering the joint. The staves are so arranged that the circumferential joints are not continuous. They are held together by circumferential steel bands which resist the bursting pressure, and whose diameter and spacing depends upon the pressure to be anticipated in each section of the pipe. The materials are easily transported and neither erection nor repair require any great degree of skill. If suitable timber is available the mill can be set up on the site and only the bands and shoes require transporting.

As heads and diameters increase the amount of steel necessary for the bands increases until it becomes comparable with that required for a steel pipe for the same duty. In general the range of useful heads is from 20 to 200 feet. These pipes have been constructed in sizes up to about 18 ft. in diameter.

Generation and Transmission.—Generators to be driven by hydraulic turbines range from the simple open-type machine which is often applicable to small units, to constructions approaching those of steam-turbine driven alternators, which are necessary for the largest high-speed machines.

At the present time the energy is almost universally generated as alternating current, on account of the simplicity and reliability obtained with a moderate generating pressure which is readily transformed to the highest pressures which may be required for economical transmission. Occasionally, however, the advantages of high-tension direct-current transmission may outweigh the essential difficulties of its generation, in which case the Thury system is available. Of the two types of alternating current generators, the synchronous and induction types, the latter has come largely into use in recent years, especially for automatic stations, on account of its robustness of construction and simplicity in operation.

Frequencies.—The question of the most desirable frequency is simplified by the fact that in most countries two frequencies—a high and a low—have become recognised as standard. In the U.S.A. and Canada, either 60 or 25 cycles per sec. is almost universally adopted; on the Continent 50, $16\frac{2}{3}$ and 15; in Great Britain and South America 50 and 25 cycles. As regards the number of phases there is little freedom of choice, the question being largely determined by the nature of the load. Single phase supply, though offering some advantage in simplicity of equipment, involves increased losses in the generators and generally less reliable performance. This system is only used where absolutely necessary, as for direct supply to alternating current railways using commutator motors. Of the polyphase systems, three-phase is preferable to two-phase for general power purposes, since the plant is more fully standardised and therefore cheaper, while rotary converters are smaller, more efficient, and give better commutation on three-phase than on two-phase systems.

Distribution.—For distribution within a short radius of the power-house the voltage of generation and transmission will be the same as that required for the supply to consumers; but for transmission to greater distances, for which the voltage is stepped up, there is a wide choice of the voltage of generation. An unduly low voltage involves heavy and expensive bus-bars and switch-gear, and in large units presents difficulty in the construction of the stator windings of the generators. A very high voltage, on the other hand, requires a winding with many windings in series per slot, a greater thickness of insulation and involves a generally reduced reliability. From the point of view of the construction of the generator it is desirable to have two conductors per slot, and the stator current should then vary from about 300 ampères in the smallest to 1,000 ampères in the largest machines. It may therefore be shown that the most suitable voltage of generation, when not otherwise restricted for a three-phase machine, should vary approximately as follows:—

Output (kw.)	200	500	1,000	2,000	5,000	10,000	15,000
Pressure (volts)	450	900	1,500	2,500	5,000	9,000	11,000

The power factor is here assumed to be 0·8. For two-phase machines the phase pressure should be about 0·9 times the above values.

One of the most important modern developments in transmission has been in the direction of reducing the losses by increasing the voltage of the transmission lines. (*See* ELECTRICITY, TRANSMISSION OF.)

Automatic Generating Stations.—The automatic generating station is especially suited to systems where numerous small-power falls are available. In such a case the expense of an operating staff at each would be prohibitive, but if each station can be made automatic, and all are linked into a common distribution system, the labour cost is reduced to a minimum. The first of such stations was set in operation in 1917. This is on the system of the Iowa Railway and Light Co., where it operates in parallel with a steam plant situated about two miles away. The automatic station contains three 500-K. V. A. generators driven by Francis turbines operating under a head of 10 feet. Normally the starting and stopping of these sets is accomplished automatically through the medium of float switches actuated by the change in the level of water above the dam. Provision is also made for controlling these operations as well as the gate openings of the individual turbines by push buttons in the central power-house. Other plants of this type have since been installed, and this method of development promises to do much to render it economically possible to utilise many low head river falls which have hitherto been neglected.

Combined Operation of Hydraulic and Steam Plants.—Owing to the variability of river flow, it is impossible to utilise more than a fraction of the total available energy unless machinery is installed which will have to be idle during the greater portion of the year. Broadly speaking it is found that the most economical results are obtained when the capacity of the turbines is such as will enable them to be run at full load for about six months in the year.

By operating a steam plant in conjunction with the hydraulic installation, it becomes economically possible to increase the capacity of the hydraulic plant, the defect of its output at times of less than normal flow being made good by the steam installation. The latter also serves as a stand-by in case of a breakdown of the hydraulic plant. (*See* SUPER-POWER.) The best method of operation of such a combination depends upon the type of load, storage capacity, etc., and can only be determined by special reference to the special circumstances of each individual plant. Very often, however, the steam station is entrusted with the special duty of carrying the peak load. (A. H. GI.)

HYGIENE: *see* INDUSTRIAL WELFARE; PUBLIC HEALTH.

HYMANS, PAUL (1865–), Belgian politician, was born at Ixelles, Brussels, March 23 1865. He became a barrister in 1885, and from 1898 to 1914 was professor of comparative parliamentary history at Brussels University. From 1900 he was deputy for Brussels and soon became the Liberal leader. After a mission to President Wilson in Aug. 1914 he was plenipotentiary in London, 1915–7, when he became head of the Ministry of Economic Affairs. From 1918–20 and 1924–5 he was Minister for Foreign Affairs. In Nov. 1918 he attended the inter-Allied Council at Versailles; he also represented Belgium at the Peace Conference in 1919 and on her behalf signed the Peace Treaty. In the same capacity he attended the conferences at San Remo, Boulogne, Brussels and Spa. He played a leading part in the settlement of the Ruhr question, the Dawes Plan, the Security Pact and the economic union of Luxembourg with Belgium. In Jan. 1920 he was appointed Belgian representative on the League of Nations, and in the same year was made president of the first Assembly at Geneva. A member of the Académie Royale de Belgique, M. Hymans wrote *L'histoire parlementaire de la Belgique* and *Frère Orban.*

HYNDMAN, HENRY MAYERS (1842–1921), British politician, was born March 7 1842 in London. His father was a barrister and founder of the Hyndman Trust for building churches. After leaving Trinity College, Cambridge, he travelled extensively and became war correspondent for *The Pall Mall Gazette* during the Austro-Prussian War of 1866. In 1881 he founded the Social Democratic Federation and from this time on was the chief exponent of Marxism in Great Britain. As such, he came into conflict with William Morris and later with J. Ramsay MacDonald. Hyndman opposed the South African War; took an active part in the Second International; but, in spite of his sympathies with India's demand for self-government he took a strongly Imperialistic line at the outbreak of the World War in 1914. He died in London Nov. 22 1921. One of his latest books, *The Evolution of Revolution* (1920), clearly sets out his general views; in addition to numerous other propagandist works he also wrote *Records of an Adventurous Life* (1911); *Further Reminiscences* (1912); and *The Future of Democracy* (1915). See Rosalind T. Hyndman, *The Last Years of H. M. Hyndman* (1923).

HYTHE, CONFERENCE OF (May 15 to 17 1920), a meeting between the British and French Prime Ministers, together with the Chancellor of the Exchequer and the French Minister of Finance, in preparation for the Conference of Spa (*see* SPA, CONFERENCE OF). A French proposal that France should be granted priority in reparation payments seems to have been put forward but not pressed, and the linking up of the reparation problem with the question of inter-Allied debts was proposed publicly for the first time in the official communiqué.

IBÁÑEZ, VICENTE BLASCO (1867–), Spanish novelist and politician, was born at Valencia Jan. 29 1867. He became an impassioned political agitator and suffered exile, hard labour and frequent imprisonment for his opinions, although he was returned to Parliament on eight occasions by his native city. His early novels, of which *Canas y Barro* is considered the best, deal with life in Valencia and are in some respects superior to his later productions. Although a republican, Ibáñez held strong anti-feminist opinions. He travelled extensively and achieved world-wide success as a writer for the cinematograph. Among his best-known novels are *La Catedral* (1903, English translation, *The Shadow of the Cathedral*, 1909); *Sangre y Arena* (1908, English translation, *Blood and Sand*, 1913); *Los cuatro Jinetes del Apocalipsis* (1916, English translation, *The Four Horsemen of the Apocalypse*, 1918) and *Mare Nostrum* (1918, English translation, *Our Sea*, 1920). He was unpopular in Spain, where his writings were ignored by the majority, and he eventually settled in Paris, becoming the centre of a group of politicians with anti-monarchical views.

ICELAND (*see* 14.227), an independent State in personal union with Denmark. Its area is 40,437 sq. m. and its population is about 100,000. In 1918 Iceland was recognised as a separate kingdom, with unlimited sovereignty, in personal union with Denmark. According to the Act of Union there are no real joint affairs; Denmark, however, provisionally till 1940, takes charge of the foreign affairs of Iceland as its mandatory. For the same period Danish and Icelandic citizens, residing in either State, enjoy in every respect equal rights. Since 1915 Iceland has had its own merchant flag; since 1918 its own national arms. Abroad Danish legations act on behalf of both Denmark and Iceland. Iceland has a legation in Denmark, and Denmark a legation in Iceland; other states are represented in Iceland by consulates.

Constitution.—According to Iceland's new constitution (1920) the King shares the legislative power with the Parliament, the Althing, an assembly of 42 members, sitting in two divisions, the Upper House (14) and the Lower House (28), but in cases of dissension it can assemble as a joint parliament. The Cabinet consists of three ministers, but there is no governor-general, and every legislative Act passed by the Althing and many administrative measures must be sent to the King in Copenhagen for signature. Since 1920 Iceland has had its own supreme court, and (since 1911) its own university. Other improvements in education are the establishment of a teachers' seminary and a system of public schools. In almost every other respect Iceland in this period has made constant and rapid progress.

Population.—The total population in 1925 was 100,000 (1901, 78,000), about 50% living in towns and trading-stations. There are seven towns with chartered privileges, the greatest of which is the capital *Reykjavik*, which has about 22,000 inhabitants (1901, 6,700).

Industry.—The fishing trade has been considerably improved by the introduction of new methods, especially steam trawlers and motor cutters, and the export of fish products, chiefly cured split cod, herring and fish oils increased from a value of 11,000,000 kr. in 1911 to 68,000,000 kr. in 1924. The cultivation of the soil is also constantly improving, though in a smaller degree, and dairy farming after the Danish method has been introduced, by which the production of butter has been greatly improved. With the exception of several handicrafts in the towns there is almost no industry. Some woollen factories have been established, and yield a good return, but capital is lacking to provide as many as are needed.

Water Power.—In its innumerable waterfalls (the greatest and most accessible estimated to represent about 4,000,000 horse power). Iceland is in possession of almost inexhaustible motive power, and it is very likely that considerable industries may grow up in Iceland in the near future; both Danish and Norwegian companies during the War petitioned the Althing for concessions to utilise some of the greater falls. The realisation of this plan was, however, hindered partly by the Icelanders' reluctance owing to their fear of invasion of foreigners and partly by the common European economic crisis. Thus far the water power has only been used to produce electric light in most of the towns and on some few farms.

Minerals.—The only mining industry is that of the precious calcareous spar, only found in Iceland, as the many rich sulphur mines and the lignite mines, worked during the War cannot pay on account of difficult transport to the coast. Both iron and copper and even gold have been found, and English as well as German experts have declared that the working of the gold mines near Reykjavik would be remunerative; here a German-Dutch Company was still engaged in preparatory investigations in 1925.

Communications.—Communications are constantly developing, and driving roads have been made in almost every district; bridges have also been constructed over most of the rivers, and a scheme for construction of a railway was in 1925 fully prepared by the Government. A telegraph cable to Shetland was opened in 1906, and telegraph and telephone lines inland have been extended practically throughout the whole country. In 1917 a wireless telegraph station was erected in Reykjavik and broadcasting (radio) introduced in 1925. The lighthouse system is yearly improving, and at Reykjavik a modern harbour with quays and cranes has been built. In 1914 Iceland acquired its own steamship company, which in 1925 controlled six mail steamers.

Public Health.—The birth-rate in 1923 was 26·5 per 1,000 and the death-rate 12·5 per 1,000, the latter showing a marked improvement on pre-war figures. A mental hospital and a sanatorium for tuberculosis, together with some other minor infirmaries, have been established and the building of a great state hospital in Reykjavik was commenced in 1925.

Liquor Control.—From 1912 onwards there came into force a system of complete prohibition of import and making of any liquor containing more than 2¼% of alcohol, with the exception of medical requirements and denaturalised spirits for industrial use. But in 1923 Spain (the chief market for Iceland's fish products) forced Iceland to allow import and sale of Spanish wines, while the prohibition for the rest has been maintained.

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ICELANDIC LITERATURE (*see* 14.240).—As in the previous period poetry takes the foremost place; although great progress was made in novel writing, and the drama also gained in significance. Among the many lyrical poets Einar Benediktsson and St. G. Stephanson, resident in Canada, were the most important, both rather heavy in style, but rich in ideas and weighty in thought. Lighter and more elegant in style are Davíd Stefánsson, Stefán frá Hvítadal and Hulda (pseudonym Unnur Bjarklind), while the best novelists are Einar H. Kvaran and Gunnar Gunnarsson. Gudmundur Fridjónsson, Jón Trausti (pseudonym Gudmundur Magnússon) and Gudm. G. Hagalínre portray folk life with considerable skill; so do J. M. Bjarnason and Laura Salverson; both reside in Canada and portray the life of the Icelandic colonists there, the latter writing in English, *e.g.*, *The Viking Heart*. The best dramatists are Jóhann Sigurjónsson and Gudm. Kamban, whose dramas achieved a great success at the Royal Theatre in Copenhagen. The drama, *The Mother-in Law*, by an Icelandic countrywoman, Kristín Sigfúsdottir, was produced at Reykjavík and Winnipeg, and was much admired.

Among the more notable writers on other subjects were, Tón Adlis, Páll E. Olason and Jon Helgason on history, J. Th. Thoroddsen on geography, and Sigfus Sigfússon on folklore. Sigfús Blöndal published an Icelandic-Danish Dictionary, the first complete dictionary of modern Icelandic.

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IDAHO (*see* 14.276).—The population in 1920 was 431,866, of which the rural population, 312,829 constituted 72·4%. The total population in 1926 was estimated by the Bureau of the Census at 522,175. The average number of inhabitants per sq. m. increased from 3·9 in 1910 to 5·2 in 1920. Boise, the capital and largest city, had in 1920 a population of 21,393 (17,358 in 1910).

Agriculture.—Agriculture continues to be the principal source of wealth. In 1925 the number of farms was 40,582 as compared with 42,106 in 1920 and 30,807 in 1910. Nearly two-fifths of all the farms were between 100 and 174 acres. The average value of land and buildings per farm in 1925 was $9,213 as compared with $313,811 in 1920 and $7,955 in 1910. The number of mortgaged farms nearly doubled in the 10 years 1910–20. The farm value of all crops in 1923 was $81,308,000 as compared with an average value for the period 1917–21 of $106,209,000. The following table indicates the statistical position of several of the more important crops for the year 1924:—

Crop	Acreage	Production	Farm value
Oats	184,000	6,624,000 bu.	$ 3,842,090
Barley	162,000	2,958,000 bu.	2,426,000
Wheat	933,000	17,828,000 bu.	23,355,000
Hay	1,018,000	2,059,000 tons	25,120,000
Potatoes	67,000	10,725,000 bu.	5,792,000

Specialised cash-crop agriculture is replacing the older type of farming. Because of transportation costs on bulky products, more attention is being given to seed production, beans, peas, head lettuce and the like. Dairying is of increasing importance, much of the output being marketed in the form of cheese. As a sheep-producing state, Idaho ranked fourth in 1924 with nearly 2·05 million head having an estimated farm value of 22 million dollars. The total value of all livestock on Idaho farms was estimated at $49,000,000, in 1924. Poultry production for the Pacific Coast market is rapidly becoming a leading agricultural enterprise. About half the farms in the state were under irrigation in 1920. The enlarged American Falls Dam, which was in 1925 the largest Federal reclamation project, was undertaken to provide additional storage capacity for the existing irrigated areas of southern Idaho.

Mining.—Mining continues to rank second in economic importance. The following table shows the value of mineral production since 1920:—

	Gold	Silver	Lead	Copper	Zinc
1920	$459,000	$8,379,000	$22,292,000	$ 491,000	$1,785,000
1921	552,000	6,184,000	9,559,000	172,000	94,000
1922	458,000	6,149,000	11,762,000	394,000	431,000
1923	733,000	6,158,000	18,550,000	2,292,000	603,000

Lead is first in importance, the principal mines being in the Coeur d'Alene district. Successful developments of lead-silver and lead-zinc ores have been made in the east central part of the state, largely stimulated by the mining activities of the Ford Motor Co. The extraction of silver is in most sections incidental to lead mining. In recent years there has been a renewed exploitation of zinc ores. The Interstate-Callahan Mine is probably the third largest producer of zinc ore in the United States. The largest copper-producing area is in Custer county. The Seven Devils range in Adams county is one of the most extensively mineralised copper belts in the west. Tungsten mines are being developed in Lemhi county. In southwestern Idaho are great quantities of phosphate rock which are being gradually exploited.

Manufactures.—There has been a marked growth since 1910 both in the number of manufacturing establishments and in the value of their products. The following are the chief industries, in order of importance: lumber, flour and grist mills, car and railway shops, printing and publishing. About half of the value of all manufactured goods is represented by lumber products. Idaho ranks first among the states in the area of state and national forests, aggregating approximately 19 million acres. In addition there are large stretches of privately owned timber land.

Transport.—In 1923 the state had 2,877 m. of steam railway and 89 m. of electric track. In 1915 the Celilo Canal, on the Oregon side of the Columbia river, was opened and vessels can now pass from the Pacific to Lewiston, a distance of 480 miles.

Government.—The legislature of 1919 completely re-organised the state civil administration in so far as the limitations imposed by the state constitution permitted. The Administrative Consolidation Act abolished some 46 boards, commissions and offices and gave Idaho a consolidated form of state government, or, as it is locally called, a cabinet or commission form of government, with the governor at the head, assisted by nine departmental commissioners. These nine departments are: Agriculture; Commerce and Industry; Finance; Immigration; Law Enforcement; Public Investment; Public Welfare; Public Works; Reclamation. Each commissioner is appointed by the governor and, except "those under the constitution who are appointed for specific terms," may be removed by him at his discretion. In certain departments a small number of designated officers are appointed by the governor, but on the whole the organisation within each department is under the control of the commissioner. This consolidated form of government concentrates authority in the hands of the governor to a marked degree. The law provides an executive budget system for the state. The Eighteenth (Prohibition) Federal Amendment was ratified Jan. 8 1919.

Education.—In 1924–5 there were 137,256 pupils enrolled in the state schools, of whom 19,759 were in the high schools and 117,497 in the elementary schools. The state university comprises colleges of Letters and Sciences, Agriculture, Engineering and Law; schools of Forestry, Mines, Education, Business Administration and Graduate Study. The total enrolment in 1925 was over 2,000. Idaho has attracted much attention because of its scientific and economical administration of higher education. A Board of Education of five members appointed by the governor for terms of five years, has general supervision over the normal schools and the Technical Institute, and, as a Board of Regents, over the university as well. The result is a unified system of higher education with little duplication, low cost and excellent standard.

The governors during the period 1910–25 were: James H. Brady, Rep., 1909–11; James H. Hawley, Dem., 1911–3; John M. Haines, Rep., 1913–5; Moses Alexander, Dem., 1915–9; D. W. Davis, Rep., 1919–23; C. C. Moore, Rep., 1923–

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ILLEGITIMACY (*see* 14.301).—Illegitimacy may be measured in different ways. One way is to state the number of illegitimate births in every 1,000 births as in Table I. The range of variation there shown between different countries is much more striking than the variation between different times in the same country. Where the figures are small they may be incomplete. Statistics are not given for the United States as a whole; in New York the rate is in the neighbourhood of 12, and in Pennsylvania, 20. In countries affected by the War the rates were generally highest during the War period; thus, in Germany, the rates in the periods 1911–4, 1915–8, 1919–22 were 94, 115, 109; in Hungary, they were 90, 104, 76; in France, 87, 132, 132 (the last for 1919 only). Taking the rates as recorded, two causes might account for this: it might be due to a rise in the number of illegitimate births, or, as in this country, chiefly to a fall in the total number of births; the second movement sometimes disguises the other. But it must be borne in mind that the figures for successive periods are not really comparable for countries with altered territories.

A better method of measurement is to refer illegitimate births to the total of unmarried women at fertile ages. Thus, from the date when the decline of the birth-rate in England began, about 1876–80, to 1919–23, the number of legitimate births, per 1,000 married women between the ages of 15 and 45, had fallen 44%; the number of illegitimate births, per 1,000 single and widowed women between the same ages, had fallen 46%; while the number of illegitimate births per 1,000 of all births had only fallen about

two per cent. Table II. shows the illegitimate rates, calculated by this better method, in a few countries for which data are available in a pre-war and a post-war period. The trend, though in some cases slight, is downward, and we know that the same trend was apparent in earlier years. This does not necessarily imply a rise in the standard of morality: it may denote an increasing use of means to prevent conception.

In Table III. the number of illegitimate births in England and Wales in 1921, expressed per 1,000 of the total census population, is analysed according to locality and according to extent of urbanisation. The third column shows these rates as percentages of the rate for the country as a whole. The last column represents an attempt by the registrar-general to allow for the number of potential mothers among the unmarried at different ages between 15 and 45 in each locality or class of area; for this purpose certain standard fertility rates applicable to different age-groups are used, and the actual births are compared with the "expected" births. The rates are higher in Wales and the northern counties than in the southern and midland counties. The more accurate index also emphasises the highness of the rate in rural districts. These differences are in part due probably to differing degrees of familiarity with the use of contraceptive measures. (*See* POPULATION.)

TABLE I. *Mean Number of Illegitimate Births per 1,000 of all Births, excluding Stillborn*

Country	1911–4	1915–8	1919–22	1923	1924
England and Wales	43	52	49	42	42
Scotland	73	73	73	67	66
North of Ireland	44[1]	45	44	45	43
Spain	48	54	61	59	..
Switzerland	47	46	42	36	37
Netherlands	20	22	21	19	18
Denmark[4]	113	115	109	108	..
Norway	69	70	71	69	66
Sweden[4]	154	149	146	140	140
Finland	77	82	85	88	..
Japan	..	88[2]	82	77	..
South Africa[3]	..	18	19	13	..
Australia[3]	..	..	48	46	46
New Zealand[3]	..	46[2]	45	45	45

[1] 1913–4. [2] 1918. [3] White population. [4] These figures are doubtless explained, in part at any rate, by a form of betrothal known as trial marriage.

TABLE II. *Mean Number of Illegitimate Births per 1,000 Unmarried Women, aged 15 to 45*

Period	England & Wales	Scotland	Switzerland	Netherlands	Denmark	Norway	Finland
1909–13	8·0	14	8·9	5·0	26	14	18
1919–23	7·8	13	5·6	4·5	20	13[1]	14

[1] 1919–22.

TABLE III. *Illegitimate Births in England and Wales, 1921, according to (A) Locality, (B) Extent of Urbanisation*

	Illegitimate Births per 1,000 of Total Population	Rates as percentages of that for England and Wales	Actual Births as percentages of Births which would have occurred with the Standard Fertility Rates
England and Wales	1·02	100	100
A.			
Northern Counties	1·12	110	109
Midland	1·00	98	99
Southern (including London)	0·92	90	88
Wales	1·03	101	111
B.			
London	0·89	87	79
County Boroughs	1·09	107	103
Other Urban Districts	0·96	94	94
Rural Districts	1·07	105	120

(D. C. J.)

ILLINOIS (*see* 14.304).—The population of Illinois according to the U.S. Census of 1920 was 6,485,280, as compared with 5,638,591 in 1910 and 4,821,550 in 1900. The rate of increase 1910–20 was 15% as against 14·9% for the whole United States and as against 16·9% for the state in the preceding decade. The population as of July 1 1926 was estimated to be 7,202,983. The increase of 1910–20 was urban, the rural population continuing to decline. In 1920 the percentage of urban population in towns and cities of 2,500 or over was 67·9% and 41·7% of the total population lived in the city of Chicago. In 1920, 52·5% of the state's population was in cities greater than 25,000. Population in villages of less than 2,500 declined from 12% in 1910 to 10·5% in 1920. Purely rural population fell from 26·4% in 1910 to 21·6% in 1920.

Population of Cities of over 40,000

City	Population 1910	Population 1920	Increase %	Estimate 1925
Chicago	2,185,283	2,701,705	23·6	2,995,239
Cicero	14,557	44,995	209·1	62,238
Decatur	31,140	43,818	40·7	50,359
East St. Louis	58,547	66,767	14·0	71,423
Peoria	66,950	76,121	13·7	81,564
Rockford	45,401	65,651	44·6	76,462
Springfield	51,678	59,183	14·5	63,923

Agriculture.—While the census of manufactures shows Illinois to be an industrial rather than an agricultural state, there has been no absolute decline in her agriculture. According to the census of 1920 Illinois was second only to Iowa among the states in agricultural importance. Based on crop values, in 1923, Texas was first, Iowa second, and Illinois third, with farm crops amounting to $459,509,000. Cereals are still the main crop and maize is the leading cereal. The largest crop was that of 1917 when 418,000,000 bu. were produced from 11,000,000 acres. In 1923 the crop of 337,000,000 bu. was a slight increase over the years immediately preceding. In 1923, 62,506,000 bu. of wheat were produced, grown on 3,479,000 acres. The production of oats has declined, but in 1923 with a harvest of 135,100,000 bu. from 3,860,000 ac. she took third place in the United States. In 1923 Illinois ranked seventh in the production of barley and rye, producing 3·33% of the barley and 5·56% of the rye grown in the United States. In livestock, Illinois, Jan. 1 1923, with 1,125,000 milch cows, ranked fourth among the States; and in other cattle, numbering 1,477,000, ranked sixth. In number of swine, 4,460,000 and the number of horses, 1,277,000, Illinois ranked second only to Iowa.

Manufactures.—In the value of manufactures, Illinois, in 1923, ranked fourth among the States. In 1919 the total value of her manufactured products was $3,366,452,969. In 1923 the total value had risen to $5,041,519,455. Manufactures employed 645,433 wage-earners, working in 14,348 establishments. The ten most important industries with the values of their respective products in that year are as follows:—

Manufactured Products, Illinois, 1923

Slaughtering and meat packing (wholesale)	$606,320,553
Foundry and machine shops	275,955,047
Iron and steel, steel works and rolling mills	213,671,552
Electrical machinery and supplies	211,366,206
Clothing, men's	186,683,333
Cars, steam road (not back in repair shop)	159,364,227
Printing and publishing, book and job	138,227,215
Printing, publishing, newpaper, etc.	132,288,355
Cars, and general construction, steam	113,604,362
Bread, and other bakery products	105,289,516

The tendency in manufacturing was toward large-scale production and corporate ownership. Of the 18,593 establishments in the state in 1919, the 799 producing $1,000,000 or over turned out some 75% of the products. In these industries 389,686 wage-earners were employed. Chicago, with its tributary manufacturing suburbs of Maywood, Harvey, Cicero, Blue Island, Chicago Heights, and, in Indiana, Hammond and Gary, is the greatest manufacturing centre of the state. A lesser manufacturing centre has grown up in the net of railways that centre at St. Louis, Collinsville, Granite City and Edwardsville. The third centre

is formed by Moline and Rock Island with Davenport, Iowa. Joliet and East St. Louis were second and third respectively to Chicago in the value of products in 1919. Manufactures in Chicago, are generally diversified. The same is usually true in the smaller centres, although a few cities are noted for their special products. Thus, Rockford is best known for its furniture manufactures, Kewanee for boilers, Elgin for watches, Moline for farm implements and automobiles.

Minerals.—In mining and allied interests Illinois occupies an important position. Coal constitutes her leading production. During 1924 67,880,000 short tons were mined, a total exceeded only by Pennsylvania and by West Virginia. The value of her petroleum production in that year was$14,200,000. Limestone, sandstone, fluorspar, lead and zinc are the other leading products.

Communications.—For transportation, Illinois relies chiefly on its steam railways. With 12,046 m. of main line she was in 1924 second only to Texas. For over 30 years little new main-line road has been built. The important extension has been in double-tracking and improvement of the right-of-way and terminals. The field of passenger and light freight and coal transport, since 1900, has been invaded by the electric lines, which by 1924 operated 3,555 m. of track. The Illinois Traction System operates a ramification of electric lines across the state from Danville to East St. Louis and radiating throughout central Illinois; on certain runs it operates sleeping and parlour cars. Illinois' most important water transportation system is that of the Great Lakes. Receipts of grain at Chicago by lake have steadily declined of late years, although the lakes are still the usual route for shipment of wheat to eastern points. Flour shipments by lake are comparatively insignificant, an important fact in view of the increasing quantity of grain milled at Chicago. Iron ore is still shipped to Chicago and South Chicago by way of the Great Lakes. In 1900 the Sanitary District Channel was opened, providing a waterway with a depth of 20 ft. for navigation between Chicago and Lockport. But from Lockport to Utica, on the Illinois river, a distance of 62 m., there was no adequate means of water transportation. A legislative Act of 1919 actively supported by Gov. Frank O. Lowden provided for the issue of bonds to the amount of $20,000,000 for the construction of an eight-foot channel, "The Illinois Waterway," connecting the points mentioned. Little actual progress had up to 1925 been made towards carrying out this project for the Lakes-to-the-Gulf water route.

The improvement of the roads in the state of Illinois has in recent years been given marked attention. A state highway commission was created in 1905, various laws facilitating local road improvement were passed, and in 1914 state appropriations for hard roads were made from the proceeds of automobile licence fees. Actual construction was begun in 1914. Acts of Congress of 1916 and 1919, apportioning Federal aid in behalf of roads, allotted to Illinois $3,300,000 and $8,700,000 respectively. The question of issuing $60,000,000 in bonds based on automobile license fees for the construction of 4,800 m. of hard roads was submitted to the voters of the state in Nov. 1918 and was approved by them. Construction of roads under Federal aid and by means of this bond issue has been going forward. In 1922 722 m. were completed and over 1,000 m. in 1923. The state Legislature in 1923 authorised a bond issue of $100,000,000, providing for the continuance of a state-wide system of hard-surface roads, and this legislation was approved by the people at the General Election of 1924.

Banking.—The northern part of Illinois lies in the 7th Federal Reserve District and the southern part in the 8th, with headquarters respectively in Chicago and St. Louis. In 1925 there were 501 National banks in Illinois with aggregate capital stock of $94,480,000, aggregate surplus of $63,265,000 and total resources of $1,701,448,000. Of these banks 32 are located in Chicago, having resources amounting to $1,103,339,000. Side by side with the National banks is the system of state banks created by the Act of 1887, and operating under the supervision of the Auditor of Public Accounts. In 1925 there were 1,396 state banks with a total capital of $160,240,000, and aggregate resources of $2,682,196,000. Of the state banks 176 are in Chicago, having resources amounting to $1,926,594,000.

Government.—Despite the difficulty of changing the organic law, in the period 1910–25 there were far-reaching changes in the organisation of the machinery for government. Under the constitution of 1870 an amendment must be initiated by two-thirds of both Houses in the General Assembly and approved by a majority of all persons voting at the next election. Further, in a session an amendment to but one article can be proposed, and no two amendments to any article can be offered within four years. Revision of the constitution by amendment, therefore, proved too difficult, and in 1917 the General Assembly voted to submit to the people the question of a constitutional convention, which was approved at the election of Nov. 1918. Accordingly, in 1919 an Act was passed for a convention to meet Jan. 6 1920. Difficulties arose over Chicago's representation in the General Assembly, and in Dec. 1920 the convention adjourned with its work unfinished to meet in Sept. 1921. Sessions were held at intervals until June 28 1922 when the constitution was adopted for submission to the people for ratification at a special election to be held Sept. 12. The new constitution, in this election, was defeated by a decisive majority.

Changes in the state's system of appointments have been effected. First, in time, was the extension, by the Act of 1911, of the civil-service system, to the greater part of the state's employees. Civil service now covers all state appointees except those appointed by the governor and confirmed by the Senate, the scientific and academic staff of the University of Illinois and the normal schools, and a few others. All examinations are competitive, although for some scientific posts "unassembled examinations" are given which consist of questions as to training and experience. By an amendment of 1917 all appointees may be removed by the appointing authority, but are allowed an appeal to the state Civil Service Commission on allegation that the removal is due to race, politics or religion. Reorganisation of governmental machinery was begun in 1909 with the abolition of separate boards for the various state charitable institutions and the establishment of one central board of control possessing also certain powers over private charitable institutions. In addition to this board a supervisory state charities commission was created. There remained, however, over one hundred state boards, bureaus and offices, paid and unpaid, created to execute various acts and to supervise various state institutions. The result was disorder and waste. A reorganisation recommended by a committee in 1914 was in great part adopted in the State Consolidation Act of 1917. This Act necessarily left untouched the constitutional offices, secretary of state, auditor of public accounts, treasurer, attorney-general and superintendent of public instruction, but set up in addition to them nine departments—Finance, Agriculture, Labor, Mines and Minerals, Public Works and Buildings, Public Welfare, Public Health Trade and Commerce, Registration and Education. The heads of these various departments, who are appointed by the governor and Senate, have acted as a Cabinet for the governor. Illinois ratified the Eighteenth (Prohibition) Federal constitutional amendment Jan. 14 1919.

Public Finance.—Expenditures authorised by the Legislature for the biennium 1925–7 amounted to nearly $300,000,000. Of the appropriations for 1925–7, $131,000,000 was for the continuance of the hard-roads plan. It was anticipated that $35,000,000 of this amount would be supplied from money received by the state for automobile licences, while the remainder would come from the sale of $100,000,000 in bonds, the issue of which was approved by the people at the Nov. election of 1924. Among other more important items of appropriation were: Public Welfare Dept. including state charitable, penal and reformatory institutions, $28,979,000; omnibus bill, $23,718,000; state treasurer, retirement of and interest on bonds, $23,575,000; public schools, $16,223,000; University of Illinois, $10,620,000; state normal schools, five in number, $3,150,000; Agricultural Dept. $2,691,000; Health Department, $1,041,000.

Education.—In 1924 there were enrolled in the elementary schools of Illinois 563,614 boys and 534,684 girls. In the state high schools there were 106,735 boys and 111,005 girls. This represents an increase of 113·76% in the number of high school pupils during a period of ten years. In addition to the public schools there were, in 1924, 960 private schools with 195,552 pupils. The total number of teachers in the elementary schools in 1924 was 42,865. In that year there were 9,117 high school teachers. The net expenditure, including new grounds and buildings and payments of bonded indebtedness with interest in 1922 was $103,375,359. Of this amount, $79,126,323 was spent on current expenses, $20,386,043 for new grounds, buildings and equipment, $2,224,466 for cancellation of bonded indebtedness, and $1,638,627 for interest on bonds. The salaries paid to teachers were comparatively low. The average salary for men was $1,679; for women, $1,449. A notable development in the public educational system was the growth in the number of township high schools, and the number of community high schools following the legislation of 1917. Under the township high-school law some 200 high schools were organised. Acts of 1913 and 1915 directed the payment by local school authorities of tuition for children who wished to attend high school elsewhere when there was none in their district. During one year, 1920, 167 community high schools were organised, and at the end of 1922 there were 465 such schools in the state. At the close of the year 1924 the number had risen to 915. With the rapid growth in the numbers of high school graduates (24,507 in 1924) there was a corresponding increase in the enrolment in the universities and colleges of the state. The attendance at the University of Chicago, 1923–4, was 13,357; University of Illinois 11,083; and Northwestern University, 9,150. In addition, there are in the state 29 colleges of recognised standing and 6 teachers' colleges. Located in Chicago are four Class A medical schools, two Class A law schools, three Class A dental schools and nine schools of theology.

Recent Political History.—In 1912, as a result of the Progressive secession, the Republican party for the first time in 16 years lost control of the state, the Democratic presidential elector winning by a vote of 405,038, as against 386,478 for the Progressives and 253,593 for the Republicans. The Democratic state ticket headed by Edward F. Dunne was elected by a somewhat larger plurality over Gov. Charles S. Deneen, Republican, and Frank H. Funk, Progressive. The Democrats, however, did not control the General Assembly on joint ballot, and had to compromise with the Republicans on the election of one Democratic Senator, James Hamilton Lewis, and one Republican, Lawrence Y. Sherman, the latter to fill an unexpired term to 1915. By 1914 the normal Republican majority in the state reasserted itself, the popular vote for Senator in that year being L. Y. Sherman, Republican, 390,661; Roger Sullivan, Democrat, 373,403; Raymond Robins, Progressive, 203,027. President Woodrow Wilson lost the state in the presidential election of 1916 by 160,000 votes. Frank O. Lowden, Republican, was elected governor over Edward F. Dunne.

In spite of the appeal for the support of the administration of Woodrow Wilson which was made on patriotic grounds, only five Democratic Congressmen were elected by the state in 1918, and Medill McCormick, Republican, defeated J. H. Lewis, Democrat, for Senator by 53,024 votes. In 1920, after an extremely bitter primary fight in the Republican party, Len Small was nominated for the governorship over John J. Oglesby. In the election, Republican state and national tickets swept the state by overwhelming majorities. In the primary election for governor, April 8 1924, Gov. Len Small received a plurality of 59,920 votes over Thurlow G. Essington, and Norman L. Jones was nominated by the Democratic party. Charles S. Deneen defeated Senator Medill McCormick for nomination for the U.S. Senate on the Republican ticket. Governor Small made his campaign chiefly on his record for the promotion of the construction of hard roads. The road-bond issue of $100,000,000 for this purpose was voted on at the same time. Gov. Small was re-elected with a plurality of 345,028 votes over the Democratic nominee. Deneen was elected to the U.S. Senate. The governors of Illinois after 1905 were: Charles S. Deneen, Rep., 1905–13; Edward F. Dunne, Dem., 1913–7; Frank O. Lowden, Rep., 1917–21; Len Small, Rep., 1921–5, and 1925– .

See, in addition to the books listed in 14.311, *Centennial History of Illinois* (5 vol., published by the state, 1918–20) and later volumes of the *Illinois Historical Collections.* (J. A. J.)

ILLUMINATING ENGINEERING, term now used to denote all applications of natural and artificial light in the service of mankind. Progress in Great Britain since 1910 is largely the result of the formation (in 1909) of the Illuminating Engineering Society, in which makers of lamps and lighting appliances and users of light co-operate; all illuminants are represented and all aspects of the subject, economic, hygienic and artistic are considered. A similar body, the pioneer in this field, has been in existence in the United States since 1906, and corresponding bodies have been formed in Germany (1913), Austria and Hungary (1925) and Japan (1915). In Germany two additional societies operating in Karlsruhe and in the Rhine-Westphalia district have also been created.

Attention has been paid to illumination at many international congresses, thus promoting the exchange of views between experts in different countries. The re-organisation of the international photometric commission, founded in 1900, as the international illumination commission, was stopped by the World War, but a fresh start was made in 1921, and the leading countries are now represented with national committees for the respective countries.[1]

Much has been done towards standardisation and agreement on common principles. Definitions of the main photometric quantities have been adopted, and a more extended series of definitions, symbols, etc., framed, while sub-committees to deal with lighting legislation, automobile headlights, etc., have been formed. At the session held in Geneva in 1924 further activities were initiated and the Commission is now extending its work to deal with various practical problems.

The International Candle.—A noteworthy step, dating from 1909, has been the agreement between France, the United States and Great Britain and, recently, also Russia, on an international candle so that the same unit of light is now in use in all four countries; but in Germany and some other countries the Hefner candle (equal to 0·9 international candle) is still in use. Preservation of the unit of light is now effected by the exchange of specially prepared electric lamp-standards between the official laboratories in the countries concerned. Meantime experiments are being made with a view to evolving an absolute standard of light, *e.g.*, one based on the maintenance of a "black body" at a specified temperature. In the United States the standard is the *lumen* or the amount of light that would fall on a surface so placed that all its parts are at a distance of one foot from a light source of one candle power.

Technical Progress.—Progress in illuminants has kept pace with this advance on the scientific side. Electric lamps, filament and arc, have been developed (*see* Electric Lighting). In the field of gas lighting there has been steady progress in design, one instance being the smaller and more compact forms of high-pressure gas lamps, now rated to give 60 candles per cu. ft. of gas consumed. In low-pressure gas lighting the use of superheated clusters of inverted mantles has made possible a gain in efficiency estimated at 30%. The distribution of the light from a number of smaller mantles is considered an advantage, and the smaller types of mantles are the most durable. Cluster-lamps giving up to 2,000 c.p. are now available.

Theory of Radiation.—Researches into the theory of radiation and the principles underlying illuminants provide a clearer understanding of the luminous efficiency theoretically obtainable. Thus a light source yielding visible white light and no non-luminous vibrations would operate at approximately 26 c.p. per watt, whilst if the light were confined to the most efficient yellow-green section of the spectrum as much as 60 c.p. per

[1] See J. W. T. Walsh, "International Co-ordination in Illumination," *Trans. First World Power Congress*, vol. 3 (Wembley, 1924).

watt might be obtained. But in the case of new illuminants efficiency is not the only consideration; such special qualities as the colour of the light (as in the neon lamps) or the nature of the supplementary invisible radiation (as in the quartz tube mercury vapour lamps) may be of even greater importance.

Reflectors, etc.—The design of shades, globes and reflectors for use with lamps has assumed great importance. By suitable design of a reflector the distribution of light from a source may be altered with wide limits. Thus extensive, intensive and focusing forms of reflectors yielding standard curves of light distribution have been designed, and corresponding rules for height and spacing, designed to give even illumination on the working plane have been derived. In most cases a shade or reflector is designed to direct most of the light downwards, where it is chiefly needed. But other cases occur, for example in shop window lighting and the illumination of large posters, etc., where reflectors are so designed and spaced as to yield an illumination over an extensive vertical area.

Glare Prevention.—Another function of shades and reflectors is to screen the actual source of light from the eye. Even when only vacuum metal filament electric lamps were available the glare from exposed filaments irritated the eye and prevented it from registering the full effect of the illumination provided. In the case of the gas-filled lamps, with their very much brighter filaments, the need for scientific screening is yet more evident. Hence in the leading stores concealed lighting of show-windows, with the light thrown on the goods but the sources concealed from the eyes of observers, is coming to be regarded as the correct method; and it is only in the smaller shops that exposed sources of light are still too frequent.

A special instance of a concentrating reflector is to be found in the " floodlighting " units, consisting of an incandescent lamp with a special " bunched " filament at the focus of a parabolic mirror. Such units are miniature searchlights and are now being used to illuminate the façades of buildings. It is possible to limit the angle of dispersion to about 15° and with a 500 watt lamp a beam with a candle power exceeding 300,000 has been obtained. With the searchlight proper, using an arc, the dimensions of the source of light can be reduced to much smaller dimensions, and a beam of many millions of candle power attained.

Searchlights.—A notable advance during the War was the design of searchlights using specially cooled electrodes leading to a yet smaller and more brilliant source and corresponding greater concentration. The cooling has been effected by two distinct methods, a blast of air and a spray of alcohol; in both cases a very substantial increase in beam-candle power for a given current consumption was obtained.[1] The brightness of the crater in such cases has been estimated at 200,000–300,000 candles per sq. in., as compared with 85,000 c.p. per sq. in., in the case of the ordinary searchlight. In Germany, Lummer, working with an arc operating in a chamber under an air-pressure of 22 atmospheres, is said to have attained the enormous brightness of 1,500,000 candles per sq. in. But this method has apparently not yet reached a practical stage.[2]

Coloured Light.—An apparatus capable of projecting pure spectrum colours on the stage, which is in effect a giant spectroscope, has been designed. By the Mutochrome projector,[3] a series of superimposed patterns can be projected on the screen and the colour of each varied at will. This is likely to prove of considerable value to designers of wallpapers and coloured fabrics, as well as having a possible application for the projection of luminous scenery on the stage.

Artificial Daylight.—Efforts have also been made to provide " artificial daylight," *i.e.*, to correct the light from artificial illuminants and render it equivalent to normal daylight for the matching of colours. Two methods of effecting this correction have been applied. In the Sheringham unit the light from a gas-filled lamp is reflected from an upper surface coated with a pattern of green, blue and a small amount of yellow in suitable proportions. In the system usually associated with the name of Mr. F. E. Lamplough, the light is filtered through a combination of tinted glass. In either case the efficiency of the apparatus is necessarily low, 60% or more of the original light being lost in making the correction. But the advantage to firms in the dyeing industry and others concerned with delicate colour-matching of having an invariable artificial light, independent of the wide variations of natural daylight, is very considerable.

Industrial Applications.—The problems of the lighting of streets, schools, factories, shops, etc., of the avoidance of eye strain in cinema theatres and the importance assigned to proper lighting in factories, the interests of health, safety and efficiency of work, have been investigated by the Illuminating Engineering Society and Home Office Committees.[4] Evidence on lighting requirements in factories has been collected from many different sources, and records of over 4,000 tests of illumination in different factories have been presented. The minimum values of illumination in the interests of safety (0·25—0·4 ft.c.) are established. Recommendations on the subject of avoidance of glare, flickers and inconvenient shadows have been made, and the illumination required for carrying out work done is shown to be not less than three foot-candles for fine work and five foot-candles for very fine work. Consultations with various joint industrial councils are now proceeding with a view to determining what constitutes suitable and adequate lighting for processes in their respective industries.

Progress in the United States.—In the United States detailed codes of industrial lighting have been adopted in seven different states. In principle these follow closely the recommendations of the British Committee. Methods of grading various lighting units according to the degree of " glare " are outlined, and the positions which may safely be assigned to such units in a workshop are tabulated. The codes also contain standards of the illumination requisite for various processes, a distinction being drawn in the most recent codes between the minimum value desirable and higher values recommended in the interests of economic production. A considerable amount of research has been devoted to the relation between conditions of illumination and efficiency of work. Thus it has been shown by Dr. Ives of the United States Public Health Service that the dispatching service in post offices was expedited and rendered more accurate by better conditions of illumination;[5] tests in laboratories in Germany have likewise revealed a close connection between illumination and many processes involving exact vision and manual dexterity.[6] The subject of industrial lighting has likewise been studied by the International Labour Bureau of the League of Nations in Geneva.

Particularly difficult cases of industrial lighting also form the subject of study by the committee on illumination, working under the department for scientific and industrial research, on which eminent architects and medical men, besides lighting experts, are represented. This committee also deals with all inquiries bearing on illumination received from the various government departments. In connection with this and other aspects of lighting, increased attention is now being devoted to the hygienic side, and at the international congress for the study of industrial hygiene held in Geneva in 1924 a special resolution was passed accepting good illumination as of equal importance with heating, ventilation and sanitary conditions, in the interests of health and safety.

Standardisation.—Standardisation in various fields is being dealt with by various sub-committees, working under the British Engineering Standards Association, which have prepared specifications on the performance and dimensions of electric lamps, and have also recently issued standard specifications for portable

[1] The Sperry Searchlight, *Electrician* (Feb. 2 1917); Haydn T. Harrison, *Illum. Eng.* (March 1918).
[2] L. Bloch, *Lichttechnik* (1921).
[3] *Illum. Eng.* (May 1925).

[4] Reports of Departmental (Home Office) Committee on Lighting in Factories and Workshops, *First Report*, Cmd. 8,000, vol. 1 and 2 (1915); *Second Report*, Cmd. 1418 (1921); *Third Report*, Cmd. 1686 (1922).
[5] *Illum. Eng.* (April 1925).
[6] *Illum. Eng.* (April 1925).

illumination photometers[1] and reflectors used for industrial lighting.[2] Other subjects now being dealt with include lighting glassware, and the illumination of schools, offices and streets.

Traffic and Lighting.—Experience during recent years has shown that the questions of lighting and transport are closely related. With the progressive increase in the volume of fast-driven motor-traffic the necessity for good public lighting has become even more urgent than in the past; and the increase in the number of street accidents year by year has drawn public attention to the importance of the question. A new problem is presented by the lighting of arterial roads connecting cities. These routes are primarily intended for fast motor traffic and their utility will not be fully realised unless adequate artificial lighting is provided, enabling them to be used with safety by night as well as by day. Special methods of illuminating such routes are now the subject of consideration.

Many devices eliminating glare from powerful automobile headlights have been suggested, some of the most promising based on the limitation of the main portion of the beam below a certain horizontal plane so as to avoid the direction of rays into the eyes of approaching drivers or pedestrians. But the most hopeful solution lies in the provision of better public lighting, which would render very powerful headlights unnecessary.

Progress in these various directions has been aided very greatly by the introduction of simple forms of instruments for measuring illumination, of which quite a variety of types are now available. The information acquired in this way has been very helpful in framing recommendations for the degree of illumination necessary for various purposes.

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ILLUSTRATION (*see* 14.321).—By 1910 the rapid advance in the various methods of process reproduction had resulted in the complete liberation of the draughtsman from any of those considerations which had limited him in the days of the reproductive wood-engravers. This new freedom was in some ways a misfortune, especially as photography made it possible to reduce a design to any convenient size, so that the artist too often forgot altogether that his object was to decorate a book. The perfect illustrator is rare, and the most admirable drawings, when they are merely attached to an author's text, may not be illustrations at all.

The new interest in typography, stimulated by the work of William Morris, but in reaction against the heaviness of his types, has resulted during the decade 1915–25 in an enormous increase in the number of beautifully printed books issued from the press. Many of the English editors content themselves with fine typography, embellished perhaps with occasional head pieces and *culs-de-lampe*, but most of these decorative details are well-conceived, and pleasantly arranged with reference to the size of the page and the area of the type.

The possibilities of the woodcut have been most fully appreciated and exploited on the European continent. Its advantage over the intaglio methods, such as etching or copper-engraving, is that the wood block can be printed with the type by a single operation. Technically, however, it is a reaction, and the smallness of its field makes it unsuitable for use in illustrating popular magazines. The efficiency of modern reproduction makes it possible for an artist to design in almost any medium, with the reasonable hope that his intentions shall not be travestied on the printed page.

[1] British Standard Specification for Portable Photometers, No. 230 (1925).

[2] British Standard Specification for Industrial Reflector Fittings for Electric Lighting, No. 232 (1926).

Some Notable Work.—Some of the best examples of the use of the half-tone and line-block processes in England are still to be found in *Punch*, and range from the graceful, elegant manner of Lewis Baumer and (until recently) of Claude A. Shepperson, to a sympathetic treatment of proletarian types in George Belcher's reproduced pencil drawings. The "sequence picture," influenced by the cinema, but drawing its first inspiration perhaps from Caran d'Ache, receives competent treatment at the hands of H. M. Bateman and "Fougasse." W. Heath Robinson in known not only as a comic artist of fantastic invention, but as a delicate illustrator of fairy tales. More purely decorative is the work of Edmund Dulac, who relies, as does also Arthur Rackham, on the three-colour process. The last three artists named have done much to raise the standard of the illustration of children's coloured books. The nursery picture-books of about 1900, in spite of the previous example of Kate Greenaway and Randolph Caldecott, were often crude in colour and ugly in design.

The influence of Beardsley is seen in the work of John Austen, Harry Clarke and "Alastair," while artists like H. M. Brock continued the Hugh Thomson tradition. F. Cayley Robinson and Russell Flint are perhaps best known for their painting, outside the sphere of illustration, but they have both done good work within it. Ethel Gabain (Mrs. John Copley) may be included in the English school, although her most important lithograph illustrations have been issued by French publishers. Two able architectural draughtsmen are E. H. New and F. L. Griggs, while Frank Brangwyn brings to the illustrations of books, such as Southey's *Life of Nelson* and Kinglake's *Eothen*, the same power of emphatic statement and grandiose conception as distinguishes his larger work. The early death of Lovat Fraser cut short a career of great promise which, in spite of its brevity, has exercised a far-reaching influence on various British arts. His method of working in flat tones and simple outline was peculiarly suited to modern colour-reproduction, and his example has been widely followed. Of the more "advanced" artists, many of whom have exploited the possibilities of the original woodcut, may be mentioned V. Gribble, R. Gibbings, Paul Nash, Albert Rutherston, Ethelbert White, A. Buckels and S. Gooden. The last-named has done much to revive the use of line-engraving on copper.

French Workers.—Enthusiasm for the original wood-engraving is greater perhaps in France than in any other country, and so much excellent work has been done by this method alone that the chief difficulty lies in the selection of representative names. A more or less homogeneous group is formed by Maxime Dethomas, with his dignified line, Hermann-Paul, with his broad handling and strong dramatic feeling; and Carlègle. The well-known *éditions Crès* are decorated admirably by Gus Bofa, by Siméon, by Sylvain Sauvage, by Contel and by Daragnès. The last-mentioned artist has used etching as well as wood-engraving, and indeed—now that the chief aim of the woodcut, to harmonise with the printed page, has been generally accepted—there is no reason why artists should not avail themselves of lithography, as does L. A. Moreau, or of line-engraving, like Laboureur, or of etching, like C. Laborde. Mention should be made of the colour woodcuts of Falké, the work of Brissaud, of Deslignères, of Galanis, whose curious use of white hachures is well known to English amateurs; of Raoul Dufy, better known in England as a painter; of Paul Vera, of Laboureur, with his curiously effective deformations; of Jean Marchand, and of Raphaël Drouart, all of whose work goes to make this present epoch of book production in France a very notable one.

Germany.—Germany perhaps more than any other country has felt the influence of the most extreme aesthetic theories. The disorder following the War and the sense of humiliation in defeat tended to anarchy and disillusionment in the arts also. An amazing number of fine books has been produced, but the illustrations to some of these are conceived in a slap-dash, sketchy fashion, impossible to harmonise with the necessary orderliness of a printed page. Even artists of the standing of Lovis Corinth and Max Slevogt sometimes scribble over, rather than illustrate, the works entrusted to them. The mass of modern German

work, however, is impressive. A few names may be singled out:—Max Pechstein, Alfred Kubin, Willy Geiger, Fritz Heubner, Julius Diez, Oskar Oestreicher, Wilhelm Wagner, Richard Seewald and George Grosz, the last-named being an able artist who exemplifies that curious obsession with sex which characterises too much modern German art. The general standard of book production in Germany is higher than it has ever been, and it is from Germany that the smaller countries of Europe, with the possible exception of a francophil Poland, draw most of their inspiration.

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United States.—The comprehensive word "illustration" covers two main branches of the art—the self-contained picture and the picture which forms the amplification of a literary theme. In the former, the illustrator is called upon to supply a picture of some situation of life or some theme or fantasy, complete and self-explanatory. In the latter, the illustrator has to embellish sympathetically the meaning of his accompanying text.

The subdivisions in both these classes are numerous. The self-contained illustration can be anything from a comic strip drawing to a poetic fantasy, but it essentially has to rest on its own individual merits. The illustration which has a literary partner can be anything from an advertising design to the pictorial embellishment of the finest periodical, book or treatise. These are the extremes covered by the word Illustration.

Perhaps the most prevalent and important branch of the art today is the illustration of magazines, books and newspapers. In recent years this art has reached a very high degree of proficiency, both in artistic technique and in the process of reproduction. Indeed it is probable that the vast improvements in reproductive methods and the refinement of paper have acted as incentives to illustrative artists. Illustrations for books, magazines and papers should be wedded to the text, and at the same time should extend the meaning of the text by their realistic, artistic or imaginative quality.

Most illustrations of to-day have realism as a predominating feature; it therefore might be argued that the great advances in artistic photography might supersede the hand-made illustration, but it is not so. The art of the illustrator cannot be dispensed with, for in its best form all the necessary realism is there, plus the almost indefinable pleasure which technique produces on the observer, whether he be an artist or not.

The best fiction illustration of the period is perhaps to be found in America. There are several very powerful illustrators in Europe, but on the whole the American illustrator excels. Amongst the many exponents of the art, selection is difficult, but it is not easy to imagine better or more applicable illustration than the work of Dean Cornwell in half tone and Dana Gibson in line—both men being leaders of schools of illustrative thought. The mere mention of these two names makes it hard to refrain from enumerating a host of other most capable illustrators, but space will not permit. The English counterparts to the above two artists are difficult to select, but the work of Frank Craig in half tone and of Frank Reynolds in line have provided some exquisite illustration. The work of all four has allowed artistic technique to help the story and yet not engulf it. They have all been great "stylists" and have many followers.

This analysis of illustration as an art holds good throughout the world, and in theory has been approximately the same since man became capable of illustration in even the primitive forms. There have naturally been modifications and peculiarities in ability and style due to elementary conditions; and there have been differences of technique, due in the main to racial causes. (B. B.)

IMMIGRATION: *see* MIGRATION.

IMMINGHAM, England, a seaport situated on the Lincolnshire shore of the Humber estuary, 9 m. S.S.E. of Hull and 5 m. N.N.W. of Grimsby, England. Constructed (1906–12) by the Great Central Railway Co. (now part of the London and North Eastern), the dock comprises a square basin and two long arms (including a graving dock) running parallel to each other on the western side, of a total area of 45 ac., with 5,400 ft. of quayage; the depth (30–35 ft.) is sufficient for practically any vessel afloat. The dock is specially designed and equipped for dealing with the coal, timber, grain and wool trades, and was officially opened by the King on July 22 1912. The area of the dock property, $2\frac{1}{2}$ m. in length and 1 m. in greatest depth, is just over 1,000 ac. with a river frontage of $1\frac{1}{2}$ miles. The site was chosen because the deep-water channel of the Humber, which lower down runs midway between the shores, here makes an inward sweep and leads right to the dock gates, thus obviating much initial dredging, providing ingress and egress at any state of the tide, and rendering the towage of vessels unnecessary.

The original village of Immingham lies a little inland, but a new town is growing up near the docks. The Grimsby electric tramways have been extended to Immingham and, in addition, a light railway runs between the two places.

IMMUNITY (*see* BACTERIOLOGY, 3.175).—The term "immunity" is used in science in the technical sense. An animal is described as *naturally immune* against the microbe of disease if the microbe in question cannot establish itself in the organism and as *artificially immune* if it was naturally susceptible and has been rendered insusceptible. Similarly, an animal is described as *naturally immune* against a poison if its organism is naturally proof, and as *artificially immune* if its organism has been rendered proof against the poison.

Natural Immunity.—A few words may be said first with respect to natural immunity against infection. We may attribute the fact that the body normally remains free from microbic infection to a conjunction of causes:—*First*, to the fact that its external and internal coatings furnish mechanical protections against infection (this point need not be further considered here); *secondly*, to the fact that the body is equipped with special machinery for the destruction of microbes (the nature of this machinery will be discussed below in connection with acquired immunity); and, *thirdly*, to the fact that certain of the conditions which normally prevail in the animal organism are inimical to the growth of microbes as a whole or at any rate to the growth of certain classes of microbes. Of the conditions here in question two which are of quite dominant importance were discovered in the course of researches on wounds carried out in the World War.

Antitrypsin.—The first and more generally important is the antitryptic power of the blood fluids. Such antitryptic power will in every case hamper, and in the ordinary case completely inhibit, bacterial growth. It will achieve this by neutralising, in part or completely, the digestive ferments of the microbes which would otherwise convert the unassimilable native albumens of the blood-fluids and serous discharges into assimilable nutrient materials. Antitrypsin in the blood fluids will therefore mean for the microbes therein implanted, either, a restriction of their food supply, or complete starvation. The facts, as far as known, all comport with this inference.

To begin with, only a few species of microbes (the staphylococcus, streptococcus, pneumococcus and perhaps the microbes of all genuinely septicaemic diseases) can proliferate in antitryptic blood fluids. Further, these microbes (we may conveniently call them *serophytic* microbes) produce when grown in plasma (we are here generalising from observations made with staphylococcus and streptococcus) trypsin which quenches the antitryptic power of the surrounding blood fluids and then digests vacuoles in the surrounding clot. Again, all serophytic microbes grow very much more vigorously (the streptococcus for example very many thousand times more vigorously) in the blood fluids when these microbes have, by an artificial addition of trypsin, been relieved from the task of themselves producing enough trypsin to quench the antitryptic power of the surrounding medium. And finally, all those kinds of microbes which are unable to grow in antitryptic blood fluids begin to pullulate there the moment trypsin is added—

and let it be noted here that a spontaneous addition of trypsin occurs regularly in wounds as soon as the emigrated leucocytes are broken down under the influence of bacterial growth and unfavourable external influences.

Effect of Alkaline Reaction.—Again—and here the second of the restraints on microbic growth spoken of above comes into question—in the course of research work on wound infections conducted in the course of the War, it was established, in connection with the microbe of gas gangrene, that the proliferation of this bacillus in the blood fluids and serous effusions is inhibited not only by the antitryptic power but also by the normal alkaline reaction of these media. Proof of this is furnished by the fact that as soon as the alkaline reaction in question is blunted off by the ante- or post-mortem formation of lactic acid in muscles deprived of their blood supply, or more directly by an infusion of any acid into the blood, the bacillus of gangrene multiplies without restraint.

Natural Susceptibility.—The problem as to why a particular animal is naturally susceptible to particular poisons is likewise a chemical problem, but a chemical problem of a different order. Formulated in the technical terms which were introduced by Ehrlich the problem is that as to why the tissues of the insusceptible animal contain no *receptors* for the poison, that is to say, no organic substratum upon which that poison can anchor itself. This is a question of the aboriginal chemical constitution of the body—a question as to why a particular species of animal was constructed of one kind of elements rather than of another.

Acquired Immunity.—The problem presented by acquired immunity to infections or poisons differs in important respects from that presented by natural immunity. With respect to such reinforcement of the natural resistance it will be well to note at the outset (*a*) that it can be achieved apart from any violent physiological commotion; (*b*) that acquired immunity does not betray itself in any altered habit of body; and (*c*) that the condition may in many cases be present to-day and gone to-morrow. All these facts indicate that the acquired immunity cannot involve anything in the nature of a revolutionary physiological upheaval such, for example, as a fundamental alteration in the blood elements, or a cutting out of receptor elements from cells.

Anticipating here, we may say that later it will be shown with regard to acquired immunity to infections that this depends upon the development of (*a*) increased antibacterial substances in the blood fluid, (*b*) increased efficiency in the leucocytes and (*c*) increased capacity for producing antibacterial substances in response to infection. Similarly it will be shown with regard to acquired immunity to poisons that this depends upon the appearance of neutralising elements (so-called antitoxins) in the blood coupled with the acquirement of increased capacity for elaborating these elements in response to an incorporation of the corresponding poisons.

Early Doctrines.—Confining ourselves to the problem as to how the bacterial infections are combated in the organism, we may begin by considering the two chief opposing doctrines which were promulgated, when, under the prompting of Pasteur's practical achievements in the field of prophylaxis, problems of immunity began to be first seriously considered. These theories included natural as well as acquired immunity.

Humoral Theory.—In the theory which goes by the name of the humoral theory, natural immunity is attributed to the bactericidal substances contained in the normal blood fluids, and acquired resistance to the acquisition or increase of such bactericidal power. The general thesis, at any rate, of this theory stands secure. Where microbes are killed otherwise than by physical agencies or by inanition, their destruction must inevitably result from some form of chemical action. So, too, the acquisition of greater power of destruction must of necessity be imputed to the achievement of more potent chemical powers. On the other hand, it cannot of course be *a priori* certain that the antibacterial elements concerned in the destruction of microbes will be found in the blood fluids and only in these. That the blood fluids do, in point of fact, possess bactericidal power was demonstrated by Fodor and Nuttall, and it was at first thought, though a careful study of Nuttall's results should have prevented this, that such bactericidal action was exercised upon microbes without distinction of kind. Later research has, however, shown that the blood fluids are directly poisonous only for certain species of microbes such, for example, as the typhoid bacillus and the cholera vibrio. Certain other species of microbes, and in particular the microbes of specifically septicaemic diseases are, as we have seen, serophytic—the number that grow out in serum being as great as the number which grow out in the best artificial nutrient medium. Thus, the so-called *humoral theory*, though it would account for the organism possessing considerable resistance to typhoid and cholera, leaves unexplained the fact of the normal organism offering very considerable resistance to serophytic microbes.

What applies to natural, applies also to acquired immunity. There is nothing to show that increased resistance to serophytic microbes and septic infections generally is accompanied by the development of any bactericidal power in the blood fluids.

Phagocytic Theory.—An entirely different conception of immunity is that familiarly known as Mechnikov's *theory of phagocytosis*. In the humoral theory the problem of immunity is envisaged from the point of view of the bacteriological specialist and to some extent also from the standpoint of the chemist. Mechnikov for his part approached the problem from that of the morphologist who takes the whole field of animal life as his province. His theory of immunity therefore starts with the generalisation that the protozoa feed upon the lower forms of life such as microbes. It further regards the fact that the higher animals have been evolved out of colonial aggregations of protozoa. In every such colonial aggregation certain of the associated cells instead of becoming specialised persist in the condition of wandering cells.

With regard to these free-living members of the protozoal colony Mechnikov divined that they function as defensive cells. And he showed in connection with sponges and other invertebrates that these wandering cells collect round invading microbes and other foreign intrusions and that they thereafter proceed to ingest and digest them or, to aid otherwise in their elimination. Lastly Mechnikov pointed out that the leucocytes of the vertebrate were homologous to those wandering cells and performed exactly the same defensive offices. In particular when leucocytes emigrate from the capillaries into a focus of bacterial infection, in the normal case, they follow this up by ingesting the intruding micro-organisms, and killing them intracellularly. *Natural* or *native immunity* was thus, in the conception of Mechnikov, due to efficient leucocytic functioning; and *acquired immunity* to the leucocytes having by a *process of training* (as he called it) acquired a power of more effectively confronting, ingesting and destroying microbes.

Eclectic Theory.—The central tenet of the Mechnikov theory—the tenet that the leucocytes play a very important rôle in the defence of the body against infection—has now found universal acceptance, but at the same time the doctrine that resistance to infection depends in every case on the action of the leucocytes has proved untenable. In connection with the defence of the organism we must distinguish between (1) defence against infection by serophytic microbes, that is against microbes which like the streptococcus and staphylococcus proliferate in the normal serum, (2) defense against infection by microbes which are incapable of multiplying in the antitryptic normal serum but are not directly killed by it, and (3) defence against microbes which are directly killed by the serum.

(*a*) In connection with the first kind of microbe the fact that although they grow freely in the serum and plasma, these are killed in large numbers in the blood and in the serum, when living leucocytes are added, shows that the cellular elements of the blood here do the work of destruction.

(*b*) In connection with the successful killing of these microbes, the leucocytes must, however, in all cases have free mechanical access to the microbes. There would for example be default in this respect if, as would happen in dealing with infected

defibrinated or infected centrifuged blood *in vitro*, the leucocytes settled to the bottom and the microbes were buoyed up out of their reach in the serum. The same would of course happen *in vivo* in all serous effusions.

(*c*) In connection with those microbes which are not directly poisoned but fail to proliferate in the serum, the most important restraining influence is the native antitryptic power of the blood, but once the antitryptic inhibitory action of the blood fluids and serous effusions has been neutralised the leucocytes, even when everything else favours them, will be impotent to inhibit microbic growth. On the contrary as soon as the leucocytes degenerate they will furnish a further quantum of trypsin and in this way directly conduce to the pullulation of all manner of microbes.

Lastly, the leucocytes do not seem to contribute to the defence of the organism against those microbes which, like the typhoid bacillus and the cholera vibrio, are directly poisoned by the serum. When we implant such microbes into defibrinated blood and then incubate and make microscopic preparations those microbes which are quickly ingested are found intact within the phagocytes while those which are left exposed to the action of the serum are distorted and dissolved. And again, when living emigrated leucocytes are brought to bear upon typhoid bacilli it would seem that few of the microbes are killed. Precisely similar results are obtained with extracts made from leucocytes. It was shown by Schattenfroh that such extracts exert bactericidal action upon the staphylococcus and streptococcus while they exert no such action upon the typhoid bacillus and the cholera vibrio. And again it was shown by Colebrook that the products of inflammation derived from foci of inflammation set up by incorporating into rabbits lint soaked in typhoid vaccine are powerfully bactericidal for the staphylococcus and streptococcus while for the microbes of typhoid and cholera they are not more bactericidal than ordinary serum.

This review of the facts shows that only in the case of serophytic microbes does the defence of the body depend upon the leucocytes and that when it is a question of defence against the other two classes of microbes (those whose growth is entirely inhibited and those which are directly poisoned by the serum) the leucocytes are either impotent or directly harmful.

Properties of the Leucocytes Concerned in Immunisation.—Mechnikov originally taught that the leucocytes were attracted to microbes and induced to phagocytose them by the toxin secreted by the microbes; and that there was here only an interaction between leucocytes and microbes and that the blood fluids could be left entirely out of the story. That that doctrine cannot be sustained can be demonstrated by a very simple experiment.

We begin by receiving a sample of blood taken direct from the vessels into normal salt solution. We then centrifuge and recentrifuge in further volumes of this normal salt solution so as to wash the cellular elements free from all traces of the blood fluids. We then make two so-called *phagocytic mixtures* combining in the one case (*a*) one volume of a bacterial suspension with (*b*) one volume of washed leucocytes and (*c*) one volume of 0·85% *salt solution*; and in the other case (*a*) one volume of washed leucocytes, (*b*) one volume of the same bacterial suspension and (*c*) one volume of *normal serum*. These mixtures are then placed in the incubator and after a suitable lapse of time a sample of each is examined under the microscope. In the first phagocytic mixture—that in which no serum was employed—the leucocytes have failed to ingest any microbes. In the specimen in which serum has been employed, the microbes have been plentifully ingested. This result depends not upon any stimulating effect exerted upon the leucocytes, but upon the fact that the serum has effected a chemical change—a so-called *opsonic change*—in the microbes. That this *opsonic change* does not in any sense affect the vitality of the microbe is shown in the case of serophytic microbes by the fact that the serum that exerts an opsonic effect furnished culture medium in which the affected microbes will all grow out into colonies. The blood fluids intervene further in the destruction of microbes in the interior of the phagocyte by combining with them in such a way as to favour their intracellular digestion. This action, which was first described by Douglas, is known as the protryptic action of the blood fluids.

The living leucocyte can also kill microbes apart from phagocytosis. The following experiment is instructive. A shallow receptacle is filled with a solid nutrient medium whose surface has been uniformly implanted with staphylococcus or streptococcus. The centre portions of the three cover glasses are thickly carpeted with living leucocytes obtained direct from the blood. We now, after different treatment, impose these cover glasses side by side upon the implanted nutrient surface. In the case of the *first* cover glass the adhering leucocytes are brought into application in conjunction with the adhering serum; in the case of the *second* they have been washed free from every trace of serum; and in the case of the *third* cover glass the adhering leucocytes, instead of being employed living, have been killed by drying.

The whole preparation is now incubated at blood heat for 12 hours or more. The microbes will then be found to have grown out forming an uninterrupted sheet of colonies over the whole surface of the nutrient medium except under those areas of cover glasses 1 and 2 which are carpeted with living leucocytes. Here the implanted microbes have not proliferated, and microscopic examination of the cover glasses shows that where the leucocytes came into action in conjunction with serum the microbes are all lying intracellularly; while where the leucocytes were washed free from serum— the microbes are all lying extracellularly. The experiment thus shows that microbes can be killed by leucocytes both intra- and extra-cellularly, *i.e.*, both by phagocytosis and also apart from phagocytosis. This holds true both under the conditions obtaining in this particular experiment, and also in numerous other conditions. That destruction of microbes by leucocytes without the intervention of phagocytosis occurs also very frequently *in vivo* is practically certain.

Results of Experiments.—Research has thus shown that the destruction of microbes in the body does not proceed only along the lines laid down in the humoral and phagocytic theories. Instead of there being, as was assumed in those theories, only one physiological device by which microbes without distinction are killed in the organism, nature would appear to provide different distinctive devices for different microbes. Some pathogenetic microbes are combated by the bactericidal action of the serum unassisted by the leucocytes, others again are prevented from proliferating by special agencies, such for example as the antitryptic power of the blood; and again a third description of microbe, the serophytic microbes, are destroyed intracellularly and extracellularly by the leucocytes aided, or as the case may be, unaided, by the blood fluids.

The above deals only with the normal protective machinery of the body as distinguished from that which comes into play in artificial immunity. In connection with the latter Mechnikov, as will be remembered, taught that acquired resistance was due not to any changes in the blood fluids, but to the leucocytes having been subjected to a process of training which gave to them a greater capacity for confronting and ingesting microbes. This doctrine had to go by the board when it was shown in numberless cases that increased phagocytosis goes hand in hand with increasing opsonic power in the blood fluids.

From this it was incautiously assumed—though this tenet was never definitely formulated—that the leucocytes constitute in artificial immunity an invariable, and the blood fluids the only variable, factor. That the phagocytic efficiency of the leucocytes was also a variable factor was first shown by Shattock and Dudgeon, who observed that the phagocytic efficiency of the patient's leucocytes is in many cases of pyrexial infection greater than that of the normal man. The phagocytic efficiency of a patient's leucocytes may also, as was further shown by Shattock and Dudgeon, be less than normal.

These observations have a direct bearing upon Mechnikov's doctrine with respect to acquired immunity, since, in all infections which are associated with constitutional disturbances, antigens from the foci of infection are being brought into

operation—in other words the organism is experiencing and is reacting to *auto-inoculations*. It follows that, conformably with the doctrine of Metchnikov, the leucocytes should in every case of pyrexial infection be conducted by successive degrees to a condition of continually increased phagocytic efficiency. Instead of that these cellular elements are, sometimes in localised infections, and practically always in streptococcus septicaemia, reduced to a condition of diminished efficiency.

Artificial Immunisation.—We have to consider next how to increase the effectiveness of the anti-bacterial machinery, *i.e.*, how to produce artificial immunisation against infection. The original point of departure was the observation that those patients who had contracted and recovered from an infectious disease were thereby rendered proof against reinfection. That observation led, in connection with smallpox, to the adoption of a procedure for the warding off of the disease. The procedure adopted in various parts of the world and introduced to Europe from Turkey, consisted in the implantation into the susceptible individual of material obtained from a patient suffering from smallpox. This procedure, which was denoted inoculation because it resembled the grafting of an *eye* or *bud* into a new stock, is in reality the parent from which all other procedures of artificial immunisation are derived. What required still to be done was to purge inoculation of its dangers and to regulate the immunising stimulus. This was successfully done in Jennerian vaccination. But the achievement of Jenner was in point of fact purely empirical.

Pasteur's Work.—After Jenner came Pasteur and with Pasteur scientific methods are for the first time brought into application in connection with prophylactic inoculation. His initial achievement was to recognise that the essential in Jennerian vaccination was that for a virulent infective organism obtained from actual cases of smallpox there has been substituted an infective organism which by the operations of nature—to wit by transfer to the cow—had been attenuated in such a manner as to render it non-lethal for man. By the exploitation of that general principle, by the employment of pure culture and by a technique of artificial attenuation adapted with infinite resource to each separate case, the whole series of Pasteurian successes in the field of artificial immunisation were one after another achieved. Artificial immunisation was not, however, purged from all its risks by the procedures of Pasteur.

It had not yet been transformed into a scientifically regulated procedure. The Pasteurian vaccines were in point of fact standardised only thus far that recourse to attenuation placed in each case a certain limit upon the proliferation of the vaccinating material in the organism of a normally resistant man or animal.

Standardisation.—A great step in advance was taken when it was established in connection with anti-typhoid inoculation that the antigen required for the setting in motion of the machinery of immunisation can be furnished by the incorporation of sterilised microbic cultures. And further, important steps to the achievement of a standardisation of bacterial vaccines were made when a technique for the enumeration of the microbes in bacterial suspensions was devised, and when it was recognised that weighed quanta of desiccated and powdered bacterial substance could be employed in cases where, owing to the felting together of the microbes, enumeration of the microbial suspension was impracticable. The counting of the microbes or the weighing of the bacterial substance is, however, only a means to an end—the standardisation of a vaccine, *i.e.*, the determination of the doses which will give the best "curve of immunisation."

The Curve of Immunisation.—The expression *curve of immunisation* calls attention to certain fundamentally important points in connection with the reaction of the body to the incorporation of vaccines. In the pre-Pasteurian and Pasteurian periods, when ideas about the nature of immunising response were still vague, it was assumed with regard to vaccines that they produced their effects only after a certain incubation period (ordinarily only after 10 days). And it was further taken for granted that the curve of immunisation would from the beginning move always in the upward direction. When, however, immunisation curves came to be constructed (and this was done first in connection with anti-typhoid inoculation) unanticipated features revealed themselves and in connection with these also time-relations which did not conform with expectation.

Negative and Positive Phases and Practical Importance of These.—In what may be called the normal case—*i.e.*, in the case where the dose of vaccine inoculated is sufficient to produce an appreciable constitutional disturbance, a bi-phasic curve of immunisation is obtained. For 24 or more hours after the inoculation the antibacterial power of the blood is reduced. This—the so-called *negative phase*—is followed by a phase of increased antibacterial power—the so-called *positive phase*—which may last for one or two or a number of days as the case may be. After this the antibacterial power falls away gradually to a level only slightly higher than the original normal. But despite this there would seem to persist in the organism (and this would seem to be the chief profit from inoculation) a power of making more rapid and more ample immunising response to any subsequent incorporation of antigen whether in the form of a subsequent inoculation of a similar vaccine, or actual infection.

When, instead of a quantum of vaccine which produces a constitutional disturbance, a smaller dose is inoculated, the negative phase is elided and a positive phase is well developed already 24 hours after the incorporation of the vaccine. And, finally, when excessive doses of vaccine, such as produce very severe constitutional disturbances, are incorporated, the negative phase may be correspondingly intense and may persist for many weeks. These facts have an important bearing upon prophylactic operations; they must also, as reflection will show, have an importance in connection with the immunisation procedure to which horses are subjected with a view to their producing antibacterial and antitoxic sera. Again substantially the same relations as between the quantum of vaccine inoculated and the type of response elicited, obtain in the case where vaccines are inoculated into patients who are the subjects of infection. But in that case the conditions are so far different that we have to consider in each case two quanta of antigen: that administered in the vaccine, and that already contained in the patient's organism. Where a patient is the subject of only a minimal infection, we may employ doses of vaccine nearly as great as those employed for the prophylaxis of healthy men. Where a patient is heavily infected, we are restricted to the employment of minimal doses, and finally, when the patient is already labouring under an excessive infection, the injection of vaccines can only do harm.

The principle that the kind of response, and the amplitude of the reaction, and the time-relations of the phases are in each case a function of the quantum of antigen brought into application is found to apply also to the case where the vaccine is added to the extravascular blood. We obtain *in vitro* every variety of effect according to the dose of vaccine brought into application and the time for which it operates upon the blood—the effects varying from an instantaneous increase of bactericidal power to a loss of most of that destructive power. And further different effects are obtained according as we select now one and now another method of testing. We obtain for example one result when we measure the bactericidal power of the whole blood; another when we measure the opsonic power of the serum; a third when we measure the phagocytic efficiency of the leucocytes. It must remain for the future to unravel these complications. For the moment the essential point to note is that the machinery of immunisation which was supposed to be constructed upon a very simple—and one may add foolproof—plan is in reality built up of very delicate and complicated elements.

The lessons which can be drawn from immunisation curves may now be summarised. The first of these is that excessive doses of vaccine may delay and possibly interfere with the prophylactic response, and further that such excessive doses of vaccine administered to patients suffering from an infection may definitely aggravate their condition. Other important lessons are that when appropriate doses of vaccine (*i.e.*, doses which are not followed by a negative phase) are administered, prophy-

lactic effects may be obtained almost immediately after inoculation. And further it should be possible to arrest a general infection by inoculating in the incubation period and then employing a reduced dose of vaccine.

In connection with this attention may be directed to the statistical records of Haffkine's anti-plague inoculations in the Byculla Jail in the City of Bombay, and to the cases put on record by Miss Corthorn. The records of the Byculla inoculations make it probable that a prophylactic effect was here exerted already 24 hours after the vaccine had been given. And the cases recorded by Miss Corthorn seem to make good that attacks of the plague were not unfrequently aborted by the inoculation of the vaccine (*see* PLAGUE).

Further evidence showing that immunisation develops very rapidly after the inoculation of an antigen is furnished in the work of von Pirquet. If a first implantation of vaccinia is followed by similar implantations on successive days, the response to these latter differs from the response made to the first. This altered clinical response—which would appear to indicate a more rapid destruction of the later implanted infective material—was described under the name of *allergy*. It was further shown by Von Pirquet in connection with the inoculation of foreign serum that the supervening clinical reaction—which appears to indicate the throwing out of that foreign serum from the blood—is accelerated when the injection of serum is made into an organism which has been before subjected to that procedure. The interval between the injection of the foreign serum and the clinical manifestations associated with its elimination from the blood (normally 10–14 days) may be reduced to a very few minutes.

Further Questions in Connection with Artificial Immunisation.—A series of further questions in relation to artificial immunity have to be considered (1) Are there agencies other than vaccines proper—in other words, other than living or dead microbes or substances derived from the bodies of microbes—which will affect the bactericidal power of the blood and leucocytes? (2) Again are the antibacterial substances in the serum specific in the sense of operating only upon one particular variety of microbe or are they non-specific? (3) Further, will leucocytes which have acquired increased phagocytic efficiency, ingest more actively only one particular species of microbe, or all microbes without distinction? (4) Finally, what are the cells in the body which elaborate the anti-bacterial substances? All these questions are intimately linked up.

Non-bacterial Vaccine.—In connection with the question as to whether there are agencies other than vaccines proper which can increase or, as the case may be, diminish the bactericidal power of the blood, it has been shown that the infliction of burns increases the bactericidal power of the serum for the anthrax bacillus. This increased bactericidal power is no doubt referable to an absorption into the blood of disintegration products derived from the burnt tissues. Again, it has recently been ascertained that increased bactericidal power can be developed in the blood *in vitro* by adding to it foreign sera and also non-foreign sera which have been artificially altered by heating to 60° C. Lastly, it has been shown in connection with the irradiation of the skin with ultra-violet light, the light of the electric arc and sunlight, that by these agencies also the bactericidal power of the blood is increased, such increased bactericidal power depending upon an increased phagocytic power of the leucocytes and also an increased antibacterial power in the serum (*see* HELIOTHERAPY and PUBLIC HEALTH). It is not yet known how irradiation produces these results, but the consideration that radiations such as are here in question are much more likely to act by breaking down than by building up albuminous substances, taken together with the fact that increased bactericidal power is achieved only with a certain quantum of irradiation and that the blood suffers deterioration when larger doses are employed, would seem to point to the conclusion that we are here, in each case, dealing with effects produced by the absorption into the blood of an antigen in the form of disintegration products generated by the irradiation.

Specificity.—The non-bacterial antigens which have been under discussion above occupy at present a position apart in the respect that it would generally be held with regard to these that they might quite likely evoke a non-specific immunising response; whereas it would be generally held that bacterial vaccines would produce only specific immunising response. But against this there is conclusive evidence to show that bacterial vaccines also evoke non-specific immunising response in the form of increased bactericidal power in the blood, increased phagocytic efficiency in the leucocytes and sometimes also increased antibacterial power in the serum. Thus, for example, by the incorporation of staphylococcus the blood can be rendered more bactericidal for streptococcus. This can be achieved also by the addition of staphylococcus vaccine to the blood *in vitro*. Similarly an addition of tuberculin to the extravascular blood will increase the bactericidal power of the blood to staphylococcus, increasing at the same time the phagocytic efficiency of the leucocytes.

These laboratory experiments are in consonance with the statistical results obtained in connection with anti-pneumonococcus inoculations at the Premier Mine in the Transvaal. Here, in 1912, in addition to a striking reduction in the incidence and death-rate of pneumonia, there was achieved a striking reduction in the incidence and death-rate from "other diseases."

Derivation of Product of Immunisation.—The discussion of the deeper problems as to where anti-bacterial substances are elaborated in the body, and as to how their production is to be explained, may be deferred for a moment. For the facts relating to immunisation against bacterial toxins must first be taken into consideration, by bringing out the following points: (1) The machinery of immunisation is in reality a machinery for neutralising or otherwise disposing of poisonous substances—poisonous substances being by definition those which enter into crippling or lethal chemical combination with the blood fluids and tissues. (2) The machinery of immunisation achieves its ends by furnishing substances which enter, as the case may be, into neutralising or precipitating or destructive union with the poisonous substances above spoken of. (3) The machinery of immunisation is brought into operation only by a particular class of poisons—to wit, by those which enter into crippling but not immediately lethal chemical combination with the cellular protoplasm—those which, to use the expressions of Ehrlich, intrude themselves into the "side-chains" and not into the "vital ring" of that protoplasm. Of such poisons four kinds specially invite attention. These are: (*a*) the poisonous constituents of the bacterial protoplasm, (*b*) the albuminous substances contained in foreign sera and certain other foreign albuminous substances, (*c*) bacterial toxins such as those which can be filtered off from cultures of diphtheria and tetanus and (*d*) vegetable and animal toxalbumens such as abrin, ricin and the various snake venoms. With respect to the first the body responds to their inoculation by a production of *bacterio-tropic substances, i.e.*, substances which enter into detrimental or lethal chemical combination with bacteria. The inoculation of sera is followed by the elaboration and delivery into the blood of *sero-tropic substances* which neutralise and precipitate these sera. The inoculation of bacterial toxins in like manner—and this sovereign discovery was made by Behring—leads to the production and delivery into the blood of toxitropic substances. These, known as bacterial *antitoxins*, neutralise and precipitate the corresponding toxins. And, finally, the inoculation of toxalbumens is followed by an elaboration and delivery into the blood of the appropriate neutralising substances.

Practical Results.—The discovery of bacterial antitoxins had led to important practical applications in connection with the treatment and prophylaxis of, in particular, diphtheria (*see* INFECTIOUS FEVERS) and tetanus (*q.v.*) By virtue of the fact that toxins and antitoxins lend themselves to accurate quantitative study, it has contributed much to our knowledge of the machinery of immunisation. It was through the study of the curves of immunising response made to the inoculation of tetanus toxin that the negative phase first became known.

Again it was by the study of antitoxin production that it was for the first time unequivocally established that the organism which has made previous response to even a minimal quantum of a toxin is thereafter capable of responding to any further quantum of that poison with a prompter and ampler elaboration of antitoxins.

Further, by the study of the antitoxin content of the blood in its relation to diphtheria toxin, it has been shown that the presence of even a small quantum of antitoxin in the blood protects against infection, and further that the insusceptibility of the majority of adults to diphtheritic infection is correlated with the possession of a minute quantum of antitoxin derived, as it would seem, from repeated minimal diphtheritic infections contracted in their earlier life. The same would appear to hold also of the scarlet fever streptococcus. We have here, as reflection will show, facts which illuminate the epidemiology of diphtheria and scarlatina and show that it is possible and may under circumstances be advisable to substitute for a prophylactic inoculation of a bacterial vaccine, an injection of antitoxin, or alternatively an injection of such quantum of toxin as will evoke an antitoxic response.

Two further points about antitoxins have important bearings upon the problem as to where and how products of immunisation are produced in the organism. (1) Antitoxins are quite rigidly specific—each antitoxin neutralising only the particular kind of toxin in response to which it was engendered. (2) After a first inoculation of toxins antitoxins are only very slowly produced. Ordinarily an interval of 10 to 20 days elapses before they make their appearance in the blood.

These properties are not, let it be noted, differential properties of antitoxins; they characterise also certain kinds of bacteriotropic substances. Specificity and comparatively tardy appearance in the blood characterise for example agglutinins, and the so-called " thermostable immune bodies."

Since there are two kinds of products of immunisation: one kind that are eminently non-specific and which are produced immediately (and can, as we have seen, be produced in the blood *in vitro*); and another kind which are rigidly specific and are elaborated only after a considerable lapse of time and are so far as appears produced only *in vivo*; we may now seek for an answer to the problem as to how and where these various products of immunisation are engendered. Since it may be taken as certain that these two kinds cannot well originate in the same cells and be engendered by the same kind of metabolic operation, we may divide up the problem and consider first by what cells and by what kind of metabolic operation the non-specific antibacterial substances are produced and then take up the question as to where and how antitoxins and such antibacterial substances as are specific are generated.

Production of Non-specific Antibacterial Substances.—The former question presents no difficulty. The facts set forth above make it clear that non-specific antibacterial substances are elaborated by the leucocytes. And further the facts suggest that the leucocytes produce these substances as ordinary secretion incited by the chemical products derived from bacterial and cellular disintegration products applied in suitable concentration.

Further the facts comport with the idea that leucocytes which have elaborated antibacterial secretions but have not as yet excreted these into the environing blood fluids will, by virtue of their increased content in antibacterial substances, possess increased antibacterial efficiency, while the blood fluids will not have gained anything in antibacterial power.

Conversely leucocytes that have excreted their antibacterial substances will exhibit diminished antibacterial power and the blood fluids which have received these secretions will have received an accretion of antibacterial power.

Production of Specific Products of Immunisation: Ehrlich's Side-chain Theory.—The problem as to how these products of immunisation which indenture chemically with only one counterpart substance are engendered in the body, is of quite another order of difficulty, and it is one of the memorable achievements of Ehrlich to have conceived how the furnishing of such specific products of immunisation could be accounted for. The problem presented itself to Ehrlich's mind in the following vivid manner: " If," it was thus that Ehrlich communed with himself, " If I take a guinea-pig—that is to say, a creature whose country of origin is Southern America—and administer to it abrin—a poison derived exclusively from Africa (and thus one which neither the tame guinea-pig nor its ancestry can ever have encountered) and if I now find that my guinea-pig furnishes me with an antidotal substance which indentures with the abrin as does a key with the wards of the lock for which it is made, is there then for me any way of escape from the conclusion that the organism of my guinea-pig has specially constructed an antidotal substance to fit the particular kind of poison I have administered—performing in this a feat of chemical analysis and synthesis which would balk the ablest chemist?" From the intellectual *impasse* into which this interrogatory seemed to conduct there was, Ehrlich discerned, a possible way of escape. He reflected that there must of necessity exist in the organism of any animal which is affected by a given poison a counterpart substance (or to use his technical term) a *receptor* which enters into chemical combination with that poison. In other words there must exist already preformed in the organism of susceptible animals, substances which have a chemical constitution such as would admit of their functioning as antitoxins.

At the same time these counterpart substances differ fundamentally from the non-specific antibacterial substances which were considered above. First of all they are not, as are the substances last mentioned, available in the form of secretory products produced only with a view to their being ejected from the cell. Instead of that, specific counterpart substances are integral elements of the cellular protoplasm, and elements of which it may be assumed with certainty that they subserve special functions in the internal economy of the cells of which they are constituents. Further the specific counterpart substances we are here considering differ from the non-specific antibacterial substances in the respect that while these latter are elaborated only in one particular variety of cell (to wit, in the leucocyte) the former are widely distributed in the organism, being located in each case in a different assortment of cells. Thus, for example, the counterpart substances to which the diphtheritic toxin would anchor itself would be located in a different assortment of cells than the counterpart substances with which the tetanus toxin would combine. And again the counterpart substances which would combine with abrin would be different. This would hold true also of the counterpart substances which would unite with the poisons derived from each particular variety of bacterial protoplasm.

So far it has been shown only that susceptible animals must by the very nature of things contain in their cell-protoplasm constituent elements which are the exact chemical counterparts of poisons. We are still very far from the solution of the mystery (*a*) of the organism furnishing antitoxins in the circulating blood; (*b*) of its furnishing antitoxins only to special classes of poisons; and (*c*) of its furnishing these in quantities far in excess of the quantum of counterpart substances originally contained in the organism. Ehrlich, in exploring for some way of exit from the labyrinth constituted by these questions oriented himself by the aid of a ground-plan, in which there was set out his general conception of the stereo-chemistry of protoplasm. In the plan in question the protoplasm is a structure made up of side-chains assembled round a central ring—the continued life of the protoplasm depending upon the integrity of the central (or as we may call it *vital*) ring; while the side-chains consist of elements which are integrated into the protoplasm for its nourishing and vital functioning. To this original ground plan there was now added by Ehrlich a new feature. The conception which he now added was that the side-chains of the protoplasm would, as soon as they became redundant, be cast forth from the cell into the circulating blood, forming there what he called *free receptors*.

Interpreted in the light of this so-called *side-chain* theory, the incorporation of poisons which make a chemical attack upon the

vital ring of the cell protoplasm would abrogate the life of the cell and would therefore be incompatible with an elaboration of antitoxins. The situation is entirely different when the poison, instead of directing its attack to the vital ring, anchors itself on to one of the side-chains. After a temporary putting out of action of those functions which are discharged by the particular side-chains in question, this would lead to the replacement of the crippled side-chains, and thereafter to a hyper-replacement and to such redundancy of these in the protoplasm as would involve casting forth these side-chain receptors into the circulating blood. This theory, which is quite as applicable to the production of specific antibacterial substances as to the production of antitoxins—would seem to lie open to critical assault in that the hyper-replacement of side-chains does not necessarily conduct to an excretion of these into the circulating blood. In point of fact in the case of muscle, on which Ehrlich here relies, it leads to something very different, to a hypertrophy of this tissue.

Finally, the side-chain theory has met with hostile criticism more especially on the ground that it would compel us to believe that the noble tissues, such as those of the central nervous tissue which are poisoned by the toxins of diphtheria and tetanus, can be converted into secretory organs so prolific as to furnish in the blood tens and hundreds of thousands of units of the corresponding antitoxins. In point of fact the side-chain theory does not in any way require us to believe this. It would do so only if it had been established that poisons such as diphtheria and tetanus toxins attack only the central nervous system. But in point of fact Ehrlich assumed that the poisons which are responded to by a production of antitoxins are all *polytropic*—in other words they turn towards and combine chemically with a number of different tissues. So far therefore as the side-chain theory is concerned, we are thus authorised to assume that, not the cells of the central nervous system, but all or any of the other and less noble tissues which are affected by the toxins, are those which produce the harvest of antitoxins.

See E. Mechnikov, *Immunity in Infective Diseases*, trans. by F. G. Binnie (1907); Sir A. E. Wright, *Technique of the Test and Capillary Glass Tube* (1921). (A. Wr.)

IMPERIAL PREFERENCE.—This consists in the charging, by states belonging to the British Empire, of lower import duties on goods coming from another state of the Empire than on like goods coming from countries outside the Empire, or in exempting Empire goods from duty altogether.

History of the Movement.—Until after the middle of the 19th century, colonial products enjoyed a preference in the customs tariff of Great Britain, and British goods in the tariffs of the colonies. Preferences in both directions disappeared about the same time. But while Great Britain removed tariff restrictions equally from all imports, from whatever source, the Colonies—now obtaining responsible government, and looking upon customs as the only available source of public revenue—proceeded to impose equal duties on all imports, from whatever source. The British Govt. in vain protested in 1859 against the imposition of duties by Canada on British goods. The Govt. of Canada insisted on "the right of the people of Canada to decide for themselves both as to the mode and extent to which taxation shall be imposed." The principle of tariff autonomy was henceforward acquiesced in by the British Govt. and acted upon by the self-governing colonies.

This was the situation for almost 40 years, in the course of which colonial tariffs became distinctly heavier. So great, however, was the reliance in Great Britain on the most favoured nation clause in her commercial treaties with European countries, that by her treaty with Belgium in 1862 and with the German Zollverein in 1865 she actually bound her colonies, without consulting them, to grant as favourable treatment to the products of the treaty country as to those of the mother country, *i.e.*, to grant no preference to Britain.

Changed Sentiment.—A new stage in intra-imperial trade relations was opened in 1897. In that year Canada granted tariff concessions to all countries treating her on equally favourable terms. In effect this was a preference to British goods; and in 1898 the Canadian Tariff Act was converted from one of general reciprocity to one avowedly of British preference. The Imperial Govt. had already in 1897 given notice to terminate the treaties with Belgium and the Zollverein.

In 1902 the policy of Canada became the policy of the Dominions. At the Colonial Conference of that year in London the following resolution was passed:—

> That . . . it is desirable that those colonies which have not already adopted such a policy should, as far as their circumstances permit, give substantial preferential treatment to the products and manufactures of the United Kingdom. That the prime ministers of the colonies respectfully urge on H.M.'s Govt. the expediency of granting in the United Kingdom preferential treatment to the products and manufactures of the colonies, either by exemption from or reduction of duties now or hereafter imposed.

Effect was given to this resolution by New Zealand and South Africa in 1903 and by Australia in 1906.

Tariff Reform.—Meanwhile in England the re-imposition for revenue purposes in 1902 of the old registration duty of 1 shilling a quarter on imported wheat had raised hopes of preference in Canada which were defeated by the abolition of the duty next year. The episode completed the conversion of Joseph Chamberlain to the principle of preference; and imperial preference was a prominent element in the policy of Tariff Reform which he laid before the country in 1903. The movement, however, failed at the time to receive sufficient popular support in Great Britain. At the next Colonial Conference in 1907, though the resolutions of 1902 were reaffirmed by the colonial representatives, the British Govt. put in a definite reservation that they could not assent in so far as the resolutions implied that it was necessary or expedient that the fiscal system of the United Kingdom should be altered.

Progress during the War.—The World War and the generous support which the Dominions gave the mother country had considerable effect on public sentiment in Great Britain. Early in 1917 the important committee appointed by the Govt. to consider commercial policy after the War (presided over by Lord Balfour of Burleigh) recommended:—

> That H.M'.s Govt. should now declare their adherence to the principle that preference should be accorded to the products and manufactures of the British overseas dominions in respect of any customs duties now or hereafter to be imposed on imports into the United Kingdom.

A few weeks later the Imperial War Conference expressed itself in favour of "the principle that each part of the Empire, having due regard to the interests of our Allies, shall give specially favourable treatment and facilities to the produce and manufactures of other parts of the Empire": a resolution now passed unanimously by the representatives no longer of the Dominions alone but also of Great Britain. In April 1917 Mr. Lloyd George and Mr. Bonar Law, on behalf of the Coalition Govt., announced their acceptance of the principle of preference, making it clear that this did not involve the taxation of food. In Sept. 1918 the British Govt. withdrew from the Brussels Sugar Convention on the express ground that they had "now approved the principle of giving preference to Empire sugar." And, finally, in the Finance Act, introduced by Mr. Austen Chamberlain as Chancellor of the Exchequer in April 1919, preferential rebates on imports from the colonies or exemption from surtax were granted on practically all articles dutiable under the existing tariff.

The range of dutiable articles had been increased under stress of war. For many years before 1915 the only duties imposed by Britain were either purely for revenue purposes—those on tea, cocoa, coffee, sugar and tobacco; or for revenue with a certain mixture of ethical motive—those on wines and spirits. But the Finance Act of 1915 had introduced duties also on certain manufactured goods (the "McKenna duties")—cinema films, clocks and watches, motor-cars and musical instruments. These were intended as luxury taxes, but had some protective effect. On these the measure of 1919 was now able to give preference.

Post-War Changes.—The area of preference was still further enlarged by the Safeguarding of Industries Act in 1921. Part I. of this Act provided for the imposition of duties on certain

articles produced by " key industries." The list included cameras and optical lenses and a large number of scientific instruments and apparatus, chemicals and special appliances, deemed essential for the safety of the Empire; and from these duties Empire goods were entirely exempted.

The growth of manufactures in Canada had affected the situation by enlarging the possibility of advantageous preference in Great Britain beyond the primary foodstuffs: motor-cars are an example. A similar extension of possibilities from Australia was brought about by the growth of fruit farming, largely as the result of the settlement on the land of ex-soldiers. The British Govt. took the opportunity of the Imperial Conference of 1923 to announce its readiness to enlarge the existing preference on dried fruits, to increase the rebate on Empire tobacco and on certain wines, and to take other action of a similar character. Before these promises could be fulfilled, the Baldwin Govt. fell from power. The MacDonald Ministry which followed declined to carry out the intentions of its predecessors; abolished the McKenna duties; and, though it did not entirely throw over preference in revenue duties, so reduced the tax on sugar, tea and dried fruits as to make the preference of less value.

Preferences Granted by Britain.—On the return to office of Mr. Baldwin at the end of 1924, the McKenna duties were restored with the accompanying preferences; and the preference on dried fruits, tobacco, wines and sugar was increased. The range of preference was further widened in two directions. The new Safeguarding of Industries (Customs Duties) Act, 1925, imposed duties on imported cutlery, gloves and incandescent mantles; while the budget of that year introduced duties on silk, natural and artificial. To each of these new duties, Empire preference was attached.

Since the first grant of preference to the mother country by the great Dominions, changes have from time to time taken place both in the general rates of duty and in the extent of the preference. In 1923 Canada, having in mind the removal of certain restrictions on the importation of cattle into the British market, undertook to give a discount of 10% on existing duties on British goods coming through Canadian ports. Australia increased its preference to British goods in 1920, and gave assistance to British trade both by anti-dumping legislation and by measures with respect to dyes. And during the last two decades a whole complex of preferences has grown up between the several Dominions and Colonies, many of them the result of definite treaties. And thus Preference within the British Commonwealth of Nations has already become a considerable factor in the economic and political world situation. (*See* also TARIFFS.)

BIBLIOGRAPHY.—The least partisan and most complete history of the whole movement down to 1921 will be found in a *Report* on Colonial Tariff Policies (1922), prepared for the U.S. Tariff Commission. Much information as to the views of the Dominions and as to the volume of trade affected is given in the *Record of Proceedings* of the Imperial Economic Conference of 1923 (Cmd. 2009, 1924). The nature and extent of the preferences accorded to Great Britain, down to March 1925, together with the conditions governing the concessions, will be found in the *Survey of Overseas Markets* (1925) by the Committee on Industry and Trade appointed by the British Govt. in 1924. That committee reported that " while it is difficult to obtain any exact statistical measure of the benefit to British trade of the preferential treatment, the surveys of British Dominion markets and the statistics of distribution of British trade leave no room for doubt that the advantage has been substantial." (WM. A.)

IMPRESSIONISM: *see* PAINTING.

INCHCAPE, JAMES LYLE MACKAY, 1ST VISCOUNT (1852–), British shipowner, was born at Arbroath, Forfarshire, Sept. 11 1852, and educated there and at Elgin. In 1874 he went to India to join the firm of Messrs. Mackinnon, Mackenzie & Company, Calcutta, of which he ultimately became senior partner; he became a member of the legislative council of the Viceroy in 1891 and a member of the Council of India in 1897. He was created K.C.I.E. in 1894. In 1902, consequent upon the Boxer rebellion, Sir James Mackay negotiated a commercial treaty with China (*see* 6.204); he was then created G.C.M.G. In 1911 he was raised to the peerage as Baron Inchcape of Strathnaver. Before the World War broke out, Lord Inchcape was already one of the most prominent figures in the British business world. As a representative of the shipping industry he took a leading part in all its affairs both during the World War and after. He served on most of the Government commissions of inquiry both in India and England. He was a member of the Geddes committee on national expenditure (1921), and chairman of the Indian retrenchment committee (1922). In 1924 he was created viscount and G.C.S.I. The positions of chairman of the P. and O. Steam Navigation Company and director of the National Provincial Bank and Suez Canal Company made him a leading figure in business circles.

INCOME TAX (*see* 14.356).—War provides a fertile soil for taxation, and a tax on income has been adopted during and since the World War in some countries which had hitherto rejected this form of direct taxation, long the sheet anchor of British finance.

I. THE UNITED KINGDOM

The British tax has been developed gradually in detail, reflecting at various stages in its history the growth of opinion, equality and justice, until to-day it is a financial instrument of great intricacy, subtlety and power. None the less the broad scheme of the law has remained unchanged in many essential characteristics for nearly a century. Flexibility is provided by the annual re-enactment of the whole income tax code through the medium of the continuation clauses in the yearly Finance Act, which serves also as the medium for amendments, extensions and declarations of the construction of the law.

The salient characteristics of the tax may be grouped under eight heads.

Scope.—The tax extends, broadly speaking, to all income arising in the United Kingdom by whomsoever it may be enjoyed, and to all income accruing to persons residing in the United Kingdom without regard to the place where it may arise. The tax walks, so to speak, upon the two legs of origin and residence. It therefore leads to the problems of double taxation. Provisions for relief against this defect, resting upon the principle of division of the total tax between the two taxing jurisdictions, exist as respects income liable both to United Kingdom tax and tax in any of the British Dominions overseas, except in the case of the Irish Free State, where the relief is based upon the principle of charging tax only in the country of residence. Further provisions for double taxation relief also exist as respects profits on shipping. One code of laws applies, generally speaking, to individuals, partnerships, companies and other bodies of persons. In the main the tax is a tax on the incomes of individuals, nearly 90% of the total actual income brought into charge being distributed among individuals who are actually resident in the United Kingdom.

Administratively, the tax is levied under five separate categories or schedules of income. But this is a matter of machinery only, and the tax borne by individuals is in reality only one tax on the total income of the individual, and not, as is often thought, a series of taxes on the separate sources of his income.

Definition of Income.—In respect of the ownership of lands, houses, etc., in the United Kingdom, the measure of income is the annual value, which means broadly the rent at which the property is let, or is worth to be let by the year (the tenant bearing his usual rates and taxes), less certain statutory deductions for repairs, and an average cost of additional expenditure on repairs, maintenance, insurance and management.

In respect of the profits on occupation of land in the United Kingdom, the measure of profit is made on a conventional basis, which assumes profits bearing a fixed relation to the annual value of the land occupied. To-day that relation in the case of land used mainly for the purposes of husbandry is one of equality, and in other cases it is a relation of one-third of the annual value.

No definition is necessary in the case of interest on public funds. Income from dominion and foreign securities (other than public debts) or from foreign and dominion stocks, shares and rents is normally liable on the full amount of the income, less charges which must necessarily be met abroad.

There remain the two main classes: income from trades or professions and income from employments. Here the broad rule is that the income to be charged is the excess of the gross receipts over the expenses incurred wholly, necessarily and exclusively in earning the profits or income in question.

The British income tax, in the words of one of the judges, "is a tax on income," and this is strictly construed by the exclusion from the scope of the tax of profits which are in the nature of capital gains; and in this respect the British system is strikingly different from that in force in the United States of America. In consequence, the law prohibits, in arriving at profits for income tax purposes, any deductions in respect of capital charges, lost capital or losses unconnected with the business. Provision is, however, made for a deduction from the statutory profits liable to tax of an allowance in respect of the depreciation of machinery or plant.

Computation of the Statutory Income.—The amount of income liable to be taxed *for* any year of assessment (a year running from April 6 to the subsequent April 5) may be, but frequently is not, equal to the amount of income earned or received by the taxpayer *in* the year. This arises from the great variety of rules which govern the computation on various bases of the statutory income of different classes. For instance, income from trades and professions or from dominion and foreign stocks, shares and rents was charged on an average of the three preceding years. Employments and income from interest on public debts or from dominion and foreign securities are charged on the basis of the year of assessment. In other cases an average of five years is used. Proposals were, however, made to Parliament in 1926 for sweeping away some of this medley of different bases, and for substituting in the case of profits from trades and manufactures, mines, railways, iron works, gas works and water works, etc., and of income from dominion and foreign securities and possessions, a uniform base of the profits of the year preceding the year of assessment.

Differentiation.—More than a century of agitation passed before this feature of the income tax was established in 1907. At first it was effected by a reduction of the normal rate of tax in favour of earned income. To-day the differentiation is granted by deducting from the earned income an allowance of one-sixth of that income subject to a maximum deduction of £250.

Graduation.—This is the principle of levying a heavier percentage upon large incomes than upon small. From the inception of the tax graduation in some form or other has figured among its characteristics. During the last half of the 19th century graduation was effected on small incomes by a scale of abatements which from 1909 to 1918 was continuously developed and widened. To-day graduation is effected as follows:—

The total of the statutory income from various sources having been ascertained, the amount of any earned income allowance is deducted therefrom. From the balance, called assessable income, there is then deducted an aggregate of various personal allowances and deductions (*e.g.*, for self or self and wife, children, housekeeper, dependent relatives, etc.), leaving a balance constituting the taxable income. Tax is calculated upon this taxable income by charging the first £225 thereof at half the standard rate and the remainder thereof at the standard rate. From the amount of tax so arrived at there is deducted any relief, expressed in terms of tax, due in respect of life insurance premiums or dominion tax.

If the system of graduation stopped at this point, the relevant curve would rise steeply until incomes in the neighbourhood of £2,000 were reached, but after that point it would flatten rapidly. In order to continue graduation an additional duty of income tax called super-tax is charged on any individual whose total income from all sources for the preceding year, as computed for income tax, exceeds a fixed sum which stands at £2,000. For administrative reasons this additional tax is assessed and collected separately from income tax, but it is only a part of the scheme of graduation for the direct taxation of incomes exceeding a fixed amount. The super-tax therefore continues the process of graduation by imposing an additional rate of tax on successive sections of the total income above £2,000. The effect of this system as a whole is to levy an effective rate of tax on each £ of the total income of an individual, rising gradually from a fraction of a penny in the £ until the rate closely approaches a maximum rate represented by the sum of the standard rate of income tax and the highest rate of super-tax.

The following table of the amount of income tax and super-tax and the effective rate of tax per £ of income on specimen incomes clearly illustrates the graduation of the tax in the case of married couples without children for the year 1926–7. It shows how the effective rate rises in the case of earned income from 2d. in the £ for a total income of £300 by gradual stages up to 9s. 7½d. in the £ on an earned income of £150,000. The rate for unearned income rises from 2½ for an income of £250 to 9·7½ to one of £150,000. Plotted on a graph, these effective rates fall upon a very smooth line unbroken by any abrupt jumps.

Income Tax and Super-Tax

Married Couples without Children, 1926–7

Total income	If income all "earned" income: Income tax (including super-tax, if any)	If income all "earned" income: Effective rate	If income all "investment" income: Income tax (including super-tax, if any)	If income all "investment" income: Effective rate
£	£ s. d.	s. d.	£ s. d.	s. d.
250	..	..	2 10 0	2½
300	2 10 0	2	7 10 0	6
350	6 13 4	4½	12 10 0	8½
400	10 16 8	6½	17 10 0	10½
500	19 3 4	9	32 10 0	1 3½
600	32 10 0	1 1	52 10 0	1 9
700	49 3 4	1 5	72 10 0	2 1
800	65 16 8	1 7½	92 10 0	2 4
900	82 10 0	1 10	112 10 0	2 6
1,000	99 3 4	2 0	132 10 0	2 8
1,250	140 16 8	2 3	182 10 0	2 11
1,500	182 10 0	2 5	232 10 0	3 1
2,000	282 10 0	2 10	332 10 0	3 4
2,500	401 5 .	3 2½	451 5 0	3 7½
3,000	526 5 0	3 6	576 5 0	3 10
4,000	801 5 0	4 0	851 5 0	4 3
5,000	1,113 15 0	4 5½	1,163 15 0	4 8
6,000	1,463 15 0	4 10½	1,513 15 0	5 0½
7,000	1,838 15 0	5 3	1,888 15 0	5 5
8,000	2,213 15 0	5 6½	2,263 15 0	5 8
9,000	2,613 15 0	5 9½	2,663 15 0	5 11
10,000	3,013 15 0	6 0½	3,063 15 0	6 1½
15,000	5,138 15 0	6 10	5,188 15 0	6 11
20,000	7,388 15 0	7 4½	7,438 15 0	7 5½
25,000	9,763 15 0	7 9½	9,813 15 0	7 10
30,000	12,138 15 0	8 1	12,188 15 0	8 1½
40,000	17,138 15 0	8 7	17,188 15 0	8 7
50,000	22,138 15 0	8 10½	22,188 15 0	8 10½
100,000	47,138 15 0	9 5	47,188 15 0	9 5½
150,000	72,138 15 0	9 7½	72,188 15 0	9 7½

Collection of the Tax.—Perhaps the most famous characteristic of the British tax is the principle of collection at the source. Seligman has called it, "perhaps the chief cause of the success of income tax." It dates from as early as 1803. Under this principle the tax is obtained, whenever it is possible to do so, by deducting it before the income reaches the person to whom it belongs. The formal assessment is accordingly laid, wherever this course is possible, on each source of income by itself and on persons who are debtors in respect of income belonging to other persons. Power is given to the payer of income to deduct the appropriate tax from the payments made to the ultimate proprietors of that income. For instance, a limited liability company is assessed to tax at the standard rate on the whole of its profits, without reference to their ultimate destination. On paying interest to its debenture holders, or dividends to its shareholders, the company is entitled to deduct and retain the amount of tax appropriate to the interest paid or dividend distributed, and the investor thus receives his interest or dividend subject to this deduction of tax. It is estimated that approximately two-thirds of the net yield of the tax is collected at the source.

Whether the tax charged in respect of any income brought into assessment is collected by deduction at the source or not thus depends upon the ultimate proprietorship of the income assessed. So far as the person charged is not the ultimate proprietor, the tax is collected by deduction at the source; so far as he is, the tax is collected directly. The chief classes of income in respect of which the tax is collected directly are the profits from trade of individuals, whether sole or partnership traders; the like profits of limited liability companies so far as they are not distributed to shareholders, debenture holders, etc.; profits from the occupation of land; income from professions and most employments; income from dominion and foreign securities and possessions not paid through agents in the United Kingdom; income from certain interest, discounts, etc.

The income of individuals upon which tax is collected directly is charged in the assessments, as far as possible, at the respective half standard and full standard rates on the taxable income, that is on the balance of the assessable income remaining after deduction of the personal allowances and deductions due. As the total income of any individual taxpayer may be made up of a number of separate items, on some of which tax is borne by deduction at the source at the full standard rate, and on others of which tax is collectible directly, adjustments are in numerous cases necessary in order to restrict the total tax payable to the amount proper to the actual circumstances of the individual concerned under the scheme of graduation and differentiation already described. These adjustments are made as far as possible when dealing with tax collected directly, any balance being dealt with by repayment of tax. They are greatly facilitated by the fact that personal statements of total income are rendered

annually by almost every individual taxpayer, for purposes of either income tax or super-tax.

With the exception of tax collected at the source on interest on public debts and on income from foreign dividends, etc., which is paid at or shortly after the time of payment of the income from which the tax is deducted, income tax contained in the main assessments for the year is due and payable on or before Jan. 1 in the year of assessment; tax contained in additional assessments signed after that date is payable on the day after the date of signature. To this general rule there are, however, some other important exceptions. The bulk of the tax charged on income from the ownership of property, tax charged on any individual or firm in respect of lands occupied for husbandry, or tax charged on any individual or firm in respect of a trade, profession or vocation, and of most employments, is payable in two equal instalments, the first on or before Jan. 1 in the year of assessment, and the second on or before the following July 1. Railway companies in England and Ireland pay tax on their profits in four quarterly instalments, on or before the 20th June, Sept., Dec. and March. Manual wage earners assessed half-yearly pay tax in respect of each half-year. Tax in respect of employments under the Crown is deducted (usually quarterly) at the source.

Administration.—In this sphere there is a striking division of authority. The original basis of income tax administration is modelled to a certain extent on provisions in the Land Tax Acts of the 18th century. The main conception in 1806, as well as in 1842, was that of a temporary impost to be assessed and collected locally with a minimum of interference by the Exchequer. The responsibility for assessment and collection of a very large part of the tax was laid upon the local bodies of Commissioners possessing certain property or other qualifications. Benches of these local or district commissioners were and are still appointed for certain cities and boroughs and for parts or all of a geographical county. The individual commissioners are entirely unconnected with and independent of official control. Each body has its own clerk. The Commissioners were also empowered to appoint assessors of taxes and collectors of taxes. Except as respects profits from commercial, financial and professional activities, the assessor was charged with making the assessment of tax; in the case of the income arising from the activities mentioned this duty was laid upon a body of commissioners known as the additional commissioners. On the main body of the local or district commissioners distinguished by being known as the general commissioners, fell the statutory duty of signing and allowing assessments made either by the assessor or the additional commissioners and of hearing and determining appeals against such assessments. Fitted into this scheme was the officer of the Crown, known originally as the Surveyor of Taxes, and to-day as H.M. Inspector of Taxes. In law his part was primarily to safeguard the interests of the revenue with strictly defined rights of intervention and objection at various stages of the formal procedure laid down by the statues.

Even in the early years this broad scheme was honeycombed with exceptions which have grown rather than diminished with the passage of years. Certain assessments for instance are hived off under the single jurisdiction of a body known as the Special Commissioners of Income Tax, each of whom, still independent of the revenue authority, is appointed by H.M. Treasury. This body performs all the duties of district commissioners in Northern Ireland; it makes all the assessments on railway companies and on their officials; the assessment of foreign and dominion dividends paid through agents in the United Kingdom is under its care; it is also solely charged with the whole of the administration of the super-tax. Then there are commissioners for the various public departments of State who are charged with making all assessments on official salaries, etc. The Bank of England and the National Debt Commissioners also act as commissioners for assessment of individual salaries, etc., paid by these bodies and those of the Bank of England are also responsible for the assessment of the profits of the bank. Again all assessments on manual weekly wage earners which are for a half year only are made by H.M. Inspector of Taxes. The taxpayer normally charged by the District Commissioners may, if he wishes, elect to be dealt with by the Special Commissioners and even if he allows his assessment to be made by the District Commissioners, he may take an appeal against that assessment to the Special Commissioners.

During the past 50 years income tax grew so much in importance and complexity that its efficient administration compelled a considerable development of the methods of administration. The high graduation of the tax rests very largely upon the factor of the total income from all sources of the taxpayer. As business and finance have grown in complexity, the sources of individual incomes have ramified accordingly, necessitating close and continuous intercommunication between various parts of the country. The scheme of administration originally laid down having made no adequate provision for inter-communication between the various bodies of commissioners, this defect has been almost of necessity filled by the development of the official organisation of the Inspectorate of Taxes, functioning under the direction of the Board of Inland Revenue. In practice, therefore, to-day the Inspector of Taxes carries out, with the full concurrence of the various bodies of commissioners, most of the duties that are vitally essential to the smooth-working efficiency of the machinery of administration. Nevertheless, the key functions of the district commissioners have been preserved throughout. In the absence of any detailed accounts or other evidence, it is the additional commissioners who determine the amount of the assessment upon business profits; even more important, the general commissioners still retain their appellate functions and so stand in an independent and impartial position between the taxpayer and the representative of the revenue.

Rates and Yield of Tax.—During the three years preceding the War, 1911–3, the normal rate of tax was 1s. 2d. in the £ and the net produce of each penny of the rate was round about £3,000,000. At that time the exemption limit stood at £160 and out of some 19,000,000 of occupied persons only 1,200,000 were within this scope of the tax. In 1915–6, the exemption limit was reduced to £130. Notwithstanding the depreciation in the value of money it remained at that level until 1920. In 1920–1, when the system of differentiation and graduation was radically altered in accordance with the recommendations of the Royal Commission on the Income Tax of 1920, the effective exemption limit was raised to £135 of assessable income, or £150 in terms of earned income. Under the influence of the change in the price level and the consequential movement of wages the total number of individuals within the scope of the tax rose in 1919 to 7,800,000, but it had fallen in 1925–6 to 4,200,000.

The standard rate of tax was changed on six occasions between 1914 and 1925. The peak rate of 6s. in the £ stood for the four years from 1918–9 to 1921–2 inclusive. It was reduced to 5s. in 1922, to 4s. 6d. in 1923 and to 4s. in 1925. The statutory income of persons liable to tax amounted in 1913–4 to £951,000,000 and the net tax collected in that year amounted to £43,500,000. These figures relate to the whole of the United Kingdom of Great Britain and all Ireland. For 1924–5, the total statutory income of persons liable to the tax for the new United Kingdom of Great Britain and Northern Ireland was estimated at £2,300,000,000. In 1924–5 the Exchequer receipt was nearly £274,000,000; in 1925–6 the Exchequer receipt was £259,000,000 and it was estimated that the collection in 1926–7 would amount to £255,000,000.

The preceding figures relate to income tax alone and do not include the yield of the super-tax. Prior to the War the point at which liability to this tax commenced was £5,000. Incomes below that figure were exempt from this impost. In 1914 the exemption level was reduced from £5,000 to £3,000. In 1918–9 the scope of the tax was altered to include all incomes exceeding £2,500 and in 1920–1 further extension was made by the alteration of this limit to £2,000. Before the War the rate of super-tax was 6d. for every £ of the amount by which the total income exceeded £3,000, although, as noted, no liability arose unless the total income exceeded £5,000. A graduated scale was introduced in 1914–5, increased in weight in 1915 and 1918, until it reached the peak rates in 1920, when it ranged from 1s. 6d. in the £ for every £ of the first £500 of the excess over £2,000, to 6s. in the £ on every £ of income above £30,000. A reduced scale[1] of rates of tax came into force in 1925–6. In the year before the War only 14,000 persons were liable to this tax. In 1924–5, the number of individuals charged had risen to 90,000. A similar and even greater increase marks, of course, the annual yield of the tax. From £3,250,000 in 1913–4 the year's collection had grown to £68,500,000 in 1925–6. These figures may be completed by noting that during the 10 years from 1916–7 to 1925–6 inclusive, the British taxpayer paid £2,768,000,000 in income tax and £493,000,000 in super-tax, making a total of £3,261,000,000. This burden was borne in addition to £1,280,000,000 in the form of Excess Profits Duty and Corporation Profits Tax, each of which was levied upon business profits before the income tax and super-tax were due to be computed.

[1] On the first £2,000 of the income.

	Rate in the £ s.	d.
On the next £500 (to £2,500)	..	9
On the next £500 (to £3,000)	1	..
On the next £1,000 (to £4,000)	1	6
On the next £1,000 (to £5,000)	2	3
On the next £1,000 (to £6,000)	3	..
On the next £1,000 (to £7,000)	3	6
On the next £1,000 (to £8,000)	3	6
On the next £2,000 (to £10,000)	4	..
On the next £5,000 (to £15,000)	4	6
On the next £5,000 (to £20,000)	5	..
On the next £10,000 (to £30,000)	5	6
On the remainder (above £30,000)	6	..

II. THE BRITISH DOMINIONS

Taxation according to faculty, that is, direct taxation based upon the principle of ability to pay, so early established in Great Britain, was naturally carried overseas to the various British possessions. It is not therefore surprising to find income taxes firmly established to-day in South Africa, in the provinces and protectorates there as well as in the Union, in Canada, where also there are provincial income taxes as well as the Dominion tax, Australia, where a similar widespread use of the tax is made, New Zealand, India and in most of the West

Indian islands. Naturally also there is a strong family resemblance between the various income tax systems, most of them having been strongly influenced by British law. Income is usually defined broadly but comprehensively, but there is a general absence of the schedular arrangement of the British tax. Broadly speaking, the year preceding the year of assessment is favoured as the basis of computation of the income to be charged. The minimum amount of income exempted from tax varies, but personal allowances to the taxpayer, his wife and children are general. Graduation of the tax is a common feature, and the device of an additional tax, or super-tax, is freely adopted. In some Dominions, graduation is extended also to companies. The methods of graduation range from simplicity to formulae of great complexity. Differentiation in favour of earned income is found, but is not widely favoured. Taxation at the source is a frequent feature, especially in respect of dividends paid by companies. The rates of tax vary widely, as may be expected from the range of budget requirements of communities of different populations and varying degrees of wealth. As a rule, the income tax in the British Dominions overseas is one tax levied upon the base of the total income, irrespective of the nature of the components of that income. In this respect, the British tradition is followed.

III. SOME EUROPEAN COUNTRIES

Latin Countries.—In Latin communities, a more complex system of income taxation is commonly found. There the development of the income tax as a fiscal instrument has been slower, and has met with much greater opposition. The influence of the ancient taxes in France of the real estate tax (*contribution foncière*), the door and window tax (*contribution des portes et fenêtres*), the business tax (*patentes*) and the personal property tax (*contribution personelle et mobilière*) led to the introduction by Caillaux, shortly before the World War, of an income tax, in the form of seven schedular taxes on income, combined with a general income tax on total income. Under this system, the schedular income taxes (*impôts cédulaires or impôts sur les revenus*) are but lightly linked together. Different rates may be, and often are, imposed under the several schedules; each schedule may have its own scale of personal abatements or reliefs; each may have its own rules for the computation of income. In France, the seven schedules cover buildings and land, agriculture, dividends, interest, etc. (again divided into four subgroups), industrial and commercial profits, salaries and pensions, professional earnings and mining. Each of the seven schedules has its own method of assessment, usually its own particular allowances, and its own special rate of tax. The general income tax (*l'impôt général sur le revenu*) is steeply graduated.

Belgium, on introducing an income tax into her fiscal system in 1919, followed the same method of schedular taxes combined with a general income tax. Here, there are three schedular taxes, on income from real property, income from investment of personal property and, lastly, income from trade business or profession or employment. Agricultural profits are included under the third schedule. For the first two schedules there is the same flat rate, but for the third, the rate of tax is graduated according to the amount of income. The general income tax is also graduated. In Spain and Italy similar systems prevail.

An income tax, designed to measure and to tax the almost infinite variations of methods by which men seek the means to satisfy their wants can never be simple, but the schedular system adds complexity to complexity. Moreover, so far as the rates of tax are differential, they tend to affect the ordinary incidence of an income tax, and so to set up reactions upon economic effort which defy measurement. There is also a strong tendency to regard the schedular income taxes, not as personal taxes but as real income taxes, a contradiction in terms which is at present proving a grave obstacle to the development of a satisfactory solution of the problem of double taxation.

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IV. THE UNITED STATES

Although taxes on gains and profits derived from personal ability as distinguished from property—so-called "faculty" taxes—were employed in the American colonies before the middle of the 17th century, no successful use of the general income tax was made in the United States until the Civil War; and the income taxes then adopted were soon thereafter repealed, or fell into practical disuse. The demand for effective income taxation, however, showed great vitality. It kept moribund income tax laws on the statute books in several states; led to abortive experiments with the tax, particularly in the 'forties and 'nineties; and finally in 1909 resulted in the adoption of a Federal excise tax "with respect to the carrying on or doing business" by corporations, equivalent to 1% of the annual net income over and above $5,000. This proved to be in substance an effective income tax.

State Income Taxes.—In 1911 the State of Wisconsin adopted a general income-tax law applicable to individuals, partnerships and corporations. The practical success of this tax encouraged other states to adopt similar laws or to vitalise the administration of unsuccessful income-tax laws already on the statute books; and although a few states either repealed or rejected the tax, about one-third of the states in 1925 had income taxes. The adoption of income taxes by the states has been largely for the purpose of replacing the unsatisfactory personal-property tax (particularly on intangible personal property) and the so-called corporation franchise tax. The newer state income taxes are generally administered by state or central authority, but provide for the return of a substantial portion of the tax to the county or local governments. There is an increasing tendency to assess the tax on the basis of the Federal income-tax return and an effort is made by apportionment devices to exempt in whole or in part business or corporation income derived from property located and business transacted outside the state. Jurisdictional questions and multiple taxation thus constitute fundamental problems. The various state income taxes differ considerably in their exemptions and rates, but in general the rates are much lower than in the Federal tax, the highest rates—in S. Carolina—being one-third of the Federal rates. However, the combined Federal and State taxes represent a serious burden on the larger incomes.

Federal Income Tax.—The foundation for the Federal system of income taxation was laid by the ratification on Feb. 25 1913 of the Sixteenth Amendment to the Constitution, which provides:—

> That Congress shall have power to lay and collect taxes on incomes, from whatever source derived, without apportionment among the several states, and without regard to any census or enumeration.

The development of the Federal income tax is suggested in the accompanying tabular statement. Under the Revenue Act of 1926 the income tax carries exemptions of $1,500 for single individuals, $3,500 for heads of families and $2,000 for corporations. Under the personal income tax there is a further specific exemption of $400 for each child under 18 years and for every dependent incapable of self-support. Individuals are subject to a split normal tax of 1½% on the first $4,000 of taxable income, 3% on the next $4,000 and 5% on the remainder; and to a surtax ranging from 1% of the net income between $10,000 and $14,000, to 20% on the net income in excess of $100,000. Corporations are subject to a flat rate of 13½%. (since Jan. 1 1926). Earned income (to the extent of $20,000) is taxed 25% less than unearned income, all incomes of $5,000 or less being considered as earned. Net income is defined as all income and gains "from whatever source derived," excluding certain specified classes of income and less certain specific deductions.

The most important characteristic of the Federal income tax is its striking productivity, the elasticity of which is illustrated in the table. The present exemptions are high compared with similar exemptions allowed in other countries, and only a small proportion of the population is directly affected by the tax. A large proportion of the tax is collected in the industrial or urban states and is thus marked by some unfortunate class and sectional characteristics. Compared with similar taxes of other countries the rates on small and moderate incomes are low, while the rates on the larger incomes were until the year 1925 unusually

Federal Income Tax

Personal Income Tax	1913	1916	1918	1919	1921	1923
Total number of returns[1]	357,598	437,036	4,425,114	5,332,760	6,662,176	7,698,321
Per cent number of returns to population	0·37	0·43	4·27	5·03	6·28	6·94
Total net income	$3,900,000,000	$6,298,577,620	$15,924,639,355	$19,859,491,448	$19,577,212,528	$24,840,137,364
Total tax yield	$28,253,535	$173,386,694	$1,127,721,835	$1,269,630,104	$719,387,106	$663,651,505
Average tax per individual	$79.01	$396.60	$254.85	$238.08	$107.98	$86.21
Average rate of tax:—						
Incomes $1,000–$2,000			1·19%	0·87%	0·81%	0·49%
Incomes $5,000–$10,000		0·61%	4·34%	3·10%	2·90%	2·04%
Incomes $25,000–$50,000		1·41%	13·32%	12·13%	11·53%	7·67%
Incomes $100,000–$150,000		3·48%	33·68%	33·12%	32·00%	19·85%
Incomes $1,000,000 and over		11·09%	64·65%	64·87%	63·59%	23·53%
General average rate	0·725%	2·75%	7·08%	6·39%	3·67%	2·67%
Normal rate $4,000 and under	1%	2%	6%	4%	4%	4%
Normal rate over $4,000	6%	2%	12%	8%	8%	8%
Maximum surtax		13%	65%	65%	65%	50%
Incomes under $5,000:—						
Per cent of total returns		36·60	89·17	87·67	92·10	91·87
Per cent of total net income returned		9·92	59·00	56·14	2·37	66·29
Per cent of total tax		1·15	12·84	10·16	12·90	12·21
Incomes over $100,000:—						
Per cent of total returns		1·54	0·10	0·11	0·035	0·056
Per cent of total net income returned		29·47	6·22	5·9	2·37	3·67
Per cent of total tax		73·11	41·66	42·77	28·11	31·76
Personal exemptions:—						
To individual	$3,000	$3,000	$1,000	$1,000	$1,000	$1,000
To head of family	$4,000	$4,000	$2,000	$2,000	$2,500[2]	$2,500[2]
For each dependent			$200	$200	$400	$400

Corporation Taxes	1913	1916	1918	1919	1921	1923
Total number of returns	316,909	341,253	317,579	320,198	356,397	398,933
Returns showing taxable income	188,866	206,984	202,061	209,634	171,239	233,339
Returns showing no taxable income	128,043	134,269	115,518	110,564	185,158	165,596
Total net income	$4,714,000,000	$8,765,900,000	$8,400,000,000	$9,412,000,000	$4,336,000,000	$8,322,000,000
Income tax yield	$43,127,740	$171,805,150	$653,198,483	$743,535,888	$366,443,621	$937,106,798
War profits and excess profits tax yield			$2,505,565,939	$1,431,805,690	$335,131,811	
Total tax yield	$43,127,740	$171,805,150	$3,158,764,422	$2,175,341,578	$701,575,432	$937,106,798
Grand total— Individuals and corporations	$71,381,275	$345,191,844	$4,286,486,257	$3,444,971,682[1]	$1,420,962,538	$1,600,758,303

[1] Returns reporting net income in excess of personal exemptions.
[2] For net income of $5,000 and over, this exemption was reduced to $2,000.

high. From the technical standpoint, the striking characteristics of the Federal tax are: The high ratio of surtax to normal tax; the marked difference in the normal tax applicable to individuals and corporations respectively; the taxation of gains from the occasional sale of capital assets, at a flat rate of 12½%; its failure, largely because of constitutional limitations, to reach interest on municipal bonds and other tax-free securities; the small use of "stoppage-at-source" (whereby the normal tax is withheld and paid direct to the government by payers out of payments due to corresponding payees); and the credit accorded for income and profits taxes paid to foreign countries on income derived from sources therein.

The tax law is extremely complex, largely owing to the taxation of capital gains and to certain "cushions" or relief provisions designed to protect the tax-payer against hardship; but the law has been simplified in a measure by the repeal of the excess-profits tax and of many of the special war provisions such as allowances for amortisation, inventory losses and the like. This has been accompanied by a movement away from centralised administration of the tax, and by a steady reduction in the rates. Nevertheless, complexity, centralisation and high surtax rates still cause excessive delay in the audit of the larger returns. The interpretation of the law has been much improved by the creation in 1924 of a Board of Tax Appeals (an extra-administrative tribunal whose decision is final unless modified by the courts), and by giving local revenue agents the power to audit and settle the smaller cases. The American tax reveals a gradual approach to the British position on capital gains and losses, which are taken into account at a special rate of 12½%.

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INDEX NUMBERS.—The phrase index number is sometimes applied to any series in which a chosen term is written as 100 and the other terms expressed as percentages of it. The earlier and more general use is, however, consonant with the following definitions:—"An index number [is] a number adapted by its variations to indicate the increase or decrease of a magnitude not susceptible of accurate measurement" (Edgeworth, *Economic Journal*, 1925, p. 379); "index numbers are used to measure the change in some quantity which we cannot observe directly, which we know to have a definite influence on many other quantities which we can so observe, tending to increase all or diminish all, while this influence is concealed by the action of many causes affecting the separate quantities in different ways" (Bowley, *Elements of Statistics*, 1920, p. 196). Thus index numbers are applied to the measurement of the *general* movement of prices, cost of living, wages, production, consumption, employment, etc.

The data from which index numbers are formed consist of records of particular quantities at two or more dates or places and information about the relative importance of these quantities in a general measurement. In constructing an index number to measure the movement of any defined magnitude it is necessary to decide on the choice of the separate quantities, on their relative importance, on the period or place to be taken as base, and on the formula of compilation. Thus, in the *Statist* index number the objective is the measurement of the change of

wholesale prices in the United Kingdom, 45 commodities are selected and regarded as of equal importance, the period 1867–77 is taken as base and the average price in that period of each commodity is equated to 100, the terms in each series of prices are expressed as percentages of that average (" price-relatives "), and the simple average of the 45 relatives in any year form the index number for that year.

A distinction is drawn, but not by all writers, between two classes of index numbers: (*a*) where, as in the definitions quoted above, the object is to measure the movements of a magnitude without specific reference to any pre-determined application, *e.g.*, the purchasing power of money in general (" indice monétaire ") as conceived by Jevons, *The Variation of Prices and the Value of Currency since 1782* (1865); (*b*) where the measurement is to be applied to a defined group, *e.g.*, the changes in the cost of a quantitative standard, such as is used in a Cost of Living index (" indice budgétaire "). Many index numbers, however, are intermediate between these classes, and much of the analysis of the form and content of the numbers is appropriate to both. Thus, in all cases of price measurement, only those commodities can be included which are measurable in a defined and unchanged unit, and for which the price can be ascertained, and (unless the geometric mean is used) a base period in which each price is equated to 100 must always be selected.

(*a*) In the measurement of the purchasing power of money in general it is argued that the prices of all commodities, not subject to regulation or monopoly, are equally significant. Theoretically the problem is one of pure sampling, and the precision of the result in any year is directly proportional to the square root of the number of independent terms included and inversely proportional to the mean dispersion of these terms from their average in that year. In practice, the terms are not completely independent, for the prices of related commodities influence one another, and the precision is thus reduced. Also, the greater the interval from the base year, the greater tends to be the dispersion and the smaller the precision. In periods when prices are changing rapidly, as in the years 1914 to 1923, the dispersion is usually considerable and the measurement loses accuracy.

There are three types of averages applicable to price-relatives: their arithmetic mean as described above for the *Statist* index number; the geometric mean of the same numbers, that is the nth root of their product if there are n commodities; and the harmonic mean, which is the reciprocal of the arithmetic mean of the reciprocals. Thus, for two commodities whose prices were 6d. and 10d. in the base year, and 1s. and 2s. 1d. in any other year, the price-relatives are 200 and 250, their A.M. is 225, their G.M. is $\sqrt{(200\times250)}=223{\cdot}6$, their H.M. is $1\div\frac{1}{2}(\frac{1}{200}+\frac{1}{250})=222.2$ If the latter year is taken as 100, the relatives in the original base year are 50 and 40, the A.M. is 45, and 45:100 = 100:222·2. The H.M. of the " forward " relatives gives the same measurement as the A.M. of the " backward " relatives; or, if the comparison is between two places the H.M. of the relatives when the first is taken as base gives the same measurement as the A.M. when the second is so taken.

These statements are more readily expressed algebraically. Write P_1, P_2 . . . for the prices in the first year (or place), and p_1, p_2 . . . for the second. Write $100\frac{p_1}{P_1}=r_1=A(1+d_1)$ . . . where $A=\frac{1}{n}\Sigma v$ is the A.M. of the price-relatives.[1] Then $\Sigma d=0$, the Geometric Mean, $G=\sqrt[n]{(r_1.r_2\ldots)}$ and

$\therefore n \log G=\Sigma \log A(1+d_1)=n \log A+\Sigma d-\frac{1}{2}\Sigma d^2 \ldots = n \log A-\frac{1}{2}ns^2$, approx. where s is the standard deviation of the dispersion of the relatives each divided by A, and mean d^3, etc., are neglected. Hence $A=Ge^{\frac{1}{2}s^2}=G(1+\frac{1}{2}s^2)$, approx. if s is small.

Also the Harmonic Mean, $H=1\div\frac{1}{n}\Sigma\frac{1}{v}=nA\div\Sigma(1+d)^{-1}$

$\therefore A=H\times\frac{1}{n}\Sigma(1-d+d^2-\ldots)=H(1+s^2)$, approx.

$\therefore H=G(1-\frac{1}{2}s^2)$, and $\sqrt{AH}=G$, approx.

Thus, if s is small A, H, G differ little from each other, but A > G > H. If G is the correct measurement A exaggerates a rise and underestimates a fall (since 100 − A < 100 − G), while H has the opposite effect. The G.M. of A and H is very nearly G. For the *Statist* index number in 1913 (1869–79 base period), A = 85·0, G = 80·9, H = 76·5, $s^2=\cdot104$. As regards precision of sampling A may be written as $A\left(1\pm\frac{s}{\sqrt{n}}\right)=A(1\pm\cdot053)=85\pm4{\cdot}4$, if the 45 correlated entries are taken as equivalent to 36 independent (*Statistical Journal*, p. 316, Mar. 1926). In this case the standard error attributable to sampling is about the same as the difference between A and G.

A general change in the relation of currency to its use tends to affect all prices in the same proportion, and " if other disturbing causes may be considered proportional to the ratio of change of price they produce in one or more commodities, then all the individual variations of prices will be correctly balanced off against each other in the Geometric Mean " (Jevons, *Investigations in Currency and Finance*, 1884, pp. 121–2; see also Bowley, *Economic Journal*, 1921, p. 202). The Geometric Mean is therefore considered appropriate to this problem. It has the advantage that it gives less importance to extreme measurements than does the Arithmetic Mean. It has the further advantage that the comparison by its use of any two years is independent of the choice of the base year (*see* below).

(*b*) The method generally used in the more objective problem of measuring the change of cost of a fixed aggregate of goods is as follows: The quantities of defined commodities which are produced or consumed in a year, or exported or imported, or are purchased in a week by a family, are estimated and the prices per unit are ascertained in a base year or period and also in the year to which the measurement is to refer. This budget of quantities is valued at the base year prices and again at the prices of the year in question; the latter total expressed as a percentage of the first gives the required index number. The computation is often effected by writing down the relative expenditure (quantity × price) on each commodity in the base year, applying to each the percentage that its price in the second year forms of that in the first, and adding the products. This sum (divided by the total of the base year's relative expenditures) gives the same index number as before. Cost of Living index numbers are computed by this method. In this form the index number appears as a " weighted average," where the weights are the relative expenditures and the things weighted are the price-relatives. From the theory of weighted averages it is known that considerable roughness in the weights has little effect on the result. It may also be regarded as an average of price-relatives which form a sample of a larger group than that included, and therefore—as under (*a*)—its precision depends on the square root of the number of independent relatives and, inversely, on their dispersion about their average.

Write Q_1, Q_2 . . . for the number of units of quantities, P_1, P_2 . . . for the prices in the base period, p_1, p_2 . . . for those in the year in question. Then $E_1=Q_1P_1+Q_2P_2+\ldots$ is the total expenditure in the first year, and $E_2=Q_1p_1+Q_2p_2+\ldots$ is the total expenditure in the second year. Then the index number is $I_1=100E_2\div E_1$.

Now write $Q_1P_1=l_1E_1$, $Q_2P_2=l_2E_1$ . . ., with $l_1+l_2+\ldots=1$. Write $100p_1=r_1P_1$, $100p_2=r_2P_2$ . . ., so that r_1, r_2 . . . are the price relatives. Then the new index number is $l_1r_1+l_2r_2+\ldots=(Q_1P_1r_1+Q_2P_2r_2+\ldots)\div E_1=100(Q_1p_1+Q_2p_2+\ldots)\div E_2=I_1$ The weighted Geometric Mean, $G_1=\sqrt[n]{(r_1^{n_1}r_2^{n_2}\ldots)}$ where $n_1+n_2+\ldots=n$, so that $n \log G=n_1 \log r_1+n_2 \log r_2+\ldots$. The English Board of Trade, for its index number of wholesale prices, uses a similar form in which, if for example n_1 is the weight assigned to cereals, $r_1^{n_1}$ is replaced by ${}^1r_1\times{}^2r_1\times\ldots$ to n factors where ${}^1r_1$, ${}^2r_1$ . . are price relatives of n_1, different quotations of cereal prices. When n_1, n_2 . . . are once chosen the comparison between any two years A and B is independent of the base year;

[1] Such an expression as Σv is to be read $v_1+v_2+\ldots+v_n$ where n is the number of similar terms.

for if the price ratios for the years are written ${}_aR_1$, ${}_aR_2$ . . . and ${}_bR_1$, ${}_bR_2$ . . . and G_a, G_b are the resultant means, then $\log \frac{G_b}{G_a} = \log G_b - \log G_a = n_1(\log {}_bR_1 - \log {}_aR_1) + n_2(\log {}_bR_2 - \log {}_aR_2) + \ldots = n_1 \log {}_{ab}R_1 + n_2 \log {}_{ab}R_2 + \ldots$, where ${}_{ab}R_1$, ${}_{ab}R_2$ . . . are the ratios of the prices of the year B to those of the year A, and the prices in the base year do not enter. If with similar notation the arithmetic average is used, we have $A_b \div A_a = (n_1 \cdot {}_bR_1 + n_1 \cdot {}_bR_2 + \ldots) \div (n_1 \cdot {}_aR_1 + n_2 \cdot {}_aR_2 + \ldots)$, in which no corresponding elimination takes place.

The weakness of this method is that, when we make a comparison between two years or two places, the relative expenditures generally differ and each scheme appears to have an equal claim to be included. This difficulty may be met theoretically by computing the index twice, first with the expenditures in year or place A and then with those in B and averaging the result. For comparison between places this method is applied, but it is seldom that the necessary " weights " can be obtained for more than one year, and till there is a further census of production or a new collection of working class budgets the double computation cannot be made. Further, if the weights are available for three years or places, A, B and C, the index for B in reference to A multiplied by that for C in reference to B does not by any weighted average formula give that for C in reference to A (÷ 100), as it should. This so-called " condition transitive " is not satisfied by any formula that is symmetrical with regard to weights.

Write ${}_aQ_1$, ${}_aQ_2$ . . . and ${}_aP_1$, ${}_aP_2$ . . . for quantities and prices in A, and ${}_bQ_1$, ${}_bQ_2$ . . . , ${}_bP_1$, ${}_bP_2$ . . . in B. The " forward " index number is $I_a = 100\Sigma_a Q_1 \cdot {}_bP_1 \div \Sigma_a Q_1 \cdot {}_aP_1$ and the " backward " index number is $I_b = 100\Sigma_b Q_1 \cdot {}_bP_1 \div \Sigma_b Q_1 \cdot {}_aP_1$. The Geometric Mean $\sqrt{I_a \times I_b}$ is Prof. Irving Fisher's " Ideal index number " (*The Making of Index Numbers*, 1922, p. 220). The arithmetic average, $\frac{1}{2}(I_a + I_b)$ and the form $I_2 = 100\Sigma\frac{1}{2}({}_aQ_1 + {}_bQ_1) \cdot {}_bP_1 \div \Sigma\frac{1}{2}({}_aQ_1 + {}_bQ_1) \cdot {}_aP_1$, may be conveniently used. The three forms of average may be expected to give nearly identical results. I_2, in which the quantities at the two dates are averaged, is perhaps the simplest in idea. Each average lies between I_a and I_b, and is greater than I_a if an increase of prices of a commodity above the general increase from year A to a later year B is correlated with a relative decrease of the quantity purchased, as may be expected if there is a possibility of substitution of one commodity for another without any general change of standard (Bowley, *Statistical Journal*, 1919, pp. 343 *seq.*).

In their measurement of the change of Import or Export index prices from year A to the consecutive year B, the Board of Trade uses the formula I_b and for comparison with the next year C the formula $100 \times \frac{\Sigma_b Q_1 \cdot {}_bP_1}{\Sigma_b Q_1 \cdot {}_aP_1} \times \frac{\Sigma_c Q_1 \cdot {}_cP_1}{\Sigma_c Q_1 \cdot {}_bP_1}$ which does not equal $100\frac{\Sigma_c Q_1 \cdot {}_cP_1}{\Sigma_c Q_1 \cdot {}_aP_1}$ obtained by direct re-valuation of the C quantities by the A prices and, if there is a very rapid change of quantities and prices, may differ considerably from it. This is an example of the " step-by-step " or " chain " method of index numbers. Note that from A to B, $100\frac{\Sigma_b Q_1 \cdot {}_aP_1}{\Sigma_a Q_1 \cdot {}_aP_1}$ is an index number of quantity of trade (prices constant), and $100\frac{\Sigma_b Q_1 \cdot {}_bP_1}{\Sigma_a Q_1 \cdot {}_aP_1}$ is the index number of value of trade. The product of these measurements of price and quantity is the index of value (× 100).

Since no form of index number satisfies all the conditions which can properly be laid down (see *e.g.*, Gini, in *Metron*, 1924, pp. 81 and 134), on the one hand we must select the form most suited for a particular purpose, on the other we can only expect precision when different relevant forms give approximately the same result, for which the conditions are that the dispersion of prices from their average should be small and the number of constituent elements should be considerable. *See* COST OF LIVING: PRICES. (A. L. Bo.)

INDEX SYSTEM: *see* OFFICE APPLIANCES.

INDIA (*see* 14.375).—The fifth regular census of the Indian Empire (March 1921) gave a total population of 318,942,480, of whom 247,003,293 dwell in British India, and 71,939,187 in the Indian States. The corresponding figures of area were 1,805,332 sq. m., of which 1,094,300 lie in British territory, and 711,032 in the Indian States. With an area rather more than half that of the United States, the country has a population about three times as large. But the increase in population, 1.2% during the decade 1911–21, was the lowest in any similar period since the decennial census was instituted:—the result of a widespread failure of the crops through drought in 1918, and an epidemic of influenza which is estimated to have carried off anything up to 10,000,000 victims.

Political Divisions.—British India consists of (*a*) nine major or " Governor's " provinces, viz.: Assam, Bengal, Bihar and Orissa, Bombay, Burma, Central Provinces and Berar, Madras, Punjab and United Provinces of Agra and Oudh; (*b*) two minor provinces, viz.: Baluchistan and the North-West Frontier Province; and (*c*) certain smaller administrative areas, viz.: Ajmer-Merwara, Andamans and Nicobars, Coorg and Delhi. The present article deals exclusively with British India, except where the contrary is stated.

The Indian states are governed by ruling princes and chiefs, and are in political relation with the British Government through the medium of political officers specially attached to the larger units or groups. The rulers of 119 states have a salute of guns, which forms a rough measure of their relative importance, as it varies from 21 guns to 9; the remaining 442 states and estates have no salute. Many of the smaller estates are divided up among several sharers. The more prominent individual states are Hyderabad, Mysore, Baroda, Kashmir and Gwalior; and apart from these units the main territorial groups of states are Rajputana, Central India, the Western India states, the Punjab states and the Madras states. Burma contains a number of Shan states, which technically form part of British India, though they are administered through their hereditary chiefs.

Religions, etc.—A classification by religions would divide every 1,000 of the people into 686 Hindus, 217 Moslems, 37 Buddhists, 31 Animists, 15 Christians, 10 Sikhs and 4 Jews, Parsees and followers of other faiths. The census recorded 22,600,000 as literate, in the sense of being able to write a letter in their own vernacular tongue; and 2,500,000 were returned as able to read and write English. Seventy-one per cent of the people are supported by agriculture, 1% only by organised industry, another 9% by the simple hand industries, 7% by trade and transport, 1½% by the professions and liberal arts, and 1½% by the administration and protection of the country.

I. GENERAL HISTORY

Lord Hardinge as Viceroy.—In the spring of 1910 the appointment of Lord Kitchener to succeed Lord Minto as Viceroy seemed probable. Fate reserved Lord Kitchener for other tasks, and the choice fell on Sir Charles Hardinge, permanent Under-Secretary for Foreign Affairs and formerly ambassador at St. Petersburg, who was raised to the peerage as Lord Hardinge of Penshurst. His long viceroyalty (Nov. 1910–March 1916) was strenuous and eventful. The earlier years were marked by the visit of King George V. and Queen Mary to India, the selection of Delhi as the site of the future capital of the Indian Empire, the revision of the " partition " of Bengal and the nefarious attemps of anarchists to compass the deaths of the Viceroy and his wife on the occasion of their state entry into Delhi. The closing years saw India in the throes of the World War.

Lord Hardinge, like his predecessor, had an hereditary connection with India, as his grandfather, the 1st Viscount Hardinge, was Governor-General (1844–8) in the stirring times of the first Sikh War. The goodwill of Indians towards the new Viceroy deepened as they saw his genuine liking for their country; his zeal to obtain redress of the grievances of Indians residing in other parts of the Empire; and his endeavours to associate

their political leaders with the work of government under the reformed Councils scheme. His diplomatic and Foreign Office experience and knowledge of the politics and conditions of the East enabled him to handle dexterously and effectively the external affairs of India and to enter into the difficulties and apprehensions of Indian Mahommedans. He cordially pursued the policy of friendship and co-operation with the ruling chiefs of native States that Lord Minto had inaugurated. When the World War came in 1914, the popularity of his administration and the personal influence and friendship which he had acquired with the ruling princes had much to do with the magnificent response of India to the call of the Empire.

The Morley-Minto Reforms.—The scheme of administrative reform which had been worked out between Lord Minto and Lord Morley, then Secretary of State for India, was in full operation when the new Viceroy arrived. The main object of the India Councils Act, 1909, had been to enlarge the Legislative Councils and make them more fully representative, introduce the elective principle, give greater powers of discussion and of obtaining information from the executive. In each Council the nominated members comprised: (1) a substantial *bloc* of officials, the *bloc* in the Imperial Legislative Council being large enough to secure, together with the members of the Executive Council, an absolute majority; (2) non-officials nominated to represent classes or interests which would otherwise be unrepresented or inadequately represented.

In all the councils, with the exception of that of Bengal, the nominated members exceeded in number the elected members. The number of the latter in any province was too few to admit of any system of territorial constituencies and direct voting. Special constituencies therefore were formed, such as universities, chambers of commerce, groups of municipalities and district boards, and also for Mahommedans as a separate class or community. The councils were empowered to discuss and move resolutions on the annual budget and in like manner to raise discussions by resolution on matters of general public interest. But they did not vote the budget, and resolutions operated only as recommendations which were not binding on the Government. The councils had no direct control over the executive, though they could inform and influence it; Lord Morley had emphatically said that India was not ripe for parliamentary institutions and that he would be no party to creating them. The Act increased the number of members of the executive councils of Madras and Bombay from two to a maximum of four, thereby providing a seat for an Indian or two Indian members; it also authorised the creation of an executive council in any province having a lieutenant-governor. The policy of associating Indians with the executive government thus affirmed as regards to provinces, was given effect to in the Government of India by the appointment first of Mr. S. P. (afterwards Lord) Sinha, and then of Sir Ali Imam as Law Member of the Governor-General's executive council.

Working of the Reforms.—Lord Minto had predicted that the conciliatory measures embodied in and associated with these changes would clear the political atmosphere. He prophesied rightly. On Jan. 5 1911, a deputation from the Indian National Congress presented an address to the new Viceroy expressing deep and heartfelt loyalty to the Crown and appreciation of the reforms which "had done much to bring about a better understanding between the Govt. and the people." As the enlarged Legislative Councils settled down to their work, even the advanced party found in the new powers a healthy outlet for their energies. As consultative and critical bodies the reformed councils exercised a real and growing influence and were an educative force. They formed, directed and developed public opinion in political matters. They acted as a restraint upon the autocratic tendencies of the Executive and made it more responsive to popular demands, and they strengthened its hands when it had to sustain Indian interests against the interests of Great Britain or of the self-governing Dominions.

The King's Visit.—The royal visit in the winter of 1911 was a complete success. The presence of the King-Emperor and his Consort in India touched the imagination of the people. The Delhi ceremonies drew vast crowds eager to see and salute the sovereign. When a visit to Calcutta followed, the welcome given by the populace of that city was even more enthusiastic and unrestrained. On Dec. 12 1911, in a great arena outside Delhi specially prepared for the occasion, the King held a coronation durbar at which he received in person the homage of the great officers of state and the ruling princes and chiefs of the Indian Empire. Largesse and "boons" of various kinds were granted, and an announcement made of great political moment. The seat of the Govt. of India was to be transferred from Calcutta to Delhi; Eastern Bengal was reunited to Bengal and the enlarged province given a Governor in Council; Bihar, Orissa and Chota Nagpur, tracts which are loosely connected with Bengal proper were made a Lieutenant-Governorship in Council; and Assam was reformed into a chief commissionership. The secret had been well kept, and the surprise was complete. The scheme, though open to obvious objections was ingenious and cleverly balanced. A reasoned exposition of its object is contained in a despatch, dated Aug. 25 1911, from the Govt. of India to the Secretary of State, submitting the proposed changes for the home Govt's approval in advance of the King's visit.

Time alone will test the wisdom of these changes, autocratically conceived and dramatically carried out. The building of the new capital was thrown back by the World War, and the cost, which was originally estimated at £4,000,000, will greatly exceed that amount. New Delhi, it is urged by opponents of the scheme, will be merely cold-weather headquarters of an official hierarchy, an imposing mass of buildings untenanted for climatic reasons during eight months of the year; while the Govt. of India, rotating between it and Simla, will live perpetually in a bureaucratic atmosphere. On the other hand the drawbacks of Calcutta were many, and constitutional changes have emphasised the desirability of removing the supreme Govt. from immediate contact with the internal administration of Bengal. The presidential Government of reunited Bengal is an undoubted success, the bitterness of feeling engendered by the "partition" has disappeared, and the interest of the Mahommedan population of the Eastern districts receives a just measure of attention from the local Government. The province of Bihar and Orissa is the weak feature of the scheme. The artificial union of two blocks of territory, geographically apart and without linguistic or racial affinities, can never be a convenient administrative unit.

Lord Hardinge's internal Administration.—The beginning of a sustained advance in popular education was made at the Delhi coronation durbar, at which a recurring grant of 50 lakhs (£333,000) to local Govts. for the purpose was announced. This was followed in succeeding years by larger grants. From 1911–5 non-recurring grants amounting to £3,250,000 and recurring grants of £826,000 were made to the provinces. The total annual expenditure on education rose during the period by nearly £3,000,000 and the number of boys and girls at school or college by 1,500,000. This expansion was numerically greatest in the primary schools. A wide educational policy was laid down, embracing the universities and secondary and technical schools and colleges. Research and post-graduate instruction were promoted in the universities. A well-equipped medical college was established at Lucknow, raising the number of medical colleges in India to five, schools of tropical medicine were founded in Calcutta and Bombay, and an institute of science at Bangalore. Non-recurring imperial grants for public health service, amounting to £2,700,000, and recurring grants of £368,000 were made, rendering practicable the execution of sanitary measures which a few years before seemed beyond the limits of financial possibility. The appointment of a royal commission under the presidency of Lord Islington, to inquire into and report on the public services of India with a view to increasing the proportion of Indians in the higher offices was warmly approved. Another popular measure was the establishment of a Legislative Council in the Central Provinces.

Indians in the Dominions and the Colonies.—Serious discontent was provoked by the position of indentured labour in

the colonies to which it was permitted, and by the treatment of Indian residents in South Africa and Canada. The first trouble arose over the refusal of the Natal Govt. to accept Indian immigrants as permanent citizens of the Union after the expiration of their indentures. As no redress was obtained the Govt. of India in 1911 prohibited for the future indentured emigration to Natal. In the following year the grievances of the Indian domiciled in the Union against the Union Govt. came to a head. The Indian settlers resorted to "passive resistance." The situation was aggravated by strikes and riots among Indian labourers in Natal. Intense feeling was aroused in India by reports of the treatment of passive resisters by the magistrates and the rough handling of strikers and rioters by the police. In a speech delivered in Madras (Nov. 24 1913), Lord Hardinge expressed evident sympathy with the passive resisters in their struggle against "invidious and unjust laws," and pressed for an inquiry in South Africa by a strong and independent committee on which Indian interests should be fully represented.

The Union Govt. resented the Viceroy's language, but the calculated indiscretion served its purpose. A commission of inquiry was appointed, and a solution was at length reached and embodied by the Union Govt. in its Indian Relief Act, 1914. This closed the passive resistance struggle. In the action they took Lord Hardinge's Govt. had the warm approval of the educated classes. With regard to Canada the grievances of Indians were less easy of settlement, and Lord Hardinge could only advise a policy of reciprocity, which could be made effective without direct retaliation and would not raise questions of the personal status of Indians in Canada.

Revolutionary Crime.—A new and sinister feature in Indian life had forced its way to the surface soon after Lord Minto arrived in the country. The wide-spread unrest, which he found among the educated classes, and endeavoured to appease by political reforms, had its echo among other classes which were permeated by economic discontent and with whom crude notions of self-rule and political freedom easily "yoked themselves," as Lord Morley put it, "to deep invisible roots of alien race, creed and inviolable caste." Secret societies, composed chiefly of young men belonging to respectable families, sprang up in many districts of Bengal, having for their object the deliverance of India from the foreign yoke. This they sought to compass by assassination and terrorism. The art of bomb-making was imported from Europe. Revolutionary literature and the use of pistols and explosives were sedulously studied, and a series of anarchical crimes occurred from 1907–9.

A group of measures were passed for dealing with seditious meetings, publications and associations, and for establishing special procedure and special tribunals for the trial of anarchical crime. Quiet was apparently restored; but in Bengal trouble broke out again towards the close of 1912; and by the end of 1913 the ordinary forces of law and order in that province had been definitely beaten. On Dec. 23 1912, as the Viceroy was making his first state entry into Delhi, a bomb was thrown and exploded in the *howdah* of the elephant on which he and Lady Hardinge were riding, severely wounding him and killing an attendant. The assailants were never brought to justice, but there is little doubt that they were connected with the anarchical movement in Bengal which had extended to the Punjab. In 1914 and 1915 revolution activities became more daring, with the assistance of German agents in America and the Dutch East Indies; but the vigorous use of the special powers provided by the Defence of India Act broke up the movement for the time being and restored order. The organisation of the revolutionary societies, their inter-connection and propaganda methods, their success in corrupting the educated youth of the country, are minutely described in the report of the Sedition Committee (1918) over which Mr. Justice Rowlatt presided.

The War Period

India's Effort.—On the outbreak of the World War in Aug. 1914, the response made by India to the needs of the Empire was signal testimony of her pride in the British connection. The political leaders instinctively suspended their controversies with the Government, and gave her their support. The martial classes eagerly responded to the call to arms. From the rulers of native states lavish offers of help poured in. They were recounted in the Viceroy's telegram to the Secretary of State, dated Sept. 7 1914, which was read in both Houses of Parliament and circulated throughout the Empire. As a wonderful demonstration of loyalty and generosity, its effect on popular feeling was immense.

With this confidence and enthusiasm were mingled some alarm and bewilderment. Trade came to a standstill. There were runs on the banks, encashment of currency notes and hoarding of coin. In the remoter districts rumours of the Collapse of the British *raj* disturbed the countryside. The Mahommedan peasantry in parts of the Punjab raided and burned the houses of Hindus and moneylenders, and military force was required to restore order. In Bengal the revolutionary societies redoubled their criminal activities. In San Francisco and Vancouver an Indian revolution was openly preached to the Sikhs settled there, and numbers of them were incited to return to the Punjab to take part in a general rising. Their designs were detected, but for some months the Punjab was disturbed by murders, dacoities and robberies, and the reckless use of arms and explosives.

India as a whole however was so calm that the Govt. was able to denude itself freely of its military resources to meet the demands of the home Govt. for troops and war material. Most of the British troops, the flower of the Indian army, the best of the artillery, and large quantities of ammunition were despatched to France and other theatres of war. In Sept. 1914 a force of 70,000 men was sent to France. By the end of 1915 India's contribution amounted to nearly 80,000 British and 210,000 Indian officers and men. At one time the original British garrison was reduced to only 15,000 men. These were gradually supplemented by territorial and garrison troops from home, but throughout the War the British element in the army in India was far below the defensive needs of the country.

The entrance of Turkey into the War placed Indian Mahommedans in a difficult position; but they loyally rallied to the side of the Crown. Against a few prominent agitators only was it necessary to take action. The premier Mahommedan prince, the Nizam of Hyderabad, and the Begum of Bhopal, in addresses to their co-religionists, effectively stated the British case, and exposed the falsity of the pretexts by which Enver Bey and his associates sought to justify the entrance of Turkey into the War. These addresses and a declaration by the Govt. of India as to its attitude towards Islam in general and the Holy Places in particular served greatly to maintain tranquillity.

Retirement of Lord Hardinge.—In Nov. 1915 Lord Hardinge completed his fifth year as Viceroy, but at the request of the home Govt. remained in office until the following April. In a farewell speech to his Legislative Council he expressed his wish to see "the early realisation of the just and legitimate aspirations of India," but he besought his hearers not to be led astray by impracticable ideals, but to look facts squarely in the face and to realise that in the Dominions self-government had been the slow product of steady and patient evolution.

Lord Chelmsford's Administration.—Lord Chelmsford, the new Viceroy, assumed office on April 4 1916. Previously Governor of Queensland and of New South Wales, at the time of his appointment he had been serving as an officer with a territorial battalion in India; and he was cast at once into one of the most difficult periods of British-Indian history, momentous alike in the number and magnitude of the problems demanding solution and in the gravity of the issues they have raised. In the very first year of his administration the political peace enjoyed by his predecessor came to an end. In the early part of the year Mrs. Besant succeeded in getting her scheme of Home Rule considered by leading members of the National Congress and the Moslem League. She continued to advocate it with great energy among students and school-boys in Madras, established a Home Rule League, celebrated a "Home Rule" day, and declaimed in her paper *New India* against the Government. Mr. B. G. Tilak, who up to 1914 had been serving a sentence of six years'

imprisonment for sedition, was equally active in Bombay. In Oct. 1916, a group of elected Indian members of the Imperial Legislative Council submitted a memorandum on proposed reforms to the Govt. of India. They described the Morley-Minto reforms as having created Legislative Councils which were mere advisory bodies without any effective control; they propounded a scheme which, while retaining irremovable executives responsible to Parliament and the Secretary of State, would have subjected them in legislation, finance and administration, to the orders of a legislative body in which elected members would be predominant.

At meetings held in Lucknow in Dec. 1916 the National Congress and the Moslem League agreed upon a scheme of reforms as the irreducible minimum with which the National party would be content. The Moslem League, originally founded for the protection of Moslem interests against Hindu ascendancy, had fallen under the influence of the " young " Mahommedans, who made Home Rule their objective and joined forces with the Congress on the condition that in certain provinces in which the Mahommedans were in a minority they were guaranteed a proportion of seats in the future Legislative Councils in excess of the number they could hope otherwise to win. Effect was given to this compact, henceforth known as the " Lucknow Compact," in the Congress-League scheme. Following the Lucknow conferences an energetic Home Rule campaign was opened in all provinces. The stir in the Nationalist camp was quickened by the knowledge that the views of Lord Chelmsford's Govt. on political reforms had for some time past been before the home authorities. A preliminary and informal examination of the changes possible and prudent had been made by Lord Hardinge. Lord Chelmsford immediately on assuming office took up the inquiry from the point where his predecessor had left it. At the close of 1916 his government submitted to the Secretary of State a considered scheme of reforms, and asked for an authoritative declaration of policy. Was the goal for the Indian peoples to be responsible government? If so, by what stages and steps should it be reached? The questions raised were large and delicate. The Cabinet was preoccupied by the War. In July 1917 the Secretary of State Mr. (Sir) Austen Chamberlain, resigned on the report of the Mesopotamian Commission.

Declaration of Aug. 20 1917.—It fell to his successor, Mr. E. S. Montagu, to announce on Aug. 20 1917, in the House of Commons, the Indian policy of the government.

> The policy of H.M. Govt. is that of increasing the association of Indians in every branch of the administration and the gradual development of self-governing institutions with a view to the progressive realisation of responsible government in India as an integral part of the British Empire . . . . Progress in this policy can only be achieved by successive stages. The British Govt. and the Govt. of India, on whom the responsibility lies for the welfare and advancement of the Indian peoples, must be the judges of the time and measure of each advance, and they must be guided by the co-operation received from those upon whom new opportunities of service will thus be conferred and by the extent to which it is found that confidence can be reposed on their sense of responsibility.

In the course of the winter Mr. Montagu visited India, and a joint report, dated April 22 1918, by himself and the Viceroy was drawn up before he left.

War Conference of 1918.—The Montagu-Chelmsford report was nearing completion when attention was recalled to the pressing realities of the War. In the Near East, German troops had penetrated the Caucasus and Turks were invading Persia. With the collapse of Russia, the opening up of a road to Afghanistan and thence to India seemed possible. In a telegram (April 2 1918), the Prime Minister made an appeal to the Govt. and people of India to redouble their efforts and prevent German tyranny from " spreading to the East and engulfing the world."

Lord Chelmsford's reponse was to convene a War conference at Delhi, to which many ruling princes and representatives of all provinces of every shade of opinion were invited. The conference heartily and loyally responded to the appeal, and agreed upon a programme of measures of no small value. In the five months preceding the Armistice 200,000 men were recruited, and had the War gone on this number would have been greatly increased. In the spring of 1917 the Legislative Council had accepted the Govt's. proposal to make a free gift of £100,000,000 to the home Govt. towards the expenses of the War. This was in addition to the obligation the Indian Govt. had undertaken of bearing the normal charges of all troops on the Indian establishment sent overseas. The part borne by India in the War and the sacrifices made by her people for the common cause are represented by an addition of over 230 crores of rupees (£153,000,000) to her debt, the sending overseas of 800,000 combatants and 400,000 non-combatants, and the furnishing of foodstuffs and other supplies at the cost of much privation among the poorer classes. If the agriculturists as a body and some other sections of the community made money out of the War, the urban classes and the multitude of persons on small salaries and fixed incomes suffered greatly from the dearness and scarcity of food and clothing.

India After the War

Reception of Montagu-Chelmsford Report.—The Armistice in Nov. 1918 was the signal for general rejoicings but ushered in a season of political strife and agitation unfavourable for the peaceful introduction of the new constitution. The Montagu-Chelmsford report had been published in the previous July. In the Sept. session of the Legislative Council the report was referred for consideration to a committee of the non-official members, and was approved by them, with certain qualifications. The moderate party held a special conference in Nov. at Bombay, and accepted the general principle of the Montagu-Chelmsford scheme, while urging that it should be enlarged in certain ways. On the other hand the National Congress, which had now become the organ of the extreme national party, wholly condemned the scheme at its Dec. meeting, demanded full provincial autonomy at once, and asserted India's right to self-determination. Unhappily another controversy now arose, which was fated to overshadow and prejudice the constitutional question by the passions which it kindled and the bitterness which it imported into the relations of the people and the Government.

The Rowlatt Bill.—The report of the Sedition Committee over which Mr. Justice Rowlatt presided had discussed the outbreaks of seditious crime, particularly from 1907, and had provided impressive evidence of the existence of a revolutionary and anarchical conspiracy in Bengal and elsewhere and the ineffectiveness of the ordinary criminal law to deal with it. The Committee proposed to strengthen in certain minor respects the existing law, and to endow the Governor-General in Council with emergency powers, to be used only in specified areas, and only after a notification declaring the existence of a state of affairs in those areas which demanded emergency measures. Those measures included: (*a*) the trial of seditious crime by three judges of the highest status, without juries or assessors who were liable to be affected by public discussion or deliberate terrorism; and (*b*) the investing of a provincial Government with powers of internment similar to those conferred under the Defence of India Act, but modified by checks in the shape of local investigating and visiting Committees. In Jan. 1919 the publication of the draft bills embodying the Committee's proposals was followed by a violent campaign by the Nationalist press and Nationalist politicians. They were represented as an attack upon the popular liberties, an attempt to invent crimes, a monstrous engine of tyranny and oppression, the forerunner of a policy of reaction and an unmerited slur upon the loyalty and law-abidingness of the Indian people. A whirlwind of excitement swept through the cities of upper India, a strange medley of ignorance and alarm, of political unrest and domestic discontents, of conscious exaggeration and mendacity.

While the bills were before the Legislative Assembly, Mr. M. K. Gandhi, a well-known social and religious reformer, revered in the Bombay Presidency as an ascetic and holy man, initiated a passive resistance movement. *Satyagraha*, as he termed it, meant insistence on truth and a reliance on soul force. On the

Rowlatt bills receiving the Viceroy's assent, Mr. Gandhi announced a day of general mourning and cessation of business. On March 30 a *hartal*, or closure of shops, took place at Delhi, the mob came into collision with the police, and deaths occurred. A wave of excitement passed over the Punjab. Violent disturbances broke out in Lahore, Amritsar and other centres when news came that Mr. Gandhi had been forbidden to enter the Province and had been sent back to Bombay under arrest. Between April 10 and 15 mobs were in possession of these and other towns in the central Punjab. Disorder assumed the character of open rebellion, definitely anti-government and anti-British, communications were cut, and the civil authority was only maintained by military force. Martial law was proclaimed in Amritsar on April 14, was extended subsequently to other districts and was not finally withdrawn from every part of the Province until June, although order was generally restored by the end of April. But the situation remained critical owing to the Afghan War, and it was thought prudent to run no risks.

In Bombay the news of Mr. Gandhi's arrest at Delhi was the occasion of an immediate outbreak of disorder in Ahmadabad, the capital of Guzerat, and in neighbouring towns. The military had to be called in, but not before numerous acts of incendiarism and violence and some loss of life had occurred. The disturbances terminated on the arrival of Mr. Gandhi, who expressed great sorrow at the excesses of his followers and was allowed to address an enormous meeting at which he upbraided the people for their violence.

Amritsar.—On April 13 " the tragedy of Amritsar " occurred. In that city banks and other buildings had been pillaged and burnt and Europeans murdered. The civil officers, finding themselves powerless to cope with the mobs in possession of the city, called upon the military to restore order. Brigadier-General Dyer, the officer commanding, deemed it necessary in the course of his operations to disperse forcibly an unlawful assembly held in the Jalianwala Bagh. Nearly 400 persons were killed by the fire of his troops, and probably thrice that number wounded. His action aroused intense indignation among Indians of all shades of political opinion, and became the subject of most bitter controversy, which was in no wise allayed by the appointment towards the end of the year of the Hunter Committee to inquire into the the disturbances which had arisen in consequence of the Rowlatt legislation. General Dyer's action was condemned by this committee, and it was decided by the authorities that he should receive no further employment in India. After a warm debate in the House of Commons (July 8 1920), this action was approved by 230 votes to 129, but the House of Lords, on July 20, by 129 votes to 86, passed a motion "deploring" the treatment of General Dyer as " unjust " and as "establishing a precedent dangerous to the preservation of order in the face of rebellion." *The Morning Post*, taking this view, raised a considerable sum as a testimonial to the censured officer. In June 1924, the case came into the law courts in London. Sir Michael O'Dwyer, who was lieutenant-governor of Bengal at the date of the Amritsar affair brought an action against Sir Sankaran Nair, formerly member of the viceroy's council, whose book *Gandhi and Anarchy* had attributed to him a responsibility for the shooting. Sir Michael O'Dwyer won the action, receiving £500 damages, and the judge, Mr. Justice McCardie, expressed the view " that the time and the method of General Dyer's punishment, if he were wrong, were most unfortunate."

The Afghan War, 1919.—Relations with Afghanistan had been uniformly good ever since the Amir Habibullah's visit to Lord Minto in 1908. He had been received in state at Agra on Jan. 9 of that year, and afterwards went to some of the principal cities in India and made a prolonged stay in Calcutta. The Amir was delighted with his reception, and let it be known that his friendship with the British Govt. had been immensely strengthened. During the World War he was staunch; but on Feb. 20 1919, he was murdered, and his son Amanullah ascended the throne.

The succession was disliked by powerful factions in the state; and in his difficulties the new Amir lent an eager ear to the distorted reports of the disturbed state of the Punjab and of the nature of the Rowlatt Acts which found their way to Afghanistan. He concluded that an invasion of India might prove a solution of his domestic differences, appealing as it would to the religious fanaticism of his Mahommedan subjects, deeply stirred by the humiliation and defeat of Turkey and by the British conquest of Mesopotamia. His plan was to incite the independent tribes to rise and to follow up their raiding parties with his Afghan regular forces. But the frontier tribes were slow to move. Aggressive movements of his troops in the Khyber were countered by the rapid mobilisation of the army in India early in May, the occupation of the Afghan advanced base at Dacca and the bombing by aeroplanes of Kabul and Jalālābād. By the middle of May the Afghans asked for a cessation of hostilities, and in June the Amir accepted an armistice. In July his representatives attended a conference at Rawalpindi and on Aug. 8 a treaty of peace was signed, under which the Amir lost his subsidy and the privilege of importing arms through India. A separate letter officially recognised the freedom of Afghanistan from foreign control. Doubts have been expressed as to the wisdom of this concession. But control over the foreign policy of Afghanistan has always been nominal rather than real, and the withdrawal of the subsidy in itself implied the rescission of the reciprocal obligation.

Waziristan Expedition.—The Rawalpindi Treaty did not end the troubles on the frontier. The independent tribes of Wazirs and Mahsuds, who occupy a large block of country south of the Khyber line between Afghanistan and the British districts to the east, had risen in May at the instigation of the Afghans and raided the adjoining British districts. The Indian Govt. determined to undertake the permanent pacification of the country, a serious undertaking, as the tribes could place some 30,000 well-armed men in the field. A strong force was assembled on the frontier in Oct. and an ultimatum given to the tribes. The Wazirs in the Tochi Valley were soon subdued, but the Mahsuds fought with dogged obstinacy and great skill. There were two considerable encounters (on Dec. 21 1919 and Jan. 14 1920) with heavy British casualties. In the end the Mahsuds accepted the terms imposed upon them, and the military operations closed on May 7 1920.

The Non-co-operation Movement.—In Dec. 1919 the Montagu-Chelmsford scheme of constitutional reform became law by the passing of the Govt. of India (Amendment) Act. The King's proclamation of Dec. 23 dwelt in eloquent and arresting language on the political advancement conferred upon the Indian peoples, authorised the Viceroy to extend the royal clemency to political offenders in the fullest measure compatible with the public safety, and announced that the Prince of Wales would visit India to inaugurate the new constitutions. The effect of these gracious words was unfortunately marred by the excitement which attended the inquiry of Lord Hunter's Committee then in progress into the Punjab disturbances of the preceding April. The National Congress met at Amritsar, and passed resolutions denouncing the Government's action in the Punjab, demanding the recall of Lord Chelmsford and condemning the reform scheme as disappointing and unsatisfactory. This hostility towards the administration and rejection of the reforms by the extreme section of the Nationalists developed in the ensuing months into a definite " non-co-operation " movement organised by Mr. Gandhi.

The publication in 1920 of the report of the committee presided over by Lord Hunter, and of the correspondence between the Govt. of India and the Secretary of State regarding its findings, and the subsequent debates in Parliament renewed the bitterness and indignation which the Amritsar proceedings had aroused in India. About the same time the terms of the Sèvres Treaty became known to Indian Mahommedans and added flame to the " Khilāfat " agitation, which the pro-Turk section of that community had been vigorously fomenting. In Aug. Mr. Gandhi proclaimed in a letter to the Viceroy his adoption of non-co-operation as a remedy against a Government for which he retained " neither respect nor affection " on account of its " un-

scrupulous, immoral and unjust " action in the matter of the Caliphate and its failure to punish adequately the officials responsible for " the wanton cruelty and inhumanity " with which the disorders in the Punjab were suppressed.

In Jan. 1921 the Duke of Connaught visited India in place of the Prince of Wales, and inaugurated the new constitutions. The speeches delivered by him in opening the Legislative Assembly, the Council of State and the Chamber of Princes at Delhi and the Legislative Councils of Madras, Bengal and Bombay made a deep impression. His earnest appeal, as an old friend of India, to all parties, British and Indian, " to bury along with the dead past the mistakes and misunderstandings of the past," struck a note which found response in the proceedings of the new legislatures and in the Indian Press.

On April 2 1921 Lord Chelmsford made over the office of viceroy to his successor Lord Reading. No viceroy had been more tried by circumstances beyond his control, and no viceroy had shown more steadfast courage, patience or devotion to the highest ideals of his great office. The era will be a landmark in the history of modern India. It saw India started on the road to self-government and admitted on equal terms to a partnership in the British Empire. (T. W. Ho.)

The New Constitution

During Lord Chelmsford's viceroyalty an important change had taken place in the political machinery. The Morley-Minto reform had introduced the electoral principle into the Indian legislatures, and given them a wider sphere of influence over the executive government. But in effect they remained advisory bodies, and the absence of any administrative responsibility whetted their critical faculty without giving them any corresponding practice in the actual work of government. The executive authorities, imperial and provincial, remained governments of officials, responsible to the Secretary of State, and through him to the British Parliament, and not amenable in any direct sense to popular control in India.

From this arrangement to the announcement of Aug. 29 1917 was a wide step, involving organic change and not taken before time. The enthusiasm which had welcomed the Morley-Minto reform had long evaporated, and the demand by the Indian leaders for administrative power was insistent. The Montagu-Chelmsford report conceded the justice of the demand, and proposed that responsible government, in the sense of government by ministers primarily responsible to an elected assembly, should be conferred on India by progressive stages. It recognised that India was not yet ready for full responsible government, that an electorate had to be created and that its representatives must at first be inexperienced. Its authors proposed therefore to confine the first stage of advance to the major provinces, and in these provinces to set up a dual form of government, generally known as " diarchy." This device, accepted only after all possible alternatives had been found impracticable, was a division of the provincial field of government into two sections, one of which would be transferred to the control of ministers chosen by the Governor from the elected members of his legislative council.

In July 1919 a bill embodying this scheme, with certain modifications, was introduced into the House of Commons, read a second time and referred to a joint select committee of both Houses presided over by Lord Selborne. The committee, after an elaborate investigation and hearing nearly 70 witnesses, accepted the main principles of the scheme, and dealt at length with the political and administrative problems involved in the bill. Their report (H.C. 203) is a most valuable constitutional document, indispensable to a study of the new régime. The bill passed both Houses substantially as amended by the committee, and received the Royal Assent on Dec. 23 1919. It takes the form of amendments of the Government of India Act, and has been so drafted as to admit of its being textually incorporated into the principal Act. As is usual with statutes relating to India, it left a great deal of the new constitution to be worked out by rules drafted and applied by the Government to meet the needs of each particular case.

Demarcation of Spheres.—If its provisions were taken in logical sequence, the first feature of the new Constitution would be its demarcation of the duties of the " central " or Imperial Govt. from those of the provincial Governments. The former retains certain powers of supervision and control over the provincial administrations; but its direct functions are now specifically listed, and the departments which are under the provincial Govts. are similarly enumerated. These Governments derive their revenue from the departments under their own control, *i.e.*, land revenue, stamps, excise, forest, etc. The Imperial Govt. takes the yield of its own central departments—railways, post and telegraphs, customs, income tax, salt, opium, etc. At present, however, these do not balance its budget, which carries the whole cost of the defence of India; and consequently it has to levy subsidies from the provinces, though it is pledged to forego them when the development of its own resources shall permit. As with the administrative and financial powers, so also are the law-making powers of the central and the provincial authorities carefully delimited.

The Provincial Sphere.—Each of the major provinces is now placed under a Governor. The whole of the provincial departments are divided in each province into two groups, the " reserved " and the " transferred." The former (at present law and order, justice, police, the land, etc.) are administered by the Governor and his executive council (of whom at least one member is an Indian); the latter (education, public health, excise, etc.) are administered by the Governor and two or more Ministers, who are chosen by him from among the leaders of the provincial legislature. These two bodies work independently, each in its own field; and their responsibilities are clearly distinguished. The Governor is the link of union, and has full discretion to bring them together for joint consultation on matters of common interest. The Executive Council in its control of reserved subjects, is responsible through the Govt. of India and the Secretary of State to the British Parliament; the Ministers in their control of transferred subjects are responsible to the legislative council on the spot. This, in the briefest terms, is the system which has been named or nicknamed " diarchy." Its purpose is to provide a field of actual duty in which Indian leaders can be trained by actual practice in the art of Government. On the one hand, they will have the assistance of the Governor, and opportunities of consulting their official colleagues in the executive council. On the other hand, the field entrusted to them will be carefully defined, so that their work can be seen and judged by the electorate, and so also that any consequences of their inexperience may not affect the sphere of administration which remains in the hands of the executive council.

The legislative council in each province has a large elected majority, with an element (under 30%) of officials and nominated members. The elections are direct and the constituencies mainly territorial. A property qualification, differing in different provinces, determines the franchise. The vote has been given to about 5,000,000 of the adult male population in the whole of India, female suffrage being left to the local option of the provincial councils. For whatever legislation and supply they require, both halves of the Government are dependent on the legislature thus constituted. In the " transferred " sphere, Ministers must secure the support of the legislature. If they fail, their policy fails; and the ordinary course is for them to resign or be dismissed by the Governor, so that they may be replaced by Ministers who can carry the legislative council with them.

In the " reserved " sphere, it is the task of the Governor and his official colleagues to reconcile the legislature to their policy. But if they fail, their responsibility for right policy to the British Parliament is in no wise diminished; certain safeguards are accordingly provided against the event of the council refusing a law or supply for which it has been asked by them. The Governor has an exceptional power to pass such a law by his own decree, if he certifies that it is essential for the discharge of his responsibility; but a measure enacted in this way has to be reserved for His Majesty's pleasure. Similarly the Government may restore a grant for expenditure which has been refused or reduced

by the council if the Governor certifies in the same sense; and in case of emergency he may authorise any expenditure which " may be in his opinion necessary for the safety or tranquillity of the province or for the carrying on of any department." Finally, should the legislature take action in any department which the Governor regards as dangerous, he has wide powers to stop a bill, or to refuse assent to it, or to return it for reconsideration, or to reserve it for the consideration of the Governor-General. Extensive safeguards thus exist against the possible misuse of its power by the provincial legislature.

The Imperial Sphere.—In the central Government there is no diarchy. The Governor-General and his Executive Council (of whom there are now in practice not less than three Indian members) still remain in sole and undivided responsibility to Parliament for the supreme Govt. of India. The central legislature, however, has been radically altered by the 1919 Act. The Lower House, or Legislative Assembly, has 144 members, 103 of whom are elected direct by constituencies similar to those which elect to the provincial legislatures but larger in area and with a higher property qualification. In the Upper House, or Council of State, are 60 members, of whom 33 are elected on a still more restricted franchise. In neither Chamber therefore is there an assured majority for the Government, to secure the laws, the taxation measures or the expenditure grants which it requires for the administration of the country. The underlying conception of this unusual situation is that it should throw the Government more upon the support of the elected representatives of the people and weaken its reliance on the direction of the Secretary of State. It was anticipated that, where the Executive Govt. and its legislature are in accord on policy, there would be a convention of non-interference by the Secretary of State, subject of course always to the overriding power of the British Parliament. It was not, however, unforeseen that the Central Govt. may not always be able to carry the legislature with it, and machinery was provided for avoiding a deadlock in such an event.

In legislative business a difference between the two Chambers may be referred to a joint sitting. If in either Chamber a bill is proposed or amended so as to affect " the safety or tranquillity of British India or any part thereof," the Governor-General may stop it. He may also, as under the previous constitution, veto a bill, or refer it for His Majesty's pleasure. Should he recommend a bill which either Chamber accepts and the other rejects, he may treat it as enacted; or if both Chambers reject it, he may make it into an Act on his own responsibility. In both cases, however, the Governor-General must first have certified that the " passage of the bill is essential for the safety, tranquillity or interests of British India or any part thereof," and the measure must subsequently be laid before both Houses of Parliament; effect may not be given to it, unless in a state of emergency, until His Majesty's assent has been received. In financial business the supply grants have to be voted by the Legislative Assembly; but if a grant which the Governor-General declares to be essential to the discharge of his responsibilities is refused or reduced, he may restore it. Expenditure on defence and in the political and ecclesiastical departments, charges prescribed by law, loan charges and certain salaries and pensions need not be voted; and the Governor-General has power to sanction vital expenditure in cases of emergency.

Further Development.—The above is an outline of the complex scheme that comprises the first stage in what the preamble of the 1919 Act describes as " the gradual development of self-governing institutions." As " the time," to quote the Act again, " and the manner of advance can be determined only by Parliament," it is provided that, 10 years after the passing of the Act, a Parliamentary Commission will go to India, to inquire into the working of the reforms, and to report on the desirability of establishing the principle of responsible government, or of extending, modifying or restricting the degree of responsible government already existing. In other words, the retention or otherwise of the electoral system and diarchy will be examined on the evidence of the work actually achieved; and it will be decided, if diarchy is retained, whether further departments should be transferred from the official half of each provincial Government to the control of Ministers. It has been necessary to recite the main features of the new constitution because of the influence they exercised on the political history of Lord Reading's viceroyalty.

Lord Reading's Viceroyalty 1921–6

Arriving in April 1921, the Earl of Reading brought to the office of Governor-General a prestige not exceeded by that of any of his forerunners. Having served as Law Officer of the Crown, Cabinet Minister, Lord Chief Justice of England and British High Commissioner in the United States, he enjoyed an eminence both as a lawyer and as a statesman which made his selection a particular compliment to India. The task which confronted him required all his courage and all his experience. Though the actual machinery of the new constitution had begun its work with relative smoothness, the country was seething with an excitement for which the political changes were merely a pretext. A moderate section of Indian leaders commanded the Councils and furnished ministers to the provincial Governments. But they owed their position to the boycott of the whole scheme by the extremist politicians, whether Hindus or Moslems, who had taken no part in the elections of the previous winter, and now held no place in the Councils or the Ministries. The real battle of India's future was being fought outside the domain of constitutional Government.

Hindu Extremism.—The more advanced Nationalist party were gaining strength and audacity under the magnetic leadership of Mr. Gandhi, who had been appointed virtual dictator of their forces at the National Congress of Christmas 1920. He was sweeping the country with his cry of non-violent non-co-operation. The yoke of foreign dominion was to be thrown off and the curse of western commercialism eradicated. India would then be worthy of complete Home Rule, and a date (at first Sept. 30 1921, but subsequently extended on several occasions) was actually prophesied for the disappearance of the British Government. In his campaign Mr. Gandhi was aided by bands of " national volunteers," pledged to deliberate lawlessness, and carrying the spirit of unrest from the towns into the rural areas. Outrage after outrage showed the inability of the masses to distinguish between non-co-operation and anarchy. The tide of disaffection was rapidly rising, and the jails could no longer contain the volunteers who courted a tolerable martyrdom. The condition of the country had not been worse since 1858.

Mahommedan Extremism.—Moslem feeling also had been growing in acerbity for several years. Long persuaded that it might rely on the special consideration of the British Govt., it had been rudely shocked by the reversal of the partition of Bengal in 1911, for the severance of Eastern Bengal into a separate province had been regarded as a measure for the protection of the large and impoverished Moslem community in that area. Genuine distress was felt at the misfortunes of Turkey in Tripoli (1911–2) and the Balkans (1912–3); and among the younger men a movement of active sympathy with the " Young Turk " party made considerable headway. When the Sherif of Mecca revolted against his Turkish overlords it was not only the young Indian Moslems who condemned his action, or resented the part which they were convinced that Great Britain had played in fomenting it. Though there was very little active disloyalty during the war, and although the cooler heads among the Indian Mahommedans disapproved the action of Constantinople in siding against Great Britain in the World War, an under-current of religious solidarity was stimulated by economic discontent and a lively sense of the waning of the power of Islam.

The Treaty of Sèvres was attacked as a device of England to humiliate her former friend and ally; and a movement of protest was headed by two brothers, Mahomed Ali and Shaukat Ali, whose liberty had been restrained for seditious agitation during the War. Their followers were known as the Khilāfat party from their claim that the temporalities of the Sultan, as Khalifa of Islam, should be restored. With them there was no pretence of non-violence; they attempted to seduce the Mahommedan

troops, played on religious fanaticism and talked of proclaiming an Indian republic. Seeing in them a useful adjunct to his own campaign, Mr. Ghandhi took the Khilāfat movement under his wing. It was in a struggle against this combination of forces that the first three years of Lord Reading's Govt. were mainly spent.

The Moplah Rising.—In Aug. 1921 the most serious of many unpardonable deeds of violence broke out. The Malabar country in Madras is occupied by 2,000,000 Hindus and about 1,000,000 Moplahs, an ignorant Mahommedan peasantry of mixed Arab and Indian descent with an evil reputation for outbreaks of fanaticism. Among the latter the Khilāfat excitement spread like wildfire; and during July and Aug. 1921 meetings were held and arms collected to prepare for the coming of an Islamic millennium and the overthrow of British rule. When the magistrate of Calicut attempted to make some arrests, he was met by armed force, and rebellion immediately broke out. Railway and telegraph lines were cut, roads blocked, Government offices burned and a Moplah king proclaimed. The few Europeans who failed to escape from the district were brutally murdered, and then the Moplahs turned upon their inoffensive Hindu neighbours. They burned villages, sacked temples, outraged women, massacred and attempted wholesale the forcible conversion of the Hindus to Islam. The extraordinary difficulties of the country made the task of suppression particularly difficult; and the troops which were locally available had to be reinforced at the beginning of Oct. by four battalions, a pack battery and a section of armoured cars. A drive was then made through the affected area, and the rebellion gradually collapsed. It is estimated that during the campaign the Moplahs lost 3,000 in killed alone.

The whole tragedy was a definite fruit of the extremists' challenge to law and order. It was also the first shattering blow to the Hindu-Moslem unity which the extremists had hoped to establish for their own purposes; Mr. Gandhi and his lieutenants professed to belittle the outbreak, but it soon became apparent how gravely the Moplah atrocities rankled in the minds of the ordinary Hindus. Meanwhile the Ali brothers had got to the end of their tether. In Oct. 1921 they were arrested, tried at Karachi and sentenced to two years' imprisonment. But the Khilāfat agitation was not now to be checked, and it soon gained fresh momentum.

Visit of the Prince of Wales.—On Nov. 17 1921 H.R.H. the Prince of Wales landed at Bombay for the visit to India which had been postponed in the preceding year. Efforts, partly successful, but frequently defeated by the Prince's arresting popularity, were made to boycott the public ceremonials arranged in his honour; yet the tour was courageously carried through. He rapidly traversed British India, carried through a heavy tale of ceremonies and interviews, visited several of the leading Indian States, as well as Nepal, inspected the northwest frontier, attended the Kadir Cup (pig-sticking meet) near Meerut, and finally left for England from Karachi in March. The just comment on results of the tour is a quotation from the Viceroy's telegram to the Prince on his departure: "You leave India having won India's heart, for the road to the heart of the people lies through knowledge and sympathy. From the day you landed in India you set yourself to gain the one; Providence has endowed you with the other."

Decline of Non-co-operation.—The year 1921 marked the apogee of the extremist movement, and among moderate men of all classes it was felt that the Govt. of India was approaching the limits of permissible patience. Mr. Gandhi was preparing a scheme of mass civil disobedience, both aggressive and defensive, and was on the eve of launching it, when on Feb. 4 1922 another hideous outrage occurred. At the Chauri Chaura village, in the east of the United Provinces, 21 policemen and village watchmen were set upon by a mob of "volunteers" and excited peasants and battered to death or burned alive. Mr. Gandhi at once suspended his orders for civil disobedience, issued a new "constructive programme" which threw his followers into confusion, but he was at last arrested on March 10 1922. Put on trial at Ahmadābād on three charges of spreading disaffection and instigating the overthrow of the Government, he pleaded guilty and was sentenced to six years' simple imprisonment. His trial produced no popular excitement. It was overshadowed by the resignation by Mr. E. S. Montagu of his office as Secretary of State, as a sequel to his having published, without Cabinet approval, a dispatch from Lord Reading's Govt., in which His Majesty's Govt. was urged, in deference to Mahommedan sentiment in India, to revise the Treaty of Sèvres.

The cause of non-co-operation now began to waver. The volunteer movement was collapsing from want of funds. Mr. Gandhi's repeated prophecies of the millennium had been falsified. The Nationalist schools which had been started to rival the Government institutions had been failures, and masses of students saw their careers imperilled. Nor was the boycott of the bar maintaining its popularity among the lawyers who abounded in Mr. Gandhi's camp. The unity of Hindu and Mahommedan action was severely shaken by the numerous outbreaks of racial violence. Above all, good harvests were steadying the masses, and economic discontent was being allayed. By the end of 1922 a strong section of the Nationalist party wished to reverse the policy of holding aloof from the councils.

The Akali Riots.—The unsettlement, however, which the Nationalists had engendered, was no longer theirs to curb, and took little heed of political manoeuvres. It had now penetrated the slow-moving Punjab, and the doctrine of non-violent obstruction to authority was bearing strange fruit on unlikely soil. For some years there had been a reforming movement among the Sikhs, directed at recovering a number of scattered temples of their religion from hereditary incumbents (Mahants) and employing their revenues for the spiritual service of the people generally. The puritan reforming section (Akalis) had got into the habit of taking the law into their own hands, and ejecting by violence the Mahants of whom they disapproved. The latter appealed to the courts, or engaged armed retainers to defend their property. In either case it was necessary for the Government to intervene; and it suited the employers of the Akali bands, adherents of the non-co-operation movement, to distort this intervention into hostility against the Sikh religion. All attempts by the Government to bring the Akali fervour into orderly channels were frustrated, and in 1922 the Akalis established such a reign of terror that military assistance had to be supplied to the police.

Then came the episode of the Guru-ka-Bagh, one of the most extraordinary stories of recent Indian history. At a small temple 10 miles from Amritsar the police had prevented some Akalis from trespassing and cutting trees; whereupon from all over the Punjab bands of Sikhs assembled to assert their right over the land. The method they employed was bewildering in its departure from the usual martial spirit of the Sikh. A band of Akali volunteers started every morning from Amritsar, under a vow to employ no violence but to reach the temple or to return senseless. The police who were deputed to protect the property were obliged to use their batons (in India, their *lathis* or iron-shod bamboo staves) sufficiently to stun the volunteers, who were then carried trimuphantly back to Amritsar in the ambulance cars which their sympathisers had in readiness. This demonstration went on day after day, until the whole Sikh community was in a ferment and its traditional loyalty to the Government was all but destroyed. In 1923 the animosity of the Sikhs was turned against the administration of the Nabha State, the Maharaja of which had abdicated rather than face an inquiry ordered by the Govt. of India. Regrettable incidents occurred; but the futility of the whole business at last began to dawn upon the Sikh mind, and by the end of 1924 common sense was reasserting itself.

It was not only in the Punjab that 1924 and 1925 were difficult years. Moslem feeling was very bitter about Great Britain's treatment of Turkey. Susceptibilities were set on edge by the Greek invasion of Asia Minor, and subsequently elated by the victories of Mustafa Kemal. Either emotion had a tendency to bring the Moslems into conflict with their Hindu neighbours,

and racial tension again became acute in the latter half of 1922. The following two years were thus marked by an almost continuous succession of sporadic disturbances in Northern India.

Second Phase of Lord Reading's Viceroyalty.—At the end of 1923 came the second general election. A strong section of the Congress Party, adopting the label of Swaraj (Home Rule), broke away from Mr. Gandhi's programme of boycott and put up a mass of candidates for the councils. The Liberal or Moderate party, which had predominated in the first triennium of the new legislatures, were attacked as having supported the Government in bolstering up an unpopular constitution. They had also lost cohesion and discipline, and a new party, describing itself as Independent, but standing on no common platform, made serious inroads on their position. For the Swarajists the election was a substantial victory. They secured nearly half the elected seats in the Central Assembly; and in at least two of the provinces they commanded the provincial councils. Their discipline was good, and they had entered the legislatures with the avowed object of " uniform, continuous and consistent obstruction with a view to make Government through the Assembly and the Councils impossible." It was only in the central provinces, however, that they proceeded at once to extremes, rejecting the budget provision for the salary of Ministers, and ultimately compelling the Government to resume the " transferred " subjects and suspend the operations of diarchy. In the central legislature, which first met after the elections on Jan. 31 1924, they concentrated on demanding that the grant of full responsible government should be expedited. When this was not endorsed by the Government, they retaliated, in coalition with a sufficient number of members of the other parties, by rejecting the Finance bill for the year, with the result that the Viceroy had to use his emergency powers and certify the necessary expenditure of the administration. The episode, however, and the subsequent conduct of the Nationalist Coalition during the remainder of the session, established them in the rôle of a constitutional opposition, thus marking a new stage in the political development of the country, so that the second phase of Lord Reading's viceroyalty may be taken as dating from Jan. of 1924.

The last prop of non-co-operation was knocked away when, in a special summer session of the legislature, the Swaraj party voted with the Government on a tariff measure; and Mr. Gandhi, who had now returned to politics, threatened to lead his followers out of the National Congress into a campaign of social reform and Hindu-Moslem unity. Of the latter the prospects were gloomy, for the tale of racial conflicts and bloodshed was ever lengthening. The culminating outbreak occurred at Kohat in Sept. 1924, and ended in the whole of the Hindu population fleeing from the town. A unity conference, hurriedly got together at Delhi, though attended by representative members of all the Indian communities, ended in little but good resolutions. Equally ineffective was an attempted coalition of all the political parties in the councils; but Mr. Gandhi was won back to the Congress camp, and the opening of 1925 found the Swaraj party temporarily in a position of considerably improved strength. In Bengal, pivoting their policy on opposition to an ordinance which the Government published against a recrudescence of revolutionary crime, they refused for a second time to vote salaries for Ministers, with the only result that the Governor in Executive Council resumed control of the transferred departments and diarchy for a time was at an end. But in the Central Assembly the policy of wrecking took second place to a growing divergence between the new Independent party and the Swarajists.

The Muddiman Inquiry.—In the autumn of 1924 an important inquiry into the working of the new constitution was held by a committee under the presidency of Sir Alexander Muddiman. Its appointment was in response to the demand by the Nationalist politicians for the early abolition of diarchy in favour of some form of provincial autonomy. Its business was to advise on any defects in the working of the 1919 scheme and on any amendments compatible with the general purpose and structure of the scheme. The report (published as cmd. 2,360 of 1925) was a twofold one. A minority of the members found that the new system had broken down, that transitional measures were inappropriate, and that steps should at once be taken to establish a permanent constitution. The majority on the other hand recorded their opinion that, though the experiment had worked too short a time to justify a final verdict, they were not convinced that it had failed. They recommended several minor improvements in the machinery and procedure; but they concluded that, " except by some form of dualism, it was not possible to afford an equally valuable training towards responsible government in India and still to safeguard those conditions upon which government depends." The Swaraj claim that responsible government should be expedited was by implication rejected.

While the controversy which followed the publication of the Muddiman report was running its course, Lord Reading accepted an invitation from the Secretary of State for India (now the Earl of Birkenhead) to visit England for the purpose of personal discussion in the summer of 1925; the Governor of Bengal, Lord Lytton, officiating as Viceroy in his absence. This was the first exercise of a new Act enabling viceroys and provincial governors to obtain leave during their term of office. It was obviously desirable to announce a line of policy in answer to the protestations of the Nationalists that the 10-year period of experiment should be curtailed, and that the British Parliament ought not to impose its judgment as to the fitness of India for self-government.

On July 10 accordingly Lord Birkenhead made a careful statement in the House of Lords, reviewed the working of the Reform Act of 1919, and emphasised the lack of co-operation and the actual hostility displayed by a section of the Indian leaders. He expressed his willingness to consider any practical scheme of advance on which Indians could agree, and he did not close the door to an antedating of the statutory inquiry due in 1929, if Indian leaders gave evidence of a sincere and genuine desire to work the present machinery. On Aug. 20 a corresponding speech was made by Lord Reading in opening the autumn session of the Indian legislature, coupled with a plea for a closer co-operation. This did not avail to dissuade the Assembly from rejecting the advice of the Muddiman Commission; but when, in the same month, the Chamber had for the first time to elect its own president, its choice fell on Mr. V. J. Patel, who accepted the office and solemnly dissociated himself from all parties, although he had been formerly one of the most advanced non-co-operationists in the Swaraj camp.

Regrouping of parties was the keynote of the caucus meetings at Christmas 1925. The die-hard Swarajists flung an ultimatum at the Government, with threats of civil disobedience, obstruction and the refusal of office; and over this the Congress split. A new wing of the party, representative mainly of western India, broke off and declared for a policy of " responsive co-operation." At a separate conference the Liberals prepared a separate platform; so did the Independents; and a powerful gathering of Moslems at Aligarh assented to a definite anti-Hindu propaganda. The united front which political India had seemed to present in 1921 was seriously disintegrated by 1926; but the processes of schism and reunion are never at an end.

Administrative Progress.—Although political excitement during Lord Reading's viceroyalty seriously hampered the daily routine of administration and often went near to paralysing the legislatures, yet the administrative system was too firmly rooted to be rendered fruitless. In the provinces the output of legislation was abundant; and in the Central Assembly measures of much importance were painfully hammered out, notably in the removal of racial privilege, in establishing a protective fiscal system, and in meeting problems of organised labour which were for the first time emerging in India. The rural community, it is true, were left the Cinderella, as well as the catspaw, of political advance; but Lord Reading sufficiently appreciated their dominant importance to procure, on the eve of his departure, the appointment of a royal commission to go into the whole question of agriculture. Fortunately there had been steady advance in agricultural prosperity. A short monsoon in 1920 necessitated considerable famine-relief operations in the succeeding year; but thenceforward a series of remarkably good harvests lowered

prices and restored the contentment of the masses. The epoch of economic distress in 1920–1 had affected the manufacturing classes even more than the patient agriculturists. Labour trouble came to the front as never before, 1921 witnessing no fewer than 400 strikes of varying magnitude, and legislative measures of a new type began to appear on the statute book.

Social Organisation.—An amended Factory Act in 1922 prescribed a 60-hours week and raised the minimum age of child workers from nine to 12. A Mines Act in 1923 dealt with the employment of women and children below ground, restricted the hours of adult labour to 60 above ground and 54 below, and enacted a weekly day of rest. The first Workmen's Compensation Act came into force in 1924, and measures were undertaken for the regulation of trade unions and the settlement of industrial disputes. Many of these steps were taken in ratification of the conventions adopted by the International Labour Conference held at Washington in 1919. They were described by the Director of the Geneva Labour Office as "the first tangible results in the East of the ideals inspiring Part XIII. of the Treaty of Peace." The same official formally thanked the Govt. of India for "the conspicuous example of social and labour progress which it is showing to the world." Besides these legislative measures, a quieter process was at work in the steady improvement of the depressing housing conditions in the large labour centres, such as Calcutta, Bombay and Cawnpore. The city improvement schemes there and elsewhere have produced remarkable results, which, even from a purely material point of view, should prove remunerative; for nothing has prejudiced the efficiency of Indian labour more than the periodical flights of the labourer back to the healthier conditions of his native village.

In the social organisation of India the post-War record is one of considerable change. The non-Brahmans of Madras struck against Brahman domination, and seized power in the new provincial legislature. The lowest strata of outcasts or "untouchables" have shown signs of organising for their own protection and betterment, and Mr. Gandhi led a vigorous, if not a wholly popular mission for their uplift. Some flutterings of a feminist movement were perceptible. An accomplished Indian lady, the poetess, Mrs. Sarojini Naidu, occupied the chair of the National Congress of 1925. Numerous ladies of the classes which formerly prided themselves on their seclusion are now to be met on political and other platforms, and some little progress is being made towards the recognition of the re-marriage of Hindu widows. Social progress, however, lags far behind political aspirations.

Recrudescence of Political Crime.—Allusion has already been made to the inroads on the tranquillity of the country which ensued on extremist agitation. They unfortunately provided cover for a revival in Bengal of revolutionary crime on the familiar lines:—dacoities, looting, assassination and the intimidation of witnesses. Conspiracies multiplied in 1923; and early in 1924 an inoffensive Englishman was shot in the streets of Calcutta in mistake for a police official; the Bengal Provincial Conference in the following July passing a resolution laudatory of the "noble self-sacrifice" of the murderer. In Oct. 1924 came a special ordinance for dealing, by exceptional procedure of arrest and trial, with anarchical offences in the province; and among the earliest suspects against whom it was enforced were two members of the Bengal Legislative Council, and the chief executive officer of the Calcutta Municipal Corporation. By the extremists some capital was made of this departure from the ordinary and not too effective methods of the criminal law; but the restoration of order which followed the ordinance was its justification.

The Indian Civil Service.—Not least among the anxieties of the time was the effect of political change on the public services which constitute the main structure of Indian administration. It was not only that members of the Indian Civil and other services found their position substantially altering, as they became transformed from the originators of policy into the subordinate executants of a quasi-parliamentary system. This was inevitable, but it was accompanied by virulent attacks from Indian politicians, who impugned the good faith of the services and made no secret of their desire to replace Englishmen by their own countrymen; and it was accentuated by the domestic anxiety which resulted from the growing cost of living, of passages to England and the like. Many valuable public servants retired prematurely, and the English universities soon stopped the supply of recruits of the type that had previously been available.

In 1923 a royal commission was appointed to inquire into the whole problem; it was composed of four Englishmen and four Indians with Lord Lee of Fareham as chairman. In May 1924 it presented a report[1] remarkable for its unanimity. It recommended a large increase in the recruitment of Indians for the services, and the entrusting entirely to local Governments of recruitment for the "transferred" services. On the other hand, it advised several alleviations of the financial position of Europeans in the services, the adequate protection of the services in the execution of their duties, and the establishment of a Public Service Commission on the lines familiar in several of the Dominions. These proposals were attacked in the Assembly, but the Govt. of India showed their intention of accepting the report and its implications, and certain declarations by the home Govt. made it clear that they were determined to maintain the policy of keeping a strong and competent European element in the leading services. Recruitment almost immediately improved, though certain of the services, particularly the civil medical appointments, cannot pretend to offer their former attractions to Englishmen.

Indians Abroad.—The Indian Relief Act of 1914 in the Union of South Africa and the outbreak of the War in the same year pushed into the background for a time the indignation felt in India about the treatment of its nationals in certain of the dominions and crown colonies. But the grievance soon acquired increased impetus with the argument that Indian troops were considered good enough to fight by the side of forces from parts of the Empire which refused civic rights to Indians in peace time. Raised in a definite form at the Imperial Conferences of 1917 and 1918, the issue led to a "reciprocity agreement." Trouble revived, however, in various forms in Natal and the Transvaal, in East Africa and in Fiji; and the Imperial Conference of 1921 was again called into consultation. It passed a resolution to the effect that British Indians domiciled in another part of the Empire should be given recognition of their right to citizenship. South Africa, however, where it is estimated that 160,000 Indians are settled, declined to be a party to this declaration, and has uniformly urged its own responsibility for regulating the status of its inhabitants in its own interests. In Natal (where the most of the Indians are domiciled) and the Transvaal the tendency, in spite of theoretical concessions, has been to discourage Indian settlers by imposing definite civic disabilities; and the Union Govt's. support of the "Class Areas bill" has alarmed the Indian settlers, who believe that it will be used as a weapon for the compulsory segregation of Asiatics in urban areas.

Bitter though the feeling became in South Africa, it reached an even more acute point in Kenya, where at one time there seemed an imminent prospect of open hostilities between the British and the Indian settlers. There the Indians had four grievances: the closure of the highlands of the colony to them, compulsory segregation, inadequacy of their franchise and representation and threats to stop immigration. From an inquiry held by the Colonial Office in 1923, a policy was announced by H.M. Govt. which, though conciliatory on most of the points at issue, failed to allay the sympathetic agitation in India; and the whole question was again brought before the Imperial Conference in the same year. Four of the Dominions and the Colonial Office itself accepted the principle of consultation with the Govt. of India on the status of Indians in the Dominions and Colonies; South Africa stood alone in refusing to hold out any hopes of the extension of the political rights of the Indian residents. From the informal discussions that ensued, a more accommodating temper developed. In Kenya the former settlement was modified by the Labour Govt. in 1924, and tension was relaxed by the local Indians accepting certain nominations for the legislature. In South Africa the patient labours of a depu-

[1] East India (Civil Services in India), Cmd. 2128 of 1924.

tation from India paved the way for the appointment of a conference to which the Union Govt. assented in April 1926.

For those who do not know India, there is difficulty in appreciating how seriously these grievances react on the political situation there. They are universally interpreted as betokening racial arrogance, an intention to humiliate Indians as such, and the rejection in practice of that Imperial citizenship which India is being offered in theory. They provide extremists with a handle for stimulating popular indignation against the British Govt. and they complicate its task. On the other hand, little allowance is often made in India for the considerations which are of vital moment to a European community imbedded in a vastly larger indigenous population.

The North-West Frontier.—On the conclusion of the War which the new Amir forced on India in 1919, there came clear evidence of a revival of Russia's old thrust towards India. It was with a view to fomenting revolutionary trouble in India that Bolshevik tentacles were pushed into Persia and Afghanistan; and when in 1921 a Russo-Afghan treaty was concluded, one of its chief features was the establishment of Russian consulates so near the Indian border as Kandahar and Jālālābad. The Amir was not averse from playing off one of his neighbours against the other; and after inviting a mission from India to come to Kabul and negotiate an Anglo-Afghan treaty, he kept it dangling throughout 1921 before coming to final terms in Nov. of that year. The conditions included the complete independence of Afghanistan, and the opening of legations at London and Kabul. With the accrediting of an Afghan Minister to the Court of St. James, a period of greater cordiality was inaugurated, though serious tension arose in 1923 over the Afghan attitude towards certain frontier outrages, and in 1925 a Russo-Afghan Trade Convention indicated the continued flirtation of the Amir with his Soviet neighbours. He has also secured a treaty of alliance and mutual defence with the new Turkish Govt. of Angora. Meanwhile he has embarked on a programme of domestic reform and progress, which offers some promise of opening his country to European influences.

Relations with the frontier tribes improved after the campaigns of 1919 and 1920; but in 1923 a gang of outlaws in Afghan territory were guilty of slaying two British officers near Landi Kotal, of shooting the wife and abducting the daughter (afterwards gallantly rescued) of an officer in Kohat cantonment, and of murdering another officer and his wife at Parachinar. Apart from the necessary punitive measures, the Govt. of India initiated a permanent policy of controlling the Mahsud country, one of the chief storm-centres on the border. Dropping the plan of military occupation, they adopted a scheme of penetration of roads suitable for motor transport, guarded by local irregulars, and commanded by two strong posts at Razmak and Manzai. Of even higher importance was the extension by five years of labour in the most forbidding country, of the Khyber railway from Jamrud to Landi Khana; the first train through the Khyber Pass being run on Nov. 2 1925. A new treaty was signed with Nepal in Dec. 1923. It contains provisions for mutual information of any trouble with adjoining states, and others for regulating the transport of arms and merchandise. The traditions of friendship with this allied state have been strengthened.

Retirement of Lord Reading.—At the end of March 1926 Lord Reading laid down the office which he had filled with courage and distinction during a period of special difficulty. By the exercise of extreme patience, he had allowed the vehemence of 1921 to exhaust itself without deriving fresh food from any untoward step of the Government and he had guided the inevitable reaction into constitutional channels. He had taken measures for the financial health of India, and particularly for economy in its military administration. He had been diligent in removing grievances within India and vigilant for her interests abroad. On retirement he received the high honour of promotion to Marquess: and he was succeeded by Lord Irwin of Kirby Moordale, a grandson of the Sir Charles Wood who, as Secretary of State for India, had laid down the lines of the existing educational system in 1854.

II. EDUCATION

The dominant factor of the educational system continues to be, as from the East India Company's days, the insistent demand of the middle-classes for secondary and university education as a means of livelihood. This has been supplied by the State to the limits of its means on very cheap terms, to the comparative neglect of the agricultural and labouring classes who, while not actively hostile to the schoolmaster, were well content to do without him. The effects of this neglect, the failure of secondary education to meet the needs of the country's industrial development and the largely unsatisfactory character of such education for any purpose combined to make educational reform the most urgent, as well as one of the thorniest, of current administrative problems. The lines laid down by Lord Hardinge's Govt. were vigorously pursued by his successors.

University Education.—The Calcutta University Commission reported in 1919. Presided over by Sir Michael Sadler, it consisted of seven members, of whom four came direct from England and two were Indians. The report condemned in emphatic and impressive language the whole system of secondary and university education, as it existed in Bengal, and, subject to qualifications, in other parts of India. It was based on an external examining university and a multitude of affiliated colleges scattered throughout the country. It was content to leave the ordinary student to believe that the passing of examinations is the only thing of value in a university training. The affiliated colleges were, as a rule, poorly staffed and equipped; the teaching mechanical; and the conditions for the students pitiable. The secondary schools feeding the colleges were even worse; and boys entered the university so ill-prepared that the first two years were spent in what was really school and not college work.

The commission advised radical reforms. The universities should be centralised, unitary, residential, teaching bodies with a government of their own. Tuition of a preparatory and not a university type should be removed to a new grade of intermediate colleges, where the curriculum would be of a varied kind and would lead up to appropriate examinations not under university control though qualifying for entrance to a university, and having an independent value as a certificate of general education. Students would thus enter the universities at a later age and at a stage represented by the old " intermediate " examination, thus relieving the universities of a part of their unwieldy host of undergraduates. These recommendations were generally welcomed, and most of the former universities (including the Hindu University at Benares, which owed much to the energy of Mrs. Besant) have been re-constituting themselves accordingly, while new universities of the teaching and residential type are being built up at Dacca, Aligarh (Moslem), Lucknow, Rangoon, Patna, Nagpur and Delhi; yet another being under contemplation at Agra to relieve the external work at Allahabad. The multiplying of universities, however, may go too far; there is already some danger of the lowering of standards, in competition for undergraduates; and it is hoped that an Inter-University Board for all India will be strong enough to maintain standards and insist on modern methods of instruction. The latest returns were materially affected by the boycott of governmental institutions under Mr. Gandhi's stimulus; but they showed the number of students at universities and colleges to be in the neighbourhood of 60,000, of whom more than two-thirds were Hindus, and not so many as 3% women.

Secondary Education.—The establishment of " intermediate " institutions advised in the Sadler report, and the equally essential improvement of the mass of high schools, have not progressed so rapidly as university reform, mainly owing to the shortage of funds. Boards for secondary and intermediate education, however, have been set up in several provinces and improvements are being slowly effected. The attendance at secondary schools of a non-technical type in 1922 was 1,240,000, females being in the ratio of rather over 10%. The " national " schools, with their cult of the spinning-wheel, which Mr. Gandhi started at the height of his non-co-operation movement, have

now largely disappeared, the best of them having been rescued by applying for official recognition. Technical and commercial schools were equally handicapped by narrow means, and the 1922 attendance at them was only some 21,000.

Primary Education.—The pace of development here has recently been seriously retarded by financial difficulties; in 1909 the number of children at primary schools was 4,420,000; in 1918 it was 6,000,000; by 1922 it had risen only to 6,310,000. And yet it is from them that all true improvement must start, as well as all hope of creating an intelligent electorate. The difficulties are many: the traditions which confine education to certain castes, communal troubles, bad communications, the dearth of competent teachers, but above all the poverty of the rural parent, who cannot spare his sons from the ranks of the bread-winners and has no belief whatever in educating his daughters. To these permanent obstacles must be attributed the fact that, according to the census of 1921, only 122 in every thousand men, and 18 in every thousand women, in the country can read and write. Scarcely 3% of the population are enrolled in the primary schools, and the total numbers under instruction of all sorts are 9,300,000 out of the 247,000,000 inhabitants of British India. In face of these figures it is not surprising that the legislatures have frequently turned to the remedy of compulsion. Acts asserting the compulsion principle have been passed in several provinces, but the translation of principle into practice is still incomplete. Meanwhile the decentralisation of primary education offers a prospect of greater elasticity, especially in adapting the school curriculum to rural needs.

III. DEFENCE

Indian Frontiers.—The defence of India is a three-fold problem—the protection of its land frontiers, the maintenance of internal order and the guarding of its seaboard. It is natural to think of the frontier problem mainly in terms of the turbulent northwest border, where the military strength has so long been obliged to concentrate. Not only is the attitude of the tribes incalculable, but Afghanistan, though the present treaty relations with it are excellent, has too often developed a spirit of unprovoked aggression in the past; and the ancient menace of a Russian invasion through Afghan territory has, after long abeyance, revived in the new form of Bolshevik activity directed against the stability of government generally and British government in particular. "The road to London," declared Lenin in 1920, "is through Kabul and India."

But grave though these preoccupations are, other frontiers must not be forgotten. On the northeast, Nepal is a state of considerable military importance which furnishes, from its Gurkha peasantry, some of the best material in the Indian army. Fortunately it has a long tradition of friendship with India and many common interests. Behind it however and marching with India on its flanks lies Tibet, harmless enough in normal times, but always liable to Chinese influence. China herself adjoins Burma for over 1,000 m., and occasional lawlessness affords some indication of what might follow the development of an unfriendly spirit at Peking or even in the province of Yunnan. Further south, a fringe of French Indo-China and then 600 m. of Siam complete the Indian border.

Nevertheless, the northwest frontier remains at present the focus of interest. Its military risks are enhanced by the extraordinary physical difficulties of the country, by the almost unparalleled fierceness of its climate, by the fact that the sturdy mountaineers are now well-armed, and also by the oscillation of the British Govt. in the past between a policy of standing on an artificial borderline against the Pathan tribes and a forward policy of advancing the British sphere of influence, or even of control, towards the frontier of Afghanistan proper.

The Kitchener Reorganisation.—It was thus on the defence of the northwest frontier that Lord Kitchener riveted his attention when, in the course of his long tenure of the post of commander-in-chief, he set himself to the task of reconstituting the army in India. Though able men before him had done much to make it an efficient instrument of war, Lord Kitchener brought to bear upon the problem new ideas and methods. The organisation of the Indian Army which he inherited dated from the Mutiny. It failed, he considered, to distinguish sufficiently between the requirements of internal security and those of offensive warfare. It did not earmark troops for these two distinct purposes and train and equip them accordingly, but left the selection and mobilisation of an active army in the event of war to the last moment. Lord Kitchener aimed, therefore, at creating out of the forces at his disposal (some 230,000 men in all), a field army capable of being immediately mobilised, of the strength which he considered would be required to defend India against a Russian advance through Afghanistan, until help could be obtained from England. He proposed to mark off this army from the troops allotted for internal defence, to distribute it conveniently by divisions (each division comprising some 13,500 combatants of all arms), in homogeneous military areas, and to train it in war formations under the generals who would command in the field. He broke up the four army commands which he found existing, and replaced them by nine divisional commands. In each divisional command he proposed to place a self-contained division of the field army, together with the necessary complement of garrison troops that would be left behind for internal defence in the event of mobilisation. When fully mobilised his field army would comprise some 120,000 combatant troops, or more than half the total strength of the army in India. Adequate transport and supplies were to be provided and every arrangement made to enable each division of the field army, thoroughly trained and fully equipped, to pass rapidly to a state of war, when required, without confusion and dislocation.

It was a large scheme, involving many subsidiary reforms, such as enlarged staffs, extensive re-grouping of troops and building of barracks, better training and equipment, increased pay and allowances for the soldier. It had only been partially put into execution when the War broke out; financial difficulties had intervened, and the fear of Russian aggression had been allayed by the Anglo-Russian agreement of 1907. In the meantime much greater progress had been made in the United Kingdom in the organisation, training and equipment of the British Army. The expeditionary forces dispatched from India were found in the earlier stages of the War to be inferior in these respects to the British troops. Then came the serious complaints of the efficiency of the higher military command in the Mesopotamian campaign, leading to the inquiry set up by Act of Parliament, and the grave indictment of the Indian military system as regards both administration and organisation, contained in the report of Lord George Hamilton's Commission (Cmd. 8610 of 1917). The system was described as cumbrous, slow-moving and over-centralised in the last degree. Almost immediately ensued the Afghan War of 1919, followed by the Waziristan campaign, with renewed complaints against Indian army administration.

The Esher Committee Report.—It was thus decided to set up a Committee, with Lord Esher as chairman, to inquire into the organisation and administration of the army in India. In the judgment of this committee, which reported in 1920, the existing military system was defective in many respects. Their recommendations involved considerable modifications of the Kitchener scheme. To one of them prompt effect was given; the nine divisional commands created by Lord Kitchener were replaced by smaller territorial units, and these were grouped into four army commands, the commanders of which would take over much of the responsibility which had hitherto been centralised in the commander-in-chief and army headquarters. The more important proposals of the committee regarding the functions of the military forces in India in any scheme of Empire defence, the authority to be exercised over them by the British War Office, and the position and duties of the commander-in-chief were hotly contested by the Indian Nationalists, who saw in them a design of subordinating the Indian Army to the necessities of the Empire and of encroaching on the independence of India.

Indian Army.—The army in India is composed of British regular troops, which form part of the British Army transferred

for a period of service to the Indian establishment, and of the Indian Army. The latter consists of Indian troops raised by the Indian Govt. and commanded by Indian officers holding the Viceroy's commission and by British officers holding the King's commission. The numerical proportion in which the two component parts of the army should stand to each other was fixed in the first instance in 1858, and further considered in 1893, when the ratio of one British soldier to 2·5 Indian soldiers was definitely adopted and has since been adhered to as the permanent basis. The proportion is struck on the regular forces, including the imperial service troops maintained by Indian states. No account is taken, on the one hand, of the Auxiliary Force, recruited from the European and Anglo-Indian community, or, on the other hand, of the reserves of the Indian Army, the Indian territorial force, the armed police, or the armies of the Indian states.

The British troops are necessarily the most costly part of the organisation; both on this account and from a sense of national pride, Indian critics of military expenditure constantly press for a reduction in the British element. In the course of a debate in the Central Assembly in March 1921, the then commander-in-chief, Lord Rawlinson, stated the case for not altering the proportion of British to Indian soldiers while the existing requirements of internal and external defence remained. Other measures of great importance however have been taken to meet the aspirations of Indian Nationalism for an Indian share in the country's defence. Since the War, King's commissions have been made available for Indian gentlemen who qualify as cadets at the Royal Military College, Sandhurst, where 10 vacancies are reserved for them annually. In order to secure suitable candidates for Sandhurst, a military college has been established at Dehra Dun, with a six-years' course of preparatory education. The question of providing a Sandhurst training wholly in India was subsequently referred to a special committee, on which two of the Nationalist leaders consented to serve.

For the effective employment of young Indian officers holding the King's commission, it has been arranged to officer eight units of the Indian Army entirely by Indians, gradually as their rank and length of service may justify, with the object of thus constituting the nucleus of a national Indian Army in the future. Another momentous step was the enrolment of an Indian territorial force in 1921. It consists of 20 provincial battalions, about 12,000 strong, liable for general military service; and there are in addition a number of university training corps. Alongside of these the old volunteer force continues under another name. It is now the Auxiliary Force, confined to European British subjects, and liable only for local service in emergencies.

In 1914 when the War broke out, the regular forces in India comprised 75,575 British soldiers, including 2,689 commissioned officers; 159,861 Indian Army troops, including 2,771 British commissioned officers and 341 British warrant and non-commissioned officers; and 21,069 imperial service troops. The reserves of the Indian Army numbered 36,000 odd, and the volunteer force consisted of some 38,000 Europeans and Anglo-Indians. During the War the Indian Army was greatly enlarged, as demands were made upon it by the home Government for service abroad. In the last year of the War the Govt. of India undertook to raise an additional 500,000 combatant recruits, and no doubt the full number would have been secured had the Armistice not intervened. Demobilisation began early in 1919, but was interrupted by the Afghan War and the subsequent campaign against the tribes in Waziristan. On Jan. 1 1926 the Indian troops serving in the country mustered 154,668 men, or approximately the pre-War strength; the British troops were only 60,359 men, or some 20,000 below pre-War strength. The defence charges in India before the War were about £20,000,000 a year; after all the economies advised by the Inchcape Committee, they are in the neighbourhood of £37,500,000, which represents an annual charge, for the protection of their country, of 3s. per head of the population of British India.

Naval Defence.—The third branch of India's defence, the protection of her vast seaboard, has hitherto been left to the British Navy, with minor assistance from the Royal Indian Marine. Without that powerful aid, India's weakness would be disastrous. "Her sea-borne trade," writes Professor Rushbrook Williams, "is rich; the proportion of her wealth collected into centres within practicable distance of her coastline very great. Good harbours are few; and from the naval point of view, with certain exceptions, not easily defensible. It seems, therefore, no exaggeration to state that adequate naval protection will in future constitute a postulate of her national existence. Should her surrounding seas fall under the dominance of her foes, she can never be secure along the road to prosperity." At present India makes an annual payment of £100,000 towards the navy, and maintains the Royal Indian Marine. Nationalist sentiment has combined with a recognition of India's helplessness at sea to claim the institution of an Indian Navy and the creation of a class of Indian naval officers; there is also a demand for an Indian mercantile marine assisted by the State. In the spring of 1926 the Government announced its intention of setting up a Royal Indian Navy, at a cost of 63 lakhs (£420,000) a year. With its headquarters at Bombay, it will be composed at first of 4 sloops, 2 patrol craft vessels, 4 trawlers, 2 service ships and 1 depot ship. It is to be a sea-going force, whose function in peace time will be the training of personnel for war service in the Indian Ocean and Persian Gulf, port defence, survey work and marine transport. (ME.)

IV. THE INDIAN STATES

The relations now subsisting between the Indian states and the British Govt. are the outcome of an evolutionary process which still continues (*see* 14.407 *seq.*). The Mutiny, the passing of the East India Co. and the grant of *sanads* of adoption to the rulers in 1862 obliterated the peril of annexation, breached the barriers of isolation and inaugurated for the states a new era of union under the Crown. Queen Victoria's proclamation of 1858 announced to the "Native Princes of India" that all treaties and engagements made with them would be scrupulously observed and that their rights, dignity and honour would be respected. The British Govt., while emerging as paramount power, thus guaranteed to the ruling princes and chiefs the measure of sovereignty which they severally possess in their internal affairs. As regards the nature and extent of this sovereignty, the following extract from a minute by Sir Henry Maine may be quoted: "There may be found in India every shade and variety of sovereignty, but there is only one independent sovereign, the British Government. . . . The mode or degree in which sovereignty is distributed between the British Govt. and any Native State is always a question of fact which has to be separately decided in each case, and to which no general rules apply." Two important principles have, however, been laid down by statute, namely, first, that the Indian states "have no connections, engagements or communications with foreign powers," and second, that the British Govt. has the right to protect and govern subjects of the states when resident or found abroad. For international purposes, therefore, state territory is in the same position as British territory, and state subjects as British subjects.

Status of the Princes.—The assumption of the Govt. by the Crown in 1858 called the princes to greater responsibilities as well as to higher honours. Lord Curzon speaking at Gwalior in 1899 claimed the rulers of the states as his colleagues and partners in the administration of the country. Their new prerogatives involved obligations not envisaged when the treaties were framed, but proceeding naturally from the solidarity of the states with British India. Many forces were at work tending to draw the relationships between the princes and the Crown into conformity with a single type, and also to increase the Govt. of India's interest in the administration of the states. The result was over-rigidity of treatment and the formulation of rules which seemed to the princes to transcend the provisions of treaties. Lord Minto, perceiving an atmosphere of discon-

tent, took the occasion to make a declaration of policy, during a visit to the Maharaja of Udaipur in Nov. 1909. He interpreted the proclamations of Queen Victoria and King Edward as inculcating a more sympathetic, and therefore a more elastic policy, and he laid stress on the fact that the foundation stone of the whole system must be the recognition of identity of interests between the Imperial Govt. and Durbars and the minimum of interference with the latter in their own affairs. Lord Minto had already taken the princes into his confidence by consulting them officially on the question of the growth of sedition in India. His declaration and the spirit in which it was acted upon gave great satisfaction to the ruling princes.

Lord Hardinge, pursuing the same policy, in 1913 and 1914 invited some of the princes to meet him in conference at Delhi to discuss a scheme for founding a central college at Delhi at which students from the various chiefs' colleges might complete their education and take a degree. H.H. the Maharaja of Bīkaner delivered a notable speech at the 1914 gathering when, speaking on behalf of his brother princes, he said:—

> We trust, and we are confident that Your Excellency will before long convene similar meetings to deal with other subjects in which we and the states represented are no less closely concerned than this one of the college, and on which our deliberations will not only be of the greatest advantage to ourselves, our states and our people, but also, we hope, of some value to the Imperial Government.

Lord Hardinge in 1914 created a new post of political secretary to the Govt. of India, in order that closer attention might be devoted to relations with the states. The past fifteen years had proved an era of striking progress and development, and the rulers themselves, encouraged to play more important parts in the drama of Indian affairs, were becoming daily more advanced in their own administration, so that new methods of political treatment were required.

In Aug. 1914, on the outbreak of the War, the princes vied with each other in the offer of loyal service. In a telegram which stirred England the Viceroy reported that the rulers of the states in India, numbering nearly 700, had with one accord rallied to the defence of the Empire and offered their personal services and the resources of their states. From among the many princes who had volunteered for active service Lord Hardinge selected seven rulers, including the veteran Sir Pertab Singh (Regent of Jodhpur), who would not be denied his right to serve the King Emperor in spite of his 70 years. His nephew, the Maharaja, who was but 16 years old, went with him. Contingents of all arms were accepted from 12 states, besides a camel corps from Bīkaner. A hospital ship was given by various states at the instance of the Maharaja of Gwalior, and as the War progressed there were many fresh evidences of the spirit of loyalty animating the princes and their peoples. The support afforded by the Durbars in the matter of raising recruits was of particular value.

Minorities and Successions.—In 1916 Lord Chelmsford, in spite of War preoccupations, decided to invite the princes to another conference. In his opening speech he laid stress on the magnificent assistance rendered by the states. The most important of the subjects discussed at the conference related to the form of administration to be adopted in a state during a minority. In 1909 Lord Minto had become aware that several of the rulers felt strongly that they had a right to be made acquainted with the considerations which guided Government in minority administrations. He therefore ascertained the opinion of the leading Durbars, and prepared a statement of the general policy of Government in the matter. In 1915 attention was again drawn to the matter in consequence of representations made by certain of the rulers that in some cases in the past the rights and privileges of states guaranteed by treaty or otherwise had been unwittingly infringed during the minority period by the exercise of the prerogative of the paramount power.

Lord Hardinge thereupon convened a committee consisting of three rulers of states and three political officers to consider the question. Their recommendations were fully debated in the conference of 1916, with the result that a resolution was published in Aug. 1917 laying down the principles for the conduct of minority administrations. In it the Govt. of India asserted their rôle as trustees and custodians of the rights, interests and traditions of a state during a minority, but admitted that the special conditions of each state required special treatment, and promised to attach due weight to requests by individual ruling princes or chiefs regarding any principles which they might wish to be adopted in the case of their own states or families, while reserving to themselves freedom of action in dealing with such requests. Seventeen general principles were laid down for observance during minority administrations. The resolution was received with much satisfaction by the princes, and the general opinion was that the pronouncement of Government was an event hardly second in constitutional importance to the *sanads* of adoption granted by Lord Canning.

The next conference, held in 1917, saw the decision of another very important question, viz.: the form of recognition by Government of successions in the states. Lord Chelmsford announced that in the case of the succession of a direct natural heir recognition on the part of a paramount power was purely formal, and that the obligation on the part of the new ruler to obtain it in no way impaired his inherent right to succeed. He also announced the relaxation of the requirement that rulers of states before paying visits to places in British India should obtain the previous concurrence of the local Government concerned. The requirement had proved irksome in practice, and under the new arrangement the obligation was limited merely to visits to hill stations and other places where special local conditions might render concurrence of the local authorities necessary.

The Chamber of Princes.—His Highness the Maharaja of Bīkaner, who earlier in the year had been one of the Indian representatives at the Imperial Conference and a member of the Imperial War Cabinet, took the lead in this conference. In his final address to the Viceroy he expressed the hope of the princes that before the British Govt. came to any decision on the subject of political reforms to be introduced in British India the ruling princes would also be consulted. He stated:—

> We feel that we too must keep a definite goal in front of us, and whilst it is essential that our rights and privileges and our position as allies and friends guaranteed to us by solemn treaties and engagements with the British Govt. remain unaltered, our states cannot afford to lag behind in the general advance which India's association with Great Britain alone has rendered possible. It is for these reasons that we are now all the more anxious to see the early establishment of a constitutional chamber which may safeguard the interests and rights of ourselves and of our states.

Lord Chelmsford replied that any scheme which they might put forward would receive most careful and sympathetic consideration from the Govt. of India. A draft scheme was accordingly prepared by a committee, and was discussed informally by the Viceroy and certain of the princes in the presence of Mr. Montagu in Feb. 1918 during his visit to India. In Dec. 1919 the King issued a royal proclamation signifying his assent to the establishment of a chamber of princes, which was eventually inaugurated by the Duke of Connaught in Feb. 1921. From the proclamation then read, we quote the following:—

> In my former proclamation I repeated the assurance, given on many occasions by my Royal predecessors and myself, of my determination ever to maintain unimpaired the privileges, rights and dignities of the princes of India. The princes may rest assured that this pledge remains inviolate and inviolable. I now authorise my Viceroy to publish the terms of the constitution of the new chamber. My Viceroy will take its counsel freely in matters relating to the territories of the Indian States generally, and in matters that affect those territories jointly with British India, or with the rest of my Empire. It will have no concern with the internal affairs of individual states or their rulers or with the relations of individual states to my Government, while the existing rights of the states and their freedom of action will be in no way prejudiced or impaired.

His Royal Highness also conveyed to the princes a special message of thanks from His Majesty in public acknowledgment of their splendid record of achievement during the War. He alluded to the fact that H.H. of Bīkaner had taken part in the Peace Conference and had signed the Treaty of Versailles, while

H.H. the Maharaja of Nawanagar had attended the League of Nations Assembly at Geneva. H.H. the Maharaja of Bīkaner was appointed to be the first chancellor of the chamber (Narendra Mandal), and was re-elected to the office each year until 1926 when he was succeeded by H.H. the Maharaja of Patiala.

With the growth of new conditions and the unification of India under the British power, a body of usage affecting the treaty position of the states had insensibly come into being, and the Durbars were therefore anxious that for the future they might have a voice in the formulation of political practice. A committee of princes, known first as the codification committee and afterwards constituted as the standing committee of the chamber, accordingly met at regular intervals and achieved useful work with the advice and assistance of officers from the secretariat and administrative departments of the Govt. of India in revising the summaries of political practice under various heads such as mining concessions, railways, telegraphs and telephones, mints and currency, opium, extradition, etc. The results were reported at successive meetings of the chamber of princes.

The Salute states in the Punjab Province were taken into direct relations with the Government of India in Nov. 1921, through the appointment of an agent to the Governor-General. A similar arrangement was made in 1923 for the five states in the Madras Presidency, and in 1924 for the Bombay states of Kāthiāwār, together with Cutch and Palanpur. A new first-class political appointment was created for the last-mentioned group, and the Bombay Political Dept. was amalgamated with that of the Govt. of India. In 1921 the Gwalior state was separated from the Central India Agency and was brought into direct contact with the central Government through a single intermediary officer, while in Rājputāna the states of Bīkaner, Sirohi and Jhālawār were at different times placed in direct relations with the agent to the governor-general instead of through a subordinate political agent. At the meeting of the chamber in the autumn of 1921, Lord Reading announced that for the future, except at installations and investitures, where local custom would continue to be followed, the King had been pleased to dispense with the presentation of nazars at ceremonial visits or receptions, either to himself or to the members of his family or to any of his officers to whom it had hitherto been customary to present them.

In 1918 and 1921 the King conferred many honours and distinctions upon ruling princes and chiefs and others in recognition of the services rendered by the Indian states during the War. The style of " His Exalted Highness " was conferred upon the Nizam of Hyderābād, and the title of " Faithful Ally of the British Govt." was formally confirmed to him. The Prince of Wales, during his Indian tour, in the winter of 1921–2, visited many of the states and was received with loyal enthusiasm and splendid hospitality. At the Imperial Conferences of 1921 and 1923 respectively T.H. the Maharao of Cutch and the Maharaja of Alwar were included among the representatives of India, and at the meetings of the League of Nations from 1921 onwards T.H. the Maharao of Cutch, the Maharaja of Navānagar (twice), the Maharaja of Bīkaner and the Maharaja of Patiāla.

Soon after the War, certain problems in connection with the organisation, training and maintenance of the Imperial service troops were taken up by the Govt. of India in consultation with the ruling princes and chiefs concerned. His Highness the Maharaja of Alwar, after pointing out that the greater states had, during the War, not only placed their units of Imperial service troops at the disposal of Government but had depleted their man power to keep these units up to full strength, advocated a complete policy of trust in the states and asked that the policy might be applied in such a manner as to eliminate all distinctions between Imperial service units and the local forces or armed police of the states. After prolonged consideration, a comprehensive scheme was prepared for the reorganisation of the state forces, embracing not only the first line troops but also the irregular troops and the state police. The armament and equipment of the first line troops was to be improved, the irregular troops were to be armed and organised in such a way as to transform them into an efficient reserve, while the police were to be given suitable weapons to enable them to cope with dacoits. More than thirty states joined in the scheme. To facilitate the training of military officers, certain vacancies at the Prince of Wales' military school at Dehra Dūn were offered to boys nominated from Indian states.

In view of the contemplated repeal of the Press laws of British India, a resolution passed in the chamber of princes in 1921 asking that some special means of protection might be given to the Indian states in place of the relevant provisions of the Press Act. Lord Reading's Govt. considered that they were obliged in honour to agree to such protection, but the Legislative Assembly vigorously opposed a bill which was brought in under the title of Indian states (Protection against Disaffection) bill. It became necessary for the governor-general to exercise the extraordinary powers allotted to him by the Govt. of India Act, and to certify that the bill was essential for the interests of British India. The bill was passed by the council of state and eventually became law.

In 1908 the Govt. of India recommended to the Secretary of State that the necessary legislation should be undertaken in order to enable subjects of Indian states, while retaining their primary allegiance to their states of origin, to become eligible for certain services in India, admission to which was under the existing law confined to British subjects. The required provision was eventually made in Section 96A of the Govt. of India Act.

A New Indian State.—Before Lord Minto left India, he announced at Benares that the Govt. of India, with the sanction of the Secretary of State, had decided to grant to the Maharaja of Benares and his successors a permanent status amongst the rulers of India, by constituting part of the family domains as a state. This remarkable step, which involved the transfer of some 300,000 persons from British to Indian rule, was taken in view of the unique position of the Benares House, representatives of which had played important parts in relation, first to the court of Delhi, and afterwards to the British Government. The change was effected by means of an instrument of transfer, the provisions of which ensured to the residents of the territories the rights and privileges which they had enjoyed under the British administration. In 1919, in view of the success of the measure, the town of Rāmnagar, adjacent to Benares City, was also handed over to the Maharaja for use as his capital. In 1913 the instrument of transfer in virtue of which the province of Mysore had been transferred in 1881 to the present ruling family of the Mysore state was superseded by a treaty, the wording being altered in certain respects to meet the wishes of the present ruler. The change was announced during Lord Hardinge's visit to the state in the same year.

Constitutional Development.—While the paramount power has parted with none of its prerogatives, the evolutionary process has gradually led to a certain breaking down of the isolation of the states among themselves, the strengthening of their position and the advancement of the dignity of the princes. They not only gained, in the chamber, means for expression of their collective needs and opportunity for influencing the development of political doctrine, but they were admitted, as joint representatives of India, to the innermost councils of the Empire through the appointment of a member of their order to successive Imperial Conferences and meetings of the League of Nations.

Thus the integral connection of the states with the British Empire has been further emphasised, and the possibility that constitutional changes in British India may react on the states has been more effectively recognised. In a few advanced states, legislative bodies have been constituted analogous to those in British India, Mysore being a prominent example, while in others the rulers have devised means for the people to voice their grievances and aspirations more easily through consultative councils. The movement is unhurried, as the time and manner of change, if change there is to be, rests with each individual ruler. But it cannot be denied that the processes at work in British

India must impair the vitality of the conservative traditions which have their stronghold in the states, and for this reason, the princes must be keenly interested in the development of constitutional reforms beyond their borders. While it is an accepted axiom that the independence of the states in matters of internal administration carries with it the counter-obligation of non-interference in British Indian domestic affairs, any fundamental change in the system of government in British India may be claimed to fall within the category of matters of Imperial or common concern, in regard to which the princes may reasonably expect to be heard. (R. Hd.)

V. ECONOMIC HISTORY

General Survey.—The economic history of India during the seventeen years 1909–25 falls naturally into three chronological divisions: pre-War, War and post-War.

The first period was one of rapid progress. After the famine year of 1908 the monsoons were satisfactory, and the harvests good. The general conditions of world trade favoured Indian commerce and Indian prosperity. Exchange was steady, budgets showed surpluses. As a debtor country India profited by the general rise of prices, needing to export smaller quantities of goods to meet interest charges. As also the prices of foodstuffs and raw materials were rising faster than those of manufactured goods, the exchange of Indian exports for imports was carried on with greater profit to India. In these five years the money values of Indian sea-borne trade increased by 40%; the gross earnings of the railways and of the post office by one-third. Characteristically, the increased purchasing power was used to absorb gold and silver to the amount of £127,000,000. But also some notable new industrial enterprises were launched, and a stronger spirit of enterprise was displayed both in commerce and industry.

The outbreak of the World War produced a temporary panic, quickly allayed. The interruption of foreign trade threw India largely upon her own resources. Efforts were made for the production of manufactured articles, particularly War requisites, not previously attempted, and various industries which work up native raw materials for the home market expanded considerably. A strong stimulus was given to the old demand that the State should take a leading part in the development of Indian resources, both by means of a protective tariff, and by helping private enterprise in the raising of capital, by research and by developments of the educational system; and a great change took place in the attitude of the Government to these questions.

The transition from the War period to international peace was marked by the "famine" of 1918, followed by another monsoon failure in 1920; by the visitation of influenza, which in 1918 and 1919 probably killed not fewer than 10,000,000 people, by much political agitation and the recasting of the constitution. A post-War boom of trade in 1919 and 1920 was followed by a severe slump in 1921 and 1922; exchange fluctuated violently, the sterling value of the rupee first rising to a record height, and then falling in a most embarrassing manner. Five years in succession showed budget deficits, amounting in the total to over 100 crores.[1] But in 1922 a steady recovery began, well maintained till the end of 1925. The monsoons, during the five years 1921 to 1925, were on the whole good, and, given good monsoons, Indian commerce is solidly based on an imperative world need for Indian staple products. There was a "return to normalcy," but not to the pre-War normal. The War cataclysm has left among its permanent effects important economic and political changes including a reversal of fiscal policy from free trade to protection.

Agriculture and Irrigation

Since the census of 1921 showed that 70% of the total population of the Dominion were supported by agriculture and pastoral industry, not Indian agriculture only, but all Indian economic prosperity is necessarily a gamble in rain. During the period under review only two serious monsoon failures occurred, those of 1918 and 1920. That of 1918 was one of the worst on record; over all India the estimated out-turn both of rice and of wheat was in 1918–9 25% below the previous quinquennial average. This was much worse than in the great famine of 1899, but there was no corresponding distress; the maximum numbers on relief never went beyond 600,000, as compared with 5,000,000. This was partly because the harvest of 1917 had been a record one, so that the famine year was helped by an unusually large carry-over; but it also indicated that government efforts to promote agricultural prosperity had achieved a large measure of success. The great shortage in the total amount of grain available in the country necessitated exceptional measures, in addition to the well-tried methods of dealing with unemployment and destitution. Export of grain was prohibited; the surplus of Burma was secured by India, and 200,000 tons of wheat were imported from Australia. The failure of the later rains in 1920 produced famine conditions in certain districts in the early part of 1921, and the number on relief went up to 400,000; and it was not till after the country had recovered from that shortage that export of grain could again be freely permitted.

At the biennial meeting in Pusa, in Dec. 1919, of the Board of Agriculture, a conference of Imperial and Provincial Departments of Agriculture, the problem of famine policy was once more re-examined in the light of the experience of 1918; and a new programme was drawn up of measures calculated to minimise the loss of grain, fodder and cattle during years of deficient rainfall, including plans for improving the storage of grain, the growing of better fodder crops, evolution of improved varieties of drought-resisting cereals and emergency means of irrigation. Special attention was given to the great loss of cattle, though this had been mitigated in the Bombay Deccan, one of the worst areas, by the success of the Bombay agricultural department in turning prickly pear into valuable fodder by burning off the prickles in the flame of the blacksmith's forge. Meanwhile among the intelligentsia of the towns there arose a foolish and short-sighted demand for the prohibition of export of foodstuffs even in normal years, a demand which, if successful, would multiply and intensify famines by removing the commercial incentive to agriculturists to produce a surplus.

The Departments of Agriculture had been reorganised early in the twentieth century, and, with still very inadequate personnel and funds, they have achieved important results in a great variety of directions. One important branch of their work consists of the introduction of improved varieties of plants. This involves, firstly, research in order to obtain from abroad, or evolve locally, the variety which will prove its superiority under Indian conditions; secondly, growing the improved variety in sufficient quantities to furnish the ryots with seed; thirdly, convincing ryots by means of demonstration farms, and otherwise, of the advantage offered; and, fourthly, in many cases, watching over the subsequent fate of the new variety to prevent it from being swamped by inter-mixture with others. The area sown in 1923–4 with improved varieties popularised in this way exceeded 5,000,000 ac., including over 2,000,000 ac. under wheat and rice, and even more under cotton. The work on wheat accomplished by the Imperial Research Institute at Pusa is famous; very valuable work has also been done on sugar at Coimbatore. The work of provincial departments is too varied to be even summarised here; as examples, taking one province (Madras) only as representative, mention may be made of the Agricultural College at Coimbatore; the introduction and popularisation of Cambodia cotton, which gives upwards of 200 lb. of superior lint per acre, as compared with the ordinary Indian crop of 80 lb. of short staple cotton; the vigorous propaganda of single paddy transplantation and the growing of green manure, which has been of immense value to rice cultivators; the selling on a large scale at cost price of fish manure; the fight against insect pests of cotton and other crops by the Madras Pest Act; and its system of popular education in agricultural science by means of simply expressed tracts in the vernaculars.

A forward step was taken along the lines of linking together the efforts of all the agricultural departments by the establish-

[1] Lakh = 100,000 rupees; crore = 10,000,000 rupees.

ment in 1920 of the Indian Cotton Committee, which is financed by a small cess on each bale of cotton produced. This has been followed by measures for the control of cotton gins and the transport of cotton in order to prevent adulteration of superior growths, and the inter-mixture of seeds of improved with unimproved varieties. It is perhaps significant that there is now more Indian cotton to be found on the Liverpool market than before the War, and the difference in the price it realises as compared with American has almost disappeared. The total crop of Indian cotton has now reached 6,000,000 bales of 400 lb. each, as compared with a pre-War quinquennial average of 4,000,000 bales. A great deal of the extra cotton grown goes to the Japanese and Chinese mills. It is intended to apply the same principles of inter-provincial co-operation to the still more difficult problem of cattle improvement. The Tamil proverb, "the calf of the good cow dies," gives a scarcely exaggerated idea of Indian backwardness in the science of cattle-breeding.

An extension of the irrigated area is the most effective of all measures of famine prevention. The area annually irrigated by Government works has now reached some 28,000,000 ac., which is not much less than the total cultivated area of Great Britain. The area irrigated by wells and other privately owned sources is about 21,000,000 acres. The two greatest irrigation schemes the world has ever known are being carried out in the Indus basin, the Sutlej valley scheme and the Lloyd (Sukkur) barrage. The way for the former was prepared by the Triple Canal project, sanctioned in 1905 and completed in 1917. The surplus waters of the Jhelum are held up by a head weir, and carried southwards by a canal to the Chenab, part being used to water a large area between these rivers, but most being poured into the Chenab above the intake of the old Chenab canal. The demand on Chenab water being thus reduced, some 20 m. higher up a new head weir on that river has been constructed, which waters a great area between the Chenab and Ravi, and, crossing the Ravi river, passes on to water the northwestern half of the Lower Bari Doab, which is land lying between the Ravi and Sutlej. Altogether over 1,700,000 ac. are annually irrigated by the canals; and the execution of the project makes it possible to utilise the Sutlej river, not only to complete the irrigation of the Bari Doab, but also to irrigate a great area on the southeastern side of the Sutlej.

By the Sutlej valley scheme four head weirs are being constructed on that river, three above and four below its junction with the Chenab; 2,075,000 ac. will receive a perennial supply of water; 3,033,000 ac. a controlled supply from the beginning of April to the middle of October. The new canals will supersede a number of "inundation canals," which give a somewhat uncertain supply from May to Sept.; and also will bring into cultivation 3,750,000 ac. of desert waste. An interesting feature of the work is that mechanical excavators are being used because of shortage of labour.

At Sukkur, where the combined five rivers of the Punjab enter Scinde through a narrow gorge, the Lloyd barrage is being built, 4,725 ft. long between the faces of the regulators on either side, which will control the flow of water into seven great canals. When fully developed the area annually irrigated will approach 6,000,000 ac., considerably more than the whole cultivated area of Egypt. As a necessary corollary the port of Karachi, of which the trade has already nearly quintupled since 1897, will be further developed by harbour works at a cost of £2,000,000.

Nowhere in India outside the Indus basin is there scope for works of equal magnitude, but a great scheme is being carried out for the irrigation of Oudh, by canal fed from the Sarda river. This project has been under contemplation for 50 years, but has been in abeyance because of the opposition of the Oudh landowners (taluqdars). They have now altered their views as a result of the experience of 1918, and the increasing cost, due to rising wages, of well irrigation. The area to be irrigated is estimated at 1,700,000 acres. In Madras even older schemes first planned by Sir A. T. Cotton, the great pioneer of scientific canal irrigation in India, have been revived, for great storage reservoirs in the Cauvery, Bhavani, Tangabhadra and Kistna rivers; and the Cauvery scheme has been sanctioned. All over India smaller works are being planned, debated and put into execution. (*See* IRRIGATION.)

Co-operation.—The policy of active encouragement of rural credit banks on the Raiffeisen plan, as the most effective means of remedying the chronic indebtedness of cultivators and improving the business side of agriculture, was adopted, after long discussion, by the Act of 1904. Registrars of co-operative societies were appointed for the different provinces, to draft model rules, register, inspect and audit the accounts of co-operative banks, and also to carry on propaganda and education in co-operative principles. In 1912 an amending Act was passed, as the result of eight years' experience; and also to extend the official encouragement to co-operation in other fields. The number of registered societies increased from 5,432 in 1911 to 61,106 in 1924; the membership from 308,000 to 2,314,000; the capital employed from Rs. 227 lakhs to Rs. 4,053 lakhs[1] (about £30,000,000). The great majority of the societies are village banks; but there are 522 "Central Banks" situated in towns, which gather in deposits, supply funds to the rural banks in their neighbourhood, and act as links between them. There are also "Apex" banks, for the provinces of Madras, Bombay, Bengal, Bihar and Orissa, Burma, the Central Provinces, Assam and Mysore. Encouraging progress is being made by societies for purchase and sale; sales to members aggregating Rs. 113 lakhs in 1924 and purchases from members Rs. 93 lakhs. There were 442 cattle insurance societies, with 6,693 members, a small but very hopeful beginning; and there is a promising movement in urban areas to use the principle of co-operation in house building and milk supply.

MANUFACTURING INDUSTRIES

On the basis of the number of people who are employed hand-loom weaving is still by far the greatest of Indian non-agricultural industries. The census of 1921 found very nearly 2,000,000 hand-looms at work, and the actual number was probably considerably greater. The Indian Industrial Commission (1916–8) discovered that the consumption of mill-spun yarn by hand-loom weavers increased by about 30% in the two decades before the War, which would more than compensate for the diminution in the output of hand-spun yarn. The War itself helped the weaver, Indian mills not being able to make up adequately the deficiency of imported cloth; so also did the very high prices of mill-woven cloth after the Armistice. But from 1922 onwards weavers' difficulties have greatly increased. The development of mill manufacture in China has deprived the Japanese mills of part of their Chinese market, and caused them to make greater efforts to dispose of their output in India. In the fierce and very equal competition which so ensues between Indian and Japanese mills, it is the hand-loom weavers who suffer most. In some districts after a struggle to live on less than subsistence earnings, they have been compelled to abandon their hereditary calling; in others, where the level of skill and enterprise is higher, they have given up cotton weaving for silk, or textures with gold or silver thread interwoven, which are called in India "lace work." The industry as a whole shows a surprising degree of vitality, fly-shuttles, which increase a weaver's output from 20 to 100%, have been adopted widely, and so also have simple machines for winding and warping, owned and used co-operatively.

Out of some 1,400,000 workers in factories of all sorts, about one-quarter are employed in cotton-mills, and some 80,000 in cotton gins and presses. This industry has had very considerable vicissitudes, but taking bad years with good, it has been prosperous and progressive. The total Indian consumption of mill-woven cloth is much the same now as in the years immediately preceding the War, in spite of the very great increase of price. But whereas before the War Indian mills supplied just under 30% of this production, their share has risen (1924–5) to 52%; while the share of the United Kingdom has fallen from 68·5% to 42·5, Japan now getting 4% of the market. On the

[1] Lakh = 100,000 rupees; crore = 10,000,000 rupees.

other hand Indian mills have lost in China their chief foreign market. The supremacy of Bengal in jute is more firmly established than ever; nearly two-thirds of the jute grown is consumed by the Bengal mills, as compared with less than half before the War; so that Bengal now produces about twice as great a bulk of jute manufactured goods, mainly in the form of gunny bags, hessian cloth and cordage, as all the rest of the world. Such industries as leather tanning, paper manufacture, brewing, woollen manufacture, which are of considerable though minor importance, were greatly stimulated by War conditions, and maintain part of the advance so won.

The two most notable new enterprises launched in the five years immediately preceding the outbreak of War were projects of the late Mr. J. N. Tata, which were brought to fruition by his sons and their partners after his death in 1904. The Tata Iron and Steel Company was successfully launched in 1907 with Indian capital; it began operations in 1908 and produced iron first in 1911. When the World War broke out it was in a position to be of great service both in Mesopotamia and in other war theatres; and, since the military requirements were for steel, the company converted into steel as much as possible of the iron it produced, though the sale of iron in the open market would have been much more profitable. Dividends of 20% on the ordinary and 290% on the deferred shares were paid in 1917 and 1918; again in 1920 and 1921 ordinary shareholders got 16% and deferred shareholders 200%; but since 1922 no dividends have been paid except preference shares; and the heavy fall in the price of steel caused by intense international competition compelled the company to seek governmental aid. Various other attempts have been made in India to produce steel on modern lines; and in the boom period after the Armistice a number of schemes for exploiting the extraordinarily rich and abundant ore deposits of Orissa for this purpose were floated; the chief result of which was to increase the potential output of the Bengal Iron Company. The Tata Iron and Steel Company is the only one actually producing steel.

Equally notable was the Tata project of utilising the heavy rainfall on the Western Ghats to supply Bombay with electric power. In order that power should be available throughout the year it was necessary to create great storage reservoirs on the Deccan tableland. The first completed was at Lonavla, whence there is a fall of 1,725 ft. to the power-house at Khopoli. The works were formally opened on Feb. 8 1915. The Andhra valley project with its artificial lake further to the north, was initiated in 1916 and completed in 1922, and supplies 100,000 horsepower. It is being followed by the Nila-Mula scheme to the south of Lonavla, expected to supply 150,000 H.P., and preliminary work is being done on the Koyna Valley project, still further to the south, to yield 350,000 horsepower. The original purpose of these schemes was to make the Bombay mills independent of coal; but as the amount of power available has increased, it is becoming possible also to revolutionise the methods of transit and consequently the conditions of housing of Bombay. By the electrification of the railways in the immediate neighbourhood of Bombay it is hoped that third-class fares may be reduced to a rate of 11 m. for one anna (approximately one penny). This will make effective the work of the Bombay Improvement Trust, which is charged with the duty of reclaiming the islands to the north of Bombay and converting them into residential and industrial areas, thus making it possible for the most prosperous, but also the most terribly congested, city in India to expand to healthy dimensions.

The close of the World War was marked by a great outburst of speculation. The aggregate authorised capital of new joint stock companies floated in the year 1919–20 alone was Rs. 281 crores, whereas the paid-up capital of all registered companies in existence in 1914 was only 75 crores. Subsequent liquidations were heavy. The most important of the new projects which failed to realise expectations was the Tata Industrial Bank, the shares of which were being bought eagerly in the early part of 1920 at a high premium. Its object was to finance new industries on much the same lines as those followed by the "D Banks" in Germany; but after a short run it was amalgamated with the Bombay Central Bank, which does ordinary banking business, the capital being considerably written down.

Banking.—On the other hand an important step towards the organisation of a more complete and effective banking system for India was taken in 1920 by the amalgamation of the Presidency Banks of Bengal, Bombay and Madras into the Imperial Bank of India. The Imperial bank was authorised to establish a branch in London, which had not been allowed the Presidency Banks, and its London Branch takes over from the Bank of England the business which the latter had previously done for the Govt. of India. The Imperial Bank has also been required to open 100 new local branches to supplement the 70 branches of its three constituents. A great deal more remains to be done to knit together the various sorts of banks operating in India into a sound and efficient system. There was a heavy mortality among Indian joint stock banks in 1913–7. The causes of this weakness still in large measure remain, and it must be regarded as a factor retarding the progress of India towards a complete financial autonomy.

The Government and Industry

Since 1910 there has been a change of policy in relation to industry. In that year the principle of *laissez-faire* was asserted by Lord Morley's despatch refusing assent to the plans of the Madras Govt. for the encouragement of new industries, and incidentally sentencing the Madras Department of Industries to temporary impotence. This department had been built up step by step since Dec. 1897 by the initiative and under the control of Sir (then Mr.) Alfred Chatterton. At a total net cost of £33,000 a prosperous manufacture of aluminium hollow-ware had been established, the use of oil engines for pumping water for irrigation popularised, well-boring carried on extensively, the use of the fly-shuttle, automatic dobbies and subsidiary machines introduced among hand-loom weavers, and other important work accomplished. A similar policy had been initiated in the United Provinces by Sir John Hewett; and there also it was dropped in consequence of Lord Morley's adverse judgment in the case of Madras. The outbreak of War brought a change in the attitude of the India Office, and in May 1916 the Indian Industrial Commission was appointed to report on possible means of direct governmental encouragement of industry not incompatible with the existing fiscal system. Its positive recommendations were numerous and varied. Departments of Industry were in consequence re-created in Madras and the United Provinces, established also in the other provinces, and, under the reformed constitution, put in the charge of Indian ministers.

Tariffs.—The reservation excluding the existing fiscal system from review was only temporary. The Reform of the Constitution was speedily followed by the appointment in Oct. 1921 of the Indian Fiscal Commission, which reported in favour of "rapid industrialisation by means of discriminating protection." In accordance with that recommendation an Indian Tariff Board was appointed in July 1923, to report on the industries referred to it which had applied for protection. The first and most important of these was steel, and the Tariff Board recommended that bounties should be paid on the production of heavy steel rails and fish plates on a descending scale beginning at Rs. 32 per ton, and that specific duties roughly equivalent to 30% *ad valorem* (*e.g.*, Rs. 40 per ton on steel rods) should be levied on other forms of British or other imported steel. This assistance not being sufficient to enable the Tata Iron and Steel Company to manufacture steel at a profit, an additional bounty of Rs. 20 per ton on 70% of the monthly ingot production was voted for the period from Oct. 1 1924 to Sept. 30 1925; and it was subsequently decided that this bounty should be continued at the diminished rate of Rs. 12 per ton till March 31 1927. In 1925 also an old controversy was concluded by the resolve of the Government to abolish the excise duty of 3½% *ad valorem* on cotton cloth woven in Indian mills. Hence the duty of 11% on imported cloth becomes undisguisedly protective.

Labour Organisations.—The post-War period has seen a remarkable increase of class consciousness among Indian urban workers. Trade unionism on British lines made its first appearance during the War in Madras, the pioneer society, the Madras Labour Union, being a fairly solid organisation of the cotton-mill operatives, which quickly found imitators among the aluminium workers, the employees of the oil companies and others. The great rise of prices and the industrial boom of 1919 furnished the most favourable possible conditions for a rapid advance of trade unionism; increased wages were necessary, employers were most anxious to avoid stoppages, but they were not in all cases ready to grant increases in proportion to the rise of prices except under pressure, for fear the rise in price might be only temporary.

Bombay was the chief storm centre. The cotton operatives in particular showed unsuspected staying power, and not only secured advances during the boom which meant an increase in real as well as nominal wages, but also, in 1925, won a more remarkable victory in resisting successfully a reduction of wages during the slump. Indian trade unions are still largely dependent on the help of outsiders as organisers, and the success of particular unions mainly depends on the single-mindedness with which these voluntary associates work for the material benefit of the members. There can be little doubt that in the future trade unionism will prove a permanent and growing element in Indian industrial life.

Labour Legislation.—India was represented at the International Labour Conference at Washington, which was followed by an "All India Industrial Welfare Congress" held in Bombay in April 1922. Important labour legislation was enacted in the same year. The Factories Act of 1922, which came into force on July 1, raised the age of admission for children from 9 to 12, for full time work from 14 to 15, prohibited night work for women, and enacted for all workers a maximum day's work of 11 hours and a maximum week of 60 hours. The Mines Act forbade the employment of children and young persons below ground, while still permitting that of women, and limited the week's work to 60 hours above ground and 54 hours below. The Workmen's Compensation Act of the same year was a very carefully drafted measure providing, on conditions designed to minimise litigation, for compensation for death or accident for 3,000,000 industrial workers. The contention that long hours of labour are more tolerable and justifiable under Indian than under European conditions springs from interested motives, and is not based upon actual fact.

Railways.—In 1907 the route mileage of Indian railways open to traffic reached 30,000 m., of which over 15,000 m. was standard (5′6″) gauge, and most of the remainder metre gauge. On March 31 1925 the mileage was 38,269 m., of which 18,781 m. were standard gauge. At that date 1,200 m. were under construction and 1,084 m. in addition had been sanctioned. A great deal of unfavourable criticism has been levelled against the railway policy—or, rather, policies—of the Indian Govt., with special justification on the counts of lack of enterprise, vacillation and undue complexity. But the broad fact remains that nearly 40,000 m. have been constructed with a capital liability of £500,000,000, which convey passengers at an average rate very little over one farthing (3·74 pies) per mile, and goods at an average rate of one half-penny (6 pies) per ton per mile. Moreover, they make profits which are sufficient to meet all interest charges and also to make substantial contributions to the revenue of the country.

Important changes are now taking place in railway administration. The relations between the Railway Department and the general administration are being altered to give the railways more financial responsibility and independence; on the termination of the leases of the East Indian Railway and the Great Indian Peninsula Railway (E. I. R. and G. I. P.), together comprising nearly 5,000 m., the working of these two lines was taken over by the State; and the system of departmental management is being superseded by divisional organisation, which was tried successfully first on the Great Indian Peninsula Railway.

Foreign Trade.—In the years immediately preceding the War Indian foreign trade made rapid progress. Very high freights and great difficulty in securing cargo space during the War necessarily reduced the volume of sea-borne traffic very greatly; but the imperative need of belligerent countries for many sorts of Indian produce caused prices to rise so much that the money value of the goods carried was not greatly altered. The exports of private merchandise from India were valued at Rs. 249 crores in 1913–4 and at Rs. 253 crores in 1918–9; imports at Rs. 183 crores and Rs. 169 crores respectively. In 1924–5 the value of the exports went up to Rs. 398 crores and of imports to Rs. 243 crores. These figures disguise rather than reveal the essential facts with regard to the changes in Indian foreign trade. There has been a considerable reduction in the volume of imports, most marked in cotton goods and other textiles; but from this decline, in spite of protective duties, iron and steel have been exempt, the increase in Indian production being no greater than the increase in Indian demand; and there has been a very great increase in the imports of machinery and mill work. Other imports which have greatly increased are mineral oil and motor-cars. The volume of exports is now at least at as high a level as before the War; but the character has considerably altered. Less grain is being exported and more tea; much less raw jute and a great deal more manufactured; the export of raw cotton has increased, and so has that of cloth, particularly coloured piece-goods, but the export of yarn has greatly declined.

India has in fact become much more self-sufficing with regard to manufactures, and less disposed to export food and raw materials except where, as in the case of cotton, high prices and increased production make export specially profitable. The causes of this change are partly to be found in higher freights and higher import duties; partly also in the changed condition of world trade as a whole, regarded as an interchange of manufactures for foodstuffs and raw materials, in consequence of which the Indian peasantry get only a small increase of price for most of the things they sell, but have to pay a great deal more for what they buy. But it is also partly due to Indian progress in manufacturing equipment and industrial organisation. (G. SL.)

SUMMARY STATISTICS

	1913–4	1923–4
Area under cultivation	(million ac.) 219·2	222·5
Area under forest	(million ac.) 82·6	86·0
Yield of rice	(million tons) 28·8	28·2
Yield of wheat	(million tons) 8·4	9·7
Yield of tea	(million lb.) 307·2	375·4
Yield of cotton	(million bales, 400 lb. each) 5·9	6·0
Yield of jute	(million bales, 400 lb. each) 8·9	8·4
Yield of raw sugar	(million tons) 2·3	3·3
Yield of rubber	(million lb.)	14·5
Output of coal[1]	(million tons) 16·2	19·7
Output of gold[1]	(oz.) 596,000	422,000
Output of petroleum	(million gal.) 278	294
Cotton: persons employed[1]	261,000	333,000[2]
Cotton: looms	96,688	137,238[2]
Cotton: spindles	6,620,000	7,245,000[2]
Cotton: output of yarn[1]	(million lb.) 683	617
Cotton: output of woven goods[1]	(million lb.) 260	402
	(thousand doz.) 895	759
Jute: persons employed	216,000	321,000[2]
Jute: looms	36,050	47,528[2]
Jute: spindles	744,289	1,003,179[2]
Jute: mill consumption	(million bales) 4·5	4·7
Railways: route mileage	34,656	38,039
Railways: train mileage	156,276	158,949
Railways: passengers carried	(millions) 458	599
Railways: goods carried	(million tons) 82·6	98·2
Deposits in banks	(crores of rupees) 96	196
Post office: no. of items carried	(millions) 1,050	1,209
Value of total imports[3]	(millions) £165	£207
Value of total exports[3]	(millions) £177	£255
Imports (net) of cotton pce.gds.	(million yd.) 3,110	1,329
Imports (net) of iron and steel	(million tons 1·0	·8
Imports (net) of silk	(million yd.) 35·5	16·2
Exports (net) of cotton yarn	(million lb.) 154	
Exports (net) of rice	(million tons) 2·4	2·2
Exports (net) of wheat	(million tons) 1·2	·6
Exports (net) of jute bags	(millions) 369	414
Exports (net) of jute cloth	(million yd.) 1,061	1,349
Exports (net) of tea	(million lb.) 293	339
No. of scholars under education: male	5,828,190[4]	8,315,188
No. of scholars under education: female	952,531[4]	1,001,466
Expenditure on education	No comparable information available	£12,560,000
Taxation per head		4·1 rupees
Land revenue per head		1·4 rupees
Exchange on London	16⅜d.	17⅝d.

[1] These figures include the Indian States.
[2] These figures are for 1922–3.
[3] Exchange is taken at 15 rupees = £1.
[4] These figures are for 1911–2. (ME.)

VI. NATIONAL AND PROVINCIAL FINANCE[1]

The Indian revenues are largely dependent on the seasonal rains. If the monsoons are weak and the crops fail, land revenue has to be remitted or its collection postponed, railway receipts fall off, the agricultural population consumes less, the Customs and Excise revenue declines, heavy expenditure is incurred in the relief of distress, exports diminish and the exchanges move against India, increasing the cost of meeting her obligations abroad. Good and bad seasons tend to occur in cycles. Lord Hardinge's viceroyalty started in a good cycle. The four years 1910–4 were years of financial prosperity. The ordinary revenues were expanding, and there were large windfalls in the opium receipts, due to the high prices which the Chinese were offering during the last few years of a trade that was being steadily reduced under an agreement for the complete cessation of the export of opium from India to China in a given period. It thus became possible to make large grants to the provinces for education and public health.

The War Period.—With the outbreak of war in 1914, Indian finance enlarged its experiences. Direct expenditure on the War was at first small, as India was charged only with the normal cost of her armies engaged on the various fronts; and the pre-War military charges of about £20,000,000 rose only gradually to £29,000,000 in 1917–8. But India's external trade was dislocated, and her railway and Customs receipts suffered accordingly; so that the first two years were marked by deficits. In 1916–7 additional taxation was imposed, but the export of war material had now begun to assume large proportions, and agriculture was also flourishing. In 1917 the financial position was sufficiently strong to justify the Indian Govt., with the approval of the Legislative Council, in making a contribution of £100,000,000 to the home government towards the cost of the War; and in 1918 a further contribution was volunteered, which had, however, to be subsequently revised after the Afghan War, and was adjusted finally at about £14,000,000. In 1917–8 taxation was again increased, but such was the activity of trade and the general prosperity of the country that a surplus of £8,000,000 was realised.

Then the tide turned, and for a series of years the national accounts failed to balance. The old standard of military expenditure was doubled; the Afghan War of 1919 and the succeeding troubles in Waziristan threw a heavy burden on the revenues; a weak monsoon in 1920 was followed by considerable agricultural distress; the trade boom which had been stimulated by the heavy manufacture of war material slowly exhausted itself, and exchange was crumbling; while a rapid rise in the cost of living left the government with no option but to make some corresponding increase in the wages of its army of employees. The deficits were met by temporary expedients which had recently been strangers to the Indian financial system—dipping into balances, accommodation from the banks and borrowing for revenue purposes.

The New System.—With 1921–2 started a new era. The estimates of the central administration were entirely separated from those of the provinces; and the former were for the first time subjected, with reservations already explained, to the vote of a popular Assembly, which took the place of the old and comparatively complacent Legislative Council. In an attempt to balance the budget, the Customs tariff was raised from a general *ad valorem* rate of 7½% to 11%, with 20% on certain luxury articles; postal and railway rates were enhanced, and the taxation on incomes stiffened. But a severe trade depression had now set in, and there had been two feeble monsoons. The year closed with over £22,000,000 to the bad; and, what was even worse, the government was compelled to budget for a further deficit in 1922–3, the legislature having rejected several of its proposals, among which a rise in the salt duty was prominent, for improving the revenue.

But sharp retrenchment had now become imperative; and in the winter of 1922 a special committee under Lord Inchcape attacked the whole problem of expenditure. Their recommendations,[2] comprehensive and drastic, extending to military as well as civil charges, were put into effect, so far as time admitted, in the estimates which were laid before the Assembly in March 1923 for the ensuing year. To complete the rehabilitation of the budget, the government proposed to double the salt tax (roughly from a farthing to a half-penny per pound); and when this proposal was defeated in the Assembly the Viceroy restored it by the use of his exceptional powers, thereby provoking a fierce political controversy. The result justified the means, for a marked revival in trade combined with the financial reforms to show a small surplus at the end of 1923–4. The budget for the succeeding year was wrecked as the result of an extremist demonstration in the Assembly; and the Viceroy had again to interpose his arbitrary authority, though he was careful to certify expenditure at a minimum figure which allowed the salt tax to revert to its old rate of 1¼ rupees per 82 pounds.

Railways.—Despite this untoward start, 1924–5 went well; trade steadily improved, and with it exchange revived, the year ending with a substantial surplus. Its course was marked by two important financial changes. On the one hand, the finance of the railways was definitely separated from the general accounts and now became a self-regulating entity instead of a handmaid to the general revenues and the sport of their vicissitudes. The railway budget is now framed upon considerations of a consistent railway policy, and its only connection with the national budget is that it is bound to make an annual contribution from its receipts, calculated at 1% on the capital liability of the penultimate year, plus one-fifth of the surplus profits, if any, in that year.

The Protective Tariff.—The second landmark of 1924 was the enforcement in practice of the policy of discriminative protection which a tariff committee of some years earlier[3] had recommended: for the Steel Industry Protection Act of 1924 imposed import duties which were clearly expected to be prohibitive on certain articles manufactured from steel, while it granted bounties on heavy steel rails, fishplates and railway wagons manufactured in India. Hardly was the Act passed when the bounties were found inadequate to their purpose and were enhanced. Schemes for similar protection to other domestic industries continued to be formulated, and the whole trend of Indian political opinion is in their support. The following year saw another fiscal measure of great, if more sentimental, importance. The excise duty on cotton goods manufactured in India, which had originally been imposed to counterbalance the tariff on imported cottons, and which had for many years been resented as a sacrifice of Indian interests to Lancashire, was at last abolished from Dec. 1 1925, in fulfilment of an arrangement which had been reached in settlement of a disastrous strike among the cotton-mill workers in Bombay. The accounts for 1925–6 seemed likely to close on the right side; and the estimates for 1926–7 again presumed a surplus, although the law of averages would point to the near approach of a short monsoon.

Budget of 1925–6.—The main constituents of the central budget, if 1925–6 be taken as a sample, are as follows:—

Source	Revenue	Object	Expenditure
	£ millions		£ millions
Customs	30·9	Defence (net)	37·5
Taxes on income	11·6	Debt services	12·1
Salt	4·6	Civil administration	7·3
Opium	2·4	Other charges	8·3
Railways (net)	3·5		65·2
Currency and mint	2·7	Surplus	·5
Provincial contributions	4·5		
Other receipts	5·5		
	65·7		65·7

The customs tariff, which long stood on a purely revenue footing with a 5% charge all round, is now divided into protective, non-protective and general sections. The protective section is at present restricted to manufactured iron and steel, but the so-called non-protective duties include luxury rates, such as 25% on sugar and 75% on cigars, while the *ad valorem* duties in the general section range from 2½% to 30%. There is a low export tariff on jute, hides, rice and tea. The taxation on incomes includes a supertax, and close attention has been given to perfecting what used to be a most unsatisfactory source of revenue; all income from agriculture is exempt.

[1] In this section the rupee is taken throughout at a conventional value of 16 pence. The full story of exchange is discussed later.

[2] *Report of the Indian Retrenchment Committee* (Delhi, 1923).

[3] *Report of the Indian Fiscal Committee, 1921–2* (Cmd. 1764).

The production of salt, whether from mines, lakes or sea water, is a Government monopoly, and the duty on it used to be treated as the reserve or balancing factor in the Indian budget; but popular pressure now seems likely to standardise it at 1¼ rupees per maund, or about one farthing per pound. Opium is a steadily diminishing figure; in 1918 there were 207,000 ac. under cultivation for the opium poppy, in 1924 there were only 133,000 ac.; exports to the Chinese market were extinguished, and in May 1926, it was announced that all exports of every kind are to cease, even to foreign governments. This cessation is to be by a tenth each year.

Provincial Finance.—Obviously, however, the figures quoted above do not cover the whole field of the state's revenue and expenditure. Quite £50,000,000 of receipts, representing their collections of land and irrigation revenue, excise, stamps and forest income, appear in the budgets of the nine provincial governments. A similar sum is expended by them on their administrative business, justice, education, public works, police and gaols, public health, etc. This clear-cut demarcation of financial responsibility was part of the new constitution. From 1833 up to 1921 the accounts of the imperial and provincial authorities had been amalgamated; in the budget of 1921–2 they were separated. The local governments now receive the yield of the sources which they administer, and are responsible for the expenditure of the provincial departments, both reserved and transferred. By far the most important of their resources is the land revenue, which, together with the cognate receipts from irrigation, compose more than half the total budget provision of the provinces. Opinions differ as to whether it is a rent or a tax; but it is a legacy from Mogul rule, and proceeds on the assumption that all the land is the property of the Crown.

In Bengal and Northern India a class of intermediary landlords has been gradually evolved, and they are assessed on their rent rolls; in Madras and Bombay the revenue is assessed directly upon the *ryot* or cultivating occupant, with reference to the estimated output of his land. The whole system is being caught up into the region of political argument, as problems of much importance are beginning to divide popular feeling, *e.g.*, the permanency or otherwise of the assessments, the security of tenure in the landlord provinces and the right of the State to determine rents. In order to enable local governments to discharge their new functions, they have been given powers of taxation, scheduled so as not to invade the sphere earmarked for the requirements of the central Government. They have been authorised, for the first time under the new constitution, to raise loans, either through the central Government or independently, and some of the provinces have already borrowed, for works of improvement such as irrigation and city development schemes.

Provincial Contributions.—The severance of provincial finance from the general accounts brought to the front a problem inherent in all federal constitutions, even if they are as embryonic as in India to-day. In former years the central Government used to finance itself in part by taking a share of the revenues collected in the provinces; and incidentally it thereby kept alive its right to intervene in the management of the sources from which such revenues flowed. When on the road to provincial autonomy a point was reached at which this right was curtailed, and the provincial revenues were credited wholly to the provincial exchequers, it became apparent that the central Government had no longer the control of funds sufficient for its own business. In India the customs, salt, opium and net railway receipts, income tax, etc., when once they ceased to be supplemented by a share of the provincial land revenue, stamps and excise receipts, etc., proved inadequate to meet the demands of defence, the public debt and the other liabilities reserved by the central Government.

Under this compulsion, and arguing that the provinces should equitably contribute to the defence of the country, the Govt. of India (with the full concurrence of the Select Joint Committee of Parliament) imposed a levy on the provinces. The total sum which they were asked to pay was about £6,500,000. It was distributed among the provinces in rough ratio to the advantage which each had gained by ceasing to share its provincial revenues with the central Government; and hopes were entertained that the central finances would improve with sufficient rapidity to enable those tributes to be gradually reduced and in a short period completely remitted. Adversity defeated those hopes, and the reduction has been slow and irregular. Meanwhile the provincial legislatures, with rare exceptions, have fastened on the arrangement as the main cause of their own financial stringency, and have magnified a not unreasonable and purely temporary expedient into an intolerable grievance, under cover of which there has been a tendency to evade the imposition of taxation that might have balanced their own budgets. Several local governments claim, in addition to their own separate revenues, a share of the taxation upon income collected within their boundaries; and some concession on this point has been yielded as an exception to the general rule of separate resources, by giving each province an allowance of three pies for every rupee by which the income assessed within the province exceeds the income that was similarly assessed in 1920–1.

Local Finance.—The 772 municipalities of British India have the disposal of an annual revenue of over £9,000,000, exclusive of Government grants and borrowings; and the district and local boards have a normal revenue of about £8,000,000. Both classes of bodies have been endowed by the 1919 constitution with a financial independence commensurate in its degree with that of the provinces. The six port trusts have statutory powers for their own business, and control an income in the neighbourhood of £5,000,000; Bombay and Calcutta in particular having raised considerable loans which rank only second in the Indian market to Government securities.

Indebtedness of India.—The Govt. of India borrows both locally in rupees and in England in sterling—the former now to a very much larger extent than before the War. The position at the beginning of the War was thus described officially:—

Out of a total debt equivalent to £274,000,000 outstanding at the end of March 1914, only about £13,000,000 represented ordinary or unproductive debt. The annual interest on the latter was £750,000 only, and on the productive debt about £8,500,000, so that our total interest charges amounted to some £9,250,000. Railways and irrigation works in the same year yielded us a return of £15,250,000. Thus we had left some £6,000,000 of clear revenue from our great capital undertakings, after meeting interest charges on our entire public debt.

This was the result of a long, careful policy of converting unproductive debt, *i.e.*, money raised for military purposes and the like, into productive debt, by the device of short borrowing for the capital required on railways and irrigation. It had put India into a very strong position to face the changes brought about by the War. The War debt, inclusive of the gifts to the home exchequer, the loans for the expenditure on the Afghan War and subsequent frontier operations, as well as the borrowing necessitated by the series of budget deficits, all went to swell the volume of the unproductive debt; and on March 31 1926 the total indebtedness of India was:—

In India	Crores of rupees
Loans	368·35
Borrowed from the paper currency reserve	49·65
Other obligations	93·27
	511·27

In England	£ millions
Loans	266·43
Other obligations	76·05
	342·48

Of the total it was considered that about 23% was unproductive. The productive loans included the capital liabilities for irrigation, which were taken over by the provinces when that subject became wholly provincial. The "other obligations" are mostly unfunded debt, such as post-office cash certificates and savings bank accumulations, provident funds, etc.; while in England £57,500,000 are accounted for by capitalising liabilities which are being liquidated by certain terminable railway annuities. In lieu of a general sinking fund an arrangement was started in 1924 by which an annual sum is appropriated from revenue for the reduction or avoidance of debt; it is calculated at four crores plus one-eightieth of the amount by which the outstanding debt of the year exceeds the debt outstanding on March 31 1923.

VII. CURRENCY AND EXCHANGE

The foundation of the currency system is the rupee (16 annas or 192 pies), a coin weighing 180 gr. and containing 165 gr. of pure silver. The subsidiary coinage comprises pieces of silver, nickel and bronze; all being legal tender up to one rupee only, except the 8-anna piece, which, like the rupee itself, is legal tender without limit. The sovereign also circulates as freely as Gresham's law permits. Alongside of these is a paper currency, at first of slow and lingering growth, in the form of Government currency notes, the higher denominations of which are, strictly speaking, encashable only in the currency circle (usually an area of one or two provinces) for which they were printed. The favourite notes are for 1, 5, 10 and 100 rupees; but there are also others for 2½, 20, 50, 500, 1,000 and 10,000 rupees. The note circulation as a whole is backed, as to more than one-half, by a reserve of gold and silver, and as to the balance by Government securities held partly in England and partly in India, with a margin for seasonal expansion based on trade bills up to a strictly defined amount.

The exchange value of the rupee follows the ordinary economic law and depends on India's trade balance with the outer world. When there is a big surplus of exports, import bills are at a premium and the rupee rises in terms of sterling; when in bad years exports decline and there is a relative glut of import bills, the rupee falls in terms of sterling. The operation of this law, however, assumes a fairly constant adjustment of the volume of currency to the requirements of trade. If there were no restriction on the output of rupees, the gold value of the coin would tend to fluctuate with the gold value of silver. Up to 1873, although the Indian mints were open, the rupee continued steady at an exchange value of 2s.; then the price of silver began to tumble until the rupee dropped almost to 1s., and so disastrous were the consequences to the finances of the country that in 1893 it was decided to close the mint to free coinage and establish a "managed" currency, with the rupee as a token coin. By this policy an equilibrium was sought.

The Rupee During the War.—By the beginning of the War this system had reached considerable strength. The rupee had been given by law a parity of 16d., and trade conditions had never put it beyond the power of the Government to maintain the exchange at approximately that figure. The machinery for managing the currency was simple. The Indian Govt. bought silver and coined rupees to meet the requirements of the country. So long as silver was under 43d. an oz. there was a profit on the operation, which was placed to the Gold Standard Reserve and (except for a brief and partial diversion) invested in sterling securities in London. Against this reserve the Govt. of India could sell sterling drafts (technically known as " reverse Councils "), if the exchange value of the rupee threatened to fall. On the other hand, if it were rising, the Secretary of State could increase his normal sales of rupee drafts on India (technically known as " Councils "), which would be met out of the Govt. of India's reserves of rupees or, if necessary, by fresh minting. Should this fail to check the rising exchange, it was generally possible to count on a free importation of private gold which would either pass into circulation or be presented to the Government for the purchase of rupees. All these arrangements were working smoothly in 1914. The Gold Standard Reserve stood at £26,000,000, all except £4,000,000 being held in gold or gold securities in England. A continued favourable balance of trade had encouraged the import of gold, of which £70,000,000 worth had been absorbed between 1910 and 1914. The Paper Currency Reserve had £24,000,000 in gold or gold securities, and the note circulation had risen to 66 crores (£44,000,000).

With the War came new and disturbing demands. India was called upon to supply the British Govt. and the Allies with immense quantities of raw materials, manufactured goods and foodstuffs for War purposes, and also to provide funds in India and in countries where Indian troops were fighting. The Indian Govt. had therefore to disburse a rupee currency in very large amounts. The home Government repaid its debts by credits in London, but the Indian Govt. required money in India, and the difficulty was to remit specie. Gold was unobtainable, silver was becoming very scarce in the London and American markets. The Indian Govt. was therefore compelled to increase the note issue without a corresponding increase of rupees held against the notes. The notes were convertible and their encashment drained away the reserve stock of rupees. The time drew near when either inconvertibility must be declared or silver obtained in large quantities for coinage. So seriously were the political effects of inconvertibility regarded that the Government strained every nerve to avert it. The 1-rupee and 2½-rupee notes were invented; the import and export of the precious metals were put under the strictest regulation; and the mints worked night and day.

The Pittman Act.—Yet, with the world shortage of silver, inconvertibility was all but reached in 1918, when help came from the Govt. of the United States. Congress was prevailed upon to pass the Pittman Act as an emergency measure. This Act enabled the Government to borrow from the Treasury the greater part of the dollar reserve of 375,000,000 oz., held as security for silver certificates. The United States Govt., as soon as it obtained this authority, allowed the Indian Govt. to purchase 200,000,000 oz. of silver dollars on terms much below the current market prices, and accelerated the dispatch of the metal to India. From July 1918 onwards American silver began to arrive in large quantities and was coined into rupees. For some months the new money went out of the reserves as fast as it was coined, but by Dec. 1918 the convertibility of the note issue was secured. Between March 1916 and March 1920 the output of the mints was represented by the enormous quantity of 1,390 million new rupees (£93,000,000) as currency.

Throughout this struggle another anxiety grew apace, in the risk of being unable to maintain the rupee as a token coin at its statutory parity with sterling. Sterling was depreciating and silver was rapidly appreciating. From its pre-War price of about 26d. per oz., silver advanced to an average of 31d. in 1916, of 48d. in 1918 and of 61d. in 1920, touching the figure of 89d. in Feb. of that year. As the conversion of the rupee into bullion became profitable when silver touched 43d., the rapid rise beyond that figure led to a wholesale melting down of rupees for clandestine export; and the Government was forced to protect itself by hurriedly pushing up the parity of the rupee until it stood at 2s. 4d. in Dec. 1919, while for a short time private remittances fetched over 2s. 10d.

The Indian Currency Committee.—The whole problem was then referred to a committee of currency and banking experts sitting in London. Reporting early in 1920, this body (with one notable dissentient) recommended[1] that the rupee should be correlated to gold, and not to sterling, which by that time had depreciated in relation to gold and had no certain value, and that it should be given a new statutory ratio equivalent to one-tenth of the gold contained in a sovereign. This would give the rupee the equivalence of 2s. when the pound sterling returned to parity with the sovereign. The committee were of opinion that the price of silver expressed in pence would remain at the point that would make the retention of a 1s. 4d. rupee impossible unless the coin itself was diminished in weight or fineness. This alternative they rejected. They thought that, having regard to the higher price levels of the world, India would still be able to maintain a favourable trade balance with a 2s. rupee, and that any consequent readjustment of rupee prices of Indian export staples would be to the advantage of the Indian consumer by acting as a drag on internal prices.

[1] Report of Committee on Indian Currency (Delhi, 1920).

The Indian Govt. accepted the committee's recommendation, and in Sept. 1920 the Indian Coinage Act established the new ratio of the rupee as one-tenth of a gold pound. But currency was already laughing at the law. There was a rush of remittances to England, and at the same time the export trade of India fell off. In common with other countries whose exports consist of raw materials, India found the demand for its produce suddenly dry up. The former surplus of exports gave place during the second half of 1920 to a large adverse trade balance which had to be liquidated by bills on London. Exchange persistently dropped from 2s. 6d. the rupee, which in the first months of 1920 roughly represented the parity of one-tenth of a gold sovereign, to below 1s. 4d. in the early part of 1921, and the price of silver receded to 32d. the ounce. The Government endeavoured to maintain the rupee at its new exchange value by selling drafts on their resources in London, but economic forces were too strong for them, and after they had diminished their gold holdings in this way by well over £50,000,000, they abandoned the struggle and left exchange to find its own level. It steadily dropped to between 1s. 4d. and 1s. 5d., when the sale of Councils was tentatively recommenced, at whatever they could fetch without regard to the statutory parity. In the hope of ending this anomaly, another currency committee was appointed towards the end of 1925, when the rupee had become fairly steady near 1s. 6d.; it had not reported when Lord Reading resigned. Meanwhile, the position had improved in readiness for any further attempt to control exchange. The Gold Standard Reserve had reached £40,000,000 of sterling securities, a point at which it was decided that further accretions should be employed in reducing the rupee securities in the Paper Currency Reserve. The latter in March 1924 contained £68,000,000 in gold and silver, and over £9,000,000 in sterling securities.

The strenuous efforts made during the War to preserve the convertibility of the currency notes were rewarded by a rapid expansion of their popularity. The circulation (66 crores) of March 1914 almost trebled in the next 10 years, touching 186 crores in March 1924, notwithstanding the practical disappearance of the 2½-rupee and the 20-rupee notes. In 1920 the whole system was improved by the Paper Currency Amendment Act of that year, which allowed an unlimited note issue provided a metallic basis of 50% was observed, required the gold backing to be held in India and introduced the principle of a certain definite expansion of the note issue during the busy season against trade bills of a durance not exceeding 90 days. Before the note circulation became so firmly established as it now is, several attempts were made to lighten the task of supplying India with silver currency by the employment of gold. Among them was the opening of a branch of the British Mint at Bombay, intended to coin sovereigns and 15-rupee gold pieces. Like all other similar experiments, it was defeated by the immediate disappearance of gold into the hoards of the people. Nearly 3,500,000 gold coins were minted at Bombay in 1918–9, and work was then abandoned.

BIBLIOGRAPHY.—In contrast with the former scarcity of good books on India, they now abound; and the following is necessarily an arbitrary selection from the newer works. The standard all-round text-book is *The Imperial Gazetteer of India*, vol. 1 to 4. Add to this the *Statistical Abstract of British India from 1914–5 to 1923–4* (Cmd. 2534 of 1925); and the reports to Parliament on the Moral and Material Progress of India, now published as *India in 1918, 1919, 1920, 1921–2, 1922–3, 1923–4* and *1924–5*, written by Prof. Rushbrook Williams, and bringing a full narrative of current events up to date.

Historical: Sir Verney Lovett's *India* in the " Nations of To-day " series (1923) is the latest authoritative work. Sir V. Chirol's trilogy should be studied: *Indian Unrest* (1910); *India Old and New* (1921); and " India " in *The Modern World* series (1926).

Constitutional and Political: The key book is the *Report on Indian Constitutional Reforms* (Cmd. 9109 of 1918) by the late E. S. Montagu and Lord Chelmsford. With it read *Dyarchy* by L. Curtis (Oxford, 1920), which contains the text of the Selborne Committee and the Act of 1919. Other works are E. A. Horne, *The Political System of British India* (Oxford, 1922); Sir C. Ilbert, *The Government of India* (Oxford, 1922); Ilbert and Meston, *The New Constitution of India* (1923).

Problems of To-day: Sir Verney Lovett, *History of the Indian National Movement* (1920); Bishop Whitehead, *Indian Problems* (1924), and as studies in Indian psychology, Lord Ronaldshay's trilogy, *Lands of the Thunderbolt, India a Bird's-eye View*, and *The Heart of Aryavarta*, published by Constable in 1923–4, respectively.

Economic and Finance: Dr. P. P. Pillai, *Economic Conditions in India* (1925) and Gyan Chand, *The Financial System of India* (1926). (ME.)

INDIANA (*see* 14.421).—The population in 1920 was 2,930,390, an increase of 229,514, or 8·5% over the 2,700,876 of 1910, as against an increase of 7·3% in the preceding decade. From ninth in rank among the states in 1910 Indiana fell to eleventh

in 1920. The density in 1920 was 81·3 to the sq. m.; in 1910, 74·9. The population as of July 1 1926 was estimated at 3,124,499. The urban population (in places of over 2,500) was 50·6% of the whole in 1920, as against 42·4% in 1910.

The six cities of Indiana with a population of 50,000 or more were:—

	1920	1910	Increase %	Estimated 1925
Indianapolis	314,194	233,650	34·5	358,819
Fort Wayne	86,549	63,933	35·4	97,846
Evansville	85,264	69,647	22·4	93,601
South Bend	70,983	53,684	32·2	80,091
Terre Haute	66,083	58,157	13·6	71,071
Gary	55,378	16,802	229·6	76,870

Agriculture.—In 1925 there were 195,785 farms of five acres and over, the total farm land area, which forms 94% of the total area of the state, being 91,917,780 acres. The assessed value in 1924 of all farm property was $2,218,034,991. The chief crops are corn, wheat and oats which produced in 1924, 100,317,606, 26,353,066 and 58,782,554 bushels respectively. Hay and rye are also produced. In 1924 the area under tobacco cultivation was 20,695 ac., yielding 18,362,243 pounds valued at $3,057,000. Large quantities of tomatoes are grown besides other vegetables and fruits of all sorts. The number of livestock reported on Jan. 1 1925 was 557,472 horses, 103,235 mules, 1,296,163 cattle, 614,000 sheep and 3,006,242 swine.

Mineral Products.—Coal mining was the principal industry, 22,340,000 short tons being mined in 1924, the state continuing to rank sixth in this respect. Petroleum wells yielded in the same year 935,000 barrels valued at $1,700,000. The large stone quarries of Monroe and Lawrence counties produced 70% of the limestone used in the United States for building, the 1923 output being valued at $17,692,112. Indiana oblitic limestone is used in nearly every state and in foreign countries. Indiana has valuable clays, shales and kaolin, and is sixth among the states in ceramic production, her clay products in 1923 being valued at $15,643,128. Drainage tiles, encaustic tiles, fire-proofing, terra-cotta, sewer pipe and stove linings are other important clay products. Pottery products include earthenware, stoneware, white granite, semiporcelain, sanitary ware and porcelain electrical ware.

Education.—In 1921 the state increased the tax levy for common-school support as well as for the support of the higher educational institutions and provision for teachers' pensions was enacted. There was a tax levy of five cents on each $100 of taxable property for the support of the three higher educational institutions of the state, producing about $2,750,000, and a levy of a fraction of a cent for vocational education producing yearly about $115,000. In 1924 $64,696,230 was spent on education. In 1925 the tax levy for higher education was repealed and the three state schools received special appropriations.

Constitution and Government.—During the decade 1910–20 there was much discussion over amending the constitution of the state, a difficult undertaking under the constitution of 1851, inasmuch as amendment requires the assent of two legislatures and ratification by a majority of the electors. In 1914 an effort was made to bring about a state convention to revise the constitution. A conference was held at the state university, out of which grew the Constitutional Convention League, whose purpose it was to bring about such a convention. Under the influence of this league, while the Legislature refused to call a constitutional convention, it agreed to submit to the voters by referendum in 1916 the question whether such a convention should be held. The proposal was voted down by a large majority, partly because of the expense involved, partly from fear of radical innovations. The vote for the convention was, however, so large that two Assemblies approved a series of 13 amendments which were submitted to the voters in 1921. All the amendments but one were rejected.

During the 12 years 1913–25 much legislation was passed extending governmental functions. Only a summary of this can be attempted here: In 1913 an inheritance tax was imposed. In 1915 laws were enacted dealing with industrial aid to the blind; flood prevention; the direct primary for state nominations; workmen's compensation for injuries; and arbitration in industrial disputes. In 1917 a Prohibition Act was passed, made more drastic in 1925 by provisions making the possession of intoxicants a penal offence and the Eighteenth (Prohibition) Federal Amendment was ratified Jan. 14 1919. Provision was also made for a system of state parks, with a commission charged with reforestation and the conservation of natural resources; and a Highway Commission was created charged with building a complete system of state roads, for which purpose, in 1923, a gasoline tax of 2 cents a gallon was provided, increased to 3 cents in 1925, bringing to the commission for road building from $6,000,000 to $7,000,000 annually. In 1921 a state budget system was adopted, and cities were allowed, at their option, to provide for city planning and to adopt the city manager or commission form of city government. In 1921 the Riley Hospital for children, a memorial gift from citizens to the state, was established under the care of the university. In 1921 the university took over the only Dental College in the state.

Since 1909 the governors of the state have been as follows: Thomas R. Marshall (Dem.), 1909–13; Samuel Moffet Ralston (Dem.), 1913–7; James Putnam Goodrich (Rep.), 1917–21; Warren T. McCray (Rep.), 1921–3; Emmet F. Branch (Rep.), 1923–5; Ed. Jackson (Rep.), 1925–

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INDIANAPOLIS, Ind., U.S.A. (*see* 14.427), which claims to be the largest city in the world not situated on navigable water, ranked 21st in size in 1920, with a population of 314,194, of whom 34,678 were negroes and 16,958 foreign-born. In 1925 the official estimate was 358,819. The population increased 34·5% between 1910 and 1920, but the number of foreign-born decreased 14·2%. The area was increased from 33 sq. m. in 1910 to 43·5 sq. m. in 1920, and to 49·5 in 1925. The output of its factories was valued at $126,313,000 in 1909; $398,667,000 in 1919; $262,285,896 in 1921; and $346,858,158 in 1923, when there were 783 establishments within the city limits employing 45,818 workers. The leading industries were meat-packing, manufacture of automobiles and automobile accessories, metal trades and machine shops, canning, manufacture of wearing apparel and printing.

After the disastrous Ohio Valley floods of 1913, a concrete levee 40 ft. high was built along the west side of the White river with a 60 ft. driveway on the top. This was completed in 1916. A new street lighting system was installed in 1915 and improved from time to time. A $3,000,000 sewage purification plant was installed in 1925. The elevation of the railway tracks entering the Union station was begun in 1917, and the old Union dépôt was rebuilt and enlarged into an attractive and commodious station. A city plan commission was established in 1919, and a zoning ordinance adopted in 1922. The park area had been increased by 1925 to 2,544 ac. and there were 53 m. of boulevard and 46 city playgrounds. The War Memorial Building, costing $10,000,000, which houses the national headquarters of the American Legion, was nearing completion in 1925. The cost of living is relatively low in Indianapolis (94% of the average for 31 American cities in Dec. 1924), as would be expected from its exceptional transportation facilities and its favourable location with respect to agricultural and manufactured products and coal mines.

INDIAN LITERATURE.—In Europe literature is, as regards its subjects, largely international, and any new fashion, such as romanticism, pessimism, the psychological novel, the detective novel, is quickly propagated. The individual qualities of prominent writers are soon known, directly or through translations,

and evoke responses more or less obvious. Moreover, the similarity of social conditions and outlook lends interest to the same problems everywhere, and international science causes them to be approached from the same points of view.

English and European Forms.—In India the bulk of the educated public is acquainted with English; new English publications are quickly available in the libraries and reading rooms; any new book which has obtained a vogue in England will soon be reviewed in India and be a subject of articles in magazines. Moreover, India has in England, America, France, Germany and elsewhere numerous students, and some journalists, who are living the lives of those countries and sharing their interests; and we have also to reckon with the presence in India of a considerable community of English and other administrators, teachers, missionaries and business men. Consequently, there is a very large output of writings which in spirit and manner, and often in subject, are not properly Indian, but either international or what may be termed "colonial." In Bengal alone over 1,000 publications in English (irrespective of bilinguals) are produced annually, and there are over 100 English periodicals of different kinds. We might mention in addition the large number of works by Indians and officials or ex-officials in India which are actually published in England.

A second department of Indian literature consists of writings in Indian languages which are based upon European models or deeply affected by such. Here we have a great mass of fiction, biography, history, much drama, lyric poetry, travels, political and social pamphleteering and an immense magazine literature, modes which are simply copied from European models. In this sphere we should not overlook the considerable number of actual translations or adaptations of individual works in English, French and so forth. This might be described as the vernacular literature of absorption.

A third stage is represented by that vernacular literature which, while it has absorbed European influences, has yet recovered an Indian outlook and temper, whether in the course of nature or in obedience to the strong reactionary feeling. Already in the 'eighties of the 19th century Bengal had produced a novelist, Bankim Chandra Chatterjee, whose work exhibits a creative synthesis of the new and the old; and at the present day the Bengālī language has, irrespective of its outstanding representative, Sir Rabindranath Tagore, a modern literature conscious of an independent inspiration.

A fourth department is constituted by the continuance of ancient modes and conceptions.

Linguistic Distribution.—Apart from the influence of particular centres, such as universities, the literature is very unevenly distributed. The matter must be stated in terms of languages. In the field of Assamese, Oriya, Bihārī, Punjābī, Sindhī, Nepālī and Kāshmīrī, the Rājasthānī dialects and Malayālam of southern India, the old modes may be said to prevail with little innovation.

High Hindī, in regard to which the same might a few years ago have been said, is rapidly equipping itself with literary and scientific compositions on modern lines. Urdū, the chief organ of Mahommedans in Hindustan, the Panjāb and Central India, is further advanced in the same direction. The two chief languages of the Bombay Presidency, Gujarātī and Marāthī, more especially the former, have a considerable modernising literature. The Telugu of Madras is perhaps not so far advanced; but Tamil has a large productivity, hardly second to Bengālī. Special educational efforts have led to the publication of a fair number of manuals in Kanarese (Mysore), as also in Gujarātī (Baroda) and Urdū (Bhopal and Hyderabad); but other Indian States are not productive on modern lines.

English.—For publications in English about the same proportions hold as for modernised vernacular literature. English works are, indeed, far more prevalent in the provincial capitals, whereas those in the vernacular abound in the less anglicised districts, Gujarātī, for instance, favouring Ahmadābād, Marāthī Poona. The non-modernised literature is also published in all considerable places.

Classical and Other Languages.—The chief classical language of India, Sanskrit, is represented by editions of two kinds, those on old Indian lines with or without commentaries in Sanskrit or in modern vernaculars, and those with commentaries in English. The former are very widely published in the Deva-nāgarī character, or in Bengālī, or in Gujarātī or in the south Indian alphabets, sometimes even in the Panjābī or Urdū; and there are various combinations of these scripts. Editions on European lines appear for the most part in the provincial or state capitals or in the university towns. New original works in Sanskrit are not infrequent in the sphere of oriental philosophy, philology, science and religion; occasionally there appear new poems and dramas of considerable extent and literary merit; and there are also Sanskrit periodicals, including even a daily newspaper.

Other classical languages are: (1) Prākrit, usually that of the Jains and published in the Bombay province or in the Hindī- or Mārwārī-speaking areas; (2) the Buddist Pāli, rare in India; (3) the Tibetan, published at Calcutta and Darjeeling; (4) the Pahlavī of the Parsees, published in Pahlavī or Gujarātī script in the Bombay Presidency; (5) the Arabic, appearing chiefly in Delhi, Lucknow, Hyderabad; (6) the Persian, more occasional. Many of the vernacular languages also have their old or classical periods, and prominently the Dravidian group, Tamil, Telugu, Kanarese and Malayālam; re-editions of their classical works are very frequent, and for the most part they are published within the areas of the respective vernaculars.

Translations of Sanskrit works are innumerable in nearly all the vernaculars, the *Bhagavad-gītā* for instance being reproduced many times every year; and some degree of the same favour extends to some of the local classics, the Hindī poems of Tulasī-dāsa, and the Hindī *Bhaktamāla*. Among modern Hindu writers Swami Vivekānanda, Bankim Chandra Chatterjee, Sir Rabīndranāth Tagore, Romesh Chunder Dutt and Haraprasad Sāstrī have also a popularity in several languages; and popular novels, in particular the favourite *Chandrakāntā* (from the Hindī), and its imitators, are frequently translated. Portuguese publications appear at Goa, French at Pondicherry and Chandernagore; the Roman Catholic missions print some brochures in Latin, and there is even an Italian periodical issued from Mangalore (*La Missione di Mangalore*).

Alphabets.—The literature of India is, therefore, highly polyglot, while individual publications are very often bilingual at least. The alphabetic aspect of the matter has also been partly indicated. In spite of the attention which has been given to the possibility of a common script for India, some advocating the Roman, some the Devanāgarī (which has a Hindī periodical devoted to its interest), there is no evidence of progress toward simplification; there is a certain amount of Roman-Urdū, and Roman is usually employed for the Konkanī form of Marāthī and for the rendering of previously unwritten languages. But in general each leading language holds to its traditional script. Sometimes it has more than one; for the Mahommedan writes his Panjābī or Hindī or Malayālam or Tamil (not, however, his "Musalmānī-Bengālī") in the Urdū character, with any necessary modifications. The Sikh may write his Sindhī in the Gurumuphi of the Panjāb. Bilingual books are therefore unusually also bialphabetic (except as regards the above-mentioned case of the Sanskrit, or similar cases with Pahlavī and Gujarātī, or Arabic texts with Persian or Urdū); and this adds to the multiform appearance of the Indian literary output, already sufficiently variegated, even if we overlook such characters as the Multānī, Modī, Kaithī, Savara, which indeed are rarely printed, or the numerous old writings appearing in philological works. The format of the book is not seldom that of the old Indian *pothī*, sometimes (in Bengal) even printed on palm leaves; while the Panjāb Gurumuphi and the Mahommedan Arabic are much less often printed than lithographed from handwritten originals.

Subjects and Forms

To begin with the lowest stratum, we must note the existence in India of an extensive, really popular literature in verse. In

all parts of India, but especially perhaps in the Punjāb, in the Kanarese country and in the Tamil area, there is a constant production of songs and ballads, provoked by any notable occasion, such as a prize fight, a flood or calamity, a crime, a tragedy, a personality or social event, an act of administration; these have a real, though probably in general a brief, life upon the lips of the people, who sing them over their work or in their social gatherings. Of late years this form has been largely used for political propaganda, innumerable small collections of "national songs" appearing in all the chief languages. There are also many collections of songs for special occasions; *Garbhī* songs for women, marriage songs, songs for the Holī (spring) festival and other celebrations, boat songs for aquatic sports in Orissa and Bengal and so forth. At certain times of the year the Mahommedans put forth vast quantities of "verses" in honour of Mahomet or dirges for Hasan and Husain. Religion has a large share in this poetic activity: songs in honour of Krishna (especially in Hindustan, Bengāl and Orissa, but also in Gujarāt and Southern India), of Caitanya (*kīrttans* in Bengal), of Kārttikeya, Ganeśa, Dattātreya, Vithobā (in the Marāthī area); songs for pilgrims to or at the various shrines (innumerable in the Telugu and Tamil country); songs for temple rites; collections of Jain hymns; and the many publications of Christian sects, which in some cases (Roman Catholic) even deign to follow Indian models. Not all this popular literature is in verse, since there are occasions when sacred stories in prose (*Hari-kathās* and the like) are narrated in or near the temples.

Oral Preservation of the Classics.—An oral existence appertains also to a good part of the various classical writings of India. This is the case not only with Sanskrit works such as the Mahābhārata and Rāmāyana, some parts of the Purānas, and some stories such as those of Sāvitrī and Hariśchandra, but also to the classics of the several vernaculars. Not to mention the substance of stories and legends, the texts of such poets as Kabīr and Tulasī-dāsa in the Hindī area; Vidyāpati, Govind Dās and many others in Bengal; Narsinh Mehta, Mīrā Bāī and Prēmānand in Gujarātī; Nāmdēv and Tukārām in the Marāthī country, Lallā in Kashmir; the Sūfī poets of Sindh; the Vaishnava and Śaiva saints and moralists of the Tamil country, are very familiar on the lips of ordinary people in their respective areas, and, besides being used in education, are frequently re-edited. In the Punjāb some parts of the Sikh *Granth* are similarly used.

The Drama.—On the borderland between the oral and the literary we have the drama. In India it was indigenous in many forms, from the heroic down to the morality, miracle play, the farce, the shadow or puppet show. Except in the extreme south of India, it would seem that the popular forms of representation have been more or less levelled out. The ordinary play, produced chiefly in Calcutta, Bombay and Madras, is similar to the European forms—melodrama, social sketch, burlesque, problem play (the old man and the young wife, the modern young man or woman and so forth), love story: it is generally interspersed with verses, and these are often separately published for popular use. The more literary drama, still sometimes in Sanskrit, takes its subjects chiefly from old Indian poetry and legend, and is not seldom an adaptation of a particular Sanskrit work (the *Śakuntalā*, the *Mahābhārata* and *Rāmāyana* or episodes therein, and so forth). The choice is to some extent affected by local celebrity, and occasionally a political application may be suspected.

Magazines.—The pabulum of the ordinary reader in India is furnished by the magazine, containing essays, biographies and descriptions, short stories and serials, notes and not rarely illustrations. The total output is enormous; for in addition to the diversity of languages we have to reckon with the division of the Hindus into castes with their separate interests and claims. Important castes prefer an organ (or competing organs) of their own, which, along with the ordinary magazine material, will ventilate any matters having a communal bearing. This literature, therefore, presents no ordinary problem to the bibliographers; somewhere in India it should be sedulously collected and preserved, on account of the special biographical and sociological items which it contains. Schools and colleges have their organs (usually, however, in English). The missionary agencies, including the Salvation Army, issue innumerable periodicals of all grades, both in English and in the vernacular. Trades and the business world, professions (teaching, medicine, law, astrology, and so on), and grades of official service all contribute to the mass of vernacular organs. There are further a *Hindī Punch*, a *Hindī Graphic*, a Gujarātī and Marāthī *Tit-Bits*, and short story magazines; music and the stage are also represented by popular periodicals. Special interests, such as the cause of women, social service, co-operation, labour, economics, business, arts and sciences, travel, boy-scouting are similarly equipped. The chief vernaculars have usually at least one literary periodical of a fairly high type. In some cases they have flourished during long periods: the *Sentamil* of Madras is in its 24th volume, the Hindī *Saravatī* in its 25th, the Bengali *Bhāratī* in its 49th, the Gujarātī *Samālochak* in its 30th, the Marāthī *Vividhajñānavistara* in its 56th. The Urdū *Humāyun* also is of some standing.

Indian Poetry.—Modern Indian poetry, excepting translations and adaptations of old Sanskrit works and themes, is usually in the form of short lyrics issued in small collections. Larger productions are for the most part collected works of single authors, or anthologies or the outcome of literary Eisteddfods. In the Hindī area the ballad of old style attains a greater length, as do Tamil *Kāvyas* on classical models. The poetry is generally erotic, ethical, philosophical or religious; but the satirical and controversial, and also, as we have seen, the political, claim a place. The verse forms are usually the traditional ones: only Bengālī, it appears, manifests original power in this direction.

Fiction.—Fiction on European lines is making rapid headway in India, and it is supplanting the old romantic tales, at least so far as prose is concerned. The Punjab may still reprint its *Hīr* and *Ranjhā*, *Rāja Rasālu*, etc., the Sindh its *Sassī* and *Punnūn*, the Urdū language its *Laitī* and *Majnūn*, and Hindī the tales of *Bhartarī* and *Gopīchand*. The novel is popular both in the form of the short story and of more substantial narratives; and it reflects all the varieties of subjects which have a vogue in English, historical, social, romantic, adventurous (including the detective novel). A new feature is the translation of well-known (including English) novels into several languages and the immense vogue of such popular stories as that of the Hindī *Chandrakāntā*.

Religious Literature.—Indian religious literature, in so far as it is not lyrical, philosophical, argumentative or philological, consists mainly of manuals of ritual for daily life (*dinacaryā*) or for particular occasions (marriage, burial, times and seasons, pilgrimages, vows), and of the stories therewith associated; for instance, the story of the Tulasī plant and that of Satya-Nārāyana are constantly reproduced. Benares takes a prominent part in such publications. Since each section, from the Vedic *Śākhās* downwards, must have its separate rituals, it results that the number of such publications is very great. Especially in southern India the innumerable local shrines have their little manuals, each setting forth the sacred legend and the rites to be observed. In the case of the orthodox and older sects, which have sacred texts in Sanskrit, this literature is often bilingual (at least), reproducing or copiously citing the originals.

We pass to a consideration of the activity in the reproduction of old canonical texts, with or without commentaries, for the purpose not of ritual but of study and edification. This accounts for a great mass of republication: in the Punjāb, for instance, there is a steady stream of thick volumes of *Selections from the Ādi-granth*. There are some valuable series of such canonical texts; the Jains have several and the Madhva doctrine of south India and the sect of the Mahārājas in Bombay have thus made accessible their chief writings. Important sects have usually one or more periodical organs, which, amid other matter, publish and comment upon their authoritative books. Many religious texts are, of course, not the property of any particular sect, and are therefore variously reproduced; and from

these we can hardly separate those which are of a philosophical rather than of a religious character: such are the Vedānta writings, the Madras periodical *Vedānta-dīpikaī*, and other philosophical journals; of wider scope, the *Siddhānta-dīpikaī* and the Marāthī *Tattvajñāna-vistara*. There are English periodicals belonging to one or the other of the above two groups: such are the *Vedānta-kesarī* of Madras, the Ahmadī *Review of Religions* and *The Theosophist* (which also has vernacular allies). Modern philosophy is represented by the Calcutta Philosophical Society, and by a now extinct Indian Philosophical Review published during several years in Baroda.

Philology.—Philology of a more general character is no longer in India restricted to one or two classical languages, Sanskrit, Prākrit, Tamil, Pahlavī, Persian, Arabic. There are societies which devote themselves to the publication of old texts in the existing vernaculars. The Bangīya Sāhitya Parishat, with its *Pattrikā* and its series of separate old Bengālī texts, has a very honourable record. The Tamil Sangam of Madura (which issues the *Sentamil*) is likewise distinguished. There are now other Sāhitya Parishats in the province of Bengal, and for Telugu also there is the Āndhra Sāhitya Parishat. For Hindī there are the Nāgari-prachārini Sabhā and certain Mandalas; for the Panjāb the Khālsā Tract Society; in Gujarāt, where societies for publication seem to flourish, the oldest is the Gujarāt Vernacular Society, while there is also a Sāhitya Parishat, and a Sāhitya-vardhana Society; in Marāthī an important series of editions of old poetry was published under the title *Kāvya-samgraha*. In literary history there are very important and extensive works by Rai Saheb Dineschandra Sen (Bengālī); Sir G. Grierson and the Misra brothers (Hindī); G. M. Tripāthī and K. M. Jhāverī (Gujarātī); Prof. W. B. Patwardhan (Marāthī); and Vīresalingam Pantulu (Telugu).

As to the general philological activity of India, it is hardly possible to draw any clear line between indigenous scholarship and that affected by European methods: the main aim and procedure of scholarship are the same everywhere, and whether a commentary is in Sanskrit or Bengālī or English seems to make little essential difference. Only comparative philology is new to India. This philological activity, wherewith is associated the investigation of archaeology and pre-British history, and from which we may exclude the astounding output of educational work up to the level of university text-books, is connected chiefly with organisations of some kind. The Govt. of India itself maintains an Archaeological Survey, which publishes annual reports in the several provinces and at headquarters, and splendid quarto and folio monographs on special matters, as well as a periodical relating to Epigraphy (*see* ARCHAEOLOGY: *India*). This example is followed by Indian States, Mysore, Travancore, Hyderabad, Kashmir. Several provincial governments have published catalogues of Sanskrit MSS. (Bengal, the United Provinces, Bombay, Madras, the Central Provinces); States, small and great, Kashmir, Nepal, Baroda, Mysore, Travancore, Alwar, Bhaunagar, have taken their part. Important series of Sanskrit or Arabic texts, too, are officially edited in Bombay, Mysore, Travancore, Kashmir, Hyderabad, Baroda.

After the Governments we may mention the universities, colleges and libraries as active in the publication of texts and researches (the universities of Calcutta, Madras, Lahore, the Benares Sanskrit college, the Maharajahs' College, Vizianagram, the Bankipur public library). Important journals are issued by societies (the Asiatic Society of Bengal, which has also published under the title *Bibliotheca India* a vast collection of Sanskrit, Arabic, Persian and Tibetan texts; the Bombay branch of the Royal Asiatic Society, the Mythic Society of Bangalore, the Bihar and Orissa Research Society, the Hyderabad Archaeological Society, the Bhandarkar Oriental Institute); and some, like the *Sanskrit Research*, the *South Indian Research* and the *Jain Purātattva*, are occasionally started independently or by religious bodies. The books issued by authors, editors, or individual publishers are, however, more numerous and on the whole the Indian publication of philological, historical and archaeological matter relating to pre-British India quite dwarfs in bulk all that is done outside. Much is highly meritorious, and some of it is fully equal to the best production of Europe. The monumental *Linguistic Survey of India*, edited by Sir G. Grierson for the Govt. of India, is now (1926) almost completed (*see* PHILOLOGY).

History.—For educational purposes and general reading, many short histories of India, of England and of other countries are produced both in English and in the vernaculars. But original research and independent judgment will be found chiefly in the few first-hand histories of particular states and dynasties; and with a few exceptions (such as the Marātha researches of Rai Bahadur, D. B. Parasnis and the volumes of Marātha records published by the Marātha Historical Society of Poona; the volumes of Professor Sarkar concerning Aurangzeb, the biography of Jahāngīr and the *Journal of Indian History*, published by the Allahabad University School of Indian History, the works on South India by Professor Kumāraswāmy Aiyangar, Subrahmanyam Aujar and a few others) in the works of Englishmen. The valuable monographs produced in Europe or India by Indian scholars relate for the most part to ancient times, and are less historical than philological. Many volumes of records and calendars in English have been published by local governments; the gazetteers also are replete with historical information not absorbed in formal histories; and there are several societies, the Bengal Historical Society, the Panjāb Historical Society and the United Provinces Historical Society, whose journals are composed of original matter.

Biography.—Biography, including autobiography, is now popular in India, taking chiefly the form of short memoirs, which in the case of princes and of important religious leaders such as Debendra Nāth Tagore and Dayananda Sarasvatī, may attain a considerable length; so also in the case of historical personages, Sivājī, Jahāngīr and others. A very favourite form, of which there are old examples, is the serial biography, containing lives of saints, lives of famous women, hierarchical, dynastic and family biographies. Valuable work of this kind has been done in regard to the Tamil and Telugu saints and poets, and the poets of Bengāl and Gujarāt. Small volumes of "prison reminiscences" have been published by political offenders, and the number of short "lives" of popular heroes, such as Mr. Tilak, Mr. Gokhale and Mr. Gandhi, is beyond counting. The old form of biography in verse is still favoured in relation to saintly and historical characters: naturally, it has aims other than information and research. Many Indians, from princes downwards, have written accounts of their travels, whether in England, on the continent of Europe, in America or in other countries, including the Far East. But India itself furnishes rich material and occasions for travellers' experiences, especially in connection with its shrines and pilgrimages, so that such titles as *Bhārata-bhramana* quite naturally recur. (F. W. TH.)

INDIANS, NORTH AMERICAN (*see* 14.452).—The Indians are no longer warlike nor to any extent resistant of the white man's methods for their civilisation.

I. IN THE UNITED STATES

The United States assumes that health, education and industry are essential to the Indian's self-support and citizenship. Accordingly, the Federal policy is to hasten his advancement and protect his personal and property rights. By Act of June 2 1924 all Indians within U.S. territory not already citizens were made so. Under the administration of the Bureau of Indian Affairs there are provided health supervisors, school and agency physicians, field matrons, nurses and travelling dentists, whose duties definitely pertain to the physical welfare of the Indians, and hospitalisation is widely maintained against all forms of disease.

Education.—For education, the Federal Govt. conducts 140 day schools, 59 reservation and 18 non-reservation boarding-schools, having an attendance of over 25,000 pupils. The course of study prescribed combines scholastic with such industrial training as is well adapted to Indian needs and temperament. The aim is to prepare girls to become good housewives and mothers, and to fit boys for practical farming or to give them

such knowledge and practice in mechanical industries as will lead to skilled workmanship. The day-schools carry six grades, and the boarding-schools six, nine or 12 grades. The object of the latter is to embrace six elementary grades, a junior high course of three grades, and a senior high course of three additional grades. From the more advanced schools students may acquire full training in such chosen trade or occupation as may qualify them to engage in remunerative pursuits upon their graduation. In all Federal schools prominence is given to hygiene, to moral conduct, to religious culture in any Christian denomination and to the practice of thrift. State public schools have become accessible generally to Indian children, and in these schools there are over 34,000 enrolled. Over 7,000 are received in mission and private schools. Approximately 87% of the Indian children of the United States are enrolled in some school. There has been a steady increase in the number who speak, read and write English.

To promote reservation industries there are maintained demonstration and experimentation farms, and several hundred farmers, stockmen and assistants are employed in giving practical instruction in modern methods of agriculture and the upbreeding and handling of live stock. Loans have been made to energetic Indians from tribal or public funds as initial capital, and these measures have been generally successful. Special attention has been given to the reclamation of arid and semi-arid Indian lands, resulting thus far in a total area of lands under constructed works approximating 636,000 ac., with an ultimate area approximating 1,370,000 acres. The annual crop values derived from these irrigated lands are equal to all prior cost. Tribal herds of sheep and cattle have been maintained on a number of reservations with financial profit, but chiefly to encourage individual ownership and enterprise.

Alaska.—The affairs of the Alaskan natives are supervised by the U.S. Bureau of Education. Eighty-five schools are conducted by six superintendents, nine physicians, 27 nurses and 157 teachers. Five hospitals are maintained. The work is carried on in 85 villages scattered along the coast and on the great rivers. Imperfect transportation and climatic conditions render the service very difficult, but the progress is substantial. Despite the heavy mortality from disease, the population has slowly increased to approximately 27,000. The Bureau of Education has established three industrial schools, situated at Eklutna, 28 m. north of Anchorage, on the Alaska Railroad, at Kanakanak, on Bristol Bay and at White Mountain, on Fish river, 25 m. from Golovin, on Norton Sound. Instruction is given in carpentry, in boat-building, mechanical and marine engineering, for boys; and for the girls: home-making, nursing and sanitation. When the Alaska school service was established, about 1885, the aborigines of Alaska were in primitive conditions, which have gradually disappeared. In many of the villages, the old huts have been replaced by neat well-furnished houses. Many Indians are employed by the great canneries of southern Alaska. They own and operate fleets of power-boats, which are of service in transporting fish from the fishing grounds to the canneries. Some find employment in the mines, while others are pilots, trappers, storekeepers, loggers or ivory carvers. In northwestern Alaska the reindeer industry is the basic industry, introduced to furnish a vocation that guarantees food, clothing and transportation. Herds were found in 1926 near all of the principal native settlements of western Alaska and at various other points. So rapidly have the herds increased that the total number of reindeer in Alaska was in 1925 estimated at 350,000, of which about 255,000 are owned by the natives.

General Progress.—Under the policies outlined, the North American Indians have made unusual progress during the years 1910–26. Their population is greater than at any time in the preceding half-century. They depend less upon "medicine men" and more upon medical science and sanitation. As compared with earlier periods, they are giving more attention to permanent homes; are less nomadic and superstitious. The women are better housekeepers, and infant mortality is decreasing. The day of paint and feathers and blanket garb has almost passed away. The younger school-trained element is creating a new leadership, manifested in changing habits, customs, industrial pursuits and social life. Marriage by tribal custom is yielding to legal rites, and crime is diminishing. Substantial advancement is noticeable in agricultural operations and stock raising, in the use of modern machinery and methods and in large gains in individual funds.

The acceptance by the Indians of American principles of government and civilisation was in some sense disclosed by the World War. In the United States the number of Indians in military service was more than 10,000, three-fourths of which represented voluntary enlistment. In Canada the number exceeded 4,000, all of whom entered voluntarily. The percentage of Indian male population of military age in the World War was probably equal to that of the whites thus engaged, and their proportion of volunteers even greater. They were distributed almost entirely in white organisations, and were highly commended by their officers. Indians ineligible for war duty were active in Red Cross and other relief work and responded to emergency demands for productive labour. (C. H. Bu.)

Comparative Information About the Indians in the United States, Exclusive of Alaska

Population and Citizenship	1911	1925
Population	322,715	349,595
Indians receiving allotments of land	164,215	245,521
Indian citizens of the United States	179,830	349,595
Educational and Vital Conditions	**1911**	**1925**
Indian children eligible for school	63,411	77,597
Indian children in Federal schools	23,647	25,706
Indian children in state public schools	11,000	34,452
Indian children in mission and private schools	4,750	7,280
Total Indian children in all schools	39,397	67,438
Capacity of all schools for Indians	43,015	64,910
Hospitals and sanatoria maintained	50	84
Capacity of hospitals and sanatoria	1,268	2,573
Indian patients treated	8,408	27,775
Indians given medical examination	42,645	83,306

II. IN CANADA

The Indians in Canada numbered in 1923 about 109,000 and are now slowly increasing. They are regarded as minors under the law and are administered by the Department of Indian Affairs under the Indian Act, whose aim is to promote the advancement of the Indians in the arts of civilisation. If, and when, enfranchised they lose the advantages of protection by the Department and are merged in the general population. Agents, 114 in number, have been appointed to encourage the Indians to settle in the Reserves set apart for them which amount to 4,911,259 ac., valued at $52,941,629. The capital of the Indian Trust fund on March 31 1923 amounted to $11,516,213. The attendance at the 340 schools provided for them was 66·5% of the pupils enrolled—6,931 boys and 6,792 girls. The total income of Indians for 1923 from all sources was estimated at $9,940,349.

INDO-CHINA, FRENCH (*see* 14.490), French colony in Asia, consisting of the colony of Cochin China (under a governor, with 20 provinces, each under an administrator); the four protectorates of Tongking (23 provinces), Annam (16 provinces), Cambodia (13 provinces), Laos (10 provinces), each with a *resident supérieur:* and the territory of Kwangchow Bay, leased from China for 99 years, under an *administrateur en chef.* Its area is 299,621 sq. m. and the population (1924) 19,624,000, of which 26,137 were Europeans (24,882 French) and 14,522,000 Annamese.

Political History and Administration.—Indo-China contributed two fighting and 17 labour battalions during the War, 48,900 other war workers and much war material. It contributed largely (Europeans and natives alike) to the war loans. Political troubles during the War were trifling, in spite of enemy agitation. The governor-general during the War was M. Ernest Roume. M. Alexandre Varenne, a Socialist Deputy, was appointed in Nov. 1925. His arrival coincided with the accession of a new emperor in Annam. Relations between the emperor and the French authorities were settled by the convention of Nov. 6 1925. The *résident supérieur* of Annam has been granted permanent authority by the emperor to consult the representatives of the people and to discuss with them any important reform or questions which may arise.

The powers of the governor-general have been reinforced by a decree of Sept. 2 1920. His local decrees (*arrêtés*) have real legislative force. He can dissolve or suspend the *conseil colonial*. He fixes taxes and contributions (except customs duties) leviable in the colony as a whole, or locally, with the advice of local authorities and vote of local chambers. The *conseil supérieur* (*see* 14.491) has been superseded since Oct. 24 1911, by a council of government with very similar duties and composition, and thus still almost entirely official; but it now includes *délégués* (elected by French votes) for Tongking, Annam and Cambodia; native representation is increased from four to five.

In Dec. 1924, the governor-general, Martin, announced a sweeping reorganisation of the whole system. The council will bear the name " congress of the Indo-Chinese union " and consist of 44 members (27 representing the French, 17 the native element) elected by the local elective assemblies of Cochin China, Tongking and North Annam, Annam and Cambodia and Laos. It will have extended financial powers. The old council and its committee will continue under new names and with reduced membership; the new congress will send delegates to both. M. Varenne will probably bring the system into force. The colonial council in Cochin China has been reorganised, its powers extended, and its electoral and native elements strengthened. Natives now have five-twelfths of the representation. The native franchise has been radically reorganised; it now includes all male native French subjects with a clean judicial bill who possess either a property qualification (payment of a land tax of 21 piastres, or a corresponding dealer's licence) or a capacity qualification gained by possession of educational diplomas, exercise of certain public functions, or " services rendered to France." This franchise gives the vote to very many small peasant proprietors; abolishes the headman oligarchies; and amounts to a far-reaching social and political revolution in the villages.

In the protectorates the councils have been democratised on similar lines and natives given an increased share in self-government. This is, it is true, limited mainly to budgetary and fiscal matters; but the change has worked smoothly; the natives have often given sound advice on technical questions. They are keenly interested in self-government, education, etc. There are also native provincial councils and native representation in the municipalities of the large towns. The system will be extended under M. Varenne.

Education and Culture.—The educational movement is parallel to the political, but as the province has over 2,000,000 children of school-going age much remains to be done. In 1924–5 primary and secondary French schools had an attendance of 2,525 (about half natives); the 3,395 Franco-native official schools, an attendance of 213,977; the private schools (native and missionary) one of 99,790, the expense on education being 6,000,000 piastres (1924). The 1917 public instruction code laid down the principle of the teaching of French, even in elementary schools, but there are reservations, defined in the *arrêté* of Sept. 18 1924. French is taught with the native tongue during the first three years of primary instruction, and is the obligatory teaching medium of the last two, which are, however, attended by only 23% of the native pupils. The " University of Indo-China " at Hanoï is a high school with many branches giving practical and theoretical training; it aims at turning out competent native assistants for the different French administrators, and training lawyers, planters, traders and manufacturers. Most of the students are Annamese. The *École Française d'Extrême Orient* at Hanoï, under the patronage of the *Institut de France*, conducts valuable research work in native art, history and language. It has a fine library and museums in Hanoï, Tourane, Saïgon and Phnom Penh, and has done epoch-making work in its *Inventaire* of Cambodian and Cham monuments, its excavation of the ruins of Angkor, etc. (see its two vols., *L'École Française d'Extrême Orient depuis son origine jusqu'à 1920* (1922) and its semi-annual *Bulletin*).

Budget.—The general budget, under 24,000,000 piastres in 1901, was 64,602,000 piastres in 1925, almost all drawn from indirect taxation. Local budgets (drawn from land tax, etc.) were 48,978,000 piastres. Each spent about 30% of receipts on public works. Reimbursements to the French budget for military expenditure reached 10,000,000 fr. in 1925. The debt is only 400,000,000 fr., absorbing 2·8% of the total revenue.

Defences.—The divisional general commanding troops in Indo-China (Hanoï) has under him three brigadier-generals (Tongking two, Cochin China). Troops consist of two regiments French Colonial Infantry (Tongking, Cochin China); two battalions of the Foreign Legion; two regiments artillery; two detachments French gendarmes; two flying squadrons, which also do excellent work in mapping and fiscal service. There are four native regiments of tirailleurs in Tongking, one in Cochin China. There are five " military territories " on the Chinese frontier and in Laos. The medical service is relatively important, and helps in the general sanitary organisation. The navy is under the command of a *capitaine de vaisseau* (Saïgon). The local squadron has been reduced almost to nothing since the War. There is question of handing the Saïgon Arsenal over to a private enterprise.

Commerce, Agriculture, Industry.—Although there is still a plethora of French officials (about 4,600), especially in the lower ranks of the Customs and Excise and similar services, there are over 3,000 French non-officials (males), traders, manufacturers and planters. In 1922 there were from 250–300,000,000 fr. invested in private French enterprises. Rice remains the staple product; 4,750,000 ac. in the Mekong Delta were under rice in 1920. There were 62,500 ac. of rubber plantations and other tropical plants were cultivated successfully. The anthracite mines of Hongay and Dongtrieu produce 1,000,000 tons annually. The production of zinc (40,000 tons) and phosphates (20,000 tons) is important. In 1925, 33,833 hands were engaged in mining (329 Europeans). The presence of coal has given birth to a rapidly expanding industry in the Red river delta, where there are large cement works, brick, tile and ceramic works, three naval yards (beside the Saïgon arsenal), two important French river steamer companies, three large cotton spinning works and minor industries. Home industry (lace-making, etc.), employs many native women. The piastre, worth 2·50 fr. before the War, was in 1926 worth 15 fr.; but on a piastre basis, exports have increased by 77% since 1900, imports by 14% only. Since the end of the War exports are some 164,000,000 piastres annually, imports 132,000,000, rice being the main article exported (maximum, 2,325,000 tons in 1921). Imports to France from Indo-China in 1925 were 612,000,000 fr., exports 760,000,000.

Communications.—There are now 2,075 km. of railways. An important line, 126 km. long, is planned which will run from Tanap to Thakhek and link up Central Laos with Central Annam. Tourist traffic is now possible and encouraged. Over 20,000,000 piastres were spent during the years 1919–25 on dredging, irrigation, etc., and 50,000,000 piastres on roads, of which there are now over 30,000 km. (11,000 metalled, 9,000 made possible for motors in the dry season).

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INDUSTRIAL ASSURANCE: *see* INSURANCE, SOCIAL.

INDUSTRIAL EDUCATION.—In the United States special training for industry in regularly organised courses is of recent origin. It was common before the World War and before restrictive legislation checked the influx of immigrants from Europe for American industries to secure most of their skilled workers from the Old World. The pressure of industrial competition led manufacturers to see that America must do something to train workers, and the labour situation during and since the War led to a rapid expansion of industrial education. The War also led to a complete redistribution of the men and women who were engaged in industry and greatly stimulated agencies devoted to the training of adults. The Federal Govt. attempted during the period of demobilisation to provide for the industrial readjustment. Especially was the effort made to care for disabled and partially disabled soldiers by training them in forms of work suited to their physical and mental abilities.

The first serious effort in the United States to provide industrial education in public schools was made by the State of Massachusetts in 1905. A commission was appointed by the Governor under the authority of the Legislature to make a report on the matter of industrial legislation. This commission was followed by a second, and the final outcome in 1913 was a code of laws providing for state-aided and compulsory vocational education. In 1911 Wisconsin adopted a law creating for the state and for local districts, school boards in control of vocational education separate from those in charge of the common schools. This radical step has not been imitated in other states.

The Federal Board for Vocational Education.—In 1917 the Congress of the United States was persuaded by a group of industrial managers and by a small group of educators, chiefly those interested in the Massachusetts and Wisconsin experiments, to set up a Federal board known as the Federal Board for Vocational Education, which was the disbursing agent for a large Federal appropriation to be distributed to the States on a dollar-for-dollar arrangement for the purpose of encouraging industrial courses, especially in high schools. This board is authorised to supervise courses in agriculture, commercial subjects, home economics and industrial or trade courses. The latter are now provided in public schools either in all-day trade schools, in all-day courses in technical high schools, in part-time courses in continuation schools, in part-time courses on the co-operative plan or in night schools, and in so-called extension classes or opportunity schools, where workers come for training when not occupied in wage earning. Much of the industrial training outside of the all-day schools is arranged so as to be available for adults.

Statistics.—The number of centres to which Federal support has been given in successive years and the registration in industrial courses in these centres are shown in the following tables:—

Trade and Industrial Schools

	Evening	Trade Extension	General Continuation	All-day
1918	300	341	..	168
1920	435	119	322	199
1922	620	150	506	237
1924	776	238	582	279
1925	816	225	556	297

Number of Pupils Enrolled

	Evening	Trade Extension	General Continuation	All-day
1918	46,333	53,005	..	18,596
1920	48,354	17,159	98,082	21,224
1922	66,477	33,106	167,911	31,390
1924	84,973	35,475	256,133	33,262
1925	86,540	30,400	265,335	39,666

Relation to General Education.—The tendency at the time the Federal Board for Vocational Education was organised was to make a sharp distinction between general education and academic education. This tendency was strengthened by the example of Germany, which was regarded before the War as the most successful nation in developing industrial education. The tendency in 1926 was to unite trade training and general education rather than separate them. Many high schools have made industrial courses a part of their regular programme. On the other hand, trade schools have found that it is necessary to include general courses if young people are to be properly trained for life in a democracy. *See* also COMMERCIAL EDUCATION.

(C. H. J.)

INDUSTRIAL PSYCHOLOGY.—Industrial psychology may be defined as the study of the conduct of men and women in their capacity as wage earners. It aims at describing and explaining all those activities by means of which a person adjusts himself to his economic environment; hence it must take into account the fundamental elements of man's constitution, his innate tendencies and their expression in thought, feeling and action both on the conscious and unconscious level, as well as his acquired aptitudes. As yet, only a tentative beginning has been made, so that we are far from even an approximation to scientific generalisation.

HISTORY OF THE SCIENCE

The development of industrial psychology has been largely determined by its history. Prior to 1914, psychologists concerned themselves but little with industrial problems. A few writers occasionally saw a possible industrial application of some psychological generalisation; and in 1913 Münsterberg[1] made a more ambitious attempt. Industrial development had been governed by the claims of machinery, rather than of man. The enormous improvement in machinery during the 19th century, the studies made in the natural sciences, the growing knowledge of the mechanism of the body, all tended to focus general interest on man's likeness to a machine. The phrase "the human machine," which is rightly applied to part of his structure, became synonymous with man himself rather by implication than by design. The outbreak of the World War, with its urgent demands for increased production in all departments of activity, brought home to society the futility of considering the worker merely as a machine.

Industrial operations, as usually conducted, had been implicitly based on a crude mathematics. If 6 units of work could be done in one hour, then 6 x 8 would be done in 8 hours, 6 x 12 in 12 hours. The physiological necessity for sleep prevented the complete working out of this principle. Up to about 6 or 7 hours, according to the nature of the work, there seemed nothing obviously wrong with the calculation; when however, the problem was one of 12 hours, the discrepancy between the facts and the calculation challenged investigation. Though it was not then recognised, that stage marked an epoch in the history both of psychology and of industry. The focus of interest was changed from the machine to the worker of the machine, and the assistance of psychology, hitherto looked upon as a somewhat recondite study, was invoked.

The Work Curve.—Previous work of a more or less theoretical character into problems of fatigue suggested the lines of investigation. Hence the earliest work in industrial psychology was concerned with fatigue. As the time was one of urgency, the problem had to be dealt with practically, and the only measure to hand was the one which had prompted the inquiry, viz., the work curve, obtained by computing and graphing the hourly output records of numbers of workers. The reproach is sometimes made against industrial psychology that it is primarily interested in output. The truth is that output happens to be a convenient measure. Psychology's real interest lies in what is measured.

Hours of Work.—Thus the earliest systematic inquiries of industrial psychology concerned the problem of the 12-hour day in munition factories, and used as data the records of large

[1] H. Münsterberg, *Psychology and Industrial Efficiency* (1913).

numbers of people working over long periods. Comparisons were made between groups of people working a 12-hour day and other comparable groups working a 10-hour day.[1] In many processes the results of the latter groups showed such an increase in hourly output as more than counterbalanced the shorter time available for production, so that the total production was actually greater than when the hours of work were longer. Similarly lost time and sickness were found to diminish with the shorter working day. When hours are shortened, a long period elapses before adaptation to the new conditions is fully obtained; on the other hand, when hours are lengthened, there is sometimes an immediate reduction in hourly output.

Since the War, researches along these lines have been pursued in such different occupations as: charging of blast furnaces, silk weaving, shell making, metal-polishing, tinplate manufacture and in the processes of collar machining, folding and shirt ironing in the laundry trade. The curves of the output of the average worker, when graphed, usually assume the same general shape, viz., a rise at the beginning of the spell, a period of relative stability, and a fall at the end. The interpretation of these empirical facts cannot yet be given. Slight variations occur according to the arrangement of the hours of work, but the type remains characteristic of many industrial processes. Muscio, experimenting on women medical students doing mental tests, obtained similar curves.

Rest Pauses.—An important innovation stressed by the industrial psychologist has been the introduction of short rests, in the middle of a working period, of about 10 or 15 min. duration. These regular breaks are technically known as rest pauses. It is sometimes argued that frequent irregular rests are invariably taken by the workers, either voluntarily or because the supply of work fails, and that regular rest pauses are therefore not required. Where, however, direct experiment has been possible, it has shown that the organised rest pause is the better working arrangement.

The observations of H. M. Vernon for the Health of Munition Workers' Committee proved the advantage of breaking up working spells, and since then it has been verified in the boot industry, in metal-polishing, in celluloid-polishing, in shirt ironing, in sweet-packing, in handkerchief-folding and in stamping lids. The introduction of a rest about the middle of the spell of work improves the output as a rule by about 5%, and in some processes it affects advantageously the period preceding the rest. Not only is the work improved, but the regular rest is much appreciated by the worker. The probability is that the improvement is largely due to changes in feeling; most people can face with equanimity and possibly enthusiasm the prospect of two hours' work at the end of which will come a period of free time, but to face four or five hours of unbroken labour is depressing.

The subject of rest pauses has not yet been exhaustively studied, and particular cases need particular study; still the above statements seem to be valid in general. Exactly when a rest pause should occur must depend on the nature of the work, while the amount of actual increase in output will vary with the relation of the human factor to the machine factor in the particular process.

Physical Environment.—Among other influences which have been shown similarly to affect the worker and have been effectively measured by means of the output curve are improvements in lighting, heating, ventilation and seating. (*See* FACTORY AND WORKSHOP LAW; FACTORY DESIGN; OFFICE MANAGEMENT.)

MOTION AND TIME STUDY

At an early stage the young science of industrial psychology had to encounter the previous application of quasi-scientific methods to industry, initiated in America by Taylor and Gilbreth. Their general object was to study the nature and rate of the movements made by a worker in order to eliminate the unnecessary ones. This is technically known as motion and time study. Unfortunately this study had resulted in imposing on all the so-called "one best way," obtained by analysing the movements of the quickest workers. So unnatural a procedure awakened much criticism and no little resentment. It is not irrelevant to note that the movement originated with engineers, not with psychologists.

Properly conducted, motion and time study are but special applications to industrial processes of the laws of habit formation. Young learners pick up, by watching proficients, many actions of industry; with practice they evolve a commendable copy but uncritically they may adopt some unnecessary movements, which, while apparently not interfering with the work, may become fixed; the result is that the worker develops muscular habits harmful to himself, or fails to attain a speed commensurate with his real ability. Just as the skater, swimmer or golfer improves by expert teaching, itself the resultant of careful study, so does the industrial worker. In such varying trades as silk weaving, metal-polishing, chocolate covering, it has been found that by systematising movements and by training novices in the relevant motions, a saving of energy results, which is an advantage to all concerned. Faulty methods of learning are not only a hindrance during the learning period, but there is also an invariable tendency for the worker to regress to them under certain conditions, even when they are apparently overcome.[2]

The aim of Taylor and Gilbreth, in standardising the time and method taken to perform a task, was primarily to reduce the cost of production, and they also had in mind the welfare of the worker and higher wages. From the worker's point of view however, the drawback of their system was that it produced a feeling of being always keyed-up. From the psycho-physiological point of view it was based on the fallacy that the shortest and speediest movements were necessarily the least tiring and that the best style of movement could be obtained from combining a number of best movements adopted by different workers. If the study of industrial processes in relation to the worker is to be scientific, it must consider the whole of the conditions, not a part; it must regard the worker as a human being, not as the performer of a limited set of movements.

LEADERSHIP AND MONOTONY

Important though the material environment undoubtedly is, no workers can do their best unless the general mental environment is right. Not even the very best material conditions will result mechanically in good work, and sometimes even poor material conditions can be nullified by good mental conditions. By this is understood the conditions governing the group as a whole, dependent primarily on the efficiency or otherwise of its leadership. Industrial life is often criticised for failing to supply that effective stimulus of working for a common end, which is more obviously evident in the army. Actually there are more factories where there is this sense of working for a common end as well as for individual wages, than those not familiar with the inside working of factories are aware of.

If, as McDougall[3] asserts, "the personalities of its leaders more effectively than any other factor engender national unity and bring it to a high pitch," it is no less true that a factory owes its corporate unity to the personality of its leader and his deputies. The time may come when it will be possible to test for leadership as it now is for intelligence; at the moment the problem has only been formulated. The qualities of leadership are required by all those in charge of others, and there is no correlation between ability to do a job and ability to superintend others doing it. To the psychologist there are certain types, almost neurotic, whose symptoms find expression chiefly in their relations with others. The person who reacts always to the emotion aroused in himself by a situation and not to the situation itself, the inevitable "nagger" who can never govern easily because he is always at war with himself, the "obsessional"[4] whose obsession can be readily touched up by the work—these represent

[1] *Health of Munition Workers' Committee*, (*a*) *Interim Report*, Cd. 8511 (1917); (*b*) *Final Report*, Cd. 9065 (1918).

[2] *The Medical Problems of Flying*, Medical Research Council Report No. 53 (1920).

[3] W. McDougall, *The Group Mind*, p. 135 (1920).

[4] M. Culpin, *The Nervous Patient*, p. 92 (1924).

a few whose emotional development makes life much harder for some of their subordinates and unbearable for others. If their other qualities, *e.g.*, their business acumen, are so outstanding as to justify their position, then they need as emotional interpreter someone of different temperament to neutralise their more pernicious effects.

A good leader should possess vitality, sympathy, justice and humour, as well as knowledge of the work. The emotional, and as a corollary, the physical effect on subordinates of different types of leaders is patent throughout industry. Where the commands of one are cheerfully obeyed, those of another arouse truculent antagonism or sullen acquiescence. Can anyone doubt the effect on the health, happiness and efficiency of the workers? Many authorities are unwittingly the cause of the sick leave they deplore among subordinates.

Monotony.—In addition to the effect of the leadership, one has to accept the fact that in modern industry, with its subdivision of labour, a large number of people are employed in repeating the same limited set of movements for hours, days, months and years. This "repetition of movement" is often erroneously called monotony. Literally "monotonous" means "of one tone;" it suggests absence of change and refers rightly to the general mental atmosphere and not to the movements of the worker. Repetitive movements must either be studied as such, in which case they belong to the psychology of habit formation, or else put in their complete setting, including, at least, the repetition work, the varying amount done as the hours go on, the opinions of fellow workers and authorities about that work, physiological changes, emotional changes, and the collective life of the factory. The total reaction at any given moment will be the reaction to a composite situation which constantly changes.

The worker on one process often stigmatises some other process as monotonous, when to the observer there is nothing to choose between them. There are compensations too in many processes if one studies the worker as a human being and not merely as the performer of a repetition process; *e.g.*, some workers experience a sense of power in operating a large or a delicate machine. It is not suggested that repetition work is good in itself; but merely to describe the repetition work as monotonous and to imply that such description embraces the whole psychological situation, is misleading.

Vocational Guidance and Selection

Observation of workers shows that in particular posts some are much more successful both subjectively and objectively than others. Hence arises the question of vocational guidance, which must be distinguished from vocational selection, a simpler problem. The latter problem sets out to select a worker to fit the job, the former to select for a given person (usually an adolescent) that job most suited to his capacities. This theoretically presupposes a knowledge of the person, a knowledge of all possible occupations, and a power of relating one to the other. Those who have done most work in this field are convinced that the most useful measure of a person is his general intelligence.

Mental Ratio.—By suitable tests it is possible to gauge with a high degree of accuracy the intelligence of any child, and to express it in a quantitative form, known as the mental ratio. This remains fairly uniform throughout the years of growth, and inborn intelligence does not develop to an appreciable extent beyond the age of puberty. It is the amount and kind of knowledge and interests that separate the adult from the child, not the intelligence with which he deals with that knowledge and those interests. To put a child of a high level of intelligence to a job requiring little, is wasteful, while the reverse process is futile; moreover, the one provokes discontent, the other worry.

Temperament and Character.—In other directions, viz., the measurement of temperamental and character qualities, less advance has been made. In this field, observation and interpretation are still the only methods available. There are some occupations where people of a particular temperament are more likely to become inefficient and break down than in others.[1] This temperament is characterised by a disproportionate development of fear in some form. Whether this is due to its innate strength or to an environmental repression, or both, cannot be adjudged yet. The sufferer shows over-anxiety concerning things he cannot alter, is unduly sensitive to the opinions of authorities, etc. Sometimes the symptoms appear in a more objective form, masking their actual subjectivity, so that the focus of anxiety appears outside the sufferer, who, with more than normal frequency complains of machine trouble, unsuitable keys (in telegraphy), etc.

Such people, in the interests of themselves, their fellow-workers and the work, ought to be diverted from occupations where their mental make-up cannot fail to be expressed in the work. If they enter such occupations as telegraphy or dispensing or even coal-mining they will almost certainly break down: the breakdown will be attributed to overwork, although actually the over-work may have rather subjective than objective reality. If there is an occupational disease recognised as such, the problem is still further complicated.[2]

When the qualities of the applicant for a job have been assessed and the requirements of various trades are known, it is possible to advise a child as to what he may most advantageously take up.

Organisation.—A vast field is however still untouched. Most of the studies made so far relate to those aspects of industry which are primarily means to an end, not ends in themselves, and even in this limited sphere there is much to be done. Little is known as yet, for example, about the organiser and his organisation. It is obvious that the organisation of a big business is no mere rule-of-thumb working out of principles gained by even a scientific analysis of other places; it has some of the qualities of a work of art, and the attitude of mind of an original organiser is akin to that of the artist. No real appreciation of the field of industry is possible without a recognition of this.

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INDUSTRIAL RELATIONS (*see* Arbitration and Conciliation, 2.331).—The term "industrial relations" is used to denote the relations between all those who are engaged in industry. The history of industrial relationships up to the outbreak of the World War is a history primarily of conflict. The workpeople had only achieved something like equality of bargaining power by dint of unremitting struggle, first for the right of association, then for the recognition by the employers of their organisations as their authorised mouthpieces.

Strikes and lock-outs, when they occurred, were increasingly stubborn as the fighting resources of the trade unions multiplied, and increasingly devastating in the economic losses which they entailed to both parties as their scope became magnified. In order to prevent the outbreak of these deadly contests, the State was compelled to set up machinery for conciliation and arbitration, and statesmen were forced to pay increasing attention to industrial questions in drafting their political programmes. But in the heat of this long-drawn-out battle between the two opposing forces the essential community of purpose which should have united them was almost completely forgotten by both sides. That both derived their living from industry and that both would perish if it withered, was a thought which seldom occurred either to Capital or Labour as a whole, the one intent upon maintaining the inalienable right of the capitalist to undivided ownership and responsibility, the other on demanding some form of

[1] M. Culpin, *The Nervous Patient*, p. 175 *et seq.* (1924).

[2] The serious nature of this is well brought out in the occupational disease known as Miners' Nystagmus. *Cf.* (1) Special Report Series, Medical Research Council, Nos. 65, 80. *Reports of the Miners' Nystagmus Committee*, London (1922–3). (2) W. Eddison, "Psycho-neurotic aspects of Miners' Nystagmus," *Brit. Jour. Med. Psychology*, vol. 3, pt. 2 (1923). (3) W. Inman, Critical Notice, *Brit. Jour. Med. Psychology*, vol. 3, pt. 3, pt. 4 (Cambridge, 1923).

socialisation, a term with many and fluid meanings but generally interpreted as implying the ownership and control of industry by the State. It is true that both parties counted in their ranks men who held that a new order, substituting co-operation for conflict, was the only road to individual or national prosperity. Their voices were seldom heard, however, above the din rising from the two contending camps, each firmly entrenched in its doctrinal positions and defying assault.

The War introduced an abnormal period in the relations between employer and workman in every industrial country of importance, because all of them were belligerent. The paramount necessities of the State and the control which it exercised over the production of almost every article except those of purest luxury suspended the free play of economic forces. Though disputes and occasionally strikes occurred, usually for higher wages to meet swelling prices, they were quickly settled by government intervention instead of by the normal processes of industrial warfare. Nevertheless, the disturbance of all accepted values which the War created, the realisation of the national dependence on the industrial worker and the partial obliteration of class distinctions by the common struggle brought about a new attitude towards the whole question of industrial relations. It is not too much to say that with the Armistice industrial relations entered upon a new phase. As yet it is still in its very early stages. To suggest the lines of its ultimate development would be premature, but there are certain novel features which have emerged and which may be taken as marking a definite departure from pre-War conceptions. They may be illustrated from the experience of the three principal industrial countries, Great Britain, Germany and the United States, where under different forms and conditions similar tendencies may be traced. In contrast to them there is the Russian experiment where with the abolition of private capital the problem of industrial relations might be supposed to have been eliminated. Nevertheless the distinction between management and workers has gradually re-emerged and with it the problem once more begins to revive, as may be seen from the article RUSSIA.

I. THE WHITLEY COUNCILS IN GREAT BRITAIN

The Whitley Report.—In March 1917 a committee, presided over by Mr. J. H. Whitley, now Speaker of the House of Commons, and usually known by his name, presented its first report to the Minister of Reconstruction on the relations between employers and employed. It proposed the establishment of Joint Industrial Councils consisting of an equal number of the employers and workers in all well organised industries. Two points may at once be noticed as indicating that the authors of the report, who included several prominent employers and trade-union officials, had abandoned the view that the relation between capital and labour must necessarily be one of fundamental antagonism. In the first place, they proceeded on the assumption that trade unionism was an integral part of the industrial machinery and that any industrial reconstruction must be based on its frank recognition. Though it is true that this principle had been admitted before the War wherever collective bargaining had been firmly established, it has to be remembered that even in 1911 a national railway strike took place to secure its recognition by the companies and that in many of the lesser industries it was still far from being universally honoured.

Secondly, the committee emphasised the need for "the largest possible measure of co-operation between employers and employed." They declared that, in order to improve industrial relations, it was essential not merely to offer workpeople better conditions and a higher standard of comfort, but also "to enlist their active and continuous co-operation in the promotion of industry." The notion of co-operation was thus reintroduced into industrial history for the first time since the factory system came into existence. No doubt isolated attempts had previously been made to revive it in individual works by means of profit-sharing schemes, works committees and similar devices, but it had never been authoritatively laid down as a principle that should govern the whole field of industrial relations.

Joint Industrial Councils.—In consonance with these general objectives, the Whitley Committee proposed three classes of function for the Joint Industrial Councils. In the first place, they were to provide the means for settling wages and working conditions. Secondly, they were to consider questions concerning the development of their industries as a whole, such as technical education, the initiation and utilisation of industrial research and inventions, the improvement of processes and machinery. Thirdly, they were to discuss certain other matters which involved the partial association of the workpeople in the general conduct of industry by utilising their practical knowledge, securing to them "a greater share in and responsibility for the determination and observance of the conditions under which their work is carried on," "ensuring the greatest possible security of earnings and employment," and discussing "organisation and appropriate questions relating to management." Moreover, in order to carry the spirit of co-operation from one end of the industry to the other, it was recommended that the councils should devolve some of their duties on district councils and works committees.

That this was a far-reaching programme involving a new approach to the problem of industrial relations hardly needs emphasis. That it should not yet have been fully realised is hardly a matter for surprise, especially when the grave economic crisis which weighed heavily upon industry after the War is borne in mind. Like other new institutions, the Joint Industrial Councils have been roundly condemned as useless, because in a few years they have failed to perform a miracle by changing the whole industrial atmosphere. But transformations as profound as those which the complete realisation of the Whitley scheme would mean are only accomplished slowly. They demand a long process of education both of employers and workers. What is important to notice is not the shortcomings but the achievements of the councils.

Seventy-three councils were brought into existence with the active assistance of the Ministry of Labour. At the end of 1923 58 were still in operation. Fifteen had fallen by the wayside, usually because they were premature on account of an insufficient degree of organisation in their trades. The comprehensive report issued by the Ministry in 1923 shows that the survivors had already accomplished a large amount of excellent work. It is true that the greater part of it was devoted to settling hours, wages and disputes, but when it is realised that many of the industries concerned had never before possessed any machinery for these purposes, their repeated success in solving thorny questions without conflict is in itself an immense testimony to their value. Many councils, however, have gone further and already performed work of a more constructive character.

Remarkable schemes have been set on foot in several trades for improving education and regulating the conditions of apprenticeship. Much has been done to improve safety and health in collaboration with the factory inspectors and the Industrial Fatigue Research Board. At least 12 councils have gone very carefully into commercial questions, such as foreign competition, the improving of transport facilities and the provision of raw materials. Finally, the pottery, tramway and wire-drawing councils have set an important example by investigating the costs, wages and finances of their industries. It is only by examining the detail of the work done that the progress which it represents and the influence which it has had on the relations between the employers and the workpeople concerned can be fairly estimated. Enough has been said, however, to justify the opinion that the Whitley scheme is operating steadily and beneficially.

Methods in the Five Great Industries.—One of the principal criticisms levelled against the scheme is that it has not been thought fit for adoption by the largest industries—mines, cotton, engineering, iron and steel and shipbuilding. In these industries machinery for bargaining and for dealing with disputes had long been in existence, which they did not wish to alter into conformity with the Whitley model. It may, however, be noted in passing that, except in the iron and steel industry, serious stoppages have occurred in all the others since the Armistice.

It may yet be found that some machinery for co-operation on a broader basis than now exists is necessary to ensure peace and prosperity in these industries.

Finally, special mention must be made of the important innovation made in the relations between the railwaymen and the companies by the Railway Act of 1921. It was originally proposed to provide for the inclusion of two Labour representatives on the Board of Management, but this suggestion was dropped in favour of a scheme setting up a Central and a National Board to deal with wage claims and disputes, and Railway Joint Councils on each of the four great lines to deal with the local application of national agreements, suggestions as to operating, working and kindred subjects, and other matters of mutual interest such as "co-operation with a view to securing increased business, greater efficiency and economy." Under these councils are sectional councils, while in every station or dépôt where 75 men are employed a local departmental committee is established, whose general objects are to provide contact between management and employees and to increase the latter's interest in their work by giving them an opportunity of discussing matters affecting not only their own conditions but also the efficiency and organisation of the working of the railway. In other words, the Whitley principle has been adapted to the railways and has certainly contributed to their smoother working.

Conclusions.—This brief survey will have made it clear that in Great Britain a distinct change is observable in industrial relations since the War. A rival notion to that of the diametrical opposition between capital and labour has been introduced in the shape of co-operation for the common benefit of both. This has involved not only the unqualified recognition of the trade unions as part of the machinery of industry, but also the admission of the right of the workman to some participation in its policy and responsibilities. Lastly, except in the case of the mines and the railways, the demand for the direct nationalisation of industry is perhaps less confident than it was before the experiences of the War and the Russian Revolution, but the idea of syndicatising industries still on commercial lines with State supervision has acquired a good deal of prominence.

II. THE GERMAN SYSTEM OF WORKS COUNCILS

The development of German industrial relations since the Armistice has taken place in a very different setting. Whereas in Great Britain the War produced a disturbing interlude which left the general organisation of society unchanged in its outward forms, if modified in its spirit, in Germany the close of hostilities brought about a radical transformation. The German Revolution not merely substituted a republic for a monarchy, but it altered the whole social equilibrium. For the first years of the new Germany the Social Democratic party was the dynamic force in the Government, and it was during that period that the Constitution of Weimar was framed. That remarkable document introduced profound changes in the sphere of industrial relations as in other spheres of German life. After laying down the principle that the "labour force" (*Arbeitskraft*) falls under the special protection of the Federal Govt. and enumerating various measures to ensure that protection, the constitution provided in Article 165 for the establishment of two institutions which are beginning to play an important part in German industrial life—the Federal Economic Council (*Reichswirtschaftsrat*) and the works councils (*Betriebsräte*).

Operation of the System.—Works councils (*q.v.*) have not been tested during a normal period, and it is still premature to pronounce any definite opinion on their value and possibilities. It may nevertheless be stated with considerable confidence that the works councils have established themselves as a permanent feature of the German industrial system, whatever modifications they may be destined to undergo. To say this does not mean that the employers are fully reconciled to them or that the workers are fully conscious of their possibilities. The former still show the greatest reluctance to admit the councils to any real participation in the problems of production. They have frequently placed obstacles in their way and have generally tried to restrict their functions to that of intermediaries between workers and management. As a result, the number of cases in which works councils can be stated to have had a beneficial effect on production is small, though on the other hand the employers' fears that they would have a subversive and pernicious influence have not been realised, save where the Communist element has succeeded in gaining control. The workers, on their side, have often not proved themselves capable as yet of using the new machinery effectively. Their lack of technical knowledge has hampered them, while in smaller works a considerable amount of indifference is still to be found. At the same time, they have established their right to receive important information, which the trade-union leaders regard as a means of gradually educating Works Councillors in their duties.

On the social side the results of the works councils have been more pronounced. They have played a considerable part in the enforcement of the eight-hour day by exercising a supervision on behalf of the trade unions, which has prevented abuses and secured closer observance of the collective agreements. But perhaps the most remarkable results achieved by the councils from the workers' standpoint have been in connection with dismissals. By investigating innumerable cases in which improper grounds of discharge have been alleged and by taking them before the conciliation boards, the works councils have gradually built up a jurisprudence which affords a real guarantee to the worker against arbitrary action on the part of his employer. If the councils had attained no other results, their action in this field alone would have justified their creation from the workers' point of view. On the whole, it may be said that, although their value and effectiveness vary greatly in accordance with the spirit which both sides have brought to bear on them, the works councils have justified themselves and are likely to acquire further authority as time goes on.

III. THE GERMAN FEDERAL ECONOMIC COUNCIL

Functions of the Council.—Any estimate of the influence of the Federal Economic Council on German industrial relations is subject to the same qualifications as in the case of the works councils. As an institution it is still in its infancy; in fact, its form is still provisional and remains to be finally determined by a bill under consideration in 1926. Hitherto it has consisted of 326 members, but experience has shown this number to be too large and the bill reduces it to 126, of whom 41 are to be nominated by the employers' organisations, covering industry, agriculture, commerce, banking and transport, 41 by the trade unions of various kinds, 14 are to represent private corporations such as the municipalities, co-operative associations and insurance companies, and 30 are to be appointed by the Federal Govt., including two representatives of the Press. The functions to be allotted to this permanent council are analogous to those which the provisional council has been exercising during the past six years. In the first place, all government bills of an economic or social character have to be submitted to it for advice and its views must be presented to the Reichstag, whether favourable to the Government's proposals or not. The council may also depute members to explain its conclusions while the bill is under discussion in Parliament. The council has a further power of considerable importance, namely, that of conducting "inquiries into questions of fact, in the economic and social field" (*Untersuchung tatsächlicher Verhältnisse auf wirtschafts- und sozial-politischem Gebiet*), and for this purpose the council is to be armed with compulsory power to obtain information and to hear evidence on oath.

Similar Institutions in other Countries.—It will be seen that the Federal Economic Council is not merely or even primarily concerned with industrial relations, but that it is called upon to advise upon all economic questions and to exercise functions of a semi-political character. In fact, it represents the modern tendency, which may be found in the formation of a *Conseil National Économique* in France and in the new Fascist *Consiglio Superiore dell' Economia Nazionale* in Italy, to submit economic questions to the consideration of expert professional bodies

instead of leaving them to be exclusively decided in the light of the political circumstances of the moment, which exert so large an influence on the deliberations of Parliaments and often produce results that are hardly consonant with the best interests of the country. From the point of view of industrial relations, however, such bodies are of considerable significance, as they mark once again the post-War tendency to admit representatives of the workers to direct consultation on the wider problems of industry, instead of leaving them as hitherto to be dealt with only by governments and employers. Enough has been said of the new bodies which the German Constitution has called into being to show that in Germany, as in Great Britain, this tendency has won a large measure of recognition and the status of the worker is undergoing a gradual development in the direction of participation in the responsibilities of management.

IV. TENDENCIES IN THE UNITED STATES

To turn from Europe to the United States is to discover industrial relations based on quite other conditions and determined by circumstances which find no parallel in the Old World. The industrial evolution of a new country with vast natural resources and incalculable possibilities of expansion must necessarily differ widely from that of small, highly developed areas such as Great Britain and Germany. The United States was a predominantly agricultural country until very recent times, and the phenomenal growth of its industry in the last two generations has not even yet been so great as to make it predominantly industrial rather than agricultural. There is still a far greater measure of fluidity in American than in European life. The workman of to-day may still be an employer to-morrow and a millionaire before he dies. A man who fails in the town can still return to the country, or who fails in one job can pass to another with the certainty of finding employment. In a word, the towering occupational and class barriers which hem in the European worker's progress through life only exist as yet in a very minor degree in the United States. The consequence has been a different attitude towards the whole subject of industrial relations. The outlook both of employers and workers remains essentially individualistic. While until recently the former has been uncompromising in the maintenance of his undivided sovereignty in his own plant, the latter have shown little interest in the orthodox doctrine of class warfare, only a moderate inclination to trade unionism and a positive repugnance to many forms of State interference. The late Mr. Samuel Gompers throughout his career fought vehemently against any endorsement of State schemes of insurance by the American Federation of Labor, and demands for industrial legislation which have been pressed for years by the trade unionists of Europe have been vigorously opposed by the trade unionists of America.

Besides this individualistic tradition, which is characteristically American, there is another factor which has directed industrial relations into unfamiliar channels. The ordinary growth of the population was quite insufficient to supply the vast demand for labour created by the rapid expansion of American industry. The result was a tremendous acceleration of the stream of immigration from about 1890 onwards, until in the years preceding the War it had attained an annual figure of over a million. A large proportion of these new American labourers were drawn from southern and eastern Europe, instead of from the northern countries which had previously furnished the main body of immigrants. They had little or no industrial experience, they were usually ignorant of the meaning of trade unionism, and even if they attempted to combine for trade purposes, they were unable to comprehend the speech either of their own officials or of their fellow members. As a result, the employers enjoyed a power in the United States which their European colleagues had long since forgotten. Trade unionism was weak and extremely difficult to promote in the face of the natural obstacles already mentioned, reinforced by the relentless and uncompromising hostility of the employers. Nevertheless, in certain industries, notably the garment trade, one of the worst paid and most difficult to organise, it made astonishing progress, and even in other industries such as the steel industry, or in coal districts like West Virginia, where organisation was unable to obtain a solid foothold, the workers began to band together for fighting purposes, often under the aegis of the loose-knit extremist body known as the "Industrial Workers of the World."

Industrial Warfare.—Under these conditions industrial warfare was carried on by both sides with a violence and ruthlessness never approached in Europe. In the face of the enormous power of American capitalism, which was often unsparingly used to crush any incipient combination for protecting their interests, the workers were driven by a feeling of desperation not merely to resistance but to open revolt. Strikes were not just tests of endurance and organisation, but not infrequently produced armed conflict and considerable bloodshed. In the decade preceding the War and during the War itself industrial relations in America were apparently growing steadily worse, and it was generally concluded by European observers that their development was following the normal course already familiar in Europe, that as the abyss between capital and labour widened, organisation would grow stronger on either side until each was perfectly entrenched against the other. Despite certain peculiar features, there was no essential difference in the problem as it presented itself in the new world. America was a generation behind Europe in its trade unionism, but was passing through the same recognisable stages and would arrive at an essentially similar conclusion. The damming of the immigration river first by the War and then by "quota" legislation would only hasten the process by solidifying the working masses in the United States and removing one of the principal obstacles to the growth of trade-union organisation.

American Proposals.—Though it would perhaps be rash to assert that this view has already been falsified by experience events seem to point to a different evolution. Since the Armistice there has been more discussion of industrial relations in the United States than perhaps in any other country. The American public seems to have awakened to its immense importance for the whole future of the country. When President Wilson called his industrial conference in 1919 to elaborate proposals for better relations, it aroused far more interest among the general public than did a similar conference convened by Mr. Lloyd George in England in the same year. Although it reached no very positive conclusions, it probably served its purpose by acquainting the American people with the elements of the industrial problem. Since that time their education has been steadily continued by the Press of all grades. The output of books, magazine and newspaper articles on the subject has been immense. Big employers like Henry Ford, J. D. Rockefeller and Edward Filene, distinguished men of learning such as President Eliot of Harvard, politicians, journalists, church congresses and numerous private bodies have contributed actively to the discussion, while a great deal of industrial investigation has been done both by individual research workers and by institutions such as the Russell Sage Foundation. The result has been to create an atmosphere more favourable to the peaceful improvement of industrial relations than exists in any European country. Without by any means pretending that the old prejudices or antagonisms as between capital and labour have been eliminated, it may be said that they have been already softened by the free play and approval given to liberal and progressive ideas, and restrained by the feeling of responsibility which the national interest displayed has engendered.

What, then, are the tendencies which are beginning to show themselves as the result of all this American discussion? In the first place, there is a marked insistence on the application of democratic principles to industry. America is a country which prides itself above all on its democracy, and once the question is stated Americans find it as difficult to approve autocratic methods in industry as they do in politics. Moreover, they are beginning to believe that in a democratic country complete industrial autocracy is not really possible, or that, in Mr. Filene's words, "industrial democracy is inevitable, because political

power has been given to the masses." In fact, the widespread interest evoked in the problem of industrial relations in the United States is largely due to the belief that unless it can be solved by industrial methods within industry, it will become a political problem to be solved by political methods outside industry. For many Americans, then, the solution of the industrial problem appears fundamental to the maintenance of democracy. The general view now gaining ground among them may be summed up in a dictum of the Bureau of Industrial Research. " One of the great tests of democracy in the years to come will be the ability of American employers and wage-workers to find a basis of democratic co-operation in the government of industry. Unless industry can be constitutionalised on a democratic basis, there is serious danger of class conflict culminating in some form of revolution."

Experiments in Certain Industries.—In order to " democratise " industry numberless " plans " are now on trial. In the garment trade a regular system of co-operation has been established by the employers and the Amalgamated Clothing Workers of America, starting with Messrs. Hart, Schaffner and Marx, one of the largest firms in Chicago, and thence spreading through the industry. On the railways an interesting experiment has been initiated on the Baltimore and Ohio Railroad which has since been adopted by other great American lines and by the Canadian National Railway. Joint committees have been set up rather similar to those which exist on the British railways, the main objects of which are the promotion of efficiency, the elimination of waste and the stabilisation of employment. All the available evidence testifies to their success, both from the employers' and the workers' standpoint. A large number of co-operative schemes may be found in other industries, varying widely in type but all based on the idea of securing the whole-hearted collaboration of the workpeople by enlisting their direct interest in the running of the establishment.

In some cases constitutions have been set up on the American model with a Senate and a House of Representatives, in others the profit-sharing element is introduced in some shape or form. By no means all of these schemes have been instituted in agreement with the trade unions; in fact, it would probably be true to say that the majority were promoted by the employer with the object of preserving the " open shop " and keeping unionism out. But whatever their origins, these works committees have undoubtedly done much to improve industrial relations. The statistics published by the National Industrial Conference Board, an important employers' organisation, show that in 1924 there were 814 establishments possessing works committees where 1,177,000 workpeople were employed, as against 225 employing 391,000 in 1919. When compared with the whole of American industry, this does not represent a very large proportion and as in the case of some of the British Whitley Councils, some works councils have failed to survive in the United States. To maintain, therefore, that the " democratic " movement in industry is universal or overwhelming would be misleading. There is still a large section of employers who remain wedded to old-fashioned methods and who are opposed even to collective bargaining. There is no doubt, however, that the new method is making steady progress, and what is perhaps most significant is the changing attitude of labour towards it.

Wages and Production.—As has already been pointed out, the individualist tendency and the vast influx of immigrants have rendered trade-union organisation far more difficult in America than in Europe. In addition, the American working man is more intent on earning good wages than on any other objective. His standard of living is considerably higher than that of any European worker and his principal aim is to elevate it still further. He is therefore disposed to assist in increasing production, if by doing so he is assured of increasing his own income. He has no objection to adopting " capitalistic " methods, to owning bonds or to taking shares in the enterprise which employs him, if he sees in them the means of augmenting his material prosperity. As a result of this attitude one finds that the situation in the United States differs from that in Europe.

In the first place, there has been a great increase of output per head since the War, due to the improvement of machinery and the more economical use of the forces of production, while on the workers' side there has been a reduction of hours and a rise in real wages. The American workman, so far from offering resistance to mechanical progress, has frequently promoted it, and some trade unions even employ their own experts on scientific management, to which until recently they were violently opposed.

Secondly, the purchase of stocks by employees has developed in a remarkable way. One American economist calculates that, whereas shareholders with an income between $1,000 and $5,000 only received $38,000,000 or 1·8% of the total dividends reported in 1916, they received in 1921 no less than $562,000,000 or 22·7%. To illustrate this point, it may be mentioned that out of the 60,000 employees of Armour & Co. 40,000 are stockholders. In the Philadelphia Rapid Transit Co. 11,000 employees held over $10,000,000 worth of stock in 1925, more than double the value of their holdings in the previous year. Similar instances could be multiplied to show that the American worker is becoming a holder of capital.

Workers' Investments.—Thirdly, labour has initiated its own banking movement. The first labour bank was founded at Washington in 1920; at the end of 1924 there were 33 already in existence, with resources estimated at about $150,000,000. The leading part in this movement was taken by the Brotherhood of Locomotive Engineers, one of the strongest American trade unions, under the leadership of Mr. Warren S. Stone. Their objects, as he states them, are simply to offer the working man safe custody for his money and sound advice for its investment. But it is calculated that the American workers are in a position to save from $6,000,000,000 to $7,000,000,000 annually, and Mr. Stone asserted that " if they would save and carefully invest their savings, in 10 years they could be one of the dominating financial powers of the world." This suggests possibilities in labour banking which are at least still far from being realised. The experiment is yet in its childhood, but whatever its final form it must exert a considerable influence on the psychological attitude of American labour towards capitalist enterprise.

Co-operation Rather than Warfare.—Mr. Stone defined three phases in the trade-union movement. The first two—organisation and the struggle for collective bargaining—are familiar in all industrial countries. " The third cycle or phase," he says, " lies in constructive development towards a system of co-operation rather than war; and the most striking evidence of this phase is the labour bank." Though we have seen some evidence of a similar tendency in Great Britain and Germany, it is only in America that the labour movement seems to be consciously and openly adopting a co-operative policy. In doing so they are not abandoning the goal of securing an even larger share in the control of industry, but their method of approach is entirely different. Instead of preaching the destruction of capitalism, they are aiming at its peaceful penetration. Prof. Carver, of Harvard, goes so far as to claim that " the only economic revolution now under way is going on in the United States. It is a revolution that is to wipe out the distinction between labourers and capitalists by making labourers their own capitalists."

This is probably an overstatement of the case, but it is certain that the policy of co-operation with capital and of intensifying production is looked upon with favour by the American Federation of Labor. The last report of their Executive Council, after defining collective bargaining as the first function of trade unionism, states that " there is a still more important function that the union can render—that of participating in finding better methods of production and greater production economies." It recommends that the Baltimore and Ohio scheme of union-management co-operation should be closely studied and the advice of experts on shop management systematically sought. The Executives even recommend that their members should take part in works committees in establishments where the trade union is not recognised, on the ground that they promote solidarity among the workers and may thus assist trade union

organisation. Mutual confidence between employer and employed are essential in order that the latter may be assured a fair return for the increased efficiency which he helps to secure, but on this condition co-operation to promote industrial prosperity is put forward as the policy to which organised labour should give a fair trial.

It would be hazardous to conclude, however, that industrial relationships in America are definitely set in the path of conciliation and co-operation. The phenomena which have just been briefly reviewed are not universal in character and have occurred during a period of overwhelming prosperity. How far they may be its cause or its consequence is an undecided question. Some observers think that the enthusiasm of labour for high production would be killed by a period of trade depression; others that it depends for its maintenance upon the uninterrupted progress of mechanical invention, which by multiplying production without increasing prices has given the American worker a steadily rising standard of living. All that can be safely said at the moment is that the United States is experimenting boldly with a new relationship between employer and worker and that the success already achieved is sufficient to make its further development a matter of obvious interest and importance.

V. CONCLUSION

This bird's-eye view of the development of industrial relations seems to suggest that they are now entering a critical, perhaps a decisive, phase of their history. Just as the end of the War ushered in a new era in international politics, so it may be destined to mark a new point of departure in the politics of industry. It is certain that, like all other human institutions, they cannot remain stationary. Either they must develop further on the lines of conflict rendered constantly more menacing to the community, as the strength and resources of the organisations of both sides increase and become growingly capable of exerting pressure on its vital organs, or alternatively conflict must give place to co-operation based on the recognition of the essential partnership of labour and capital and on their common interest to stimulate production, if they are to survive in an age of aggravated competition. Whereas before the War the signs of this latter tendency were barely discernible, clear evidence of its growth has been shown to exist to-day in Great Britain, Germany and the United States. A similar movement may be found in other industrial countries such as Czechoslovakia, Austria and Norway, where compulsory works councils are in operation, or in France, where there are voluntary councils in many factories. But it is much too soon to suggest which of the two tendencies will prevail. The decision between them will only be slowly worked out over the coming decades. The ultimate answer will determine for good or for evil the future course of our industrial civilization.

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INDUSTRIAL RESEARCH: *see* RESEARCH, INDUSTRIAL.

INDUSTRIAL SCHOOLS.—In Great Britain children may be sent to industrial schools on such charges as found begging, found wandering and not having any home, found destitute and having parents undergoing imprisonment, found in the care of a parent or guardian of criminal or drunken habits, frequenting the company of a reputed thief, residing in a disorderly house and for more serious offences, such as theft, larceny, housebreaking.

Industrial schools tend to approximate more and more closely to the ideal of residential elementary schools, situated in pleasant surroundings in rural districts, for the attendance of children suffering from parental neglect, or subjected to an environment likely to cause delinquency or criminal habits. The schools are inspected by the Home Office and the Board of Education, and as far as possible " institutional " life is eliminated. As much freedom is allowed as is consistent with the maintenance of order and good conduct, and the clothing supplied is similar to that worn by ordinary school children.

School Routine.—School routine, as a rule, consists of general educational work and vocational training in equal proportions. Sports and games are encouraged. The trades and occupations taught to boys are tailoring, shoemaking, carpentry, farming, gardening and instrumental music; a few of the institutions are training ships. Girls are trained in all branches of domestic work. The after-careers of the great majority of industrial school children are satisfactory, and many of the children obtain lucrative and congenial employment. With the decline in truancy, truant schools have been discontinued, and truants are usually committed, in London and elsewhere, to industrial schools until they reach the age of 16.

Boarding-out.—Many education authorities have adopted schemes providing that children under eight years of age who are committed to industrial schools shall, whenever conditions are suitable, be boarded-out with foster parents. By this arrangement the children receive the advantages of home life, generally in rural surroundings, and can attend the local elementary schools. In 1925 nearly 300 London children were boarded-out with foster parents. Cordial and often enduring relations are formed between the children and their foster parents.

Statistics.—The number of persons dealt with in juvenile courts has decreased during recent years. In 1913, proceedings were taken against 37,520 children. During the War the number reached the high-water mark of 51,323 in 1917. There has since been a gradual decrease; in 1924 the number was 29,624. The majority of the " 1924 " children were dealt with as follows:—

Fined	9,190	Bound over . .	2,410
Dismissed . . .	6,560	Ordered to be whipped	607
Placed on probation .	5,812	Sent to reformatories	529
Charge withdrawn .	3,779	Sent to industrial schools	526

The decrease in the number of charges may be attributed to improved social conditions, increased and more efficient organisation of children's care work, and the development of the national system of elementary education. There has also been a large decrease in the number of committals to industrial or reformatory schools in proportion to the number of children charged, largely due to the greater use now made by the courts of the powers conferred by the Probation of Offenders Act, 1907. Magistrates hesitate to remove a child from its home unless they are satisfied beyond doubt that such a course is in the best interest of the child. (*See* CHILD LABOUR AND WELFARE.)

(G.H.GA.)

INDUSTRIAL WELFARE AND MEDICINE.—Human beings possess intelligence, and their health depends on psychological as well as on physiological environment. Mental and physical activity are necessary to health. From the industrial point of view both require to be maintained in order to ensure efficiency, which spells for an employer a contented personnel and for the employed physical health and a " worth while " life. Appreciation of this point of view has in recent years been expressed through different activities aimed at maintaining mental contentment and physical health, at preventing sickness and mortality, and at restoring the sick to health; these lines of activity are not mutually exclusive. They may for convenience be considered under the headings of Industrial Welfare, Industrial Fatigue and Industrial Medicine.

I. INDUSTRIAL WELFARE

This entails not merely compliance with statutory requirements as to the provision of specified accommodation, but the task of getting each worker to take an intelligent interest in his own health and efficiency, in that of his fellows and in that of the establishment to which he belongs. The movement, which was only embryonic before the World War, received great impetus in Great Britain from the recommendation of the Health of Munition Workers' Committee that welfare work should be adopted for munition workers, and from the series of memoranda the committee issued explaining how the work should proceed.

Progress in Wartime.—A department was created in the Ministry of Munitions to develop the scheme which at first was particularly pursued for women, girls and boys. Welfare supervisors were appointed to supervise (*a*) needs within the factory, and (*b*) needs outside the factory. The work within the factory covered the selection of workers for engagement; supervision of general behaviour; of progress and apprenticeship; of transfer and disposal of workers; of general cleanliness, ventilation and temperature; of canteens; of ambulance, rest-rooms and first-aid; of cloak-rooms and sanitary conveniences and of overalls. Outside the factory it covered housing accommodation, transit facilities, sick visiting, recreation and education. The keeping and studying of personal records of earnings, sickness and accidents was organised. Welfare committees composed of workers were found invaluable to the activities of the superintendents. The scheme was first developed for national factories, but the stimulus to private firms of financial assistance from excess profits duty helped greatly to wider extension of the policy.

While activity on these lines, which came to an abrupt termination on the cessation of hostilities, was still in progress, the Home Office, in 1916, consolidated much of the ground won by obtaining powers under the Police, Factories, etc. (Miscellaneous Provisions) Act, 1916, enabling the Secretary of State by order to require occupiers of factories to make reasonable provisions relating to "arrangements for preparing or heating and taking meals; the supply of drinking water; the supply of protective clothing; ambulance and first-aid arrangements; the supply and use of seats in workrooms; facilities for washing; accommodation for clothing; arrangements for supervision of workers." Under these powers 14 orders have already been made concerned with the special needs of different industries. At the same time a series of valuable pamphlets have been issued to set forth how the requirements of the orders can be complied with. Action on these lines continues; but already some matters have become of general application, thus drinking water must now be supplied in all factories, while the provision of first-aid has become generally compulsory under the Workmen's Compensation Act, 1923.

Extension of Voluntary Welfare.—Meanwhile activities which may be called "voluntary" welfare have extended, notwithstanding the tendency during trade depression to hold back from new ventures. At least 1,000 firms to-day have welfare workers, as compared with about 30 in 1913. Housing efforts, recreation grounds, institutes, educational schemes, nurses and sick visiting, canteens and dental clinics at factories, all provide examples of extension of factory welfare without legal compulsion. In these ways modern industry is recognising that well-directed welfare is an economic proposition and makes for contentment.

The Mining Industry.—Reference has so far been confined to the welfare movement in reference to factory employment; but action has not been confined entirely to this field. In England in 1872 the Metalliferous Mines Regulation Act called for the provision of accommodation for enabling persons employed in metalliferous mines to dry conveniently and change their clothes. In 1910 the Mines Accidents (Rescue and Aid) Act gave power to make orders relating to: (*a*) The supply and maintenance of appliances for use in rescue work, and the formation and training of rescue brigades; (*b*) The supply and maintenance of ambulance appliances and the training of men in ambulance work.

The Coal Mines Act of 1911 contained, too, an important clause providing for accommodation and facilities for taking baths and drying clothes where the majority of workmen employed in a mine desire such. Unfortunately this clause was a dead letter except at some half-dozen collieries. But under the Mining Industry Act, 1920, welfare work for miners received a great impetus. This Act provides a fund, derived from a levy of 1d. a ton on the output of each mine every year, to be applied for purposes connected with social well-being, recreation and conditions of living of workers, and with mining education and research, and with such purposes as the Board of Trade may approve; but the provision of dwellings is expressly excluded from such purposes.

The fund amounts to about £1,000,000 a year; its allocation is directed by an independent central committee on which both miners and colliery owners are represented. Four-fifths of the contributions coming from each coal-field must be spent within that field: the remaining one-fifth of the fund is devoted to welfare matters of mutual interest to the whole industry, such as the promotion of research into safety and health, and the provision of higher education for miners and their families, to each of which purposes the central committee has set aside approximately £500,000 out of the first five years' contributions to the fund. Expenditure from the fund is now year by year keeping pace with contributions. The Act of 1920 was due to expire in 1925, but the success achieved by the activities thus instigated has led to prolongation of the life of the levy to the fund for a further five years.

The total credits of the fund on Dec. 31 1925 amounted to £4,740,339; and apart from the £100,000 already mentioned, allocations had been made for district purposes as follows:—

Description	Total Number of Schemes	Total Number of Allocations	Money Allocated
Recreation (chiefly recreation ground and institutes) . .	844	1,455	2,027,564
Health (convalescent homes, pithead baths, ambulance and nursing services, etc.) . .	126	198	958,771
Junior education . . .	18	25	26,362
Expenses of district committees	..	96	25,464
Total	988	1,774	3,038,161

The research is directed by a safety-in-mines research board, acting in collaboration with a health advisory committee; higher education is effected by assistance given to local education authorities and universities.

The central committee consults with district committees concerning the amount and purposes of grants in each district. Interest attaches to the items shown on the table just given. They display the activities of the fund as progressing (with the one exception of a few allocations for pithead baths) on needs *outside* working hours; while progress in factory welfare made under statutory orders is extending with regard to needs *within* working hours. The contrast is sharp.

A Comparison.—In the case of factories voluntary effort is forwarding outside welfare schemes; but in the mines no similar efforts are taking place with regard to such needed inside welfare as the provision of drinking water, improved lighting, pithead baths or kitchens.

The procedure followed in these two lines of advance is also in contrast. Factory welfare proceeds through statutory orders, compliance with which can be enforced; while mining welfare consists of activities, originated and pursued by the mining community, but financed through a statutory levy. Thus the activities pursued for munition workers have been diverted into two separate streams. Still all welfare activities, in addition to their wide social aspect, undoubtedly exert a powerful influence in promoting industrial health.

II. INDUSTRIAL FATIGUE

The maintenance of health in industry, especially with regard to women and young persons, has always been a driving force in

our code of legislation controlling factories and mines, but its close study is practically a new science, known technically as the study of industrial fatigue. In Great Britain the study is to-day pursued on general principles by the Industrial Fatigue Research Board, an integral part of the Medical Research Council. This board came into existence in 1918, owing to appreciation of a national need for intensive investigation to which attention was directed during the War by the activities of the Health of Munition Workers' Committee. Problems of interest to particular establishments are tackled by the National Institute of Industrial Psychology (*see* INDUSTRIAL PSYCHOLOGY). Much practical knowledge as to human activity, embodied in over 30 reports issued by the board, and in the Journal of the Institute, has been placed on a scientific basis.

Certain points may be succinctly stated: work is necessary to health, and health is needed for efficient work; even steady work is better than spasmodic efforts; an optimum temperature, which should vary about a mean, exists for each process and is associated with best output, least sickness and fewest accidents; ventilation is to be read in the stimulating effect of air movement, rather than in change of air; rest periods during long spells of work, particularly if posture is changed, may increase output and lessen monotony; monotony in repetitive work, in temperature, in ventilation, in long spells of activity without pauses, and even in food supply, is disadvantageous; good factory canteens improve health and output; change of personnel, *i.e.*, labour turnover, reduces production and increases lost time due to sickness and accident; suitable overalls create pride in work and in person; vocational training adds joy to work; vocational selection on engagement increases output and reduces labour turnover; certain workers exhibit a predisposition to sustain accidents and should be employed only where accident-risk is at a minimum; the tendency to sustain accidents is associated with a tendency to fall sick.

The introduction into industrial organisation of such knowledge promises rapidly to revolutionise industrial management, and to prove the health-value to the community of well-conducted occupations. More knowledge as to the laws of human activity remains to be acquired; but by adopting what is already known, industry will prove to be our most powerful influence for maintaining public health.

III. INDUSTRIAL MEDICINE

Industrial medicine is concerned with the prevention of sickness and the restoration to health of the disabled. Prevention calls first for determination of causes, and is based on information gathered from various sources. Thus, the occurrence of industrial accidents must be notified by employers to inspectors of factories and of mines. Modern research into data so collected has enabled important protective measures to be adopted, and has also established the tremendous importance of personal, as contrasted with mechanical, factors; they account for 80% of industrial accidents. Further, just as in the case of sickness, the newly employed and those who are not-quite-well are disposed to sustain accidents, while some workers exhibit a definite predisposition to get hurt. Action should, therefore, aim at interesting workers in accident prevention through the safety-first movement (*see* SAFETY FIRST), at reducing labour turnover, at maintaining health, and at eliminating the susceptible. Under the heading of accidents are here included sudden gassings, *e.g.*, from carbon monoxide, nitrous fumes and arseniuretted hydrogen, as well as caisson disease.

Occupational Diseases.—Information as to the occurrence of certain occupational diseases, *e.g.*, anthrax, toxic jaundice, chrome and epitheliomatous ulcerations, and poisoning from lead, mercury and arsenic, is obtained from notification sent by practitioners to the chief inspector of factories. Lead poisoning is the leading instance; it has been used, on account of its specific effect upon women, as a stalking horse for legislative advance against industrial poisons; its causation, displayed by study of notified cases, has now been narrowed down to inhalation of dust and fumes containing lead. Measures adopted to prevent the generation of dust or to keep it under control, have proved so successful that lead poisoning in factory industries has lost most of its terrors; only where measures have not been, or cannot be, adopted, as in the house-painting industry, is it still a serious occupational menace; but constant alertness is needed to perfect the protection of those employed as new processes come into vogue, *e. g.*, the use of the oxyacetylene flame to cut through steel plates coated with lead paint when breaking up old ships.

Compensation claims for diseases named in the Schedule to the Workmen's Compensation Act, 1906, give information concerning the occurrence of other diseases, of which certain troubles which particularly concern coal-miners are the most important, *i.e.*, nystagmus, and miners' beat knee, beat hand and beat elbow. Here recent investigation into causation is ahead of prevention; thus, the distressing trouble, nystagmus, of which the manifest symptom is involuntary oscillation of the eyeball, is associated with work for long periods in imperfectly lighted galleries of coal-mines; the worse the illumination, the greater the prevalence of the disease. Owing, however, to the danger of explosions from mine-gases, the problem of improving the lighting underground is not a simple one (*see* COAL; MINING).

Cataract.—In contrast stands another compensatible eye trouble, cataract, which occurs among glass blowers and furnacemen exposed to glowing heat. Here means for prevention are known; they consist in wearing spectacles, the glass of which has been specially devised for cutting off heat rays but difficulty arises in getting the workers to use them.

Phthisis.—Further knowledge is drawn from occupational mortality records. They reveal any undue prevalence among a group or groups of workers of some particular cause of death; phthisis is the most notable example (*see* TUBERCULOSIS). Recent statistical investigation has shown that when this cause of death (*a*) is the only one in excess, its undue prevalence is due to the spread of infection among persons whose daily work brings them close together, *e.g.*, in tailoring, printing and making boots and shoes; (*b*) is associated with excessive death-rates from other lung diseases, and occurs later in life than usual, as happens among sandstone masons, gold-miners, tin-miners, grinders of metal, some pottery workers and others, its excessive prevalence is due to inhaling fine dust of silica, which sets up a condition in the lungs known as silicosis, a condition which takes some years to develop and predisposes its victims to tuberculous infection; and (*c*) is associated with excessive death-rates from all other causes of death, and occurs rather earlier in life than usual, as occurs among publicans and inn-servants, its undue prevalence is caused by excessive indulgence in alcohol.

Knowledge of causation in each case points the way to prevention: (*a*) Commodious, well ventilated and lighted premises, associated with medical examination to eliminate the tuberculous, will rid tailoring, printing and shoe-making from the scourge of phthisis. (*b*) Reduction to a minimum of risk from breathing silica dust must abolish silicosis; the problem now belongs to the technical engineer and is being solved in certain industries. Compensation is granted for silicosis on the South African gold mines, on the Broken Hill mines of Australia, in Ottawa, Canada, and in Great Britain in the refractories industry under the powers of the Workmen's Compensation (Silicosis) Act, 1918, which may be extended to other industries. The financial burden of compensation is promoting active attention to dust prevention and control. (*c*) Limitation of alcohol consumption, such as has been taking place in this country in recent years, and could be extended, has already reacted not only upon the occurrence of phthisis in industry, but also of ill health from other causes, including accidents.

Cancer.—Another disease to which mortality records have directed attention is occupational cancer (*see* CANCER). Workers who handle pitch, a distillation product of gas-tar, and others who mix pitch with coal-dust in the manufacture of briquettes, suffer from warts which appear on the exposed parts of the skin, and also on the scrotum. These warts show a special tendency to become epitheliomatous with the formation of " pitch " cancer. Shale-oil workers coming in contact with crude paraffin,

a product obtained by distillation, similarly suffer from warts and "paraffin" cancer; but workers manipulating refined paraffin do not suffer. Chimney-sweeps have long been noted for their high death-rate from scrotal cancer which originates from exposure to soot, a distillation product of coal. Quite recently an equally high mortality from scrotal cancer has been revealed among mule-spinners in the cotton trade due to contact with lubricating oils, possibly obtained from shale. Cancer of the lips and buccal cavity is nearly confined to males who by smoking expose these parts to the distillation products of tobacco. The evidence here summarised suggests that certain products obtained by distilling vegetable substances can sensitise the skin to cancer, *i.e.*, to the filter-passing virus now known to be the specific agent concerned.

Evidence from the dye industry suggests that the products in question may possibly be benzene compounds. Workers in this industry exposed to certain amino-benzene compounds, particularly benzidine and naphthylamine (compounds which, when they gain access to the body, are excreted by the kidneys), have been found to develop malignant tumours of the bladder. The new growths which occur on the skin in the tar cases, and in the bladder in the dye-workers, have certain features in common: at first there is a simple hyperplasia; the exact moment when malignancy supervenes is a matter of doubt; and metastasis is the exception. Possibly we have in these benzene compounds instances of substances which, by modifying tissue growth, possess the power of preparing the way for the cancer virus.

More recently still lung cancer is reported among arsenic and cobalt miners in Saxony, possibly due to radium emanations from inhaled dust. To radium emanations is also described necrosis of the jaw, a most painful disease, among workers applying luminous paint.

Effects of Treatment.—Treatment during the early stages of illness and injuries sustained in occupation is not peculiar to industrial medicine, even though recent advances in orthopaedic surgery have been of great benefit to those manually employed. But in a few cases treatment is special to the disease, *e.g.*, the onset of caisson disease can be met by immediately resubmitting the victim to the high pressure atmosphere from which he has just too rapidly emerged; or, again, persons overcome by carbon monoxide gas can be best brought round by the new method of administering a mixture of oxygen and carbon dioxide through artificial respiration; while burns caused by acids or alkalis, which must be specially neutralised before ordinary treatment is applied, may be added to the list.

Convalescence.—The convalescent stage on the contrary may be profoundly expedited by occupation, particularly where recovery is slow and tedious. The industrial convalescent tends either to return to work too soon before he is ready for full employment, when he may quickly break down again, or, by saving himself, develop bad habits; or to delay—particularly if he is receiving compensation—until he has lost skill, developed some permanent stiffness, or become neurasthenic. He needs, at an early stage, amusement to divert his thoughts; next, occupational therapy, in which work is performed for wages during limited hours, in order to occupy his mind and assist in restoring lost or weakened function, *e.g.*, a hand stiff after a wound; or lastly, vocational training for new work when he cannot return to his previous occupation.

Occupational Therapy.—At each stage industry can play its part, but with regard to occupational therapy and training it is the only available agency. "After-care" in workshops, and special settlements for those discharged from tuberculosis sanatoria is pointing the way, which is equally valuable for orthopaedic, mental and other cases. The need for occupational therapy and vocational training is rapidly coming to the front both in Great Britain and America; and industry is being called upon in its own interests in order to regain skilled workers, in the interest of the patients, and of the community on which they must otherwise be a charge, to play its part in restoring to usefulness those who have broken down in its service and must either regain their strength anew or start life afresh.

IV. WELFARE AND MEDICAL SERVICES

The need for welfare supervisors in factories is now well recognised; and, even though trade depression in recent years has held in check the creation of such posts, they continue to increase in number. The duties attached to the post must determine the staff required, but the following scale is some guide:—

Welfare supervisors for women and girls: up to 300 workers, one welfare supervisor; a further 300 workers, one assistant supervisor; a further 450 workers, a second assistant supervisor; a further 600 workers, a third assistant supervisor.

Total 1,650 women and girls, one senior welfare supervisor and three assistants. After this number one assistant should be added for every 600 workers. Welfare supervisors or apprentice masters for boys: up to 100 boys, one welfare supervisor; a further 200 boys, one assistant supervisor; a further 350 boys, a second assistant supervisor; a further 500 boys, a third assistant supervisor.

Medical Service.—Medical service in factories commenced with the appointment of certifying surgeons under the Factory Act of 1844, but it has not advanced with the importance of the work. A proposal was embodied, however, in the last Factory Bill, which may appear in the next consolidating Factory Act, to modify these posts in such a way as may be expected to improve the service. Already a few firms are employing whole-time medical men, and others part-time, to render service far in advance of anything now contemplated by legislation; they find the return from such service far outweighs the cost. The duties which must determine the size of the medical staff, often include examination of new comers, treatment of injuries and sickness originating on the premises, re-examination after a period of absence, ambulance lectures and organisation of first-aid treatment, health inspections of every part of the premises. Such duties for a personnel of 2,500 at an engineering factory are found to provide ample work for one whole-time medical officer. It is significant that no firm that has once established a medical service, has been known to abolish it; the tendency is rather to extend it. Closely allied comes dental service at factories, which is steadily increasing on account of the better health and time keeping which the service gives.

The varied activities outlined above, viewed as a whole, present an interesting and rapidly growing influence for good. The 19th century saw attentions directed to perfecting the power-driven machine and the industrial process, while the health and comfort of the worker were comparatively neglected. The seeds of deep-seated disaffection, a manifestation of ill-being, were thereby sown. To-day advances in processes and in machinery continue, but the need is being grasped for attention to the human machine. In industrial health lies the solution of many problems.

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INDUSTRY, WAR CONTROL OF.—Government control of industry has appeared sporadically in every important war of modern times, under the form of commandeering of supplies and means of transportation and production. It has also occasionally assumed the form of price-fixing. But, except in the rare cases of cities under siege, governmental control never assumed the form of a general system, dominating the whole economical life

of a belligerent nation, before the World War of 1914–8. In that War the general control of industry was inaugurated promptly by Germany, after a considerable delay by France and England, and, after many half-way measures that proved ineffective, by the United States in the last year of the War. In the case of every belligerent nation the extension of control was a gradual process, which had by no means reached its logical limits when hostilities came to an end.

The conditions that forced control of industry upon the several warring nations were:—

1. Universal conscription, with its tendency to disorganise all industries, essential and unessential alike, by the withdrawal of the most energetic labourers and " key-men " in the technical and administrative staffs;
2. the vast consumption of material and equipment under the technical conditions of modern warfare;
3. the insatiate demand for financial resources for maintaining and supplying the huge armies in the field and the services incidental to them;
4. the maintenance of the health and spirit of the working civil population through the provision of the necessities of life at practicable prices.

While the conversion of national industry to the uses of war was nowhere complete, it is a conservative estimate that in all the chief belligerent states from three-fourths to four-fifths of all industry was by the time of the Armistice converted to the meeting of war requirements, direct or indirect.

I. GERMANY, FRANCE AND THE UNITED STATES

Germany.—The first systematic action toward industrial control was taken by Germany. Upon the declaration of war by England it became at once evident that overseas supplies of raw materials, on which German industry had become largely dependent, would be cut off. The conservation of supplies on hand and their appropriation to essential uses was imperative. Within a fortnight, at the instance of Walter Rathenau, the Government, in co-operation with the cartels, had completed a rapid survey of the material resources of the nation and had worked out a policy, based partly on the requisition of materials and plant, but mainly on voluntary agreements, which offered a reasonable assurance of the continuous supply of military necessities on the scale then contemplated as adequate—erroneously, as the development of the War proved. Through the Reichsbank and the system of financial institutions dependent on it the necessary credit was supplied without stint to all industrial enterprises regarded as essential for war. The mobilisation plans provided from the outset for the exemption of " key-men," technical and administrative, and the suppression of unessential industries provided labourers to take the place of those who had been called to the colours. On Dec. 2 1916, the control of industrial resources was strengthened by a law instituting an industrial conscription of labour, applying to all males between 16 and 60. Auxiliary measures stiffened Government control over industrial enterprises. But to the end of the War the essential basis of industrial control was the quasi-voluntary agreement between the Government and the independent business man or group of business men, with a reserve power of compulsion in the Government's hands resting on the control of materials, credit and labour. This power of compulsion served to secure supplies, but did not restrict prices so strictly as to preclude large war profits, with attendant manifestations of popular discontent that grew more serious as the War dragged on.

France.—In France the outbreak of the War was followed by a mobilisation of men for military service which took the experts and " key-men " out of industry along with those who could be easily replaced. In consequence economic life was seriously dislocated. Unemployment reached extraordinary proportions. After the mobilisation in Aug. 1914, the principal industries employed on the average only 60% of their normal personnel, and as late as Jan. 1915, 20% of the industrial working population was unemployed.

French industry, being highly individualistic in spirit, was far slower than that of Germany to adjust itself to war needs and war control. Gradually, however, a machinery of control was set up, of which the most effective part was the disposition of manpower. Committees of economic action composed of business men and engineers were organised in the several departments, to co-operate with the military and administrative authorities in supplying labour to agriculture and the essential industries.

Price control, so far as the munitions and supplies for the army were concerned, was effected through contracts, with sufficient reserve power over labour, raw materials, transportation and credit on the side of the Government to ensure reasonable terms. The prices of products for the use of the civil population were subject to an informal and inadequate control through the departmental committee of laymen co-operating with the administrative authorities. In neither case was the control rigid enough to check a rise in prices, which produced much discontent among the workers, whose wages did not rise in equal proportion.

United States.—The situation in America, upon her entry into the War, was in many respects peculiar. The Allies had already attained to a practical maximum of their industrial war effort, and the demands of war were still rapidly expanding. In this effort American industry had already come to play a conspicuous part. Allied war industry was drawing heavily on America for steel, copper, cotton and a large class of wholly or partly finished war materials. A powerful chain of war industries had been built up in America; labour and materials were rapidly advancing in price, and profits rose on a huge scale.

The American Govt. was forced to meet the problem of supplying the American armies with the materials of war without cutting off the supplies needed by the Allies. Control was essential not only to national but to international ends. Whereas in the early part of the War each belligerent had aimed primarily at effecting the most practicable distributions of resources between its own military and essential civil uses, the United States from the outset was confronted with the problem of making the best practicable distribution among the military, Allied and essential civil uses. American control was bound to envisage the entire system of needs of the Allied and Associated Powers.

More fundamentally, the United States represented the last reserve of men, munitions and money. There was no possibility of making good deficits in production from any neutral source, except, of course, that certain raw materials like the nitrates of Chile had to be drawn from neutral territories. In the circumstances the need for thorough-going control of industry was peculiarly vital.

The difficulties to be overcome in instituting control were, however, all but insurmountable. No close relation between government and industry had been developed, as in Germany; neither was the American administrative system adapted to prompt co-ordination. At the outbreak of the War the army and navy, each enjoying the power of commandeering, were in a position to enter the market for supplies, in competition with the Allied purchasing agencies, and there was no authority anywhere competent to allocate limited supplies in the order of importance of needs or to keep prices within bounds. A council of national defence, consisting of the Secretaries of War, the Navy, the Interior, Agriculture, Commerce and Labour, with an advisory council and a widely ramifying organisation of committees, of executives and experts, had been created prior to the declaration of war. Out of this grew a multiplicity of organs of control, a War Industries Board, a railway control, a control of ocean tonnage, a food administration, a fuel administration and a War Trade Board. But there was no central co-ordinating principle except the war powers of the President, which in the nature of the case could be exercised only sporadically.

Co-ordinated control of industry came into existence on March 4 1918, when the President, by a letter, reorganised the War Industries Board and specified its duties, constituting it in effect the administrative organ with power to apply the President's war powers over industry. Mr. Bernard M. Baruch was named by the President chairman of the board, with direct responsibility for its functioning, the other members of the board to act in an advisory capacity.

As finally reorganised the board controlled the exercise of the power of requisitioning. The army and navy, the railroad administration, the food and the fuel administrations, the War Trade Board, the Shipping Board, the War Finance Corporation, the Allied Purchasing Commission and other agencies dealing with industry, were required under the President's orders to co-operate with the War Industries Board. Thus it became possible to secure effective co-ordination in the whole field of industry. The board was in a position to control exports and imports, the movement of traffic over the railways and coastwise shipping; it was able to ration out materials, fuel, power, credit facilities to every business establishment in the country, to place a check upon every construction enterprise, public or private, except on proof of absolute necessity, to standardise production in the interest of economy, and in short to do everything necessary to ensure that the resources of the nation at war should be applied most effectively to the national needs, both of the people as a whole and of the military forces.

In America direct authority to fix prices was never granted by law nor established by executive order. The War Industries Board had, however, sufficient power to control prices in effect, and in case of need it actually controlled them. No specific theory of fair prices lay behind the board's control, but a conception of efficient economic organisation for war. The standard toward which price-fixing was working in its last phase was one which would have permitted peace-time profits and wages but nothing more. The problem of price-fixing in the United States was greatly increased because prices had already reached a very high level before America entered the War.

Labour.—War control of industry in its highest phase of development amounted in effect to nationalisation of economic resources, labour, capital, material things. Men could not work at what they liked best or put their capital to the most lucrative uses or sell their materials and goods to the highest bidder. They were called on to subordinate their private interests to the national needs. The conception of public service became generalised, as it were, and although with the end of hostilities private motives were again given free play, the conception of service retained a large measure of its vitality, exerting a considerable influence upon action.

Labour, conceived of as "man-power," won recognition early in the history of war control as the most vital of the national resources. The proper provisioning of labour, care for the health of the labourer and his family, maintenance of proper housing standards and the like, assumed the rank of military necessities. Here too the influences set in motion in war carried over into times of peace. In no country did public opinion settle back into its old indifference to the requirements of labour. It would be hardly an exaggeration to say that the ideal of a living standard of wages attained a new influence through the experience of war control.

Permanent Economic Results.—One of the most striking results of war-time control was the revelation of the extent of economic waste in the conventional scheme of production. By co-ordination, concentration of effort upon essentials and by curbing of excessive variety in forms through standardisation, it became possible for the United States, while maintaining 4,000,000 men under arms, to supply the civil needs of its population with no appreciable lowering of peace-time standards. While recognising that such extreme application to practical needs would in the long run be deadening to industry, most leaders of industry came out of the War convinced of the necessity of eliminating much waste that had gone unnoticed in the pre-War period.

War control of industry promptly fixed in the minds of those who participated in its decisions a conception of international economic interdependence. Control of the resources within a nation led straight to the necessity of controlling exports and imports, and this in turn led to an understanding of the need of permanent economic relations under which all nations might have equal access to the raw materials of the world. This remains a problem, the solution of which will tend to lessen the chances of war.

Another result of the war-time control was the more systematic survey of the potential resources, and their development where at all practicable. As a consequence, many resources are being developed in peace that formerly had been neglected. War control, with its compulsion to the use of substitutes, gave a greater freedom and elasticity to production, making a higher degree of efficiency possible in peace time. Incidentally to the control of industry, financial institutions, money and credit were everywhere subjected to control, with the result that new and more efficient methods of handling specie reserves and managing the flow of credit were devised and added to the normal equipment of peace times.

Some countries, finding themselves cut off because of the War from their usual sources of manufactured articles, soon learned to make these things for themselves, with the result that when peace returned the old manufacturing countries found that a part of their former markets for manufactured articles had been permanently lost. And so with raw materials; new sources of supply and substitutes were found. Thus, international trade is a longer time finding its normal ebb and flow.

For the most part the achievements of war control were made possible only by the solidarity of feeling and concentration upon national purposes engendered by extreme national necessity. No conclusions as to national control in peace time can be deduced from them. What may be deduced from the experience of the World War is that war under modern conditions demands drastic control of industry. War cannot now be conducted incidentally with business as usual. (B. M. B.)

II. CONTROL IN GREAT BRITAIN

During the first two years after the outbreak of the War comparatively few changes of importance were made in the British industrial and commercial system. In general, reliance was placed on the pre-War method of stimulating supplies to meet Government requirements by means of high prices. The slogan "Business as usual," which began as a useful injunction to people to keep their heads, exercised later a harmful influence in retarding the necessary transformation of industry and its subjection to an organised control without which the War could not have been won. The chief factors which finally overcame the resistance, not only of the business community, but also of the Government itself, to any drastic interference with industry were: (1) the rise in prices, which threatened to increase the cost of the War to an intolerable extent; (2) the competition of the civilian demand with vital requirements for war purposes; (3) the attitude of labour—the necessary corollary to "business as usual" is "strikes as usual"; (4) above all, the need for economising tonnage after the inception of the unlimited submarine campaign in Feb. 1917.

Fixing of Prices.—Unlike Germany, which began with the control of raw materials and was later driven to a (very inadequate) control of manufacturing processes, in Great Britain control started with the fixing of the prices of finished products and was then extended inevitably through each stage of production until it reached the raw material. Cost accountancy played an exceedingly important part in the British system of control. For each process of manufacture conversion costs were established, based on careful investigation, which allowed a reasonable profit to the normal firm. The restriction of profits on Government contracts increased the attractiveness of the civilian trade in which prices were not regulated, and, besides prejudicing military supplies, gave rise to great inequalities in the treatment of different firms. This led to powers being given under the Defence of the Realm Acts to the Government to requisition the output of any firm—which in turn immediately brought to the front the question of raw material prices. It was realised that a stable basis must be obtained on which to build up the series of conversion costs. Hence the Government was forced to purchase or control the supplies of the principal raw materials of industry so as to be able to allocate them to manufacturers at fixed prices. One of the greatest of these operations was the Government purchase in 1916 and following years of the

whole of the British and Australasian wool clips (*see* Wool). By the end of the World War over 90% of the total imports into Great Britain were brought under the control of the War Office, the Ministry of Food, the Ministry of Munitions, the Board of Trade and the Admiralty.

In the munition industries the price of iron and steel was fixed in 1916, and the continual increases in the costs of production due to rising wages were met by subsidies to the producers. No private business was allowed to use any of the necessary raw materials without a certificate or licence from the Ministry of Munitions. The engineering industry was reorganised on a very comprehensive scale, and government factories were set up in great numbers. The experience obtained in these factories as to exact costs of production was very valuable in enabling prices of contracts given to the great armament and other outside firms to be reduced during the course of the War in spite of increases in wages. The labour problem, which was especially great in the engineering industries, was met, on the one hand by the suspension (for the duration of the War) of trade-union restrictions on women's labour, output, etc., and by a great restriction of the right to strike; and on the other hand, by the power given to the Government to declare any establishment to be a "controlled establishment" under the Munitions of War Acts, and as such liable to have its whole output requisitioned at prices fixed by the Government, and to pay to the Treasury 80% of its "War profits" (*see* Munitions of War).

In the face of great difficulties the system of price fixing based on costings was successfully applied to agriculture, and advantage was taken of the control of prices to stimulate in particular the direct human foodstuffs—wheat and milk— and to make their production relatively more profitable than meat and butter. Thus the mistakes made, especially in Germany and Austria, of fixing maximum prices which on the one hand tended to discourage agriculture and production, and on the other led to the over-stimulation of meat and animal fats, were avoided.

Decentralisation.—An essential feature of the British system of war-time control was decentralisation and the greatest possible measure of local autonomy. In some cases, branches of the departments themselves were decentralised, *e.g.*, the Department of Wool Textile Production had its headquarters in Bradford, and in the munitions and most other industries important local offices were set up in different parts of the country. Wherever possible the existing organisation of each trade was utilised and drawn into the scheme of control. While broad lines of policy were laid down by officials of the civil service (not necessarily permanent officials), their detailed application and local operation in each trade were largely left to representative bodies of the trade, working in co-operation with the Departments concerned. In two important industries autonomous bodies were set up with executive powers. The Board of Control of the Woollen Industry, sitting in Bradford, was composed in equal proportions of representatives of the War Department, the industrial and commercial interests, and labour, and to this body, on which the departmental representatives were in a minority, was transferred complete control over the whole civilian side of the industry (within the limits of the wool allocated by the military Supply Department for civilian consumption) together with other important functions. In the cotton industry, the Cotton Control Board sitting in Manchester was constituted the legislative organ for regulating the industry. This board also was composed of industrial and labour representatives with two nominees of the Board of Trade.

Very great importance was also attached to the establishment in the different branches of each trade of advisory committees of business men who gave their services voluntarily and did much valuable work in the practical operation of schemes of control. In the Ministry of Food an agricultural council representing producers and a consumers' council were set up, to which orders were submitted before they were issued, thus ensuring the willing co-operation of all concerned.

All Industry Under Control.—Until Feb. 1917, in many industries, government control was still somewhat perfunctory, but from then onwards the increasing intensity of the War and the submarine blockade led to a great tightening up of the whole system. The great decrease of tonnage, together with the inter-Allied pooling of supplies, imposed a tremendous pressure on British industry which could only be met by concentrating the whole resources of the country on essential services, and on those alone (*see* Control, Inter-Allied). The Government made use of its control over raw materials to interfere drastically with the course of trade, and above all to restrict the freedom of industry working for civilian consumption. This it accomplished partly by rationing the supply of raw materials to non-military producers, or (in the case of food) to the home consumer, and partly by its man-power policy. In some industries, *e.g.*, boots, clothing, the state secured the adoption of schemes for the production of standardised articles, the profit at each stage of production and sale being limited on the same lines as military supplies. The popular discontent over the excessively high prices for such products was thus in some measure alleviated.

By the end of the War, virtually no important branch of industry had been left without some form of regulation or control. The system of Government control in England, which for comprehensiveness and efficiency of operation was unequalled in any other belligerent country, would have had even more favourable results if it had been possible to apply it earlier in the War, and if it had been supported by a system of war finance which avoided inflation, with all its evil consequences.

(C. W. G.*)

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INFANTRY (*see* 14.517).—To appreciate the lessons learned from the experience of infantry in the World War in relation to the past as well as to the future, it is necessary to emphasise one particular aspect of infantry evolution—the gradual decrease in size of the unit which one man can command. It is desirable also to visualise what "command" really implies. A corporal is said to "command" the squad of recruits which he is training on a barrack square; he does it by shouting words of command to them. Marshal Foch also "commanded" the Allied armies in Western Europe in 1918; he did it, however, without raising his voice above its usual pitch.

Between the marshal and the corporal were a host of intermediate commanders of every sort, kind and description, but we are concerned here mainly with infantry commanders and especially with those in the junior ranks. For theirs is the hardest task in a battle, and it is upon them that success depends. "The wisest plans, the most thorough preparations, the most brilliant guidance avail nothing unless the fight is won by the fighters—by the platoons." The minds of superior officers therefore are devoted—especially in peacetime—to hard thinking on the problem of what they can possibly do or invent to make junior infantry commanders superior to the adversaries whom they may meet in action. A general's command implies much forethought as well as some experience in its holder, and thus his "command" again has a different meaning. He is a trainer, and it is with respect to this aspect of "command" that we are chiefly concerned.

Units and Weapons

If we turn to the past for a moment, we find that the Greeks invented and trained their phalanx and the Romans their legion, and with these two systems the infantry arm dominated the known world for several centuries. Each of these formations was trained by precise drill, executed almost daily by junior commanders. Moreover this drill was in each case suited to the age and the *esprit de corps* of the period. In battle the voice of the infantry superior could be heard and was instantly obeyed, both in the phalanx and the legion. Then ensued the Dark Ages and comparative chaos dominated by feudal horse soldiers until archery made infantry again supreme. Precise drill was at the

root of the success of the archers and fire orders were strictly enforced.

If we take Crécy (1346) as an example, we find that Edward III. initiated fire orders himself, though he left the command of the front-line to his son, the youthful Prince of Wales, in charge of the archers. A careful survey of the ground at Crécy from the commanding position of its windmill, in which King Edward was posted, enables one to see how it was possible for him to issue fire orders to the archers posted below him. They were only a few hundred yards from him, but he could see better than they could when the crowd of French cavaliers would offer the best target to the British longbowmen. These bowmen had under several reigns been disciplined and drilled with precision in the use of their weapons, and that is why they defeated the gallant but undisciplined mob of horsemen who attacked them without method at Crécy. It is also obvious that the diminutive size of the battle-field enabled the commander-in-chief, posted behind his reserve, to initiate fire orders and see their effect—in fact he performed duties which now appertain to platoon commanders. Moreover, the size of the whole battle-field corresponded with a sector allotted to one battalion or at most to two in 1918.

Thus the process of devolution of the physical command occupied some five centuries, chiefly because it took all that time to alter infantry armament from bows to Lewis guns; partly also because each generation of professional soldiers clung with punctilious tenacity to the unsuitable drill of a previous age. Similar tenacity is visible to-day but changes are in the air. Frederick the Great (1740) attained parade-ground precision even during the shock of encounter, and won his battles by means of remorseless drill, stepping to music and machine-like fire tactics with inaccurate muskets. Such is the force of tradition that in 1914 German companies in Flanders illustrated Frederick's tactics with the aid of song to inspire their *Parademarsch* within close range of British infantry. But their opponents' rifles were accurate in 1914 and the death roll was enormous.

Frederick, however, did not teach one system on the barrack square and then practise a totally different one on active service; but that is what the British infantry did before the South African War (1899), and what some officers would like it to do again. Their line of reasoning is that, as every war alters tactical formations, it is not of much avail to learn any tactics which may perhaps be discarded in the next war.

British Infantry in 1913.—In Oct. 1913, the British infantry underwent a drastic change, in spite of much opposition. The old " Eight Company " battalion was altered, and the system was adopted of dividing battalions into four companies, each 200 strong. This change gave a peace strength of about 100 men per company available for training and the organisation of a battalion at the beginning of the War was as follows:—Headquarters, machine-gun section (two guns), four companies. A company consisted of its headquarters and four platoons; a platoon of four sections. A section was commanded by a non-commissioned officer and was a normal fire unit. Four battalions, from various regiments, were grouped into a brigade. In the British Army the regiment, is a unit of sentiment and the spring from which *esprit de corps* arises. It is based on a fixed regimental dépôt which is the common link of battalions scattered over the British Empire. The four-company battalion marked a stepping-stone in the history of the British infantry, because the platoon became the " tactical " unit instead of the company. As a logical consequence the fire unit (section) decreased in size and became the command of a junior N.C.O.—a corporal or lance-corporal.

At first this change seemed incomprehensible to the lay mind, because it was contrary to the idea that in modern war the improvement of communications tends to centralisation and control by the higher authorities. But the extent of the modern battle-field and the increase and improvement of mechanical weapons tend to isolate and break up infantry units more and more. A further consequence of the change was that British infantry organisation became based on a four-unit system from the brigade to the platoon. This uniform distribution of units in multiples of four proved to be handier than the French or the German distribution in multiples of three. By the end of 1918 the four-unit system was pronounced to be the best, whether for tactics, administration, reliefs or daily routine—but especially for tactical handling in the field. One reason for this is that " odd " numbers destroy the even distribution of duties.

Other Armies, 1914.—In the German, French and U.S. armies the regiment consisted of three battalions, and was a tactical as well as an administrative unit. In Germany it was commanded by a colonel with a lieutenant-colonel as his second-in-command. The battalion, commanded by a major, was divided into four companies, each commanded by a captain. The company was divided into three sections (*Züge*) each under a subaltern who had as his understudy or second-in-command, either a sergeant-major, a " vice-sergeant-major " or a " sword-knot ensign " (aspirant-officer). On mobilisation for war one additional officer was allotted to each company. Prior to mobilisation every infantry regiment and Jäger battalion was provided with a machine-gun company of six guns, plus one spare.

The French company was organised into four sections, commanded in war by three subalterns and one adjutant (superior company sergeant-major). The sections were grouped in pairs to constitute *pelotons* (platoons) under the senior of the two section leaders. In peace there were only two subalterns on the establishment for the four sections. Machine-gun sections were allotted to battalions as in the British Army. In the United States the company was composed of three officers and 150 rifles, divided into two sections, each of three squads. In the World War, however, the U.S. infantry regiment was remodelled on the continental model, having also a regimental machine-gun company, a headquarters company and a supply company.

Thus before the War the infantry battalion was in almost every country about 1,000 rifles strong allotted to four companies each commanded by a mounted officer. But the British battalion was the weakest in fighting strength, because its First Line Transport and other services were deducted from its 1,000 rifles, whereas the regimental systems of continental infantry provide these services from a separate establishment. The subalterns were dismounted officers whose commands varied as follows: British 50 men, German 80 men, French 50 men, United States 75 men. But in the British infantry a large proportion of the 50 men borne on the strength of the platoons were absent on other duties. For instance, they were signallers or machine-gunners, or bandsmen or transport drivers or pioneers—they were in fact everything except fighting infantrymen, and they should never have been on the rolls of the fighting platoons. The British Treasury, however, ordained otherwise and thus made training and fighting difficult for every platoon commander.

Changes during 1914–8.—During the progress of the War the basic organisation of the infantry of the belligerent powers was not materially altered. The changes were chiefly in the direction of additional weapons and a multiplication of kit, which reduced the infantry soldier to a beast of burden laden under a weight which destroyed his mobility. In 1915 the British infantry, as compared with the German, suffered from a paucity of machine-guns, and was slow to increase its machine-gun strength. At first an increase was made (up to four per battalion), and when manufacturers raised their output these were formed into machine-gun companies. They were gradually divorced from the infantry and formed into a machine-gun corps, firstly as brigade machine-gun companies and finally as divisional battalions. By the time this had been accomplished the lighter Lewis gun had made its appearance and had been allotted to infantry units. The first issue (not long before the battle of Loos 1915) was only four guns per battalion, but by the end of Nov. 1915, when brigade machine gun companies had been formed, the establishment of Lewis guns was increased.

The tendency at first was to use this weapon like a heavy machine gun, but when its characteristics were better understood it took its place as a company weapon in 1916, and as a platoon weapon in Feb. 1917. By March 1918, 36 per battalion became available. We then find the platoon composed of four sections, two of which were armed with one Lewis gun each. The allot-

ment of an automatic weapon on such a scale marked an important step in the tactics of infantry. One of these new weapons, handled by only two men, could deliver a stream of bullets equal in number to, and more accurately aimed than, what could formerly be projected by 25 soldiers with rifles. Obviously the number of men required in the forefront of the battle could be reduced without affecting the volume of fire. This meant fewer casualties and bigger reserves and the maximum number of soldiers in every section was reduced to one leader and six men, making a total for all ranks of a platoon only 31 actually taken into action.

The Germans were faced with the man-power problem before any of the other belligerents, and they also appreciated the value of the light machine-gun. In March 1917 they issued three to every company, and afterwards raised this allotment to six by giving two guns to each platoon. Finally, each German battalion consisted of a heavy machine-gun company of 12 guns and three infantry companies armed with six light machine guns each, without counting the special machine-gun companies allotted to divisions for every battle. This tremendous increase in automatic weapons had an inevitable effect on infantry formations. The costly attacks on narrow frontages were abandoned. The successive lines or waves of men gave place to open formations. The four sections of a platoon were gradually separated from one another and compelled to manoeuvre and fight under their own leaders. When platoons were too weak to man four sections they fought with only two, one of which was armed with a Lewis gun. The frontages allotted to the leading platoons were increased and in some of the great battles of 1918 we find platoons attacking on frontages of 200 and even 300 yd. with very small effectives. Fire-power was at last understood.

Special Weapons.—In addition to the Lewis gun, rifle-grenade and hand-grenade, the Stokes light mortar proved to be a useful infantry weapon. Although it did not form an integral part of battalions, the brigade light-mortar batteries drew their personnel from the infantry and the mortars were allotted to battalions during operations. The light mortar was the nearest approach to an infantry gun in the British Army and, though not an ideal weapon, rendered great help in reducing enemy machine guns and strong points. The German mortars in the summer of 1918 were distributed as follows: each regiment had a regimental "*minenwerfer*" company, organised in three sections, each with three light *minenwerfer*, and in addition two or three medium *minenwerfer*. The important part played by these weapons in battle tended to prove that infantry, when scientifically armed and on ground that affords cover for movement, can act independently of other arms, and is capable of fighting its own local battle either with or without artillery support and tanks. To fulfil this rôle, however, it needs to be more highly and scientifically trained than before the World War. The importance of training the commanders of companies, platoons and sections cannot be over-emphasised, and it was the shortage of these trained officers and non-commissioned officers which caused so much deterioration after the battle of Ypres in 1917. It was also the cause of avoidable casualties in every subsequent battle.

Post-War Organisation.—The British infantry battalion is now organised in a battalion headquarter wing, and four companies. The wing includes a machine-gun platoon. Each company consists of company headquarters and four platoons, each platoon of headquarters and four sections, two of which are armed with one Lewis gun each. The platoon is the largest unit composed of men whose sole duty is to fight, and the War established it as the "tactical unit" of infantry. The section is the fire unit and consists of a leader and six men, a number which experience has proved is the largest that can be directly controlled in action by one commander. Thus the British subaltern officer's command in battle became 28 fighting men, as compared with 50 in 1914—but the Lewis guns, rifle-grenade and hand-grenade increased the fire-power of the platoon out of all proportion to the number of its men.

The French battalion comprises a headquarters group, three ordinary companies, a machine-gun company and a section of accompanying weapons (mortar or infantry gun). The company at war strength is composed of a headquarters section and four combat sections, and the section of three groups. The fighting group consists of a team of riflemen and a team of automatic riflemen, the team in either case comprising a corporal and five men. In peace or when the strength is lowered by casualties, the number of sections in the company, or groups in the section may be reduced, but the actual groups are maintained at full strength. The French nowadays place all their reliance upon the light automatic rather than on the rifle, and their new organisation is the outcome. Although their group is far stronger than the British section, to which it corresponds, the side of all its ten men centres round the service and introduction of the one *fusil-mitrailleur*, and the rifle team inevitably loses much of the value of its greater mobility. On the other hand, the British organisation, though possessing greater freedom and power of manoeuvre, means that the platoon commander has the difficult rôle of combining four sections of which two are radically dissimilar in arms and in action to the other two. The German battalion, also, consists of three companies and a machine-gun company. A company is organised in three sections; each section (*Zug*) is divided into four or five groups (*Gruppe*) of eight men each—two light machine groups and either two or three rifle groups.

The Rôle of Infantry

The question is sometimes put, "What is the use of infantry? Is it not butchery to expose men on foot to the mechanical horrors of the battle-field of to-day?"

Limitations of Machines.—Man on foot is still more universally mobile than any machine. The more destructive weapons become the more does man seek impregnable shelter in which he can escape the missiles of death-dealing machines. An enemy may conceal himself in a hiding place which is inaccessible to any machine; but where man has entered there also man can follow to seek him out, and until the assailant possesses a mechanical octopus he must himself go in to dislodge his adversary. The appliances manufactured by inventive genius only help to break down the barriers to this final act of combat. A great artillery bombardment will drive the enemy to ground, but even where concentration of shell-fire is achieved, it cannot dislodge him. He is safer in his dug-out than in flight. The tank is tangible, it is true, and therefore less petrifying, but man can avoid it or hide from it more easily than from infantry. Moreover it is less agile, more cumbersome, more limited in its modes of action than the foot-soldier. There are types of obstacles which it cannot yet surmount, ground which will not bear its weight, or which is too rough or steep to cross. Cavalry like infantry is a human arm, but it affords too easy a target, is too quickly stopped by rifle or machine-gun fire and is less mobile on rugged and broken ground. Its superior speed is insufficient compensation for these drawbacks except against broken and flying infantry. Thus we see that infantry is still essential in battle, that its power is based on human rather than on material factors, and that its tactics spring from moral elements of which one is fear.

Destruction of Enemy Morale.—To wear down the enemy's nerve control is the rôle of the commander, of the artillery, of bombing aeroplanes. When opposing armies are in close contact the infantry shares in the process by raids and false attacks. In the battle the part of the infantry is to snap, not wear down, the enemy's control over his fear. The fracture is effected by the enemy's realisation that he is powerless to ward off his assailant's blow. To accomplish this we must pass a sufficient though not necessarily a larger proportion of men through the curtain of his fire to a point so close to him that they can assault or offer the threat of an assault which he realises he is powerless to prevent. The key to this assault is fire at short range to pave a way for the onslaught. Hence formations which avoid loss by taking advantage of cover and conserve the will to close with the enemy are necessary. Surprise, the simpler, more certain and less costly method, is effected by assault from an unexpected direction against an unguarded spot. The key to infantry success is therefore movement or in military language

manoeuvre. Fear above all is caused by uncertainty and apprehension of the unknown which breaks down the will to resist and gives to the assault in flank or rear its supreme value. Thus at close quarters mere numbers are not the deciding factor, and assaults are better launched by platoons than by battalions.

Strengthening One's Own Morale.—What are the factors which enable the average man to fight down fear? First undoubtedly comes confidence—confidence in his superiority to the enemy, based on his own skill in handling his weapons; faith in his leader's skill and judgment combined with devotion to him as a man; trust in and comradeship with his fellows—the assurance that he will be backed up, that his efforts will not be in vain. Secondly, *esprit de corps*—which is allied to confidence. Thirdly, discipline—the power of association to overrule instinct. Lastly, action to minimise reflection on the dangers to be faced.

The Training of Infantry

Confidence is born of training—the training of each individual, the training of the leader, the training of the unit. These successive trainings forge the infantry weapon and make it fit to act its part on the battle-field. Moreover these various trainings of human beings symbolise the truth that man is still the master of the machine. But no greater error is current to-day than that infantry is the most easily trained arm. None needs more care, more skill if it is adequately to play its part. For it is the least mechanical and by far the most human arm in existence. Yet experience of the World War indicates that of all the arms and services, infantry, the backbone, was the least trained. This defect was due not so much to the reason that less care, less research and thought were devoted to it—though these factors counted—but to the reason that it is the most difficult arm to train, because it possesses so few concrete elements. It is concerned with tactics and ground.

Elements of Training.—To train infantry is to exercise an art, whereas to train gunners is to apply a science; the one requires an artist, the other a calculator. The man in the ranks of the artillery, the tank corps, the air service, is often a mechanic—executing a concrete task in a definite manner. Initiative is the province of the officer, but even he in the subordinate ranks of other arms is concerned with producing a material effect. The infantryman's use of material—his weapons—is only a means to an end not an end in itself. He himself survives the scientific developments of countless wars because his human value remains unchanged. Even in the employment of his weapons he is guided by variable factors and conditions. But the use of his variety of weapons is only complementary to the use he makes of tactics and ground before he gets to grips with his enemy.

The variety of elements with which he has to deal has led as a rule to each different unit being trained—too often mistrained—according to the whims and prejudices of its temporary commander, who is apt to confine himself to such parts of the subject as he himself knows best. Hence a tendency towards over-emphasis of such matters as drill, musketry, bayonet fighting, which can be easily mastered by the intellect of the average officer. Hence also the neglect of tactical training, which demands thought and is difficult to learn and teach because it deals with moral and variable factors and requires a modicum of imagination.

Minor Tactics and Fire Tactics.—The tactics of infantry must be based on human nature and not on mechanics or geometrical perfection. Yet it is almost incredible how in the past showy evolutions deduced from the parade-ground have persisted on the battle-field. It is a truism to say that a revolution has been wrought in infantry tactics by the inventions which mechanical science has brought to bear on war. But it is no less true that the consequences of this revolution take years to understand. This lesson may be summarised in the phrase—"the power of manoeuvre." It needs a complete reorientation of military thought and fresh views before we begin to extract right methods from the melting pot of war. Yet that infantry which soonest learns its lesson will be supreme.

A mastery of elementary tactics is essential if infantry is to attain its goal in battle. It must be permeated by the best doctrine which the last war can teach, and its junior commanders must no longer be subjected to the whims or prejudices of whoever happens to be in temporary command. Moreover the doctrine should be adopted by authority and be expressed in language so simple and by metaphors and illustration so clear, that it can be as readily grasped by subalterns and corporals as by general officers. Its manual of instructions should be as intelligible to the Australian bushman as it is to the staff college graduate.

Development of Leadership.—In 1806–15 the British were capable of a sustained effort in the theory of tactics as originated by Sir John Moore, and there is reason to believe that British infantry could to-day be trained to as high a pitch of comparative excellence—but not without a definite doctrine of minor tactics and some evidence of leadership to inspire its wholesale adoption. This quality of leadership in peace-time needs the special ingredients of spirit, intelligence and human sympathy, together with sufficient character and determination to carry conviction to the mass. Just as Sir John French inspired a new doctrine of peace training at Aldershot after the South African War, so now could a leader develop the experiences of the last war and reduce fire tactics to simple exercises for platoon and company commanders.

Such a doctrine would probably be based on the little group of men following a corporal whom it knows because he has trained it. In the hurly-burly of modern war these little groups retain cohesion because men will follow a leader whom they see close to them, whose voice they can hear and whose presence is familiar. These groups (named sections), trained by higher leaders whom they trust, will forget themselves and accept any risks in battle if they are convinced by habit that their effort will not be in vain, that their successes will be immediately supported. A fire unit which forms part of a trained team will sink itself unhesitatingly if it knows that the rest of the team will not leave it in the lurch or allow it to bear the brunt alone; that, when it has spent itself to make an opening, others will relieve it of the burden. But can we reasonably expect generals who were trained in pre-War tactics to take the lead and compel their subordinates to alter their methods of training?

Tactics and Manoeuvre

For decades the infantries of all countries attempted to produce tactics adequate to the new weapons at their disposal by multiplying the lines which were successfully used by their forerunners in the days of the musket—with its short-range and slow rate of fire—and the case shot and solid shot of the artillery. They moved shoulder to shoulder with intervals. The idea of manoeuvre was absent. Even down to the closing stages of the World War the action of infantry units in battle—as distinct from a skirmish or an affair of outposts—was confined to frontal attacks. Manoeuvre was the weapon of the higher commanders only. A division or a brigade moved as a body; hence it was its commander alone who had the power of striking an enemy force at two or more different angles concurrently. We have already seen how slowly the idea of decentralised fire orders developed. It was the same with decentralised manoeuvre.

In any large action each of the infantry units was allotted only a fraction of the frontage of the force of which it formed a part. This narrow sector was hedged in on either side by neighbouring units of a corresponding size. How then was it possible for attack or defence on the part of infantry units to be aught but straight to their front? How can they manoeuvre if they have no space to move in? And how can they be expected to move to a flank if they possess no intervals and no flanks?

The Continuous Line.—Thus it came to pass that in spite of the fire effect produced by scattered Boers sitting on distant *kopjes* in South Africa (1899), and in spite of Japanese losses in assaults at Port Arthur and elsewhere in Manchuria (1904), European tacticians failed to shake off certain notions about continuous lines and storming masses. They appreciated the

importance of putting what they called "weight" into the decisive attack, but failed to realise that the weight or forcefulness of an attack no longer increases in proportion to the number of infantrymen thrown into it. In South Africa wide and premature extensions were adopted to minimise losses on the flat veldt, but such extensions did not lead to any idea of manoeuvre. On the contrary, the unmanageable thin lines one behind the other were incapable of intelligent manoeuvre—as was discovered in peace training after the South African War.

Even then the idea of manoeuvre to a flank by a small body was not grasped, or at any rate was not taught as a definite doctrine. Skirmishing lines in extended order made rushes and utilised ground; they fired in small bodies and opened at long ranges; at the decisive points they were gradually thickened up into a crowd. These crowds surged forward at a given signal and assaulted to their front. But the infantry soldier was so near his neighbour in these sham battles that he had scarcely sufficient space to load and fire his rifle without hitting one of his friends; the units became so mixed together in the process of thickening up that neither the corporal nor the subaltern could exercise control over his own men or any unit; often he could not find them during the decisive stage of the battle. Fortunately the "cease fire" sounded and reorganisation took place; but in 1914–8 there was no "cease fire" and no umpires and the warring infantries were slow to learn. This was no doubt inevitable, and is a sufficient reason to try now to gather the lessons of 1918, and it may not be out of place to suggest that the tactical experiences of 1918 have not been embodied in the tactical handling of units in 1926.

Group Formations.—Official manuals seem always to lag behind the age, and in fact human nature conquered the line formation before its breaking up was officially sanctioned. Tradition held fast to her pre-War habit, but the need for a control which could not be obtained with the extended line helped to breach the ramparts of orthodoxy. The group attained its final and complete recognition after its success against the German "pill-box" defence in the dreary wastes of the Ypres salient in the autumn of 1917. Also the Germans in their 1918 offensive deliberately trained their infantry in similar groups with orders to penetrate everywhere by infiltration. British dispersion, enforced by new weapons and human nature, rendered penetration possible by attacking infantry groups—termed "sections" in the British army—between the posts or machine-gun "nests" of the defenders. By exploiting every initial penetration the commander on the spot attacked in front and flank simultaneously such posts of the enemy as opposed him in his own sector. This newly acquired power of manoeuvre restored to infantry the master-key of victory, and retains for it still the important rôle which the old stereotyped tactics were rapidly losing. But it took three years of war and unprecedented losses to drive home a lesson which peace training may probably obliterate.

The Infantry Attack.—The outstanding lesson gained from the new-won possession of infantry units—the power of manoeuvre—is that tactics can be based on the fundamental principles which govern the action of other independent bodies which manoeuvre. The platoon is no longer fixed in a segment of the machine of battle but is an independent moving part fighting its own small action.

Its forward sections should press on unceasingly in order to find and penetrate any weak spots in the defence and to advance to the objectives assigned to them. If the forward body of a platoon is checked by an enemy post, it fixes it firmly by fire so that the enemy's attention is absorbed "by a menacing hand at his throat" whilst the manoeuvre body (termed the platoon reserve) works round his flank to deliver a surprise blow. This act of fixing can be achieved by a combination of fire with movement. There must be the threat of the forward spring in order to fix the enemy's attention. Fire alone, from the hastily chosen halting places of an attacker, cannot be relied on to absorb the whole attention of a defender behind selected cover. Unless each forward infantry section is imbued with a determination to press forward, the posts of the defence may be able to bring cross-fire on groups which have penetrated the position. But there is still a further means by which the enemy can be fixed.

Artificial Smoke Screen.—The World War added a useful weapon to the infantry—armament-smoke. This new element gives the user the conditions of day but imposes on his adversary the conditions of night. Mist or fog has often been a decisive but accidental factor in battle, but with the introduction of artificial fog which can be projected at the will of the user, the enemy's view is impeded whilst his own movements take place in daylight. In attack, the forward sections may fix the enemy posts more effectively by firing smoke to windward of them than by rifles or Lewis guns. Thus smoke helps small local assaults.

Decisive Manoeuvre.—The manoeuvre body of an infantry company follows close behind its forward platoons and remains under the hand of the captain. If and when the whole of a forward platoon is held up by the fire of an enemy centre of resistance, the captain uses his manoeuvre body to turn a flank. To achieve this he might have to quit his allotted sector and follow in the wake of a more successful unit on his flank. Passing through the gap he turns and assaults an exposed flank of the centre of resistance. Such a blow has the moral effect—coming as a surprise and threatening the line of retreat—which is the key to victory. But if the defenders of the post turn to meet this flanking attack, the forward body should rush in and assault them from the front. Such combinations are simple if peace training is staged on the basic principle of "fixing and manoeuvre," as the key formula of fire tactics.

This combination of fixing and manoeuvre is the bed-rock principle of every street fight. Watch a couple of small boys tackling a bigger one. What happens? One of the small boys rushes straight at the big boy, and when his attention is fixed the other runs in from behind and delivers a blow. The first small boy puts all his energy into this effort, for he knows instinctively that if he fails the opponent will beat them each separately. But if the big boy attacks one of the small ones, the other in like manner rushes in from behind. Thus fixing and decisive manoeuvre should become a formula engraved on the mind of every infantry corporal and subaltern, and he should also be trained to act upon it instinctively. It has won general acceptance since the end of the War and concerns above all the tactics of the platoon, which is the smallest unit which can fix and manoeuvre without waiting for orders from a superior.

Defence.—Attacking infantry, owing to its open formation, can offer immediate resistance to hostile counter-attack. It halts and each unit consolidates its own ground forthwith, with its defensive posts distributed in depth and disposed to give each other support by fire. The rôle of the forward bodies is to break up the enemy's organised attack. If the attacker makes a gap or effects a lodgment into the position of any forward bodies, the reserves counter-attack to throw him out. Should the attack break through the forward positions on a broad front, the reserves take him in flank by fire. Just as manoeuvre is superior to frontal attacks, so is defence-fire which enfilades from a flank the more damaging to the attackers' morale. In this as in all cases the training and determination of the better infantry wins the day, but the great advantage possessed by the defence—almost its only advantage—is that its action can be thought out beforehand. Its reserves can be placed on a flank in readiness for action, and can be practised on the actual ground to counter-attack from favourable positions with auxiliary arms to help them.

Picture of an Infantry Battle.—Who is there with experience of big attacks embracing miles of country in France that has not seen the most resolute infantry suddenly assailed by a burst of surprise-fire from the flank or rear? Its self-forgetting determination grows uncertain; it ceases to move and looks furtively for cover. If the surprise-fire continues from invisible shooters, the men become irresolute and nervous. The will to advance is gone. If the threat of a counter-assault from a flank should immediately follow they look to their rear and break or dribble away. Unless their own commander coming on from behind

can throw in an opportune reserve to counter the counter-attack and restore the local situation, the attack is stopped. That is how, so often in France, one German machine-gun nest—just one little group inspired by the will to resist, nourished in the principle of surprise—would hold up the attack of a company and sometimes of a whole battalion.

It is thus we learn to visualise the infantry unit—battalion, company or platoon—in the battle of to-day. It possesses the power of offensive movement and yet is protected by its open formations. Its articulation into interdependent moving bodies capable of manoeuvre is the main infantry feature developed by the World War. The illimitable extension of fronts, brought about by the vast numbers which nations in arms put into the field, forced the military leaders to seek and discover a solution to the deadlock—and they found it at last by granting the power of manoeuvre to infantry units down to the platoon. This revolutionary idea began to emerge in the Flanders attacks of 1917 but was still only in its chrysalis stage when the War terminated in 1918. It still lacks a clear, simple working formula which can be practised by lance corporals in their daily exercises.

Future Development

A question naturally arises as to the probable direction which the development of infantry will take under conditions caused by new inventions, particularly mechanical ones. In what way must we improve and reform our infantry methods in order to lighten the infantryman's burden in view of the probability that he may have to wear a gas mask in every future attack? The question may be considered under two heads: firstly, means to increase mobility; secondly, tactical doctrine.

Mobility.—Almost every mechanical advance means a step towards greater mobility. Every arm and branch of the service is becoming more mobile—or else decaying—under the influence of the petrol era. In the transport of an army the horse has already given way to the road motor, and this in turn promises to yield to a cross-country tractor with caterpillar tracks. The heavy artillery is already motor-drawn, and the lighter field artillery will follow suit. Mobility is the foundation stone of the value of infantry. Its unique position has always rested upon the fact that it is more *universally* mobile than other arms. But on the normal field of battle, if it is to maintain its unrivalled position as the "handyman" of war, its mobility must keep pace in proportion with that of the other arms. To give it increased mobility two problems must be solved. Firstly, means must be devised for bringing infantry to the scene of its action more quickly and with less fatigue than by the use of its legs. In the second place, infantry equipment must be lightened. The soldier must not again be treated as a beast of burden—other means than piling loads on his back must be devised.

Equipment.—If infantry is to possess an adequate agility its weapons and ammunition must be lightened to an appreciable extent or they must be carried for him. In fact the infantryman of the future must be regarded as an athlete. Every article which he does not need in the combat itself must be discarded or carried for him on accompanying transport.

Wanted: a Battle Drill.—A further development in tactical methods which has been mooted is a controllable system of movement on the battle-field. At present armies retain drill movements for the parade-ground and throw them aside when they go on active service. As human nature in battle retains only that which has become instinctive habit it is scarcely surprising that in moments of crisis one has seen men advancing, against the deadly fire of machine-guns, in close-packed bodies. But if drill were brought up to date on the lines of open order and the group, it is probable that moments and even hours of priceless value would be saved. But even during the actual attack, there might well be occasions when an ingrained method of control could be used to quicken the manoeuvre of deployed units and direct them to take advantage of local situations. Voice control would be out of the question, but if signals were few and simple, visual control might be used, particularly if a clearer means of signalling were devised.

Let anyone with experience of war ask himself if there were not moments in his recollection when he might, had his men been drilled in such a system, have saved precious minutes, an opportunity which never returned, by the use of a signal instead of the slow method of sending a message by runner. The old close order was under control, but modern fire made it impossible. With extended order the battle degenerated into the chaotic movements of an uncontrolled mob. An ingrained system of battle drill, in which intervals and distances were purposely exaggerated, would enable sub-units to be manoeuvred, to be opened or closed in "concertina" fashion according to the ground and local circumstances. Such a system might go far to combine the flexibility of the old with the invulnerability of the modern formation.

It seems improbable that in the future we shall see the extensive and elaborate field fortifications of 1914–8. The new mobility brought in by the tank, the caterpillar tractor and the aeroplane, would appear to prevent the stagnation which produced labyrinthine entrenchments in the World War. (*See* Machine Guns; Strategy; Tactics; War.) (I. Max.)

INFANT WELFARE: *see* maternity and infant welfare.

INFECTIOUS FEVERS.—In this article the various infectious fevers are dealt with.

Chicken-pox, or Varicella (*see* 6.130).—Several writers have maintained within recent years that a close relationship exists between herpes zoster (shingles) and chicken-pox, and that the virus of the two diseases is identical, on the grounds that: (1) Chicken-pox in one individual may follow herpes zoster in another within the ordinary incubation period for the former, *i.e.*, within 21 days. (2) In such cases no other source of infection may be discoverable. (3) Much less frequently herpes zoster may be apparently contracted from a case of chicken-pox. (4) Herpes and chicken-pox may sometimes coexist in the same individual. The problem, however, cannot be solved until the causal agent of chicken-pox has been discovered.

Diphtheria (*see* 8.290).—The principal cause of the spread of this disease is now generally admitted to be the human carrier, whether sick or healthy. In the great majority of cases the disease is disseminated by the diphtheria bacillus being expelled from the mouth or nostrils by coughing, sneezing, spitting, kissing or speaking. Apart from tonsillectomy, which is not always practicable, there is no certain method of ridding the carrier of bacilli. On this account a remarkable change has taken place in the methods of prevention of diphtheria. In 1913 Bela Schick of Vienna devised a test whereby immunity or susceptibility to diphtheria can be determined. The test is performed by injecting intracutaneously a minute dose of diphtheria toxin. If the subject is immune, no reaction occurs, whereas susceptibility is shown by the appearance of a small red swelling at the site of injection within 24–48 hours. Those found to be susceptible are given three subcutaneous injections of a mixture of toxin and antitoxin, which was first introduced by Von Behring in 1913, but not used on an extensive scale until some years later by Park and Zingher in the United States. After the lapse of some weeks or months immunity as determined by the Schick test is established and lasts for some years, if not throughout life, whereas the immunity afforded by injection of diphtheria antitoxin is not likely to last longer than three or four weeks.

The experience of the years from 1910 to 1925 has confirmed the earlier observations as to the value of the antitoxin treatment of diphtheria. Death and severe paralysis are practically unknown when the patient receives an adequate dose within the first 24 hours, but become increasingly frequent with each 24 hours' delay. The intramuscular method is the best mode of administration, as it is quite as simple as the subcutaneous and ensures more rapid absorption of the antitoxin.

Measles (*see* 17.947).—Caronia of Rome has isolated (1923) a minute diplococcus, which he regards as the specific cause of measles, from the blood, bone-marrow, naso-pharynx and cerebrospinal fluid of children during the prodromal and eruptive periods. Injection of healthy children with attenuated cultures of this organism produced immunity to measles, but inoculation

of large and repeated doses gave rise to a typical though mild form of the disorder. Further confirmation of Caronia's investigations is required before his organism can be accepted as the cause of measles. Subcutaneous injection of the serum of convalescents within the first six days after exposure to infection is a preventive method first employed by Nicolle and Conseil in 1918 and subsequently carried out on a large scale by Degkwitz in Germany and other clinicians on the Continent and in the United States. In nearly all cases this method either prevents an attack of measles altogether or renders it very mild. In the absence of convalescent serum, which is often difficult to obtain, the whole blood or serum of adults, especially the parents, who have had measles, can be used.

Scarlet Fever (*see* 24.303).—The recent work of G.F. and G.H. Dick indicates that scarlet fever is a local infection of the throat caused by a particular type of *Streptococcus haemolyticus*, which is capable of producing a soluble toxin, absorption of which gives rise to the general manifestations of the disease. These observers successfully inoculated volunteers by swabbing their tonsils and pharynx with a culture of the organism. Subsequently they devised the "Dick test," which determines the susceptibility or immunity of an individual to scarlet fever, and is performed by injecting into the skin a filtrate of the culture which produced the disease. If the person is immune no reaction occurs, while susceptibility is shown by the appearance of a red area within 12–24 hours. Desquamation, which was formerly considered as the chief agent in the dissemination of the disease, is now generally regarded as harmless, unless the scales have been contaminated by discharges from the nose and ears. The duration of infectivity is now held to be much shorter than formerly. It is probable that most cases cease to be infectious in the course of the fourth week, unless they are complicated by discharges from the nose or ears. Specific immunisation against scarlet fever is still in the experimental stage, but very promising results have been obtained by subcutaneous injection of susceptible persons with a small amount of the toxic filtrate of the variety of *Streptococcus haemolyticus* which causes scarlet fever. Further observations are required to determine the duration of the immunity acquired by this method. Passive immunity can be acquired more rapidly by injection of a special scarlet fever antitoxin, but is probably less permanent.

The method employed by the late Dr. Robert Milne, consisting in inunction of the skin with olive oil and application of 1·20 carbolic oil to the throat, has proved to be valueless, as it does not prevent the spread of infection or the occurrence of complications and return cases. Encouraging results have been obtained from the use of an antitoxic serum prepared by injection of horses with gradually increasing doses of sterile scarlet fever toxin. It has been found that if the serum was given early the course of the disease was shortened, and the incidence of complications and sequelae greatly diminished.

Typhoid and Paratyphoid Fevers (*see* 27.503).—The great diminution in the incidence of these diseases in recent years in many countries has been due partly to immunisation in the army and navy during 1914–19 of a large proportion of a particularly susceptible age-group and partly to the careful supervision of the water and milk supplies, which has reduced the disease to such an extent that the health authorities are able to devote more attention to the prevention of contact and carrier cases. Numerous statistics have been published in various countries showing the efficacy of antityphoid and antiparatyphoid vaccination. Among the most striking are those given by Russell. During the two years in which the United States took part in the World War there were 1,065 cases of typhoid or paratyphoid or one among 3,756 men, with 156 deaths or one death among 25,641 men, as compared with one case for every seven men and one death among every 71 men in the Spanish-American War of 1898. The duration of immunity following inoculation varies from two to four years or longer, but under certain circumstances, such as ingestion of massive doses of typhoid bacilli and impairment of resistance, which are specially liable to occur among soldiers on active service, the immunity is lost in a much shorter time. The serum treatment of typhoid and paratyphoid fevers is still in the experimental stage, the great decrease in these diseases having prevented a trial of it on a large scale in recent years. Vaccine treatment unlike vaccine prophylaxis has not become generalised, and the results obtained are inconstant. Some observers, indeed, regard the vaccine treatment of typhoid as an example of non-specific proteintherapy, as the same results have been obtained by injection of *B. coli* and staphylococci.

Diet.—The modern tendency is to feed rather than to starve the typhoid patient, who is now no longer condemned to an exclusively milk diet for several weeks, but may be allowed other readily digestible articles of diet from an early stage. A more liberal diet enables the patient to offer a better resistance to the disease, to be less liable to complications and to make a more rapid recovery.

Treatment of Carriers.—After the carrier state has lasted six months without being affected by drug treatment such as hexamethylene tetramine for urinary carriers, and chloroform, menthol and lacto-bacillin for intestinal carriers, operations such as removal of the gall-bladder (cholecystectomy) in the cases of intestinal carriers, or of the kidney (nephrectomy) in the case of urinary carriers must be considered.

Paratyphoid Fevers.—These are acute infectious diseases due to the action of bacilli, of which three varieties have been described, viz., *Bacillus paratyphosus A*, *Bacillus paratyphosus B*, and *Bacillus paratyphosus C*. Though on the whole less severe except in war time, they closely resemble typhoid fever in their clinical appearance and course, and can only be distinguished therefrom by bacteriological examination. Another point of difference is that while typhoid fever is an exclusively human disease, paratyphoid fevers may infect both man and animals, *e.g.*, dogs, cows, rabbits and pigs, and be transmitted from man to animals and vice versa.

Typhus (*see* 27.508).—As the result of their study of the epidemics which occurred in Tunis from 1906 to 1909 Nicolle and his collaborators have shown that typhus is transmitted by the bite or faeces of infected lice, and not by other insects such as bugs, fleas or mosquitoes, or by discharges from the mucous membranes as in other infectious diseases. Recent research indicates that the minute intracellular organism known as *Rickettsia prowazeki* is the cause of typhus, this conclusion being based on experiments showing that the virus of typhus and *Rickettsia prowazeki* are inseparable in infected lice, as well as on the presence of bodies indistinguishable from *Rickettsia prowazeki* in typhus lesions in man, where they have been found with great regularity in the blood-vessels of the various tissues.

The Weil-Felix reaction, which was described by Weil and Felix of Prague in 1915, occupies as important a position in the diagnosis of typhus as the Widal reaction in that of typhoid fever, or the Wassermann reaction in that of syphilis. It consists in the agglutination by the patient's serum in a dilution above 100 of a proteus-like organism named X 19 isolated from the urine of a typhus case. The reaction appears toward the end of the first week, rises rapidly to its maximum between the 11th and 13th days, and gradually falls in convalescence, but may remain positive for months and thereby enable a retrospective diagnosis of typhus to be made. The prophylaxis of typhus consists in the complete delousing of patients and contacts, as well as in the disinfection of clothing, which is best carried out by steam. The serum and vaccine treatment of typhus is still in the experimental stage.

Whooping Cough (*see* 28.616).—It is now generally recognised that the micro-organism in the form of a cocco-bacillus, described by Bordet and Gengou in 1906, is the causal agent of whooping cough. It is found in a practically pure culture in the catarrhal stage and first week of the paroxysmal stage, and then rapidly diminishes in number, being outgrown by numerous other organisms, especially *Bacillus influenzae* and the pneumococcus. In the great majority of cases, therefore, the disease ceases to be contagious long before the characteristic whooping has ceased. Recent writers have drawn attention to the fact that whooping cough is not so rare in adults as it is commonly sup-

posed to be, but that it may assume at this period atypical forms which are responsible for a spread of the disease. A vaccine prepared from the Bordet-Gengou bacillus usually in association with other micro-organisms has been used on a large scale in the prevention and treatment of whooping cough, but clinicians are by no means unanimous as to its value. Among the numerous drugs recommended for the treatment of the disease ether administered by intramuscular injection has recently enjoyed a considerable vogue on the ground that it reduces the number and severity of the paroxysms. (J. D. Ro.)

INFLATION: *see* CURRENCY.

INFLUENZA (*see* 14.552).—The term influenza will be used to imply " a pandemic outburst of disease characterised, clinically, by a rapid course, catarrh of the respiratory tract, pyrexia and some degree of prostration; and epidemiologically, by a tendency to occur in several successive waves at short intervals of time." This provisional definition is applicable to the visitation of 1918–9, and to other outbreaks of febrile respiratory catarrh more remote in time and about the distribution of which less is known, but is not applicable to the sporadic cases or even the localised epidemics of respiratory catarrh to which the name influenza has been so often applied, especially in the years following fairly closely upon pandemic outbursts.

The Influenza Pandemic of 1918–9.—This pandemic swept over the world in three successive waves, the first appearing quite suddenly in May and June 1918, the second starting at the end of September or early in October and waning in December, and the third wave, less uniform in character, appeared early in March 1919. This outbreak, attributed by France to Spain, by Spain to France and by America to Eastern Europe, seems to have appeared almost simultaneously amongst the nations of the " Entente " on the Western front, and amongst all those communities in intimate touch with them and in the closely linked theatres of war. It showed the explosive character that is possible only for a highly invasive infection assisted by conditions of swift communication such as obtain in modern war.

This first wave made its appearance a little later amongst the Central Powers and their neighbours. Early in July it attained its full proportions in Germany, Austria, Norway, Sweden and Denmark, Holland and Switzerland. In several large areas of the world's surface, in the South American republics, in Bermuda, the British West Indies, the Azores and in the islands of the Pacific and Australia, the summer of 1918 seems to have passed without an influenzal outbreak. In New Zealand, cases are said to have appeared in Aug., the harbingers, perhaps, of the autumn, rather than the first manifestations of the summer, wave.

This first wave passed rapidly, so that a " frequency curve " by weeks, in which the incidence in the worst week is taken as 100%, shows a steep ascent to a maximum, followed by an equally steep and almost symmetrical fall, the whole episode passing within about five or six weeks. So benign was the type that many cases among soldiers at the battle-front escaped record, as the men never " reported sick " but merely rested for a day or so in their units, and this was fortunate, as the army hospitals were soon overcrowded. The death-rate was inconsiderable, but there was an ominous tendency to a higher mortality amongst the later cases, just before the wave came to an end, seeming to suggest an increase in virulence. The first batch of cases looked " like a mild attack of measles without a rash." Respiratory catarrh, congested conjunctivae, headache, lassitude, pyrexia of short duration, a feeling of prostration with the return of temperature to normal, and then a rapid recovery of health; such was the course in the vast majority of the cases during the first wave. Complications were almost unknown during this outbreak. A few cases which developed broncho-pneumonia or haemorrhagic oedema of the lungs towards the end of the wave sent up the case mortality. In all these characters, the first wave closely resembled the outbreak of 1890, except that in 1890 the death-rate was greatest amongst the middle-aged and elderly, while in 1918 the chief sufferers were amongst the " young adult " groups.

The Second Wave.—Towards the end of September or early in October, the second wave suddenly gathered force and swept over the world. St. Helena is said to have escaped. Mauritius, too, had a reprieve; and the quarantine measures applied by Australia were successful for the moment but this fatal pandemic spread throughout Europe, America, Asia and Africa.

The upward curve of morbidity was almost precisely similar to that of the summer and the maximum was reached as quickly as in the previous wave, but the fall was much slower and less regular. The outstanding difference between the two waves was the marked tendency to pulmonary complications and the high death-rate of the second. The singularly uniform syndrome of the summer epidemic gave place, in the autumn, to several varieties of clinical picture depending on varying combinations of several factors, amongst which might be reckoned the virulence of the microbic invader, the resistance of the patient, the nature of the bacterial flora of his respiratory tract, and environmental conditions such as occupation, wages and housing. As a rule, the attack was ushered in by the catarrhal and pyrexial symptoms noted in May and June. In many cases, especially where circumstances permitted of immediate rest and treatment, the disease took a favourable course towards recovery, although prostration was clearly always a more marked feature than in the summer. In others, the early pyrexial catarrh was sometimes followed by intense toxaemia leading so rapidly to a fatal issue that there was no time for pulmonary complications to develop. But frequently the lungs became severely affected and the patient passed into a state of anoxaemia recalling that due to exposure to the " pulmonary irritants " of gas warfare.

But there was a formidable difference between the two conditions. While the " phosgene " patient had to deal with a sterile exudate, evoked by a chemical irritant and capable of rapid absorption if vitality was maintained, the lungs of the influenza patient were charged with an exudate evoked by a living virus which had already overcome tissue resistance and could offer to " secondary invaders " conditions of symbiosis favourable to their growth. Here lay the danger. The virus of influenza could open, as it were, the door to the *streptococci, pneumococci, staphylococci* and other organisms normally held within safe numerical limits upon the respiratory mucous membrane. The *post-mortem* appearances, while tending to have certain basal characters in common, varied considerably with the nature of the " secondary invaders " and other factors. In nearly all cases, there was a haemorrhagic tendency not often seen in other acute lung affections; and this sometimes amounted to a haemorrhagic oedema involving the greater part of both lungs. " Wet lungs," " dripping lungs," were expressions frequently heard in the *post-mortem* room. Areas suggesting haemorrhagic infarcts with their bases extending under the pleura were often noticed. The cut surface of the lungs showed, as a rule, peribronchiolitis and patches of broncho-pneumonia with a general state of oedema throughout the parenchyma of the lung; or a whole lobe might give the appearance of red, or in older cases, grey hepatisation.[1] The third wave had no distinctive characters. It resembled the first wave rather than the second, though pulmonary complications and fatal cases were fairly numerous.

Etiology.—As to the causative organism of influenza we remain, even now, still in doubt. The view that the *Bacillus influenzae* (Pfeiffer) was the cause of the disease, received little support from the new investigations carried out from 1918 onwards. This work was directed, for the most part, to the search for a " filter-passing virus." During the second wave of 1918, the researches of C. Nicholle and Lebailly in the French War Zone, of H. G. Gibson, F. B. Bowman and J. I. Connor at Abbeville, and of J. A. Wilson at Étaples, in the zone of the British Armies in France, afforded highly significant evidence in favour of a filterable virus, although the restrictions imposed upon bacteriological work by war conditions and the transitory nature of the epidemic rendered conclusive findings impossible.

[1] For a detailed account of the *post-mortem* appearances, together with their morbid histology, see the article by Maj. Tytler, R.A.M.C., in *Special Report Series No. 36*, Medical Research Council (1919).

In 1919, an investigation was undertaken by Zamanouchi, Sakakami and Iwashrima, in which the filtered and unfiltered emulsions of sputum from 43 cases of influenza were injected into the throats and noses of 24 healthy volunteers, six of whom had recently suffered from influenza. Of the 18 previously uninfected persons, all developed influenza after an interval of two or three days, but the six who had had the disease remained in good health. Similar results were obtained with the filtered blood of patients. At the same time, the spraying of cultures of Pfeiffer's bacillus, sometimes " pure," sometimes mixed with other respiratory bacteria, into the throats of 14 healthy persons failed to lead to illness of any kind.

P. K. Olitsky and F. L. Gates in the Laboratories of the Rockefeller Institute for Medical Research were able to approach the subject with much more deliberation and with a much better equipment than was available in France; and their results are proportionally more convincing. Like Gibson and his coworkers, they produced in rabbits a condition closely resembling human influenza by means of filtered or unfiltered nasal secretions taken from human patients during the earliest stages of the attack. They provided independent confirmation of the discovery of Gibson and Bowman that " cultures " in Noegouchi Medium were capable of transmitting the disease to animals, and showed that the anaerobic and filterable organism thus cultivated retained its activity after long exposure to glycerine and possessed antigenic properties. To the minute organism isolated by them in the course of this inquiry, they gave the name of *Bacterium pneumosintes* (πνεύμων lung: and σίντης injurer), " since a striking feature of its effect in rabbits is to diminish the resistance of the lungs to the action of ordinary pathogenic bacteria."

Their work received speedy confirmation at the hands of Dr. M. H. Gordon, C.M.G., F.R.S., in the course of an influenzal outbreak among the Nursing Staff of St. Bartholomew's Hospital, London, in 1922. Still further support for a " filter-passer " as the virus of influenza was later provided by Sir Spenser Lister in South Africa. These independent inquiries, leading to similar findings in America, England and South Africa, go far to establish the " case " for a filterable virus as the causative agent of influenza; but caution is still needed in drawing final conclusions until a more precise knowledge is available as to " filter-passers " in general (*see* FILTER-PASSING MICROBES).

Epidemiology.—In the absence of final knowledge as to the causative agent, many points of fundamental importance still remain obscure. Was the pandemic of 1918–9 a sudden awakening to virulence of some germ already widely distributed in western Europe or was it a " new arrival " operating in " virgin soil "? Then the question arises: " Where could such a germ come from? " If previous pandemics were due to the same agent, no doubt, somewhere, from one pandemic to another, some human individual or chain of individuals carried on the virus until the time was ripe for a fresh outbreak.

The first wave coincided with the arrival of the first drafts of American troops in Europe, who must have brought into common circulation pathogenic strains that had long remained dormant in isolated and relatively immunised communities. The crowded troopships afforded just the incubation places that would permit of the maturation of such an infection; and Europe, with its crowded concentration areas and billets, offered an unequalled opportunity for its spread. The last influenzal pandemic had occurred just 28 years before. There might be a few scattered " carriers " and perhaps some residual immunity among the middle-aged and the elderly; but the adolescents and the young adults would in 1918 be " virgin soil." It was just these lower age-groups that suffered most.

How, then, explain the second wave with its greater severity? —and the third? Surely, if immunity played a part, these waves should have been much less extensive, much more benign, and confined to those persons who had previously escaped. These are good, but not final, arguments. The passage of the first wave may have left behind it a virus of exalted virulence, many " carriers " and many " allergic " subjects whose behaviour to reinfection might betray the phenomena of hypersensitiveness of the respiratory surfaces and a tendency to inflammatory exudates on contact with the air-borne virus. Under such conditions a fresh outbreak would be specially likely to arise in the fall of the year, a period of rapid fluctuations of temperature when the chill evenings drive men into the warmth and close contact of crowded dug-outs, shelters and billets.

It is impossible to believe that the so-called " influenza " to which deaths were attributed every year between 1892 and 1918 was the same disease as the fulminating pandemic that followed. Apart from the extreme contrast in invasive power, the distribution of " influenza " mortality by age-groups[1] emphasises the essential difference between, let us say, the death-rates for 1917 and 1918, the one having a preponderating death-rate amongst the old, the other, amongst the young. Such differences can hardly leap into existence within a few months. The known facts of increase and diminution of bacterial virulence do not support the idea that such a vast alteration is probable or even possible in so short a time.

Acquired Immunity.—Evidence that morbidity and mortality were less marked, in the second wave, amongst those who had been attacked in the first, when thoroughly analysed[2] was found to indicate that " these data show a considerable immunising power in the summer attacks and we conclude, although with natural hesitation, that it is probable, on the average, that an appreciable degree of active immunity was attained by those who passed through an attack in its first and mildest manifestations."

The evidences for immunity are of varying efficiency in different places, and the populations of many areas show no tendency at all to acquire resistance to infection as judged by a comparison between the behaviour of those attacked and those missed by the first wave when confronted by the second.

We believe these data to be unsound as a basis for comparison. It is highly probable that many persons were infected during the summer and yet failed to show appreciable illness. The vast difference that may exist between the numbers *infected* and the numbers *affected* by a bacterial invasion can be judged from what we know of the meningococcus and the diphtheria bacillus. And yet these latent infections may confer active immunity, as we know from the " Schick Reaction " in the case of diphtheria and from many other examples as well. The mere fact of a previous " attack " is not a safe guide in classifying populations for inquiry as to their relative immunities. The best evidence of the acquisition of immunity is to be found in the phenomena of natural recovery of the individual and of the disappearance of pandemic waves from the community. The fact that these groups of pandemics are separated by long and fairly regular intervals, as a rule about 20 years, is not without significance in this connection, since at least this period might be necessary to reduce the residual " immune population " from the last pandemic to an ineffective number.

Artificial Immunity.—No vaccine can be entirely satisfactory unless it is known to contain the virus or germ of the disease in question. The vaccine issued by the War Office and afterwards by the Ministry of Health was confessedly of a provisional nature since the causative agent was still uncertain. Its formula was as follows:—

	Per cu. cm. of vaccine
Bacilli influenzae (Pfeiffer)	400,000,000
Pneumococci	200,000,000
Streptococci	60,000,000

Unless Pfeiffer's bacillus be accepted as the causative agent, this vaccine must be described as consisting entirely of the " secondary invaders." As such, its issue was entirely justifiable and its effects were such as might be expected: satisfactory in diminishing complications and mortality but practically *nil* in preventing the disease. Vaccine, then, cannot, as a prophylactic, help us much at present; nor can we, in the light of recent experience, hope for great results from general measures of hygiene.

[1] *Proceedings of the Royal Society of Medicine* (Jan. 1919).
[2] *The Report of the Ministry of Health*, chap. 6 (1918–9).

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(S. L. C.)

INGE, WILLIAM RALPH (1860–), English divine, was born June 6 1860 at Crayke, Yorks., the son of William Inge, sometime provost of Worcester College, Oxford, and was educated at Eton, and at King's College, Cambridge. From 1884 to 1888 he was a master at Eton, and during the last two years of that time was fellow of King's College, Cambridge. From 1889 to 1904 he was fellow of Hertford College, Oxford. Bampton lecturer in 1899, and Paddock lecturer in New York in 1906, from 1905 to 1907 he was vicar of All Saints', Ennismore Gardens, London, and in 1907 was made Lady Margaret professor of divinity at Cambridge. In 1911 he became dean of St. Paul's, where his sermons attracted great attention owing to their originality, their caustic criticism of the tendencies of modern life and a somewhat pessimistic tone which earned for him the sobriquet of " the gloomy dean."

Among Inge's numerous historical and theological works may be mentioned *Society in Rome under the Caesars* (1888); *Christian Mysticism* (1899); *Types of Christian Saintliness* (1915); *Philosophy of Plotinus* (1918); *Outspoken Essays* (1919, Second Series 1922); *Personal Religion and the Life of Devotion* (1924).

INGLIS, ELSIE MAUD (1864–1917), British physician and surgeon, was born at Naini Tal, India, Aug. 16 1864. After a childhood spent in India and Australia, in 1878 she settled with her family in Edinburgh. She studied at the school of medicine for women in Edinburgh and at St. Margaret's College, Glasgow, graduating M.B. and C.M. In 1895 she took up private practice in Edinburgh and was instrumental in establishing a second school of medicine for women in that city. Dr. Inglis became one of the most prominent suffrage workers in Scotland. In Aug. 1914, inspired by her, a special committee of the Scottish Federation of Women's Suffrage Societies, aided by the National Union of Women's Suffrage Societies, undertook the organisation of the Scottish Women's hospitals for foreign service, and raised £449,000. She first went to Serbia in April 1915 to relieve Dr. Soltau at Kragujevac. In Nov., during the enemy invasion of Serbia, Dr. Inglis and a few others remained behind until Feb. 1916 as prisoners of the enemy to care for the Serbian wounded. In Aug. 1916 she took a unit to the Dobruja for service with the newly formed Serbian division attached to the Russian Army. She died at Newcastle-on-Tyne Nov. 27 1917. See Lady Frances Balfour: *Dr. Elsie Inglis* (1918).

INITIATIVE (*see* 23.1).—The initiative is one of the two forms of direct popular legislation, the other being the referendum. Switzerland is the classic land of both initiative and referendum. As late as 1910 its experience with these devices of popular rule was much more extensive than that of the rest of the world combined.

The Swiss example was copied first in the United States where the initiative was introduced by South Dakota as early as 1898. Subsequently nearly half the states in the American Union have adopted one or both forms of direct legislation. Most of these commonwealths are west of the Mississippi, but of more recent years five eastern states, among them Ohio and Massachusetts, have accepted the initiative. Twelve states provide for official bulletins of information, commonly known as " publicity pamphlets," containing texts of laws to be voted upon with arguments pro and con, which are distributed before the vote to all electors in the state. As a common feature of the commission and commission-manager forms of government now in effect in some 400 cities throughout the United States, direct legislative methods have also been made widely applicable to local charters and ordinances.

Following American developments in this field the next great step in the extension of the initiative was taken after the World War by the constitution makers of several revolutionised or new states of Europe. In varying forms this device has been established by the constitutions both of the German Reich (1919) and of the Prussian State; also by the constitutions of Austria, Estonia and the Free City of Danzig—all the latter dating from the year 1920. The constitution of the Irish Free State (1922) provides specifically for the referendum; it authorises also the Irish Parliament to establish the initiative by law, expressly stipulating that a petition signed by 50,000 voters shall be sufficient to start action either upon a constitutional amendment or upon an ordinary law.

Swiss Experience.—Up to 1908 the Federal initiative in Switzerland was employed, generally without success, to promote radical measures. Since that year it has scored a number of constructive achievements, among them the amendments providing for Federal regulation of water-power (1908) for election of the National Council by proportional representation (1918) and for the submission of treaties concluded for periods of 15 years or more to popular vote upon the same terms as ordinary legislation, *i.e.*, petition signed by 30,000 voters or demand of eight cantons (1921). In 1922 a drastic capital levy initiative proposal brought forward by the Socialists was defeated by a popular vote of 736,652 to 109,702 and by all cantons against none. Experience with direct legislation under the new constitutions of Europe has been too brief to warrant conclusions. In Germany where a petition requires 3,000,000 signatures, the initative has been used but once (June 20, 1926) but without success. (*See* GERMANY.)

American Experience.—In the United States the initiative has been freely employed, so freely indeed that in connection with referendum measures the ballots of certain states have been at times greatly overcrowded. The initiative has been repeatedly used by small reform groups to advertise their projects. In Oregon it was employed successfully to pass a so-called compulsory school attendance law (1922), obviously inspired by hostility to parochial schools, which was held by the Supreme Court of the United States (1925) to be unconstitutional. Coincident with the extension of direct legislation there has developed a tendency to exclude from its operation certain classes of measures, particularly finance bills and Acts of an urgent character. Thus in the United States the Massachusetts initiative and referendum amendment (1917) bristles with restrictions excluding from popular vote religious issues, judicial tenure and powers, local legislation, specific appropriations, anti-Prohibition measures and various personal and property rights. In spite of much criticism, however, direct legislation is generally sustained by popular opinion in those American states which have provided for its establishment.

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(R. C. B.)

INLAND WATER TRANSPORT.—Transport by navigable waterways in the last years before the War reached very high figures indeed. In 1875, 10,400,000 tons were carried by water in Germany; in 1910, 64,750,000 tons. The bulk of the increase was on the large rivers and canals; the less important waterways showed no advance, and in some cases actually a falling-off. In the Netherlands and Belgium the ports of Rotterdam, Amsterdam and Antwerp benefited by the great development of Rhenish industry in Germany, the Rhine being admirably suited for carrying both ores and coal. In the riparian states of the Danube the movement of industrial products downstream and of cereals and oil upstream has produced a similar increase in water-borne traffic.

This general development of traffic by navigable waterways everywhere led to the undertaking of important hydraulic work in the construction of new waterways and the improvement of existing ones. Steps were taken to regulate and canalise rivers; canals were cut to link up important rivers; existing canals were enlarged so as to be navigable by vessels of larger tonnage; and gradually a whole network of navigable waterways has spread over central and western Europe. The total length of the navigable waterways in France before the War was more than 11,000 kilometres. In Germany it exceeded 10,000. The capacity of the German waterways was on the whole greater than that of the French, since many of the canals in France were navigable only for vessels of 300 tons or less.

Effects of the War.—The World War interrupted the development of inland navigation, and its termination was followed by a transport crisis due mainly to the disorganisation of the railways through the wear and tear of rolling stock and rails, and the

destruction of considerable portions of tracks and railway installations. Normal currents of traffic had to be re-established, and demobilisation raised a difficult transport problem. Even the full use of navigable waterways was insufficient to meet immediate requirements. The destruction of many waterways with their works (bridges, locks, etc.) and of many vessels used in inland navigation, helped to make matters more difficult. But repairs were fairly quickly effected and in 1920–1, indeed, when the railway crisis was still acute in consequence of a shortage of rolling stock, there was a surplus of inland navigation tonnage owing to the considerable increase in freights due to the rise in the cost of living. Governments avoided or took measures to prevent any great increase in railway rates until the existence of large deficits showed that it was necessary to adapt rates to the increased expenditure. Navigation, on the other hand, being entirely in the hands of private individuals, had to adapt itself immediately to the increased working expenses.

Furthermore, governments in some cases used the railways to establish new currents of transport, which had become desirable in consequence of altered frontiers, or to help national seaports to compete with foreign seaports. Sometimes, too, by instituting competitive rates on the railways, governments tried to obtain larger receipts which would enable them to meet the deficit of the railway budget. Another factor which unfavourably affected the financial results of inland navigation concerns was the absence of proper upkeep of the waterways during the years 1914–8. Rivers which require constant attention suffered to a large extent in this respect, and it proved impossible to employ the river-craft to their full capacity.

But the main cause of the bad conditions of inland navigation after the War was that financial and economic crises, the instability of the exchanges, and general impoverishment did not allow the resumption of transport which had been expected.

In France the total amount of goods carried on rivers and canals, which was 41,896,754 tons in 1913, was only 21,500,000 in 1920. In 1924 the figure had risen to 36,758,000 tons, traffic assuming large dimensions in the north of France, as well as in respect of goods and vessels coming from and proceeding to the port of Strasbourg. The following figures for the port of Paris may be noted: in 1913, 4,786,649 tons were loaded and 11,709,824 tons unloaded; the figures for 1924 were respectively 2,769,166 tons and 10,221,228 tons.

The total traffic for the Rhine, which in 1913 was 54,562,574 tons, had fallen in 1918 to 25,608,609 tons and by 1923 as low as 16,608,609 tons. In that year—a quite abnormal one certainly, owing to the Ruhr occupation—traffic through the port of Duisburg-Ruhrort, which in 1913 was about 26,000,000 tons, and which was still 14,000,000 tons in 1922, fell to 3,980,412 tons.

The situation is exactly the same as regards traffic across the German-Dutch frontier near Lobith. From over 37,000,000 tons in 1913 the figures fell in 1918 to scarcely 5,000,000 tons, but by 1924 had risen again to 23,000,000.

On the Danube in 1911 the total movement of goods was 6,802,639 tons and in 1924, 3,757,010 tons. The year 1925, however, showed a considerable increase in traffic.

The same effects are observable in Russia, although, in this case, it is necessary to take account of the great disturbance caused by the Civil War, the Bolshevist régime and the famine which ravaged the Volga basin in 1921. In 1913 the total weight of goods carried by water amounted to 2,281,900,000 pouds (approx. 38,000,000 tons), of which corn accounted for 229,000,000 pouds. In 1920 the total figure had fallen to 665,500,000 pouds. The corresponding figure for corn is negligible. For 1925 the total figure was, according to official statements, 1,405,200,000 pouds.

Nevertheless, general improvement took place. Take as an example the port of Rotterdam. The total amount of goods transported on barges in 1924 was 19,000,000 tons, whereas in 1923 the figure was only 8,000,000 tons. Even allowing for the effects of the Ruhr occupation, this denotes a very considerable increase.

Extension of Waterways.—The improvement of navigable waterways was resumed after the War and, although many big schemes can hardly be expected to materialise, it is none the less true that a large number of far-reaching plans are already in course of being realised, or are ripe for execution.

Rhône-Rhine Navigation.—The navigable waterway which the canalisation of the Rhône would establish from Marseilles through Lyons and Geneva (if the French and Swiss governments agreed about the régime for the Lake of Geneva), might be of first-class importance for traffic to Switzerland, and the eventual continuation of this waterway through Switzerland by the canal known as Entreroches (a scheme warmly supported by the Swiss Assn. for Rhône-Rhine Navigation), would increase its importance. This scheme for a navigable waterway between the Rhône and the Rhine through Switzerland seems still immature.

Rhine Navigation.—The second large scheme prepared by the French Govt. is for the great Alsace Canal between Huningue and Strasbourg. This canal, which will serve both for navigation and the supply of water-power, is to follow a course nearly parallel to the Rhine over a distance of about 114 kilometres. The plan involves the erection of a weir across the Rhine bed. Further, eight power stations will be constructed on the canal and two locks placed at each station. The dimensions of this waterway would allow barges of 1,200 tons, normal type on the Upper Rhine above Mannheim. The scheme for this canal required the approval of the Central Commission for Rhine Navigation. After giving its consent to the construction of the first reach of the canal in 1922, the commission in April 1925 approved the scheme for the seven other reaches subject to certain conditions.

Switzerland has prepared a scheme for the regulation of the Rhine between Strasbourg and Basel. This scheme has also been conditionally approved by the Central Rhine Commission, and the work may therefore shortly be put in hand (*see* RHINE).

Communication with Antwerp.—A clause in the Treaty of Versailles provides for the possible construction of a deep-draught canal from Antwerp to the Meuse and the Rhine, ending in the neighbourhood of Ruhrort. The early execution of this scheme is unlikely, especially as the plan for the Antwerp-Moerdijk canal, which is provided for in the new Dutch-Belgian Treaty, will secure for Antwerp advantages at least equal to those offered by the Antwerp-Ruhrort canal and at an infinitely smaller cost. No technical details are yet known of the Antwerp-Moerdijk canal scheme, but the waterway thus created will be made navigable for the large Rhine barges, that is to say, for vessels up to 3,000 tons.

Meuse Canalisation.—In the Netherlands the most important scheme now being carried out is the canalisation of the Meuse on Dutch territory, which further involves a junction canal between the Meuse and the Waal and the Juliana canal from Maasbracht southwards, the latter intended to link up the mining centre with the navigable waterways of the country. The canalised Meuse will be navigable for boats of 2,000 tons. Locks 260 metres long will be able to take a tug and two barges of 2,000 tons each. The Meuse-Waal canal will be navigable for boats of the same tonnage.

Completion of Rhine-Vistula System.—In Germany two large schemes are being carried out. The Mittelland canal, which will connect Hanover with the Elbe near Magdeburg, will establish an uninterrupted navigable waterway between the Rhine and the Vistula. This canal will form the last section of the waterway begun with the construction of the Dortmund-Ems canal between 1889 and 1899, followed by the Rhine-Herne canal, opened in 1914, and the Bevergern-Misburg canal constructed during the War. The last-mentioned canal, which is 172 km. long, is without locks. The total length without locks, including certain parts of adjacent canals, is no less than 213 kilometres. The Mittelland canal will be navigable for boats of 1,000 tons. It will cross the Elbe by a bridge, the plans for which have been submitted for the approval of the International Elbe Commission.

Rhine-Main-Danube Connection.—The second important scheme in process of execution is the junction between the Rhine, the Main and the Danube. The idea of linking up the Rhine and the Danube is a very old one. Charlemagne conceived the idea of constructing a canal, traces of which can still be seen. The Ludwig canal, opened in 1846, was only navigable by small boats up to 120 tons and has never been much used. It is anticipated that the area tapped by the Rhine-Main-Danube navigable waterway will exceed that of any other European river and canal system. The scheme involves the canalisation of the Main, the construction of lateral canals and of a junction canal between the Main and the Danube, joining up with the latter near Kelheim. It also necessitates the regulation of the Danube between Regensburg and Hofkirchen, and between Passau and the frontier and in addition its canalisation over the stretch between Hofkirchen and Passau, that is to say, in the Bavarian Kachlet. The waterway will be navigable for canal barges of 1,200 tons and for Rhine barges up to 1,500 tons. The scheme also provides for the utilisation of hydraulic power; in fact, it is the production of electric power that has made the scheme practicable.

Other German Schemes.—Among the other plans for the construction of canals in Germany, such as the Hansa canal, the canal from the Weser to the Main, the Kuesten-Kanal and the junction canal between Neckar and Danube, only the last deserves serious consideration at present. The canalisation of the Neckar might be of considerable value for the development of navigation and for the port of Mannheim. At one time it seemed that, mainly for political reasons, opinion in Germany was in favour of constructing the Weser-Main canal (the Weser being the only important river which has escaped internationalisation) in order to direct part of the traffic from the Danube to Bremen, after the construction of the Main-Danube canal. The Weser could also carry some of the traffic

normally carried by the Rhine and the Elbe. But the changed political situation makes it improbable that this scheme will be put into effect at any early date.

Italian Waterways.—In Italy a canal has been constructed from the Po to Brondolo on the Lagoon of Venice. A canal is also in course of construction from Milan to the confluence of the Adda and the Po, whereby Milan will be linked by waterway to Venice.

Czechoslovakian Waterways.—In Czechoslovakia, besides canalisation work on the Elbe and the Moldau and the regulation of the Danube, the Govt. has carefully considered two canal schemes, an Elbe-Danube canal and an Elbe-Oder canal navigable for vessels of 1,200 tons. The length of the Elbe-Danube Canal would be about 300 kilometres. Its course would follow as far as possible the line of the most important towns. Financial considerations are retarding the execution of these schemes.

Polish Waterways.—Polish plans include schemes for several canals which, navigable by boats of 1,000 tons, would constitute, together with the regulated parts of the Vistula, a complete system of navigable waterways across Poland. This plan would involve the construction of a canal which would start from Kattowitz in Upper Silesia, extend northwards and join the Vistula either at the mouth of the Brda or near Thorn, making use in several of its sectors of existing navigable waterways as, for example, Lake Goplo. Another canal would extend from Posen via Konin and Warsaw to Pinsk, taking in a part of the Warte and of the canalised Bug, together with the reconstructed King's canal between Brzesc and Pinsk. The latter waterway would have to be continued from Pinsk to the Russian frontier in order to link up with the great navigable system of Russia.

The Russian System.—The Russian rivers which are naturally navigable have suffered but little from the lack of upkeep in the course of the last 10 years. The proposal to construct the Rostov canal to unite the Volga and the Don may be carried into effect, though there are great technical difficulties in the way of this scheme. Its completion would reduce the cost of transport of oil from Baku, fish from Astrakhan, corn from the valleys of the Volga and the Kama, coal from the Donetz and merchandise from Persia. The importance of the proposed canal is obvious, as the immense system of the Volga, which is navigable for more than 16,000 km., will thus be linked up with the Black Sea, and the Baltic, Black and Caspian Seas will be connected by navigable waterways. There is already a service between Leningrad via the Mariinsky system and the Volga to Astrakhan and thence to the Persian port of Enzeli. The immense territory of Russia may become of capital importance in the future from the point of view of inland waterway communications. The system of waterways is more than 200,000 km. in length, of which at present some 40,000 are navigable. The Asiatic Russian system from the Ob-Yenesei mouths to Central Asia and Lake Baikal lies outside the scope of this article.

Economic Considerations.—Economic considerations will naturally play an extremely important part in any decisions taken in regard to the improvement of existing waterways or the construction of new ones. The question will inevitably arise whether a railway would not prove more serviceable than a waterway. The preference will clearly go to whichever mode of transport is cheaper. In comparing the advantages of waterways and railways, we must distinguish between rivers and canals; and we must further discriminate between canals built across flat country and those constructed across land where there are marked differences in level.

Rivers not naturally navigable may generally be rendered navigable by regulation works, such as spur dikes or longitudinal dikes, or by canalisation works such as the construction of dams across the bed of the river and locks to enable boats to pass. The forming of large reservoirs in the upper courses of waterways belonging to the basin of a large river may also constitute an excellent means of improving navigability by regulating the flow of water. In this way a greater minimum depth is obtained and the period of navigability during the year is lengthened.

As a rule the cost of building a railway having the same carrying capacity as a river is appreciably higher than the cost of making the river sufficiently navigable. Moreover, the cost of river-craft having a given loading capacity is less than that of railway rolling stock having the same capacity. Further, the haulage power of a locomotive is only a small fraction of that of a tug. This argument remains true even if a proper use of a waterway involves the execution of improvement works. Moreover, the economic development of the area served by the river leads to a considerable increase in passenger and parcels traffic, for which the railway is necessarily more suitable than the waterway, so that we always find railway lines alongside the river, connecting up the various important centres situated thereon. The argument that a river can compete with a railway holds good even if the traffic does not, strictly speaking, consist of heavy goods, such as ores or coal. The Danube is a case in point; before the War the volume of traffic on that river amounted to nearly 7,000,000 tons.

The case is different, however, if it is an artificial navigable waterway, *i.e.*, a canal, which has to be built. As a rule such a work is not justified from the economic point of view unless the prospective traffic in heavy goods (ores, coal, building material, cereals, and certain other agricultural products) is to amount to several million tons per annum. In order to determine the cost price of transport by canal we have to allow for possible profits and advantages derived from the exploitation of hydraulic power, and accordingly we have to make a distinction between a canal crossing flat country and a canal built in mountainous districts. Many projects for artificial waterways have been rendered feasible by the utilisation of water power. Wherever the configuration of the ground has permitted, recent schemes have combined the construction of a navigable waterway with the exploitation of hydro-electric power. The question therefore whether, in any given case, it is preferable from the economic point of view to construct a canal rather than a railway cannot be answered so readily as when the alternatives are a railway and a river; the answer depends upon a very large number of factors.

International Rivers.—A special category of waterways is constituted by those which come under the scope of the Convention on the Régime of Navigable Waterways of International Concern[1] concluded at Barcelona on April 20 1921. The criteria adopted at Barcelona were the fact of crossing or separating a number of countries, and natural navigability to and from the sea. In addition to the obligations which devolve upon riparian states, particularly in connection with works of upkeep, the Barcelona Convention lays down the principle of freedom of navigation and equality of treatment for all flags.

The objection has sometimes been raised that two different ideas have been confused, namely, the territorial idea and the idea of international traffic. It is clear that if it is in the interest of international traffic that there should be no flag discrimination, this principle applies wherever international navigation is carried on, independently of the fact whether the navigable waterway crosses or separates several states or not.

On the other hand it is only natural that, as regards international rivers, there was a desire to impose certain strict obligations on riparian states in connection with the hydraulic works to be carried out; these obligations, however, should rather be regarded as reciprocal obligations between riparian states. It would seem not impossible by drawing a clear distinc-

[1] In the application of the statute, the following are declared to be navigable waterways of international concern:

1. All parts which are naturally navigable to and from the sea of a waterway which in its course, naturally navigable to and from the sea, separates or traverses different states, and also any part of any other waterway naturally navigable to and from the sea, which connects with the sea a waterway naturally navigable which separates or traverses different states.

It is understood that:

(*a*) Trans-shipment from one vessel to another is not excluded by the words " navigable to and from the sea ";

(*b*) Any natural waterway or part of a natural waterway, is termed " naturally navigable " if now used for ordinary commercial navigation, or capable by reason of its natural conditions of being so used; by " ordinary commercial navigation " is to be understood navigation which, in view of the economic condition of the riparian countries, is commercial and normally practicable;

(*c*) Tributaries are to be considered as separate waterways;

(*d*) Lateral canals constructed in order to remedy the defects of a waterway included in the above definition are assimilated thereto.

(*e*) The different states separated or traversed by a navigable waterway of international concern, including its tributaries of international concern, are deemed to be " riparian states."

2. Waterways, or parts of waterways, whether natural or artificial, expressly declared to be placed under the régime of the General Convention regarding navigable waterways of international concern either in unilateral Acts of the states under whose sovereignty or authority these waterways or parts of waterways are situated, or in agreements made with the consent, in particular, of such states.

tion between the territorial idea and the idea of international traffic, to lay down, for all navigable waterways on which international traffic can be carried on, contractual provisions similar to those which have been drawn up for maritime ports.

Inquiry into Existing Conditions.—In accordance with a resolution of the Economic Conference of Genoa, which was approved by the Council and Assembly of the League, the Organisation for Communications and Transit decided in 1924 to make inquiries of the various European governments concerned regarding the present situation of inland navigation in their respective territories. It also decided that the study of the complex problems which might be raised in connection with the great international rivers with many riparian states, should be entrusted to Mr. Walker D. Hines, United States Director of Transport during the War, who was appointed after the War as arbitrator in the allocation of river tonnage on certain international rivers. Accordingly Mr. Hines carried out an exhaustive study of the position of inland navigation on the Danube and also carefully examined the existing difficulties on the Rhine. It is hoped that Mr. Hines's reports on Danube and Rhine navigation as well as the results of the general inquiry will help to promote co-operation among the riparian states and to solve existing difficulties, in order that inland navigation may develop unhindered, and may occupy among the various means of communication a position which will enable it to play a great part in restoring economic stability and promoting the prosperity of the European nations. For the development of inland water transport in America *see* the articles GREAT LAKES AND ST. LAWRENCE and MISSISSIPPI RIVER.

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INOUYE, KAORU, MARQUESS (1835–1915), Japanese statesman (*see* 14.587), died Sept. 1 1915.

INSANITY (*see* 14.597, and PSYCHIATRY; PSYCHOANALYSIS; PSYCHOSIS; PSYCHOTHERAPY).—A change in the conception and in the handling of the facts characterises the present century. Instead of "Lunacy" and "Insanity" we speak to-day of mental disorders, of psychoses and psychoneuroses, viewed as problems of the adaptation of the individual to his environment.

During the World War a wide range of mental disorders had to be met by medical and military officers many of whom had never before concerned themselves with such problems. A new type of sympathy and sense of duty towards the victims of "war shock" laid the foundation for a more understanding interest in mental disorders in general, and aroused the demand for their effective management, not by mere relegation to official asylums, but by active therapeutic measures.

Definition.—"Insanity"—implying as a rule an incapacity to grasp the fact and nature of the existing sickness or disorder and a lack of responsibility for personal care and conduct, with possible neglect of or actual danger to self or others—is a contingency rather than the essence of many disorders, and cannot properly be studied and understood by limiting oneself to the "insane" as we find them in the centres of segregation which we call asylums, refuges, retreats or mental hospitals. The wider field of psychiatry (*q.v.*) now includes mental and behaviour problems outside as well as inside hospital walls, and experienced help, medicinal at times but also to a large extent taking the form of guidance in the problems of adaptation, has supplemented or replaced mere custody in institutions. Mental hygiene, administered through mental health boards and committees in the United States and in several European countries, offers constructive and preventive measures which are carried out largely in centres where physicians, psychologists and social workers collaborate in the work.

ADVANCES IN ETIOLOGY

Nationality and Race.—Interesting statistics on mental disorders in different nationalities making up the admissions to the Massachusetts hospital at Worcester, and to the New York state hospital at Blackwell Island suggest that national and racial habits play an important part, the greatest differences lying in the relative rôle of alcohol and syphilis and in the frequency of temperamental and psychoneurotic maladjustments.[1] The Irish admitted had 27·69% alcoholic psychoses and 37% largely psychogenic (temperament- and behaviour-determined) disorders, while the Jews presented 0·32% alcoholic but 65% largely psychogenic disorders. Of the Irish only 7·59% showed paresis (*i.e.*, a form of brain syphilis); of the Jews 14%; of the Germans 20%; and of the negroes 29·41%.

Occupation.—The incidence of mental disorders in certain occupations is dependent largely on the degree of exposure to harmful influences, and also on the temperamental factors which may determine the choice of a profession.[2]

Heredity.—The question of heredity is not as simple as it appeared in 1911. While the dispositions are inherited, it seems highly probable that additional factors, in the form of life-experiences, play a considerable rôle. The attempts to use Mendelian principles led to the conviction that affective disorders (manic-depressive psychoses) follow a dominant, and schizophrenic disorders a recessive type. The work of Mott and others appears to show that these two conditions may follow a law of anticipation according to which the mental symptoms develop at an earlier age in succeeding generations of psychopathic stock. Lately, we meet with the assumption that at least two or more factors are needed to determine schizophrenic or manic-depressive attacks, and geneticists like Jennings even tell us that we had best forget the theory of unit characters, in man, because of the complexity of the facts to be considered. Eugenics (*q.v.*) has shown itself applicable in two ways, negatively in the sterilisation of the most obviously degenerate offspring of psychopathic families, and positively in the training of the young towards healthy mating and sound sexual hygiene.

Infections.—The claims made with regard to the importance of infection (14.598) and in the publications of a few surgically inclined psychiatrists have not been borne out under recent scrutiny. Both the "agglutinines pointing to streptococcus infections present in every case" of manic-depressive disorders, and the claims of 80 to 90% recoveries after removal of focal infections and of the colon, are largely discredited, partly on the very material of those making the claims. In the face of all the propaganda, the theory of autointoxication and much of the more recent theory of endocrine disorders as etiological factors in mental disturbances are having an equally difficult time before the rigorous tribunal of strict hospital and field work and statistical tests. This does not mean that the "physical causes" are being neglected or belittled. Much research has been and is still being carried out on the morbid anatomy and biochemistry of the psychoses and psychoneuroses. Mott has demonstrated changes in the endocrine and particularly the generative glands of dementia praecox which in his view point to an "inborn lack of vitality" in these patients. However, the old controversy between the physiogenic and the psychogenic theories as to the causation of mental disorders is dying down before the newer and more comprehensive conception of psychobiology, according to which the physical and mental make-up, the personality tendencies and the determining factors and situations are taken into account in the study and treatment of the patient. Most cases constituting or akin to the dementia praecox or schizophrenia or parergasia group (described as katatonia and hebephrenia in 14.606) have been shown to be much more readily understood and formulated for purposes of treatment on a genetic-psychodynamic basis, with special attention to the cir-

[1] G. H. Kirby, *New York State Hospital Bulletin*, 1, p. 666.
[2] James V. May, *Mental Diseases, a Public Health Problem*, p. 32.

cumstances of the development of symptoms, than on the basis of a sweeping claim of inevitable deterioration due to "unknown" toxins or other causes, or on the theory of insufficiency of endocrine glands.

Special Types of Disorder

Feeble-mindedness.—The study of feeble-mindedness has been enriched in various ways. The Binet-Simon tests and their modifications furnish a dependable and comparative measure of the actual intelligence in terms of the "mental age" and the "intelligence quotient" or I.Q., *i.e.*, the mental age attained divided by the chronological age. One speaks of idiots where the attainable age does not exceed three years, of imbeciles up to a seven-year level and of the higher grades of feeble-minded or morons between the eight and 15-year level. A retardation of less than three years may lie within the range of error. The British royal commission of 1904 found that in groups of urban industrial and agricultural areas there was an average of ·32% of feeble-minded children and adults in the general population, and of ·83% of feeble-minded among the children of school age, with a higher percentage in towns than in country districts. A house-to-house survey of the children of school age of a well-circumscribed industrial district of Baltimore, Md., was undertaken by the Henry Phipps Psychiatric Clinic and published by Dr. C. Macfie Campbell.[1] Since then numerous surveys in the United States have corroborated the Baltimore results, which make it clear that about 2% of the children of a community should have special institutional training and some of these protection for life, an additional 6% should be in special classes for the retarded, and another 5% should have at least individual adaptations of the curriculum.

Greater attention to the psychology of education has revealed the fact that children may fail to keep up to the standard of their age for causes other than feeble-mindedness, and may present problems of maladjustment which had best be handled by the psychiatrist. In England and Scotland the Mental Deficiency Act of 1913 has widened the range of defectives who may legally be committed to institutions and makes provision for moral imbeciles. Early diagnosis and anti-syphilitic treatment of defect due to congenital syphilis is followed by improvement.

Acquired Mental Diseases.—A distinct advance is shown by the fact that the disease entity concept is giving way to the less dogmatic concept of reaction-types. The specifications of the types of mental disease given in 14.597 are to-day largely replaced by a more genetic and constructive formulation and interpretation of patients or individualities.

Dementia Praecox.—An intermediate phase of rather optimistic simplification had introduced the concepts of manic-depressive (or affective) psychoses as essentially non-deteriorating, as opposed to the schizophrenic psychoses (also called dementia praecox), which are apt to pass into deterioration, emotional indifference and apathy. The manias and the melancholias would constitute the manic-depressive psychoses, while hebephrenia and katatonia are now included in schizophrenia. But even these diagnoses, which aim largely at prognosis, have had to yield to the recognition that one had best admit a number of practically important reaction-types of special working and tendency of evolution, requiring further a specification of the causal factors and the assets of the patient both for the determination of the intrinsic nature and the formulation of a prognosis in each case.

The simple notion of "one patient one disease," and a classification under a one-name diagnosis indicating either a good or a bad outcome, cannot do justice to the multiplicity of points which demand consideration. A totally new conception of the constitution of personality and its hereditary and individual components has supplemented the formerly dominant and almost exclusive conception of brain destruction by poisons and other agencies. There is to-day less interest in special disease entities than in the working of definite processes or developments variously open to modification and adjustment.

[1] *Mental Hygiene*, 1917, i., pp. 96–147.

The psychoanalytic contributions towards our knowledge of personality and towards the interpretation of mental symptoms, and the methods of treatment based on these theories, are variously evaluated, but have been stimulating in the study and utilisation of life-experiences (*see* Psychoanalysis and Psychotherapy).

General Paralysis.—One of the most remarkable changes has occurred in our experience with the most fatal and disastrous form of mental disorder, general paralysis or paresis. There is no longer any doubt about its being due to an invasion of the brain by the spirochaete of syphilis. The disease may occur in children or adolescents through hereditary transmission of this organism, as well as in adults in whose cases symptoms may appear 10 or even more years after acquired syphilitic infection. But, far from being a uniformly fatal disease, it has now been found to yield to treatment. Early diagnosis, assisted by the application of the Wassermann test to the cerebrospinal fluid and not only the blood serum, and therapeutic infection with malaria (*q.v.*) or other recurrent fevers which appear to be incompatible with syphilis of the nervous system, enable as many as 40% of patients to enjoy a prolonged remission from their symptoms or to obtain a complete cure.

Commitment or Certification

It is unfortunate that there will probably always be a group of patients or phases of illness that lie between the two extremes of (1) voluntary co-operation and (2) forcible treatment. While there is a growing desire to extend facilities for treatment on a voluntary basis, it frequently happens that delay in dealing with an unwilling patient involves risks when suicidal or homicidal impulses are present. Following the lead of the continental clinics, hospitals have been opened in the United States and elsewhere for the study and treatment of early cases of mental disorders.

Most of the American institutions have an increasing number of "voluntary commitments" requiring in writing a "three days' notice of intention to leave," so that the physician may have the right to detain the patient pending the consideration of the best course to take in the further care. The commitments themselves in many states are left to a statement of two impartial physicians; in others they require court procedure or even jury trial, a method that is, however, more and more limited to habeas corpus actions, *i.e.*, a demand to show cause for the detention of a patient as a "committed" person.

The medico-legal problems of responsibility in mental disorders are still in an archaic state on account of the unfortunate fact that the rules of evidence which were invented for the normal are not favourable for the presentation of facts which have a psychiatric bearing. Another point of loose practice occurs in the United States in the proper disposal of patients who are declared "not guilty on account of insanity." A patient who gets into conflict with the laws should remain under safeguard until he shows evidence of insight and capacity for self-management.

The principles of equity procedure in use in juvenile courts promise beneficial reform and valuable experience based on a study of the individual delinquent according to psychiatric principles. The moral changes which are liable to follow an attack of epidemic encephalitis constitute a new and difficult problem (*see* Encephalitis Lethargica).

Statistics.—Statistics are notoriously inadequate where no continuous census and control of the population and its whereabouts is maintained. The number of "certified" insane patients under care in England and Wales was 131,557 on Jan. 1 1925, an increase of 1,217 over the number on Jan. 1 1924, but evidently less than the number before the War; 48·9% are males, 51·1% females. The recovery rate calculated on the direct admissions is given as 34·86%. The death-rate calculated on the daily average number of interned patients is 7·62%. The absence of any greater increase of numbers during and since the War is probably only apparent. The fifth report of the British Lunacy and Mental Deficiency Board of Control (1919) brought out a ratio of 208 (instead of the usual 76) cases of death to each

1,000 of the interned insane and defective population, owing to a temporary increase of tuberculosis, diarrhoea and dysentery, typhoid fever, etc. The lack of fresh milk and fats and the disorganising of the nursing through the War must have been largely responsible.

Effects of Prohibition.—Considerable interest adheres to the question of the effect of prohibition in the alcoholic mental disorders. Wherever the alcohol traffic has been brought under control the reduction of " alcoholic insanity " has been striking. Where propaganda against prohibition has been most active, a moderate return of the old conditions has been noticeable. The experiment is too short and too imperfectly carried out to furnish an answer to the many questions arising.

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(A. Mey.)

INSECT BITES AND STINGS.—Insects may be the cause of disease or of morbid conditions in man in several different ways: (1) by living *on* his skin or hair, as in the case of three varieties of pediculi or lice (the head-louse, the body-louse, the crab-louse); or *in* his skin, as with the itch-insect (though this is strictly not an insect at all but a spider-like parasite), or with the tropical chigger, jigger or sand flea; (2) by depositing their eggs on the skin or mucous membrane, or on wounds, whence the larvae find their way below the surface, usually by boring or burrowing, as is the case with several tropical flies; (3) by being the instrument of transferring a bacterial infection to man from some other animal, as is the case with the rat-flea in plague, or by taking part as host in the life-cycle of a spirochaete or a protozoon and passing the parasite on to man, as is done by certain mosquitoes in yellow fever or in malaria; (4) by the direct and immediate effects of their bite or sting. It is with this last method only that the present article is concerned.

In Great Britain, as in most other countries, such bites and stings are exceedingly common, the most frequent biting insects being the common flea, the bed-bug, gnats and mosquitoes, and the most frequent stinging insects being the wasp, the bee, the hornet and the ant. It should be realised, too, that the effects of the louse are due not merely to its presence, as mentioned above, but to its actual bite.

The consequences of these bites and stings are well known, very few persons escaping some personal experience thereof, though susceptibility varies widely in different persons. Local irritation may be extreme, and the skin lesion produced may vary from a small reddened or erythematous patch or a tiny papule, to large urticarial or nettle-rash wheals, or even to a spreading cellulitis or inflammation of the tissues under the skin. These effects, though giving rise to intense discomfort, are rarely serious and usually pass off completely in a few hours or at most a day or two. Occasionally, however, dangerous developments occur.

The conditions most likely to lead to such developments are: (1) a very large number of stings, as when a swarm of angry bees settles on the body; (2) the lesion being on a mucous surface such as the tongue, the palate or the pharynx; (3) the supervention of some local complication such as erysipelatous or other streptococcal infection, or the direct transmission of some form of septic poisoning as by the bite of a fly which has been feeding on putrid material. In all such cases skilled surgical aid should at once be sought, as in extreme instances death has occasionally resulted and urgent measures may be necessary to deal with the situation.

Treatment.—The poison injected with an insect sting is, at least in many species, formed by a mixture of the secretions of two glands, one of which is acid (formic acid) and the other of which is alkaline. In most cases the acid predominates; hence weak alkaline solutions (soda or ammonia) are commonly effective in allaying the irritation. In some cases, however, especially, it is said, with the sting of some wasps, the alkaline element is predominant and in such instances a weak acid lotion (such as diluted vinegar) gives most relief. Other local applications of an effective character are alcohol, spirits of camphor, a solution of menthol or of permanganate of potash, a dilute solution of carbolic acid, or even slices of the homely onion. In every case the sting itself, if it remains in the skin, should be carefully removed.

As preventive measures when insects are prevalent, camphor, menthol, lavender and oil of eucalyptus appear to have some virtue; and skilful and assiduous campaigns against flies, mosquitoes and wasps have of late added greatly to the amenities of a number of localities. *See* Bacteriology; Kala-Azar; Parasitology. (H. B. Br.)

INSTALMENT SELLING is in essence an extension of credit to retail purchasers, under some form of contract by which the purchaser agrees to make partial payments at stated intervals over a period of weeks, months or even years. It enables thousands of persons of limited means to acquire goods which they could not otherwise possess. The goods purchased are usually delivered after the payment of an initial deposit. This deposit is sometimes merely a nominal sum; but frequently it amounts to one-fourth or one-third of the price of the goods. The seller retains title, or its legal equivalent, in the property until the last instalment is paid. This is accomplished by means of a chattel mortgage, a conditional sales contract or a lease. The latter is the method employed in Great Britain. In this article a résumé of American developments will be given first.

I. IN THE UNITED STATES

The customary practice in the United States, where the greatest development of instalment selling has occurred, is described as follows: " When goods are bought on lease or conditional sales contract, the title remains in the sellers, and passes to the buyer only upon completion of the stipulated payment. Under the lease plan, instalment payments are designated as 'rent.' (This form of instalment selling was devised to conform to the laws of certain states.) But when the chattel mortgage form is used, the title passes immediately to the buyer, and he gives the mortgage as security for payment of the balance due. Under any of these forms, the sellers may repossess the property if the conditions of the sales contract are not met by the buyer." (See *Instalment Merchandising, Compilation No. 2*, issued by the National Association of Credit Men.)

A tremendous expansion of instalment selling took place in the years following the World War. The aggregate amount of instalment credit in force in the United States in 1926 was estimated to be close to $3,000,000,000; and this estimate, though based on insufficient data, is believed to be conservative in view of figures from the automobile industry showing that the total of automobile instalment paper then outstanding amounted to about $1,500,000,000. The grand total of all instalment sales in the United States in 1925 was said to be $5,000,000,000.

This extraordinary development was naturally viewed " with alarm " by many conservative economists, merchants and bankers. Aside from what might be called moral objections, the chief criticism was that large-scale instalment buying must lead to unhealthy inflation and consequent disorganisation of business and finance. It is probable that severe business depression, with its accompanying unemployment and the consequent failure of workers to pay their instalments, would prove disastrous to commercial firms that had failed to scrutinise carefully all credit applications. On the other hand, it was pointed out with much force that a high element of safety attaches to credit risks, each relatively small, which are widely scattered throughout the community. The continued success of many firms whose experience in instalment selling long antedates the latest boom, is proof that such a business may be as soundly and as profitably conducted as any other.

Credit merchandising, in fact, had made a rapid growth before the beginning of the present century. It was first applied extensively to the sale of subscription books and was later adopted by the piano and musical instrument business. It was

then applied to the sale of furniture, sewing-machines, jewellery, gas-stoves; and thousands of these products have been paid for by the month by people with moderate, steady incomes. A very large proportion of instalment purchasers in the days before the automobile were housewives who found it possible to make small weekly or monthly payments out of their household allowances. Women have continued to exercise a large influence on this type of buying; and most articles thus obtained are decided upon by the whole family.

For a long period a certain social disapproval hung over instalment buying, particularly if the articles purchased were luxuries. The purchase of homes by this method was, however, always regarded as praiseworthy, and most homes have been bought on this plan. The boom of recent years, which has almost entirely removed the social stigma, began with the adoption of this method of selling on a large scale by the automobile industry. When the United States entered the World War the time payment plan was utilised in the sale of huge quantities of Liberty bonds; and in the years that followed many investment houses did a considerable volume of business selling securities on deferred payments.

The volume of instalment sales of automobiles prior to 1916 was almost insignificant. Mass production of motor-cars closely followed the development of finance companies to care for instalment business. Some of these finance companies were organised outside of the automobile industry; others were organised by large manufacturers. One of the most important of these was the General Motors Acceptance Corp., the volume of whose transactions grew from $10,000,000 in 1919 to nearly $150,000,000 in 1925. Alfred P. Sloan, Jr., President of the General Motors Corp., stated that the losses, *i.e.*, retail charge-off, during this whole period were only .199 of 1% of the volume of retail business handled. (See *Nation's Business*, April 1926.) C. C. Hanch, General Manager of the National Assn. of Finance Companies reported the results of an extensive survey completed during 1924 as showing a loss ratio of less than $\frac{1}{8}$ of 1% on aggregate new and used car business, amounting to $195,500,000. (See *American Bankers' Journal*, April 1926.) It is seen therefore that losses in collection have been very small.

In 1926 there were more than 1,000 finance companies in the United States created for the purpose of handling automobile purchases. More than 75% of all motor vehicles sold during the previous year were purchased on the instalment plan, the deposit usually being about $\frac{1}{3}$ of the price of the car, the balance being divided into 12 equal monthly payments.

Finance corporations did two kinds of business, wholesale and retail; that is, they financed the purchase of cars by dealers from manufacturers and the purchase by retail buyers from dealers. In the case of one low-priced car it was possible in 1925 to get possession by making an initial payment of $12.40, and furnishing two endorsements to the note. This was followed by weekly payments of $5 for a year, and at the end of the year a so-called balloon-payment completed the transaction.

The fee of the finance company added to the purchase price was known as the time-price. After deducting the initial payment from this time-price the remainder was generally divided into 12 or more equal parts which constituted the monthly payments. Finance corporations usually calculated 15% per annum interest on money actually outstanding, or from 6 to 8% on the purchase price. However, in some cases, where initial payments were very low, the subsequent payments extending over more than a year, and with no responsibility by the dealer for collections, the final cost to the purchaser was as much as 30% above the cash price.

Finance corporations secured their funds from the banks, and the particular function they served was to provide the necessary machinery for investigation, supervision and collection which the banks lacked. The different contract forms employed have already been described. It was customary for the purchaser to make out a note to the dealer for the amount remaining after the initial payment. The dealer passed on this note to the finance corporation, which paid him its face value minus its own fee. The dealer would either indorse the note, and thus assume responsibility for the payment of the monthly instalments, or he would agree to re-purchase the car in case of default by the purchaser. In some instances, however, the dealer assumed no responsibility: under this, the "no-recourse" plan, the charges of the finance company were higher. Under any plan the purchaser was usually required to insure the car against fire, theft and accident.

The prosperity of the automobile industry and the enormous sale of motor-cars in the United States was the direct outcome of instalment selling. This fact could not escape notice by manufacturers and dealers in other products. Consequently many articles never hitherto distributed by this means were offered on the time-payment plan; and many retail merchants who had once frowned on instalment selling either adopted the method gladly as a proved means of increasing business, or did so reluctantly to meet competition. In 1926, in the United States, it had become possible to purchase practically every article of consumption costing upwards of $25 (with the possible exception of food) on time payments.

This trend was well illustrated by the announcement in 1925 by a leading men's clothing store of Chicago of a so-called "budget system" under which garments might be purchased on a cash payment of $\frac{1}{8}$ to $\frac{1}{4}$ of the purchase price, the remainder being payable in 10 weekly instalments. This shop had always conducted its business very conservatively, and had refrained from everything remotely related to instalment methods. Other retailers were inclined to be censorious, and clothing manufacturers were divided as to the merits of this innovation. But the management reported, after a short test, that it was successful, and some interesting facts were brought out. This store, like many others of the same class, maintained charge accounts for a large number of customers; and it is stated that payment on these accounts was often delayed as much as 60 or 90 days. But the customer who pays $\frac{1}{4}$ down and then 10% of the balance each week pays for his goods more quickly than he would under the ordinary charge-account.

One of the most conservative stores in New York has instituted an elaborate budget system for the sale of furniture. This budget system is essentially a plan for selling on time payments, but it has the advantage that the store first consults with the purchaser as to his income and furniture requirements, seeking by this means to minimise their risk and at the same time more accurately to satisfy the customer's needs. The consultation is of genuine benefit to the purchaser and often enables him to make a larger purchase with greater economy than if he bought haphazardly or piece by piece.

It is apparent that under these conditions credit can be extended to thousands of persons to whom a merchant would hesitate to grant an open charge account. Moreover, the purchaser doubtless feels it safer and more convenient to budget his payments by the week or month rather than to have the entire amount fall due within 30 days and then allow the account to remain unpaid for a longer period, through the acquiescence of the store-keeper, but with a consequent impairment of the purchaser's credit standing.

Although it has been customary to add a time-price or interest charge in making instalment sales, some merchants have endeavoured to maintain the same price for the cash customer as for the instalment customer. This practice probably cannot long continue. Certain stores have already taken advantage of the situation to advertise "no credit" and "cut prices" for cash, with the idea of showing the public the cost of time purchases. The possibility of selling more cheaply on a strictly cash basis will doubtless prove sufficient incentive for the expansion of this class of business; and by the operation of ordinary economic law will serve as a salutary check on instalment buying.

The cost of instalment selling, considered by itself, is high. It has been estimated to be as much as $800,000,000 yearly in the United States. This might be regarded as sheer economic waste were it not for the fact that tremendously increased production, made possible by the time payment privilege, has

served to lower prices; so that the purchaser buys enough cheaper to pay the cost. Increased demand likewise keeps factories busy and gives employment to more workers. The protagonists of instalment selling insist that much of the prosperity of the United States since the War, in the face of strong European competition with its cheap labour, can be traced to the development of the home market by means of time-payment financing. It is even suggested that certain backward countries could benefit by the cautious introduction of this method of marketing.

It is typical of the diversity of opinion which still envelops the subject that some authorities regard instalment buying as tending to demoralise the purchaser, while others, probably more numerous, believe that it benefits the individual and society. "We are sorry," said the Babson Statistical Organisation in July 1925, "to see this stampeding to an instalment business. We don't believe that it is wise for anyone unnecessarily to get into debt, whether manufacturer, merchant or the public. Getting into debt has been the cause of most failures, and we are sorry to see another stratum of the public adopt it. On the other hand, is there any ethical reason why your employees are not justified in giving serial notes for their purchases of goods, as you are justified in giving notes for your purchases?"

The story is told by a writer opposed to instalment selling of a man on an income of $60 a week who had contracted for purchase amounting to $72 a week. He explained that he could not resist the persuasive suggestions of salesmen. But most observers agree that the American household had not lost its sense of proportion; and the occasional emergence of cases like this is a reflection on the credit departments of the sellers rather than on the principle of instalment selling. It is probably true, also, that further experience with deferred payments not only tends to make credit departments more cautious, but likewise trains the purchaser to be on his guard against undertaking obligations which he cannot meet.

This training must have considerable social value. The workingman who seeks to buy a piano or an automobile on credit soon learns the importance of having a good reputation for meeting his obligations promptly. The instalment merchant would prefer, as a matter of fact, to sell an expensive article to a man of moderate income with a proved reputation than to a more prosperous individual who was dilatory in meeting his obligations. Having bought his automobile or piano, having discovered the value of established credit, and having learned some of the mechanism of business, the buyer becomes a more stable unit in the community. He sees it will not be at all impossible for him to buy his own home, and, if his interests lie in that direction, to establish his own business.

The question is at once raised: why does not the instalment purchaser save the money in the first place? The psychologists could doubtless provide a complete answer; it is perhaps sufficient to say here that it is easier to pay for an article already acquired, especially if the sense of obligation is reinforced by a properly managed collection department, than it is voluntarily to lay aside each week or month a certain sum for the satisfaction of a desire that cannot immediately be realised. The wage-earner, attempting to save, necessarily finds it difficult to resist the demands made on his money, even though he manages to avoid petty temptations to squander; and instalment selling serves its best purpose when it provides the purchaser with products of enduring value. The fact is business could hardly go back to the pre-instalment days even if it wanted to.

An analysis of the population in the area between Boston and Chicago, the Great Lakes and the Ohio river, proved that for the purchase of an article costing $75 or more, after house-rent, groceries and clothing are taken care of, only 10% can pay cash; 30% are entitled to standard credit terms on a 30 to 90 day basis, and 60% must have four months to one year to pay. (See *Advertising and Selling Fortnightly*, April 22 1925.) It is only necessary to glance through the magazines and note the advertisements of hundreds of articles selling for more than $75 to realise that these businesses could not prosper if they were forced to reduce their output to the level of the cash demand. Where, then, does the money come from to pay for these products? It is difficult to escape the conclusion that people work harder and deny themselves casual expenditures in order to pay for something of real worth which they greatly desire. In many instances, too, it is certain that the article so acquired promotes greater productivity on the part of the purchaser.

The opposition to instalment selling has come from many sources. Partly, no doubt, it is inspired by manufacturers and merchants who have failed to change with the times; partly from other manufacturers and merchants whose goods will not lend themselves to this method of merchandising and who suspect, rightly or wrongly, that money is being diverted from the purchase of their goods. Open opposition has come from labour leaders, who probably feel that the working-man who is paying for goods on the instalment plan will be less disposed to go on strike, and perhaps prove more docile in his attitude toward his employer. A few banks have expressed themselves as opposed to the instalment business, but the majority have been willing to underwrite it in one form or another, otherwise the vast expansion already noted could not have occurred.

If instalment selling is to continue on a sound and profitable basis, there is no doubt that certain precautions must be observed. (1) It seems undesirable to extend this method of sale to expensive products of great fragility or little intrinsic worth. (2) An article combining high cost of operation, upkeep and depreciation, with little or no earning power, is for the most part unsuited for sale on long-term credit. (3) Special safeguards must be devised if the goods sold on time have little or no value when repossessed, or if the period of payment is likely to outrun their usefulness. (4) No company should engage in credit business without a well-equipped collection department under the direction of an experienced credit man. (5) Credit should be granted only after sufficient investigation to give a reasonable assurance of the applicant's ability and willingness to pay.

The last point is by all odds the most important; there could hardly be any "problem" as to instalment selling if all credit departments were properly managed. The seller is never forced to sell against his better judgment, and if abuses have crept in, the seller must take the major share of the responsibility. Fortunately, such abuses tend to rectify themselves. There is no surer road to business disaster than the extension of credit on terms that are too easy, or to irresponsible persons, or on goods that are utterly unsuited to anything but cash sale. These principles of sound instalment selling are not new; they were discovered by the first banking institutions that began to lend money for the promotion of business. They are principles, however, that may have to be learned all over again by certain finance corporations and business houses who have taken up instalment selling as a quick and easy means to greater profit.

(H. Bra.)

II. IN GREAT BRITAIN

The development of the system of purchase on the instalment plan in Great Britain and her colonies has proceeded on similar lines to those outlined above in the United States, though not in so accentuated a form. The idea was by no means new in England, since pianos were being sold on the hire-purchase system in London so far back as 1838. The present century, however, has seen an enormous expansion in instalment selling, which has been accelerated since the end of the World War. One instance of this will suffice. In 1919 few motor-cars were sold on the instalment plan in Great Britain. Four years later one of those best able to judge computed that of the £15,000,000 retail turnover on motor vehicles, over £4,000,000 was done on the hire-purchase system, the greater proportion of this latter amount being spent on commercial cars, including motor-vans, motor-lorries and motor chars-à-bancs. In 1925 the total turnover had risen roughly to £52,000,000, of which not less than one-half was done on the instalment payment system.

The estimate of the hire-purchase traders is that between 50% and 60% of the furniture turnover and over 50% of

the piano, motor-cycle, sewing-machine and farm implement business in the same year was done on the same basis. Even the British Govt. in 1926 was selling by instalments surplus army stores including aeroplanes and horses. The percentage of instalment selling of factory machinery in Great Britain is, however, very low on account of the fact that British limited liability concerns prefer either to take a discount for cash or to take credit for the full amount of the purchase, since many of them are public companies. Particularly remarkable, however, are the successes reached through the sale of what may be called "implements of business." For instance, the Remington Typewriter Co. offered their portable typewriters on the instalment system in April 1925, the terms being an initial payment of £2.2s.0d., followed by eleven monthly payments of £1.1s.0d. Taking the sales for the six months preceding this offer at the rate of 100 per month (a purely fictitious figure) it was found that the sales had increased in Oct. 1925 to 210, in Nov. to 269 and in Dec. to 325. Thus in eight months instalment selling had increased the sale of portable typewriters by over 200%, while the newspaper advertising for the eight months was only about 5% above that for the preceding six months. To-day there is practically no great London or provincial department store that is not selling furniture, gramophones, wireless sets, pianos and sewing-machines on the instalment system.

The financing of instalment selling in Great Britain has proceeded more slowly than in the United States. There is one important reason for this. The City does not like motor flotations at any time; and it likes motor finance corporations even less. Accordingly, these companies have usually had to go to the insurance companies or their own directorate for their money. Further, the British public has never become enamoured of motor shares, and this dislike has extended to the shares of the finance companies. Yet there are several corporations in Great Britain doing a turnover of £2,000,000 to £5,000,000 per annum, and it is probable that the present prejudice of both the City and the small investor against the shares of such concerns will be overcome eventually. The system of financing motor hire-purchase in Great Britain is identical with that in use in America. In the case of a new car, however, it is usual to ask 25% in cash as a first payment, the remaining payments being spread over a period of 6 to 18 months. It is common for the financing company to charge 7% to 8% on each transaction for 12 months' accommodation. Obviously the actual rate of interest paid is 15½% to 16% since the average amount on loan for each month is only half of the total. It must be remembered, too, that the retailer is normally charging his customer from 5% to 8% for the credit given, so that the net cost to the retailer is quite small. It will be clear, therefore, that the use of the instalment method of selling entails a greater capital in relation to turnover than cash selling. In other words, it tends to turn a former cash business back to the basis of the old-fashioned credit business, when the customer took from 3 to 12 months' credit.

The question which exercises British business men is whether an expansion of instalment selling similar to that which has taken place in the United States during the past six years would be salutary or dangerous. Goods sold on the instalment system are, in a sense, put into stock. One of the main causes of any business slump is the excess of goods in stock. In a time of depression it is clear that the number of failures to meet payment would increase. How seriously would it increase? Further, as the bank rate rose, the financing companies without large reserves would find their profits heavily cut, and possibly turned into losses. At the same time it would be difficult for them to secure new business on account of shortage of money and higher rates of interest. British finance and British business are compelled to study this problem for themselves, since the conditions of American business are so different and no serious slump has occurred in the United States since instalment selling became so prevalent. The conclusion, however, would appear to be that the sale by instalment of articles with a re-sale value, *i.e.*, of articles which do not depreciate with enormous rapidity, is safe within almost any achievable limits. But very large sales in articles unsuitable for re-sale owing to the heavy depreciation, *e.g.*, clothes, might be extremely dangerous if acute business depression became rapidly felt.

The legal aspects of instalment selling in Great Britain are somewhat different from those prevailing in the United States. The property in an article purchased on "deferred payments" passes to the purchaser, *i.e.*, he becomes owner from the moment of the first payment, whereas under the hire-purchase system the purchaser merely acquires the right of possession, no right or property passing to him until the final payment has been made. It is vital therefore for the business which desires to sell its goods on the instalment plan to see that the actual contract signed by the buyer is one for hire-purchase, in which the successive payments are considered merely as rent, until the final payment is made, prior to which latter event the ownership remains in the vendor. Otherwise the purchaser after obtaining possession will be able to sell or encumber the goods, and an innocent purchaser or mortgagee will obtain priority of title.

Another contingency which has to be considered in Great Britain is that of distraint for rent. In the United States generally the landlord does not possess this remedy. All he can do is to put the tenant who is in arrears out on the street together with his goods. In Great Britain the landlord can enter upon the premises, seize the tenant's goods found therein, and sell them to realise the amount of rent due, and this liability extends to goods purchased by the tenant under the hire-purchase system, other than pianos, sewing-machines, safes, gas-engines and printing-machines. On a par with this is the danger of the purchaser becoming bankrupt, in which case the trustee in bankruptcy may, and probably will, sell the goods in question for the benefit of the debtor's creditors, unless the agreement has been drawn up in consonance with the best British practice. The legal situation, generally speaking, is so full of pitfalls and the law on many points so uncertain that any firm considering entering into the instalment business should take care to obtain the best legal advice on all phases of the subject.

It should be added that, from a credit standpoint, the instalment business has proved quite as safe so far in Great Britain as in the United States. The average losses through bad debts by the members of the Hire Traders Protection Assn. is under 2% per annum. One of the leading London firms reported recently that their loss from bad debts was less than 1% per annum. Even in one of the most risky fields, that of the sale of motor-cars by instalment, the average percentage of losses from this cause has never been placed above 2½% by competent authorities. (C. Ch.*)

INSULIN.—In 1889 Von Mering and Minkowski proved that the complete removal of the pancreas from animals produced signs and symptoms which are practically identical with those found in human beings suffering from diabetes mellitus. Previous to that year the pancreas, the gland which secretes powerful digestive enzymes into the first part of the small intestine, was not definitely associated with the utilisation of sugar by the animal body. It was soon shown that a small amount of pancreas grafted under the skin prevented the development of diabetes in an animal from which the rest of the pancreas had been removed. It was also discovered that blockage of the pancreatic duct did not produce diabetes, although degeneration of the pancreatic tissue, with the exception of numerous small structures called the islets of Langerhans, resulted.

Historical Notes.—These minute structures apparently unrelated to the acinous tissue which forms the digestive enzymes, were first noted by Paul Langerhans in 1869. Schafer was one of the first to suggest that pathological changes in the islet tissue might be responsible for the production of diabetes in man. He also suggested that "Insuline" would be an appropriate name for the hypothetical internal secretion by means of which some authorities believed the islet tissue to exert its control over sugar metabolism.

Experiments and Discovery.—In the year 1921 Banting and Best, at the University of Toronto, began a series of experiments the results of which proved that a substance could be obtained

from the pancreas which would enable diabetic animals to utilise sugar. This substance was originally secured from the degenerated pancreas of the dog. The degeneration was produced by tying the pancreatic ducts, which causes an atrophy of the cells of the gland which produce the digestive ferments, but leaves intact the islet tissue. The available supply of degenerated pancreas was, of course, very small and efforts were soon made to secure the material from other sources. After a series of experiments in which small amounts of material were obtained from the normal pancreas of the dog and from the fetal calf pancreas, the active substance was obtained from the adult beef pancreas by alcoholic extraction of the fresh tissue. This discovery provided ample material with which to study in detail its action on experimental animals and to apply it to the treatment of patients suffering from diabetes mellitus. Animals from which the pancreas has been removed suffer from the same symptoms that the human diabetic experiences (*see* DIABETES). The sugar which cannot be used accumulates in the blood and is excreted in the urine. The normal animal stores sugar in its liver in the form of glycogen, but the diabetic liver does not form this substance. The administration of insulin to the diabetic animal corrects all these abnormal conditions and enables the animal to utilise carbohydrate in a normal manner. The average life of a completely depancreatised dog before the discovery of insulin was less than three weeks. These animals have now been kept alive, by the administration of insulin, for over two years and will undoubtedly live much longer.

Use and Value.—Insulin was first applied to the treatment of diabetic patients in Jan. 1922. The results have been uniformly successful, and thousands of patients are now being kept alive by the hypodermic injection of this material. Insulin does not cure the disease but replaces the internal secretion which the diabetic has lost the power to produce. The substance is administered subcutaneously and is not effective when given by mouth.

Standardisation.—Insulin is standardised by observing the extent of lowering of the normal rabbit's blood sugar produced by small amounts of the active material. The administration of too much insulin to diabetic patients is dangerous but the situation can be recognised by the occurrence of definite symptoms. The condition can be quickly corrected by the ingestion of sugar in any convenient form.

Employment in Cases of Coma.—Previous to the discovery of insulin a large proportion of diabetics died of coma. The intelligent use of insulin combined with proper dietetic treatment prevents the development of coma. Patients in coma can in most cases be rescued by the administration of large doses of insulin.

Specific in Diabetes Mellitus.—Insulin has proved to be a specific in the treatment of diabetic coma. It is invaluable in the treatment of severe diabetes mellitus. The use of the active substance in the investigation of the physiology and the biochemistry of the carbohydrates in the animal body has already brought to light numerous important new facts. It is quite possible that it is in this last field that insulin will contribute most to the welfare of the human race and the progress of medical science. (C. H. B.)

INSURANCE (*see* 14.656).—The years immediately preceding the World War were not extraordinarily interesting from the insurance point of view, although those of military age who then effected assurances had, later, excellent reasons for satisfaction that they had done so, since all who were insured with British offices were covered, whether or not the risks of war were specifically excluded from the terms of the policy.

I. GREAT BRITAIN

Life Insurance

Most of the British offices transacting what is known as ordinary life assurance had issued policies free from all restrictions, whereas some of the companies transacting industrial assurance had specially excluded the risks of war. All these companies which had done so decided, however, to waive their rights. The value of the complete cover may be gauged by the facts that, after the outbreak of hostilities, an additional premium of £7·7·0% was quoted to cover the war risks, and that the rate soon advanced to as much as 20% per annum.

Losses of the War Period.—What the World War meant for life assurance was indicated in a paper read by Mr. H. Brown, assistant actuary of the Commercial Union Assurance Co., before the Insurance Institute of London on Dec. 20 1920. Referring to the British offices, Mr. Brown estimated the war losses during the five years 1914 to 1918 inclusive as follows:—

1. Mortality in excess of the pre-War ratio resulted in a loss of about £3,000,000 a year.
2. Depreciation in excess of the amount for just before the War was estimated at £4,000,000 a year.
3. The reduction in the net rate of interest due to the high income tax resulted in a loss, as compared with the pre-War period, of about £500,000 a year.

The total losses, as compared with the period immediately preceding the War could, therefore, be estimated at, roughly, about £7,500,000 a year during the five War years. In the years immediately before the War the total divisible profits of the British offices, in respect of ordinary life assurance, amounted to about £6,500,000 a year, of which about £6,000,000 was divided among the policy-holders, and about £500,000 was distributed among the shareholders of the proprietary companies. During the War the normal profits continued to be realised subject to the deduction of the special war losses described. The special war losses thus exceeded the normal profits of the same period and it may be estimated that, down to the end of 1918, the War probably cost the life offices, as a whole, about five years' bonuses.

Post-War Conditions.—After the end of the War a great change came over life assurance conditions. Instead of suffering depreciation in security values year by year, the investments began to appreciate, while favourable opportunities for the investment of funds continued. Against this fact had to be set the consideration that taxation continued to be heavy. The offices were, however, relieved from the burden of the serious war mortality. They were still guided in their calculations of premium rates by mortality tables relating to the experience many years ago. Investigations are being made by the Institute of Actuaries into mortality experience, but the results are not to be expected for some time. Meanwhile, these two bodies have issued the results of their inquiries into the experience of annuitants. These show that the longevity of annuitants is distinctly greater than that of the general public. Consequently, in 1924–5 most of the British offices amended their annuity rates and would probably have further increased the prices asked but for the favourable rates of interest which they obtained on their investments.

While the difficulties of the British offices due to the War were serious, they were far less formidable than those of some of the continental companies in countries whose currencies depreciated heavily in value. Agreements were reached between the different countries respecting the basis of settlements. A large number of policies were, for instance, effected by Belgians with German institutions, and an agreement was only reached at the end of 1925 respecting the settlements. In the United States the effect of the War on the insurance offices was comparatively small. The American offices have mostly withdrawn from life assurance outside the United States. This secession has provided opportunities for Canadian offices some of which have vastly increased their business within the last decade. The assurance per head in Canada and in the United States is very much greater than the corresponding amount in Great Britain. The average sum assured in the last-named is only about 50% of the corresponding sum assured in Canada and not much more than one-third the assurance per head in the United States.

Industrial Life Assurance.—Criticism of the industrial life assurance system in Great Britain led to the appointment in May 1919, of a departmental committee by the Board of Trade to inquire into the business carried on by industrial assurance

companies and collecting societies. The report of this committee was issued in July 1920, and made various recommendations. Evidence was given before the committee that the convenience and economy in collection could be improved by the introduction of the block system, under which an agent is assigned an exclusive area for his work. The lead in the reduction of working costs has been taken by the Prudential Assurance Co., which by gradual steps has lowered its working costs from 40·5% of the premium income in 1920 to 27·86% in 1924. This reduction made possible the introduction of a reversionary bonus system for the industrial policy-holders on the general lines applied to ordinary life assurance. The committee recommended the appointment of an industrial assurance commissioner, and his first report, which was issued in 1924, showed that the appointment had been of value to the assuring population, particularly in its relations with the less satisfactory type of offices.

Fire Insurance

Fire insurance was affected by the World War in so far as relations existed between insurance companies and the assured in countries which were at war with each other and also by the influence of the War on prices on commodities. This was particularly seen in the great increase in the amount of the claims during 1919–20. In fact, the cost of the claim settlements has been much higher in the post-War period than in the pre-War period. This development is illustrated by the estimates of the cost of the principal fires in Great Britain and Ireland. The cost of these, which only take into account fires in which the damage amounted to £1,000 or more, as estimated by *The Times*, amounted to £3,300,000 in 1916, to rather over £4,000,000 in 1917 and to £5,500,000 in 1918. In 1919 the cost of the principal outbreaks advanced sharply to £9,462,000; in 1920 they were £9,374,000; in 1921 they amounted to £8,128,000; in 1922 to £6,218,000; in 1923 to £7,192,000; in 1924 to £5,017,400; and in 1925 to £5,122,100. It will be seen that since 1920 the cost of the claim settlements has very much declined, which reflects, at any rate partly, lower values.

Losses from Fires.—In order that the total cost of all the fires in Great Britain and Ireland may be estimated, it is usual to assume that 50% may be added to the above figures in order to include the cost of all fires in which the damage amounted individually to less than £100,000. Excluding the exceptionally costly years 1919–20 it will be seen, therefore, that the total cost of all the fires in Great Britain and Ireland may be calculated at something like £10,000,000. These figures are small in comparison with the cost of the fires in North America, in which the British insurance companies transact a large volume of business. The losses in the United States vary very much from year to year, since losses, when they occur, are usually extremely costly. In 1922, for instance, the total cost was estimated at about £80,000,000.

Losses from Earthquakes.—There have been no other losses comparable with those caused by the earthquake at San Francisco in 1906. The British offices settled all claims made upon them promptly, in full. On Sept. 1 1924 there occurred the great earthquake in Japan. The British and American insurance companies had, however, been careful specifically to exclude the risk of earthquake from the terms of the insurance. It was generally held that, with such a definite exclusion, they could not pay claims for damage for which they were in no way liable. In order, however, to show practical sympathy with the Japanese people, the British companies offered to return all premiums for the year which had been paid in respect of property damaged or destroyed. The American offices also intimated their readiness further to return the premiums paid, and the attitude of the insurance companies was known to have created a favourable impression in Japan. Claims were also made in respect of the damage caused by a great fire at Smyrna in Sept. 1922, during a war between Turkey and Greece. Insurance companies maintained that the fire was a direct outcome of war, the risks of which had been definitely excluded from the policies covering property in the city. Their attitude was upheld in the courts.

Insurance managers have pointed out that claims are frequently paid in respect of damage for which they are not actually liable. By inadvertence, some fact may have been omitted from the proposal form, and insurance companies, instead of standing on their rights, have been ready to settle claims. In the case of damage directly caused by earthquake and war, an essential principle was involved which, it was declared, they could not throw to the winds in justice to the rest of the assured and to their shareholders.

The increase in the size of buildings has meant a great increase in the values at risk in limited areas, and losses in respect of commodities stored in warehouses now amount to very large figures. As an example, a fire in a tobacco warehouse in the Port of London in April 1923 amounted to as much as £1,050,000. The risk of damage caused by civil disturbance, which has been apparent in various countries since 1911, has induced the insurance companies to make the fact clear that such damage is not covered by the terms of the ordinary fire insurance policy. The risk may usually be covered for a small extra premium, and many commercial enterprises now take the precaution of specially effecting such insurance. When there are no exceptional circumstances rendering the risk unusually hazardous it is accepted for a nominal rate. In cases, however, in which the risk has seemed to be a quite serious one, high rates have at times been paid. The London market is the principal centre for the acceptance of such risks, and business has from time to time been transacted there in respect of most countries.

Marine Insurance

In the years immediately preceding the World War there was a demand for the insurance of ships and cargoes against war perils. The insurance was granted as a rule at nominal rates, but the existence of the demand was indicative of the uneasiness which prevailed. Happily for the maintenance of British commerce, a government scheme had been prepared in advance, since it had been realised that, unless the resources of the nation were behind British shipping, vessels would, on the outbreak of hostilities, remain in port or would immediately take shelter there and overseas commerce would have been brought to a standstill. When war broke out, schemes were immediately brought into operation. That designed to cover vessels was worked through the instrumentality of the mutual shipping clubs, and provided that, in return for a premium, the Government should assume the greater part of the risk. For the purpose of accepting the war risk on cargoes a government office was established in the city of London under the auspices of the Board of Trade and with the active assistance of leading underwriters.

At the same time, underwriters at Lloyds and of the insurance companies themselves wrote risks, with the result that the lesser risks were accepted by underwriters at rates below those quoted by the government office, which was thus called upon to assume the more serious risks. Underwriters also granted war insurance in respect of many neutral ships and their cargoes to which the British Govt. scheme did not apply. The maintenance of the government schemes was, however, of great value, especially at times when losses due to the submarine warfare were very heavy. But for the fact that the government scheme was available for the acceptance of the war risk, in respect of cargoes in British ships, the rates of premium quoted in the open market must at times have risen to very high, if not prohibitive, levels. A substantial surplus was realised on account of the government cargo insurance scheme.

Missing Ships.—One difficulty which had to be taken into account was that a large number of ships became missing, and that it was not always easy to decide if these had been lost though direct war perils, or if their loss had been due to the risks of navigation, especially as some of the usual aids had been withdrawn. This question was carefully considered by a committee representative of shipping and underwriting, and it was agreed that, in the event of vessels becoming missing, there should be arbitration. The underlying idea was that an arbitrator, after hearing such evidence as was possible, could form an opinion as to the probable loss of the vessels, whereas if the question had been taken into court the proceedings might have been long and costly and no better decision could have been expected. In some cases the loss was apportioned by the arbitrator in such proportions, as seemed reasonable, among the war-risk and marine-risk underwriters.

Underwriting.—In spite of the War, or rather because of it, large underwriting profits were made in the London market during the period of hostilities and immediately after it. Underwriters took great risks in which they were, as events showed, justified. The remarkable rises in the values of ships and commodities meant that premium incomes were very much augmented, and many companies, new and old, were attracted to the business. Two years after the cessation of hostilities there was a marked reaction. With the sharp decline in the values of

tonnage and commodities the amount of insurance business likewise declined. In view, especially, of the great increase in the size of the market, there was not enough insurance to feed it, particularly as underwriters had become accustomed to assuming far larger lines than they had been used to write before the War. Severe depression set in, and various attempts were made, extending into 1926, to try to obtain some stiffening of rates.

An extraordinary feature of marine underwriting in recent years has been the extended period over which claims have been presented. Before the War it was considered that an account could, for practical purposes, be considered as closed at the end of the third year. There might then be still a few claims unsettled, but the total of these would not be of sufficient magnitude to disturb the main results of the underwriting as then disclosed. After the War no such calculations could be made, and it is now common for claims to be presented for any of the years up to 10 after which the insurance was written. There were special reasons for such delays during, and immediately after, the war period, when tonnage was in keen demand. Any repairs that could be postponed were deferred for as long as possible, especially as the repairing yards were fully occupied with work.

Miscellaneous

Workmen's Compensation.—Important recommendations respecting the system of compensation for injuries to workmen in the United Kingdom were made by a departmental committee appointed by the Home Secretary in May 1919, which reported in July 1920. The committee was presided over by Mr. Holman Gregory, K.C., M.P., and included representatives of the workers and of insurance companies. The committee, after a thorough examination of the subject, found that there were certain defects in the system then obtaining, but were of opinion that these defects could be remedied, largely without resort to a state system of insurance, although not without the introduction of a certain measure of state control. They proposed that, in future, definite percentages of the premium income should be expended in benefits to injured workmen or their dependents and that the remainder should be available for the management expenses or profits of the companies, and the payment of commission to agents, the latter not to exceed 5% of the premium income in any case. They calculated that there would thus be saved on the then cost to employers a sum of between £1,250,000 and £1,500,000 a year, which, under the existing organisation, would be paid away in expenses of management, commission and profits.

In order to provide against the risk to the workmen of uninsured employers proving unable to meet the obligations placed on them by the Act, it was proposed that every employer other than the Crown, a local or public authority, a statutory company or a householder in respect of servants not employed by him for the purpose of his trade or business, should be required to insure against the workmen's compensation risk. Employers with an annual wage-roll exceeding £20,000 were to be entitled to claim exemption from compulsory insurance upon compliances with prescribed conditions. Householders were excluded from the provision of compulsory insurance because, as the risk of accidents to domestic servants is small, the premium charged by insurance companies is more or less nominal, and also because it was considered that the cost and difficulty of enforcement would be out of all proportion to the numbers of persons involved. The committee was informed that a large proportion of householders already insured, and they believed that when the proposed increased liabilities were effective, few would be so unwise as to fail to cover their risk by insurance. Up to the end of 1925 no legislative action had been taken on these recommendations.

Motor-Car Insurance.—The general insurance department of a composite company includes miscellaneous forms of insurance, among the chief of which is motor-car insurance. During the World War comparatively little was done in this type of business. In 1919–20, when private cars again came into use, the insurance experience was very unsatisfactory. Costs of repairs were on a high scale, and there was an epidemic of thefts. For 1920 some of the leading companies reported substantial losses. Early in 1921 rates of premium were advanced, and since then the business has, on the whole, been transacted on a fairly profitable basis.

Credit Insurance.—Of recent years notable developments have taken place in the insurance of bad debts in British oversea trade. This business has for many years been successfully transacted by the Trade Indemnity Co., in which the great composite insurance companies have taken a financial interest. In 1925, on the initiative of Mr. A. M. Samuel, M.P., then head of the Overseas Trade Dept. a committee of bankers, financiers and business men was set up in order to investigate the advantages that might be secured from a further extension of insurance facilities for this purpose. This committee, whose report was issued in the spring of 1926, made certain recommendations with a view to a further development of this type of business. (C. Ma.)

II. THE UNITED STATES

The business of insurance, with its basic element of mutual assistance, has shown a progress in the past 15 years both in volume and ramification unsurpassed by that of any other industry. In the United States as in no other country has insurance in all its various phases become universally recognised as an essential of commerce and industry. To this fact may be attributed in large measure the achievements of America in business enterprises. Insurance coverages permit men and corporations to hazard their resources on new developments without fear of loss from natural and unavoidable catastrophes. The importance of insurance as a national factor may be visualised by the fact that at the end of 1925 the combined companies had a premium income of $4,000,000,000 with total admitted assets of over $14,000,000,000.

Life Insurance.—The life insurance companies aim to supply the demand for life insurance as best suits the wants of all classes and conditions of men. The old life insurance policy, while the business was in an experimental stage, was so loaded with conditions and restrictions and so limited in its applications, that comparatively few persons availed themselves of this protection; but recently numerous forms of policies have been devised to suit the wants of all sorts of people, and the conditions and restrictions have been eliminated to such an extent that practically the only exaction remaining is that the person insured shall pay his premium. The last 15 years have been notably prolific in the invention and development of plans of life insurance. Ordinary life insurance, through its several classes of policies—whole life, limited payment, term and endowment—provides ample choice for the selection of a form of protection best suited to the needs, financial resources and saving abilities of all classes from the average wage-earner to the multi-millionaire. The great industrial insurance companies, with their weekly payment contract, reach the homes of the working classes and enable them to provide for funeral benefits and against personal distress and dire want. Paramount among the recent innovations in life insurance is group insurance, through which industrial corporations collectively insure employees regardless of age or physical defect. The premium is lower than that which could be obtained through individual contracts, by reason of the overhead savings in insuring a large number under one policy. Other introductions include business and partnership insurance, disability, double indemnity benefits and monthly income insurance.

The comparative aggregates of the old line legal reserve companies are proof of life-insurance expansion. In 1910 the total life insurance in force was over $16,000,000,000 and the aggregate admitted assets totalled something short of $4,000,000,000. During 1910 the combined companies had a total premium income of about $600,000,000 and wrote during that year a trifle over $2,500,000,000 of new insurance. The totals for these companies for the year ending Dec. 31 1925, show that legal reserve life insurance companies had over $71,000,000,000 of insurance in force, including industrial business, and assets of over $11,600,000,000. The premium income was almost $2,500,000,000 and the new insurance written in 1925 was over $16,000,000,000. In a country with a population of 115,000,000 people, there were in 1926 practically 100,000,000 policies of life insurance in force, on what were estimated to be about 60,000,000 lives. So extensively has the idea of life insurance been sold in the United States that it is estimated that more than every other person in the country is insured.

Fire Insurance.—Because fire insurance has for years been recognised as an essential adjunct of industrial and commercial enterprise, its growth in the years since 1910 has not been, from a comparative standpoint, as spectacular as life, casualty or miscellaneous insurance. Nevertheless, its progress has kept pace with the industrial development of the country and has met the demands imposed upon it by the upheaval occasioned by the World War and the evolution of recent years and recent inventions. While in the period there was nothing in the nature of a catastrophe such as the conflagration and earthquake in

San Francisco in 1906, nevertheless losses were uniformly high and consistent underwriting losses were incurred. In the period, too, there were upward of 75 single fires in the United States having property losses of over $2,000,000, and reaching as high in one instance as $35,000,000. The energy and resources of the fire-insurance executives during the period have been directed along the lines of fire prevention and fire protection work. Fire-insurance engineering experts are now consulted in every building operation, and there is no incorporated village or city which has not taken cognisance of the fire hazard by the organisation of fire departments, by water systems and by the adoption of fire prevention and protection ordinances. Control of the physical hazard, however, has been offset by the development of the moral hazard to which a great part of the fire losses at the present time may be attributed. The growth in resources and volume of the fire insurance business is indicated by a résumé of the total transactions of the companies. The figures show that the assets of the companies totalled $550,000,000 in 1910, were slightly over $700,000,000 in 1915, over $1,000,000,000 in 1919, and over $1,730,000,000 at the end of 1925. In 1910 the premium income of these companies was but $287,000,000. It had reached $353,000,000 by the end of 1915 and almost doubled itself in the intervening four years, for during 1919 it was almost $700,000,000. Consistent progress during the succeeding years resulted in these companies showing a premium income in 1925 of $901,000,000. Modern industrial advancement has done much to stimulate the growth of fire-insurance companies, while at the same time demanding a wider scope of indemnification. This has resulted in the undertaking of many additional lines of insurance by the fire-insurance companies, the principal of which is motor-vehicle insurance. Other lines of insurance transacted by fire companies include tornado, windstorm and cyclone, hail, inland marine, sprinkler leakage, riot and civil commotion, air-craft, explosion, earthquake, rain, crop, flood, frost and freeze, tourist baggage, parcel post, water damage, use and occupancy, and registered mail. While the total premium volume from many of these lines is at the present time small, nevertheless it indicates a comprehensiveness of service quite in keeping with the modern tendency to place upon insurance the burden of preventing economic or financial catastrophes from any possible anticipated contingency.

Ocean Marine Insurance.—Ocean marine, which is the oldest known form of insurance, reached a volume during the period of the World War never before approached. The demands placed upon insurance companies for marine coverages exhausted the resources of existing carriers, and induced the entry of most of the larger fire-insurance companies into this field. To supplement further the demand during the War, there was organised a bureau of war risk insurance by the U.S. Treasury Department. This was of inestimable assistance to American commerce, and produced a premium volume during the period of its existence of about $50,000,000, the bulk of which was obtained between Nov. 17 1916 and April 27 1918—almost $39,000,000. Ocean marine insurance, however, has not progressed in America with other forms of insurance, because it is bound by national laws and subject to national taxation, though it is an international business and in direct competition with international carriers, unrestricted by laws and not subject to the high taxation imposed upon American carriers. The premium volume of American companies for ocean marine insurance amounts to around $40,000,000 per year.

Casualty and Miscellaneous Insurance.—Casualty insurance is the latest development among the general classifications of insurance prevailing in the United States. To a great extent it typifies modern progress, and the bulk of its business is directly due to modern economic and inventive conditions, workmen's compensation and automobile liability insurance being the two leading classes in regard to premium volume. The forms of casualty and miscellaneous insurance cover accident; automobile collision, property damage, and liability; bail bonds; bank deposits; burglary and theft; credit; check forgery; engine and machinery; fidelity; flywheel; health; live stock; liability, public, elevator, employers, etc.; plate glass; property damage and collision; surety; steam boiler; sprinkler; title; workmen's collective and workmen's compensation. In 1910 casualty and miscellaneous insurance companies had total assets amounting to about $300,000,000, while their total premium receipts were $94,000,000, The leading classes of business were liability insurance, with premiums of $28,000,000; accident, with premiums of $23,000,000; fidelity and surety, $15,000,000; health, $6,000,000; plate glass, $3,500,000; burglary and theft, $2,500,000. In 1925 we find that companies offering the various forms of casualty insurance and miscellaneous insurance had over $1,700,000,000 of assets, while their premium volume was almost $650,000,000. In that year the leading classes of coverage were as follows: workmen's compensation, premium income, $130,000,000; automobile liability, $117,000,000; surety bonds, $56,000,000; liability (public, etc.), $47,000,000; accident, $45,000,000; automobile damage, $41,000,000; fidelity, $33,000,000; burglary and theft, $28,000,000; health, $20,000,000; plate glass, $16,000,000. It is worth noting that the writings in two of the individual lines of casualty insurance in 1925 exceeded the total writings in all classes in 1910. (A. L. J. S.)

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INSURANCE, SOCIAL (*see* 14.656).—Social insurance is the name given to the arrangements, whether provided by the state or private agencies, whether voluntary or compulsory, for paying a certain sum of money, or goods and services in kind, as compensation for the loss resulting from certain kinds of emergencies which in their nature lead to diminished capacity to earn or to an increase of expenditure. The object of all branches of social insurance is to protect the workman against the fact and fear of insecurity and its accompaniments—the exhaustion of savings, a lowered standard of living and recourse to public or private charity. This device gives him a legal right to a definite sum. The causes which may reduce the workman to want are of two kinds: those which are unexpected, catastrophic and undesired emergencies, and which entail a lowered capacity to earn or an inability to earn; and those which are desired and normal happenings, but entail an increase in expenditure even where the income has not diminished. In the former class should be included industrial accidents and occupational diseases, non-industrial accidents, ill health, invalidity, blindness and unemployment, burial, unprovided widowhood and unprovided orphanhood and, in the latter, old age, maternity and provision for growing children. In order to deal with these problems modern states have created new institutions, assumed control of existing machinery and provided subsidies, and their legislation on the subject constitutes in its totality a veritable code guaranteeing the workman a minimum of security in all his emergencies.

I. GENERAL INTRODUCTION

Origin of Social Insurance.—Social insurance began as a device employed voluntarily by workmen to protect themselves against

emergencies. Trade unions, friendly societies, employers' welfare funds and private insurance companies organised provision for the cost of burial, ill-health and unemployment, and settled the rates of contributions and of benefits. Germany, under Bismarck, was the first country to realise the value and necessity of the compulsory method of insurance against sickness, industrial accidents and old age, which was applied to practically the whole industrial population by the laws of 1883, 1884 and 1889. Great Britain was the first to experiment (in 1911) with a national compulsory system of unemployment insurance, and possesses the most comprehensive system of pensions for widows and orphans of any country in the world. The schemes first introduced in the Central and Western countries in Europe are now being copied by other countries, by the South American Republics and Japan.

Since the War new risks have been provided for in countries where before only one or two were recognised. Classes hitherto excluded from insurance legislation are being brought increasingly within its scope. Gradually the families of insured members are being recognised as standing in equal need of insurance with the breadwinner. Money and service benefits are being added to bring them up to an amount which will give the insured population a minimum sufficient to maintain them in efficiency.

A new factor which is likely to grow increasingly insistent is the effect of compulsory insurance on the costs of production and consequently on international competition. It is in the interest of countries like Great Britain and Germany, which spend heavy sums annually on social insurance, to press for the extension of similar activities in other countries. In 1924 Great Britain spent an aggregate of some £170,000,000 (contributed by employers, workers and the State) and Germany some £60,000,000 on the various branches of the social insurance systems. The International Labour organisation has adopted at its annual conferences a number of conventions and recommendations on unemployment insurance, maternity insurance and workmen's compensation, and the exhaustive studies made by its staff provide an armoury of information.

In Great Britain legislation in connection with provision against social risks, either by way of compulsory insurance, provision by the employer or regulation of voluntary insurance falls under the following heads: compensation for industrial accidents and industrial disease, old age pensions, sickness and invalidity insurance, maternity, unemployment, widows' and orphans' pensions, blind persons, family endowment (provision for children under the War Pensions and Unemployment Insurance Acts). Each of these is dealt with below.

Great Britain may claim to have the most comprehensive system of social insurance in the world, but most industrial countries have adopted some schemes covering one or more risks. The two branches most highly developed in the United States of America are workmen's compensation and pensions for widows and orphans.

Basis of State Action.—Why does the State interfere in the matter of social insurance? From the days of the Elizabethan Poor Law the State has been the ultimate resort of those who are destitute. When all other means had failed those in distress, they could turn to their parish for relief, though this relief has generally been inadequate and granted only under deterrent conditions. Social insurance reduces the number of those who will become destitute.

Moreover, unless compulsion is applied, few will make adequate provision against these social emergencies. But to the community as a whole, assuming no change in our habits, these risks are unavoidable, and it is now regarded as the business of the State to contrive that they shall be provided for. Even the individual who is fully conscious of the dangers he runs will frequently be unable to make adequate provision, and therefore Parliament may decide that the immediate costs should be borne by the employer or by the State itself. Another consideration has been slowly emerging. Only Parliament can decide that large bodies of people shall be compulsorily insured. When it has gone so far it cannot allow private organisations to administer the insurance badly or at too great a cost. Since the administration is extremely simple, once the actuary has worked out costs in relation to benefits, there is everywhere a tendency for social insurance to be organised through State-monopolised funds. Behind all these arguments of a practical nature lies the consideration that every worker is an asset to the State, and the community as well as the individual suffers when his health or efficiency is impaired.

Limits of Social Insurance.—Many of the older advocates of social insurance are beginning to be nervous about its colossal growth, and complaints are frequently made of the heavy burden which it imposes on the nation. It is misleading, however, to lump together, as some critics do, aggregate expenditures on pensions, health and unemployment insurance, workmen's compensation and burial insurance premiums, and bring out a grand total of some two or three hundred million pounds which is called "national expenditure." It is not national expenditure in the sense that it is all provided by the Exchequer. On workmen's compensation and burial insurance the State pays nothing. And its contributions in respect of the three compulsory insurance schemes are, of course, only a fraction, even if a substantial fraction, of the total cost.

The following tables show the respective shares of the workers, the employer and the State in Great Britain.

Health, Widows and Orphans and Old Age Contributory Pensions
(weekly contributions)

	Worker	Employer
Men	9d.	9d.
Women	6d.	7d.

State contribution (*a*) Health: two-ninths of the total cost of benefits (payable on disbursement). (*b*) Pensions: £4,000,000 a year. (There will be a slowly rising *additional* cost to the Exchequer in respect of old age pensions at 70, equal to £1,700,000 in 1926–7 and £4,700,000 in 1935–6. At the same time there will be a relief to the Exchequer in respect of health and unemployment insurance. The *net* Exchequer charge on all these pensions will, it is estimated, be £5,700,000 in 1926–7, rising to £6,400,000 in 1935–6. The finance of the scheme is complicated; it will be found discussed in detail in the Government Actuary's Report on the Financial Provisions of the Widows', etc., Pensions Bill, Cmd. 1925.

Unemployment
(weekly contributions)

	Worker	Employer	State
Men	7d.	8d.	8d.
Women	6d.	7d.	6d.
Boys (16–18)	3½d.	4d.	4⅝d.
Girls (16–18)	3d.	3½d.	4⅜d.

Moreover, it is plain that if the State were not paying these millions which have been reduced by the Economy Act of 1926 into the insurance funds, it would be forced to pay as much, or perhaps even more, in other ways—*e.g.*, in supporting a public health service, in various palliations of unemployment, in extra Poor Law relief, or some similar form of public assistance. State-aided insurance, in short, is judged to be true economy. So it is that we find extensions and improvements being advocated in all directions. The paradox of social insurance, indeed, is its steady growth in spite of constant attacks upon it and the lack of any visible widespread enthusiasm for it.

Unification.—Parallel with the movement for the extension of social insurance there is a movement for its unification. At present all the emergencies are treated by different administrative machinery, with different methods for raising funds and different rates of contributions. Since the objects underlying all these schemes are broadly the same, the prevention of destitution, the abolition of the fear of insecurity and the provision of a minimum in all periods of need, it is undesirable that these variations should continue. Moreover, the workman, the insured person, wishes to be spared the trouble of dealing with a host of organisations. However the present medley has been brought about, it is surely desirable that all these different schemes should be unified. And unification must be taken to

mean not merely the correlating, co-ordinating or riveting together of all the schemes, but their complete amalgamation in respect of finance, administration and underlying principles.

The advantages claimed for a unified scheme are:—

(1) The problem of social emergencies will stand out prominently and steps for prevention will thus be encouraged.
(2) Administrative expenses would be very much less and insurance could be provided cheaply. The benefits given for the same premiums will consequently be higher.
(3) The workman dealing with one body will be more likely to know his rights and how to claim them.
(4) Existing anomalies, such as death by industrial accident receiving different treatment from death through a non-industrial accident, or natural causes, will be abolished.
(5) A department of state will be better able to tackle the whole problem than the variety of agencies that now are at work. Improvements will be carried out more easily, investigations will not be hampered by private interests.

No doubt such a department of state would be a huge affair. Nor would the change over from the present system be easy. Vested interests and inter-departmental jealousies would have to be overcome, and the machinery for dealing with every insured workman greatly extended and improved. But that is the direction in which social insurance is tending, and not only in Great Britain. In some of the more important recent codes of social insurance, those of Russia and Czechoslovakia, sickness, old age, invalidity and death are treated in unified schemes. The proposed French and Australian schemes are also very comprehensive. The unification of social insurance is also being debated in Germany.

II. WORKMEN'S COMPENSATION

In Great Britain the Employers' Liability Acts of 1880 and the Workmen's Compensation Acts of 1897, 1906 and 1923 constitute the legislative basis for providing compensation to workpeople who suffer "personal injury by accident arising out of and in the course of employment," or in consequence of one of the industrial diseases brought specifically under the Act of 1923. In the Act of 1880 negligence had to be proved against the employer. But in the Act of 1897 employers were held to be responsible for injuries arising out of work in their establishments, even when negligence could not be proved, on the ground that the workman was unable to bear unaided the monetary loss which injuries involved. In 1906 the scope of workmen's compensation was greatly increased. In the Workman's Compensation Acts the individual employer is alone held to be responsible for paying compensation, and neither the worker nor the State makes any contribution towards the cost. It is still open to the employer to choose whether he will insure himself in some private insurance company against the risk of having to meet compensation claims, or pay them himself.

The number of workpeople who obtain some measure of protection is estimated at over 17,000,000, but the statistics of its working relate only to some 8,000,000, to those employed in: shipping, factories (to which the Factory and Workshop Acts apply), docks (including wharves, quays, etc.), mines, quarries, constructional work (not including building construction) and railways.

Rates of Compensation.—The rates of compensation laid down by the Act of 1923 are broadly: for partial incapacity, a sum equal to half the difference between the man's earnings before and after the accident; for total incapacity, half-wages up to a maximum of 30s. a week. Compensation is payable from the fourth day of incapacity. Where, however, the incapacity lasts for four weeks, the first three days also rank for compensation. Thus in addition to the loss of at least half his wages the workman in most cases suffers the loss of the waiting period, the cost of doctors, medicines, artificial limbs, etc., the cost of training for a new job; and in all cases where disputes arise he is liable to meet the costs of litigation. Although in theory the employer is liable to bear the total costs of an accident, in practice it is doubtful whether much more than a third of its financial burden is placed upon him, the workman bearing still about two-thirds of the loss.

In fatal cases a sum of between £200 and £300 is paid to the widow, which may be raised by additional allowances for children up to a maximum of £600. It should be observed that whilst some provision is made for dependents in the case of fatal industrial accidents, no provision is made for their needs in the case of non-fatal accidents.

The Home Office has estimated that the total of the charges and expenses for workmen's compensation in the seven great industries was not less than £5,000,000 in 1913 and 1914, £6,000,000 in 1919, £8,500,000 in 1920, 1921 and 1922, £9,000,000 in 1923. But these figures relate only, as we have seen, to about half the industrial population. Assuming that the accident rate in the other occupations is only half what it is in the seven great industries, then in 1923 the cost of workmen's compensation to employers must have been about £13,500,000. Since, however, the workman is still made to bear between one-half and two-thirds of the loss resulting from an accident, it has been estimated that the annual loss due to industrial accidents and diseases amounts to between £30,000,000 and £40,000,000 per annum.

The administrative expense in the case of workmen's compensation has for many years been about 50% of the premium income. The Holman Gregory Departmental Committee reported in 1919 that "During the last five or six years the employers have had to pay £100 in premiums for every £48 paid out in benefits to insured workmen." The companies agreed in 1923 to confine administrative expenses to within 40% of the premiums they received, with a further reduction to 37½% at the beginning of 1927.

Although employers generally insure themselves against the risk of being called upon to pay workmen's compensation, they are not bound to do so, and very frequently the smaller employers fail to make any such provision. Cases thus arise where the workman is obliged to take less than he is entitled to by law. It has therefore been proposed that employers should be compelled to insure, so that the workers may be certain of receiving compensation.

Over 30 diseases have now been scheduled as being due specifically to various industries and in respect of which compensation is provided. But in the many kinds of industrial diseases which may also arise apart from the employment—*e.g.*, bronchitis in cotton workers—no compensation under the Act is provided. This system is also criticised as involving frequent litigation and delay in payment. Moreover, agents are alleged frequently to induce injured workmen to take smaller amounts than their due. Insurance companies, as often as they can, induce the workman to accept a lump sum, since in spite of their heavy cost of administration they have only clumsy machinery for making weekly payments and for the review of benefits as the children grow older or die. Lump sum payments very frequently mean the rapid dissipation of benefits.

Neglect of Preventive Measures.—Perhaps the most serious fault is the neglect of preventive measures. There is little evidence of a steady and significant decline in the number of industrial accidents, of which about 400,000 occur annually. The neglect of the well-known and tried devices of the "Safety First" Association, with their educational influence on the workpeople, both by employers and by the insurance companies, is a glaring piece of carelessness. Second only to this in importance is the scant attention paid to the rehabilitation of injured workmen.

It has been suggested that a Government fund for insuring employers against the liability to pay compensation could be run at a much lower administrative cost than private insurance. In the United States competitive funds have an administrative expense of 6 to 9%. Another suggestion is the linking up of workmen's compensation with health insurance and the scheme for widows' and orphans' pensions. This might be desirable in itself, but would necessitate compulsory insurance in a state scheme. It would indeed involve altering the whole basis of the present law. The device of workmen's compensation has been so widely adopted that the International Labour Organisation was able to adopt a convention on this subject at its conference in 1925.

III. PENSIONS

Old Age Pensions.—Old age pensions were first granted in Great Britain by the Act of 1908. This Act, which was amended in some particulars by the Acts of 1911, 1919 and 1924, provided for the payment of pensions to all persons who had reached

70 years of age, who had been British subjects for at least 10 years or if natural British subjects had resided in the United Kingdom for a period of not less than 12 years since attaining the age of 50.

The amount of the pension was to be adjusted to the means of applicants. They must be below a certain standard before they could claim, and the pension was in no case to exceed 10s. a week. The scheme was non-contributory in character, and the entire cost of the pensions and of the administration was defrayed out of national taxation. Under the existing Acts, the application for a pension must be made, in the first place, at the local post office on a "claim to pension" form. The local excise officers appointed under the Acts by the Treasury to be pension officers report on the means of the applicant; the pension committee decide on the validity of the report and the rate of pension. The claimant or pension officer, if dissatisfied with the decision, may appeal to the Minister of Health within seven days of receipt of the notice of the committee's decision. If the claim is allowed the applicant obtains his weekly pension at the local post office.

The Old Age Pension Act of 1908 was the first Act to provide permanent public assistance outside the Poor Law. Its advocates argued that even if the workman could save enough to provide for ill health or unemployment he could not be expected to save enough to provide both for himself and his wife after 70. The scheme adopted bore signs of its origin in the older system. The pension is granted only to those who are not, it is true, destitute, but necessitous. No one is eligible who has an income of £50 a year or over. The amount of the pension varies directly with the need of the applicant. The poverty qualification infringes the idea of social insurance, the essence of which is to grant a legal right to a definite sum. The pensions scheme, it is true, does this, but grudgingly and on conditions which savour of the Poor Law. It involves vexatious inquiries; it discourages thrift and the aid of relatives; it is unjust. On the other hand, it is the first branch of social insurance in which the State intervened directly. Its inquisitorial character was inevitable in a non-contributory scheme.

In 1910, the first full year of the working of the old age pension scheme, the cost was £8,468,128. In 1924 it amounted to £24,000,000. In 1965 the Government actuary estimates that the same scheme will cost more than double that amount, some £57,000,000. This is attributed to two causes, the growth in the annual number of births between 1850 and 1890 and the decline in the death rate. The cost of granting universal old age pensions without tests or a means limit would be an additional £14,000,000 a year, rising to about £19,000,000 in twenty years. The total net cost of administration of the scheme, covering the expenses of the pensions committee, was estimated for the year 1924 at £800,000. This constitutes an administrative expense of 3⅓%.

The operation of the old age pensions scheme revealed an appalling mass of poverty among those over 70, and it was known that the lot of those between 65 and 70 was little better. The Act of 1925 introduced contributory old age pensions at 65, and also abolished the means disqualification for those insured. This Act, however, allows the non-contributory pension at 70 to continue until it is slowly absorbed by the contributory insurance scheme.

Non-contributory old age pension schemes exist in:—

(1) Australia, Denmark, France, Great Britain, the Irish Free State, New Zealand, Norway, in certain of the United States and Uruguay.

(2) Contributory pension schemes have been introduced in Rumania, Spain, Switzerland, Belgium, Italy, the Netherlands, the Serb-Croat-Slovene kingdom, Bulgaria, Czechoslovakia, and recently in Great Britain.

The Act of 1891 passed by Denmark for assisting the aged has thus been the forerunner of the modern schemes of old age pensions and insurance which have now been adopted in most industrial countries.

Old age is assumed to occur at some stated age which varies from 50 to 70 years according to the country.

Pensions for the Blind.—In Great Britain the Blind Act of 1920 provided that all blind persons of the age of 50 or over should be granted pensions at the same rates and on the same conditions as those applying to persons of 70 and over. The local authorities are empowered to make provisions for the blind—such as the establishment of workshops, assistance to homeworkers, home teaching and assistance in book production—out of the public funds. Such provision is aided by a state grant.

Widows' and Orphans' Pensions.—The contributory Old Age and Widows and Orphans Act 1925 marked a new development in social insurance in Great Britain. Two methods are open to a Government for making provision for widows and orphans, that of compulsory contributory insurance, or as it is termed in Great Britain, contributory pensions, or that of non-contributory pensions.

From January 1926 widows have received a pension of 10s. a week, together with 5s. for the first child under 14, or under 16 if the child is still attending school, and 3s. for each of the others. This scheme has been linked with one for providing old age pensions of 10s. a week at 65 instead of 70 to all insured men and women without inquiry into their means. Both these schemes are joined to the existing scheme of contributory health insurance and the non-contributory old age pensions. It has been estimated that the benefits accruing to an insured man and his dependents under the Act are roughly equal in value to an endowment assurance for £200 payable at death or at the age of sixty-five.

But instead of being entitled to an old age pension, if his income was very restricted, at the age of 70, he will under the new scheme be able to draw his weekly pension of 10s. for the rest of his life on reaching the age of 65, whatever other sources he may possess and whether he gives up work or not. His wife will also be entitled to a pension at sixty-five.

The new scheme provides also that on his death—at whatever age—his widow will receive a weekly pension of 10s. until her death, unless she marries again; if he leaves children at school under the age of 16, his widow will be entitled to draw 5s. a week for the eldest and 3s. a week for each of the others; and if the children are motherless as well as fatherless payments will be made in respect of them until they reach the age of 14, at the rates of 7s. 6d. a week for the eldest child of a family and 6s. a week for each of the other children.

The pension age, it should be observed, is reduced only in the case of those who are insured, and it is only in their case that the existing means disqualification is to be removed. Those who have not been insured as workers remain under the existing system. The costs of health insurance may be expected to be lessened by the scheme, because many workers who will be drawing their old age pensions at 65 will no longer be entitled to their invalidity benefits. Under the Economy Act 1926 the Government lessened, therefore, the state contribution to health insurance.

The first full year in which old age pensions at 65 will be paid will be 1928–9, when the costs will be £12,400,000, from which they will steadily rise up to the maximum in 1965–6, when they will amount to £21,500,000. In that year the total cost of old age pensions will be £85,900,000. In the first complete year (1926–7) the cost of widows' and orphans' pensions will be nearly £11,000,000, and the amount will rise steadily until 1965–6, when it will be £38,800,000. In that year the total payment on account of old age pensions and widows' and orphans' pensions will be £125,000,000.

For many years to come the old age pensions scheme is to be a growing liability and the war pensions scheme a dwindling one. In 1926 these two services cost about £94,000,000. In forty years they will cost about £90,000,000. After that the state grants out of taxes grow less until, as the percentage of those who come in after 1956 increases, the Government will be called on to pay less and less, and its liability will gradually dwindle to nothing.

The contributions to be paid by the insured persons are 4½d. a week by a man and 2d. by a woman, while the man's employer also pays 4½d. and the woman's 2½d. The State also contributes its share under the new scheme.

As regards the administration of the scheme, contributions are collected in the same way as in the case of health insurance. In fact, the health and pensions contributions are combined, and the same stamp and the same card serve for both. The approved societies issue the certificates showing that a person is entitled to benefits, but the actual payment is made by the post office. It is calculated that the administrative expense will be no more than 2% of the contributions.

Germany, Czechoslovakia, Italy and Holland have very inadequate schemes on a contributory basis. New Zealand, most of the states of North America and Canada have adopted non-contributory schemes of pensions for widows and orphans.

IV. INDUSTRIAL INSURANCE

Abuses of the Unreformed System.—By industrial life assurance or burial insurance the working classes obtain benefits sufficient to cover the cost of burial. This form of insurance is common in Great Britain because of a very deep and wide

spread terror of a pauper's funeral. Between 1903 and 1924 the amount spent by the workers on this branch of insurance increased by about 400 per cent. The great success of the industrial insurance companies is due to the army of some 70,000 agents employed by them to collect weekly the small premiums. Burial insurance is brought by them to the worker's home in such a form and at such a price that he can provide for it out of his small earnings. Indeed, the agents have been able to persuade many working class families, and especially the mothers, to take out one or more policies for each member of the household, so that it is a common thing for a workman to spend between 1s. and 2s. a week for this branch of insurance. It has been claimed that " there is scarcely a home among the millions of the working classes in this country which is not visited at least once a week by these agents. " In 1921 it was stated that there were over 50,000,000 " industrial policies " in force, for which £35,000,000 was paid annually in premiums. To this should be added the interest on invested capital. It is estimated that expenditure for " death " benefits is equal to about twice or three times the amount spent on health, maternity, and disablement taken together.

This business has been subjected to very strong criticism. A departmental committee, presided over by Lord Parmoor, reported in 1920. It was found that some 44% of the premiums went in agency and management charges, proving that this method was needlessly costly. Excessive house-to-house canvassing led to considerable overlapping and wasteful competition. The persistence of the agents led to the purchase of policies by persons who could not afford to pay for them, with the result that some 5,000,000 policies lapsed annually. There had been failures and scandals and the system was full of abuses.

Three policies were proposed for dealing with the situation:—

(1) To nationalise the business and to provide burial benefits *compulsorily* under the national insurance scheme.
(2) To control it, to remove the more flagrant abuses, and to limit the joint charges of administration and profits.
(3) To control it, but to leave the insurance companies to remove the main causes of complaint themselves.

The Parmoor committee recommended this third policy, which was in effect adopted by Parliament.

Statutory Regulation.—The Industrial Assurance Act 1923, the outcome of the report, made the Chief Registrar of Friendly Societies the industrial assurance commissioner, with wide powers, and every office, whatever its constitution, which transacts industrial assurance business is now required to make returns to him. The companies are required to make an additional deposit of £20,000 in respect of industrial assurance business, and the collecting societies have to make a similar deposit.

The accounts of the industrial assurance business must be kept separate from other branches of insurance business. The commissioner has power to examine into and report upon the affairs of any company or collecting society where an offence has been committed or in his opinion is likely to be committed. Every office transacting this business had to have a valuation made by an actuary not later than the end of 1925, and where a deficiency was disclosed the commissioner might present a petition for winding up the company. Attempts are being made to lower the administrative expenses in four ways. The " block system " of canvassing for business, by which a definite area or number of blocks of houses is assigned to one agent, is being substituted for the anarchic method which allowed every agent to canvass where he would. Companies will still compete with one another, but not the agents of the same company. There is also an increasing tendency to pay agents by salary rather than by commission. This will give the company greater control, and encourage sounder methods of obtaining clients. In the third place, efforts are made to induce regularly employed people to pay premiums monthly. Fourthly, higher premiums are canvassed for in order to lower the proportion of administrative expense. One company working along these lines has reduced the expense from 40% to something below 30% in a few years. But we are warned that from even this company we must expect no reduction of the rate of administrative expenditure to premiums below 20%.

There are strong arguments against allowing the business to remain voluntary. The present method, apart from incidental abuses, is open to objection on the ground of its wasteful administration and the undesirability of continuing the voluntary method when the compulsory is adopted in related branches of insurance. Now that we have a system of life insurance endowment policies in the widows' pension scheme, it is contended that it is absurd to omit life insurance burial policies.

Many countries grant this additional benefit in conjunction with their health insurance schemes, an arrangement which keeps administrative expenses low. The State can administer this benefit at an expense below 2% of the premium income.

V. HEALTH INSURANCE

The National Insurance Act of 1911 constituted in many respects a new departure in British social policy. Workmen's compensation was already in operation, but the judicial justification of the new scheme was entirely different, whilst the state was, and still is, very little concerned in its actual administration. The Old Age Pension Act might be regarded as the offspring of the old ideas of Poor Law, and it was very easy to administer. The device now introduced of contributory insurance conveying a legal right to a definite amount was unknown previously in Great Britain. The Act of 1911 was in fact a novel experiment, both as regards the health insurance and the unemployment insurance sections.

Health Insurance.—The National Insurance Act 1911, Part I., makes provision for insurance against loss of health and for the prevention and cure of sickness. It is compulsory on all manual workers between the ages of 16 and 70 and non-manual workers with incomes under £250 who have not claimed the right of exemption. Over 15,000,000 persons are included. The normal benefits provided under the scheme include:—

(1) The payment of a weekly benefit of 15s. for men and of 12s. for women for not more than 26 weeks as sick benefit.
(2) A disablement benefit after the 26th week of 7s. 6d. per week so long as the beneficiary is incapable of work.
(3) A maternity benefit of 40s. to the wife of an insured man, which is raised to £4 when she is herself an insured person.
(4) Provision for medical benefits. This medical benefit consists of such medical treatment as can consistently with the best interests of the patient be properly undertaken by a general practitioner of the usual professional skill. It also includes the provision of medicines and of such medical and surgical appliances as are approved by the regulations issued by the supervising body, the Ministry of Health.

The employer is responsible for the payment of the joint contribution for himself and for the employee, which since January 1926 is 9d. for each employed man and 8½d. for each employed woman, but he deducts 4½d. in the former case and 4d. in the latter case from their wages. But, as shown above, the contributions in respect of pensions are now combined with these, and the actual value of the weekly stamp affixed by the employer is 1s. 6d. for men, and 1s. 1d. for women. The purchase money of the stamps, which are obtained from the post office, is paid into the National Health Insurance Fund. The State adds two-ninths of the cost of the scheme. The benefits are determined actuarially on the basis of the contributions from the employers, the workers and the State.

The administration of the scheme is carried out by approved societies and insurance committees. Approved societies consist of trade unions and friendly societies, collecting societies and special branches of insurance companies, which are to be " recognised " if they are democratically controlled and non-profit making. The medical benefits are administered by the insurance committees. These consist of local bodies representing the interests concerned, the insured persons, the doctors and the Ministry of Health. Deposit contributors, of whom there are about 250,000 are persons unwilling or unable to become members of approved societies. They are entitled to benefits up to the amount of the contributions paid in respect of them. Unlike ordinary members, they cannot draw more than that amount if their illness continues.

Most approved societies have attracted the majority of their members from particular trades. In consequence some have a high sickness rate and some a low one. The latter are in a position to give additional benefits above the normal benefits; the former suffer from deficits even when they give only the normal benefits. This system involves a certain amount of unfairness, to counterbalance which four devices for securing some measure of equalisation have been introduced:—

(1) The system of "reserve values" to allow for the age distribution of members.

(2) The contingencies fund to guard against the probability of an excess of liabilities, or deficiency on valuation of a society due to expenditure for benefit being in excess of the expected.

(3) The central fund to guard against the probability of a deficiency on valuation caused by abnormal rates of sickness due to the nature of the occupation of the members or the environment in which they live, or an epidemic such as influenza, or some other cause beyond the control of the society.

(4) The women's equalisation fund to meet the fact that women, especially married women, have a high rate of disability, principally on account of child-bearing. This fund was withdrawn and a sum added to their reserve value in its place.

In spite of these funds, the benefits obtained by clerks and agricultural labourers are very much higher than those obtained by miners, and it has been suggested that the whole of the Government grant of two-ninths should be used to guarantee all insured members the same benefits.

Proposed Amendments.—A royal commission was appointed in July 1924 to inquire into the scheme of national health insurance, and to recommend any alterations or improvements that might seem desirable. It reported early in 1926. Two reports were issued, both recommending changes and extensions, but, the minority being a good deal bolder than the majority. There was general agreement on the fundamental soundness of the system, on the need for a considerable extension of benefits, and on abolishing the insurance committees and transferring their functions to the local health authorities. The extension of benefits advocated by the majority is, however, to be made only "as and when funds are available to meet the cost." The minority report, on the other hand, rejects this proviso, and makes definite recommendations in favour of an all round extension of benefits, and especially for (a) the provision of medical treatment and attendance for children of school leaving age and for the dependents of insurance; (b) extended provision for child-bearing women before, at and after confinement; and (c) increase of the rates of cash benefit paid under the Health Insurance Acts to the present rates under the Unemployment Insurance Acts—*i.e.*, 18s. a week for men and 15s. for women.

Furthermore, the minority recommended the abolition of the approved societies system. The approved societies, they hold, are a failure. They are not democratically controlled, they are uneconomical, and they are "a hindrance to the development of a complete public health policy." The local authorities, therefore, should take their place.

Compulsory health insurance schemes are to be found in many European countries, including Germany, Austria, Bulgaria, Czechoslovakia, Great Britain, Norway, Poland, Russia, Belgium and the Serb-Croat Slovene kingdom. All the States in Australia have introduced non-contributory maternity grants. Japan introduced a scheme of health insurance in 1922, and Chile in 1924. In Poland, Russia and the Serb-Croat Slovene kingdom the territorial fund has in effect a monopoly of insurance. In Germany, Austria and Czechoslovakia the territorial fund is the leading but not the sole insurance institution. In some countries, *e.g.*, Germany, Rumania and Bulgaria, survivors' insurance, consisting as a rule of both burial benefits and pensions for their dependents, is attached to the various health insurance schemes.

Unemployment Insurance.—Great Britain was the first country to introduce a system of compulsory unemployment insurance. The National Insurance Act 1911 (Part II.), as a first instalment, made provision for insurance against unemployment in certain selected trades. The scheme was extended to include additional groups of workers by the Munition Workers Act of 1916. The Act of 1920 brought into insurance all persons of the age of 16 and upwards employed under a contract of service, excepting domestic servants, outworkers, agricultural workers and non-manual workers employed at a rate of remuneration exceeding £250 a year. Employees of local authorities, railways and certain other public utility undertakings, members of the police forces, and persons with rights under a statutory superannuation scheme may, in certain circumstances, be excepted.

As in the case of Health Insurance, the scheme is contributory, and the stamp and book method is employed for collecting contributions. Every insured person is given an unemployment book, on which his employer fixes a stamp weekly for the amount to be paid in contributions in respect of himself and his employee; the part of the contribution made on behalf of the workman is, of course, withdrawn from his wages.

The rates of contribution, as revised in 1926, are, for men, 8d. a week from the employer, 7d. from the employee and 8d. from the State; for women, 7d. from the employer, 6d. from the employee and 6d. from the State. These contributions are paid into the unemployment fund, out of which come all benefits and administrative expenses connected with the scheme.

Rates and Conditions of Benefits.—The rates and conditions of benefits laid down in the 1924 Act are that after three days' unemployment, provided no suitable work is available, men receive a flat rate of 18s. a week and women 15s. a week, with an additional allowance of 5s. a week for a dependent wife or husband, and 2s. a week for each dependent child. Under the Act of 1920 one week of benefit was payable in respect of every six contributions, and not more than 26 weeks of benefit were payable in one year.

Every insured person claiming unemployment benefit must lodge his unemployment book at an Employment Exchange when making a claim. If the insurance officer is satisfied that no work in his own trade is available, and that the workman is bona-fide unemployed, he will receive his benefit. A workman is regarded as unemployed for the purposes of the scheme when he is able-bodied, efficient and, though willing to work in his own trade at the current rates of pay, is unable to find employment because of lack of work. Benefits are not paid to those thrown out of employment through trade disputes. The employment exchange system, with its lists of employers in search of work-people and of workers in search of employment, together with other sources of information available to the officer in charge, enables him to judge of the bona fide of applicants for benefit. If they are offered suitable employment and refuse it, the benefit is withheld.

Courts of referees of employers and employees constitute a court of appeal from an insurance officer. He in turn has an appeal against them to an umpire.

The total number of insured work-people in Great Britain and Northern Ireland has grown to nearly 12,000,000 and the annual receipts of the unemployment fund at the present rate of contributions are between £40,000,000 and £50,000,000 per annum. In 1922 the expenditure of the fund was over £58,000,000, and a debt to the Treasury was incurred, most of which has since been slowly repaid.

The extended scheme of 1926, including also the mass of industrial workers (agricultural workers and domestic servants are excluded), was introduced on the eve of the trade depression, so that reserve funds had not been accumulated to meet the great demands. Rates of contributions and of benefits have been frequently changed; the unemployment fund instead of being a creditor has become a debtor of the Treasury. The administrative checks on applicants originally intended and the limitation of benefits have not been applied. In 1920 there was introduced the system of what was at first called "uncovenanted" benefit, and is now known as "extended" benefit. Extended benefit is benefit allowed to unemployed persons who have exhausted their "standard" benefit (*i.e.*, what they are strictly entitled to in respect of their contributions); it is granted under certain conditions and at the discretion of the Minister of Labour. This discretion was taken away in 1924 and extended benefit was made a right, subject only to the fulfilment of the statutory conditions; but it was restored by the Act of 1925.

All this has led to unemployment insurance being decried as a "dole" system. But dole is clearly a misnomer for the standard benefit. And even as regards extended benefit, the expectation always is that the recipient of it is one who had contributed to the fund, and who will in the future pay the premiums against the benefit he has drawn in advance. It should be noted that the debt to the Treasury is not very large, and is certain to be repaid from the unemployment fund as soon as the volume of unemployment diminishes. During a period of four years from the beginning of the depression in 1920 workers' contributions were £62,000,000; those of employers £71,500,000, and of the State £46,000,000. Thus the Exchequer provided slightly over a quarter of the total amount spent. Taking the whole duration of the scheme, the State has given and lent very little more than was originally intended by Parliament. (The Economy Act of 1926 provided for a reduction of the State grant in respect of unemployment insurance.) Nor is it a fact that the same people have remained unemployed all these four years. An investigation made in 1924 into 10,000 claims showed that 4·7% of the claimants to unemployment benefit had had no insured employment from 0 to 29 of the 125 weeks of the period covered, that

22·7% had done some insured employment in from 30 to 59 weeks; 23·5% in from 60 to 89 weeks; and 30·5% in from 90 to 125 weeks. But if it is wrong to say the workman is drawing a "dole," it is clear that the nature of the insurance scheme has changed owing to the intensity and continuance of the industrial depression. At present the scheme provides for the insurance of all workers in the insured trades by means of premiums paid by or in respect of those alone who are actually employed and not by all those who are insured.

Since unemployment is a normal feature of industry, there is a prima facie ground for making benefits equal wages. There is indeed a large school which demands "work or maintenance" for all unemployed, and maintenance at full rates of pay.

But the practical difficulties of this are obvious. Generally speaking, criticism of unemployment insurance takes the form of suggestions for improving and strengthening the existing scheme, not for abolishing it. It is proposed that agricultural workers and domestic servants should be included, that greater power should be given to advisory committees of employers and employees in its administration, that Parliament should set up a body with authority to advise what political and economic policies will mitigate unemployment, and an interdepartmental body for giving effect to such policies.

Thirteen years' experience has demonstrated that compulsory unemployment insurance is entirely practicable, that the British scheme has been conceived on right lines, that it embodies ideas which are socially desirable, that it is actuarially sound, that it is extremely elastic, and that it has been one of the signal successes of British administrative effort.

A departmental committee of inquiry into the whole question of unemployment insurance was set up by the British Government in 1925.

Compulsory unemployment insurance has now been adopted in six other countries. It was introduced in Italy by a legislative decree in 1919, which was superseded by a decree of 1923. Austria introduced it in 1920. Queensland adopted it in 1920 and Soviet Russia includes it in its Labour Code. Poland introduced a system in July 1924. The Irish Free State is continuing the compulsory system it took over from England.

The voluntary system of unemployment insurance supported by state subsidies previously known as "the Ghent system," is in operation in nine States, but the British method is steadily gaining more adherents.

Insurance by industry.—The proposal to organise insurance by industry has attracted special attention in relation to unemployment. But there is no reason why it should not be considered also in relation to the other branches of social insurance. Workmen's compensation in this country is organised in a manner which ought to satisfy the advocates of insurance by industry, and it is possible, if it is desired, to organise unemployment insurance and health insurance in a similar manner. This idea underlies Professor Commons' scheme for the American States.

The arguments in favour of this course and against it may be briefly summarised as follows:—

If the burden of these social emergencies in each industry is placed directly on that industry, a financial incentive will be given to the employers to prevent them in each industry, and a similar arrangement might even be made for each firm so as to prevent them in each firm, and so lessen their burden. Why not, it is asked, use this obvious instrument for stabilising employment? Each industry could form one representative organisation of all concerned in it, which would attempt to grapple with these social emergencies. Experience of working together in this way by employers and workpeople would enable them to face other problems. Thus insurance by industry is seen to be part of the wider policy of giving the workers some share of control in industry. Another argument used is the justice of adjusting benefits to earnings. Unfortunately, some of these arguments have little force. Thus the money incentive that can be offered would be relatively so small that experience with the rebate system offered under the 1911 Act to employers who kept a stable staff proves that it would have little or no effect in inducing employers to seek means to reduce the amount of unemployment. The desire to give the workman and his employer some share in the administration of the scheme can be achieved through increasing the functions of advisory committees both of employers and of work-people. Similarly the better adjustment of benefits to wages can be achieved in other ways.

There are many difficulties in the way of this proposal. First there is the difficulty of classifying and delimiting industries, though it must be admitted that the same difficulty will have to be tackled if Whitley Councils are ever to be made really effective. Nor have suggestions been wanting how to deal with the class of floating labour, especially of unskilled labour which finds employment now in one industry and now in another. It is argued also with force that in case of decaying trades the technical process may become obsolete, but the industry continues, and it is proper for the industry to bear the burden of maintaining those who are too old to adjust themselves to the new conditions.

But there are other serious objections. Each industry would have to institute its own system of exchanges, and this would make the administrative expenses of insurance high. Besides, workmen might be tempted not to transfer from a high benefit industry to a low one even when it was economically desirable for them to do so. Labour would tend to become immobile.

Moreover, it may be doubted whether it is really unfair for, say, clerks to pay towards the cost of insuring unemployment in the coal industry. They consume coal, the trades in which they are engaged probably use it. Shipbuilding is dependent upon the iron and steel manufacturing industry, engineering, woodmaking and other industries. Most industries are dependent on coal and transport, and they all use electricity and gas. When industry has grown so interdependent there seems to be no substantial injustice in a flat rate system. (J. Co.)

VI. MEDICAL ASPECTS OF HEALTH INSURANCE

Insured Persons.—The number of insured persons in Great Britain is approximately 15,000,000. They consist of persons under a contract or service, namely all manual workers without any income limit, and non-manual workers with an income limit of £250 a year. Certain other persons, within the same income limit, who have previously been employed insured persons or who have married an insured woman, are allowed to enter the scheme voluntarily. On the other hand some employed persons who have sources of income other than their employment may be exempted, and certain whole classes are excluded from compulsory insurance because they are serving under conditions which provide benefits equivalent to those of the insurance scheme.

The Medical Service.—This large proportion of the workers of the country has been entitled not only to the cash benefits described, but, since January 1913, to such medical advice and treatment as can reasonably be expected from general medical practitioners as a class, other than in respect to a confinement. This is a very wide range; and gratuitous service even beyond this range has repeatedly been given. There are about 15,000 medical practitioners engaged in this work. Every registered medical practitioner who wishes to do so has the right to take part in the service, unless and until he be removed therefrom after due inquiry according to prescribed methods and machinery. To this provision the medical profession has always attached the utmost importance. Equally important are the provisions that every insured person has a free choice of all available doctors, that he may change his doctor at any time, and that the doctor may, with due notice in the case of illness, request his patient to seek other advice. The maximum effective number of insured persons for whom any doctor may, single-handed, make himself liable is 2,500. With a doctor of quick mind, methodical habits, and considerable ability, who devotes the major part of his time to insurance practice this number is reasonable, but in an average case where a corresponding amount of private practice is undertaken, this number is probably too large for efficient work in times of stress. In some densely populated areas where the number of doctors is relatively few and the lists

correspondingly large a certain amount of complaint may at times have been justified, but these conditions are, by common consent, adjusting themselves and the service improving. In fact, the number of doctors who have lists effectively exceeding 2,000 is small, the average number of insured persons per doctor being less than a thousand.

The aim of all these arrangements is to make the conditions of insurance practice approximate as nearly as possible to those of private practice. The actual and legal relationship between doctor and patient is the same in both, the only modification of this statement (and that a small one) being that since the whole body of insurance practitioners of an area have undertaken the responsibility for attending all the insured persons of that area, each practitioner must attend any insured person in an accident or other emergency whereas this is merely an obligation of humanity in non-insurance practice. In addition, the doctor under the insurance system undertakes to give certain certificates with regard to incapacitating illness and to keep certain records and make certain reports as required by the Ministry of Health.

Effects of the System.—After 13 years of such a system it is true to say, in general, that the incidence of incapacitating illness among the working population has diminished, that whole classes of persons are now receiving a real medical attention which formerly they did not get at all, that the amount and character of that attention is immensely superior to that given under any of the old forms of contract practice, that illness is now coming under skilled observation and treatment at an earlier stage than formerly, and that the bias towards preventive rather than mere remedial treatment has been reinforced.

Good as this is it might yet be better. The existing definition of insured persons includes some—the higher-paid manual workers—who could make the necessary provision for themselves without state aid. Equally clearly it excludes many others who urgently need such aid,—*e.g.*, poor persons not under a contract of service, such as hawkers and small tradesmen. The dependents of all the lower-paid insured persons, however defined, manifestly need aid for securing adequate medical attention in some way and might well be brought within the insurance scheme. To make the required adjustments will give rise to some formidable difficulties but these should be faced and overcome. The difficulty with regard to the inclusion of dependents is almost wholly one of finance. The difficulty of including other poor persons is that of collecting compulsory contributions (not necessarily weekly) from those who have no employer. The difficulty of excluding the higher-paid of those now included is that of applying an income limit to the manual worker as well as to the clerk. These difficulties are not insuperable.

Extension of Scope of Treatment.—The extension of the scope of the medical advice and treatment available so that it shall include not merely such as can in the best interest of the patient be given by general medical practitioners as a class, but also consultant and specialist services (including dental treatment), and the advantage of pathological laboratories, would not only be of immense advantage to both doctors and patients, but would solve a good many of the minor problems which give rise to daily troubles under the existing system. The expense of such an extension as has been recommended by the royal commission on the Insurance Acts, to whose reports reference has already been made, would not be prohibitive, and experience already gained would greatly facilitate the necessary working arrangements with the medical profession. A subsequent further extension to cover residential institutional treatment, the provision of nurses, and other ancillary services would be quite practicable and would complete a national system designed to leave no one without the means of readily obtaining adequate medical attention in all forms of illness. (H. B. Br.)

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INTELLECTUAL CO-OPERATION, International Institute of.—In Sept. 1921 the League of Nations, on the proposal of M. Léon Bourgeois, added to its existing technical committees an International Committee on Intellectual Co-operation, made up of distinguished scholars chosen first from 12, afterwards from 14, different countries. Its membership included, among others, Mme. Curie, Prof. Einstein, Prof. Gilbert Murray, M. Jules Destrée and Dr. Millikan. M. Henri Bergson was elected its first chairman.

The task assigned the committee was that of studying the better organisation, through united international effort, of literary, artistic and scientific work. The committee soon became convinced that if it were fully to accomplish its task it must have a permanent administrative organ to prepare its programme and carry out its plans. In 1924 the French Govt. offered to defray for the League the expenses of such an organ, asking only in return that Paris be its seat. The League accepted the offer; and in Sept. 1925 the International Institute for Intellectual Co-operation opened its offices in Paris, at the Palais Royal.

The institute is divided into seven specialised sections which are as follows:—

General Section.—This makes a preliminary survey of all problems submitted to the institute. It draws up an annual set of international statistics on intellectual life and its changes in level. It studies all general problems and suggestions that bear upon the international organisation of intellectual work.

Scientific Relations.—This section deals with specific problems of international scientific organisation. It keeps in touch with the important existing institutions and associations in this field, and aids them to co-ordinate their efforts, encouraging the creation of new bodies where these are necessary. It follows closely the powerful but still unco-ordinated activity of international scientific congresses.

Artistic and Literary Relations.—These two sections study the organisation, from an international point of view, of literary and artistic production. They prepared in 1926 a plan for an International Office for Museums. They investigate the question of general protective laws for artists and works of art.

University Relations.—This section acts as a link between institutions of higher education in all parts of the world. To this activity

the committee attached a particular importance from the first. In 1923 they suggested to the Council and the Assembly of the League the need for an International University Information Office, since created. In 1925 the Assembly decided to refer to the Institute for study the question of a general international *entente* in matters of education.

Legal.—This section deals with the legal problems raised by plans for international intellectual co-operation. In accord with the International Labour Office, it studies the economic conditions of intellectual workers.

Information.—This section studies also the means by which the results of intellectual work are diffused, particularly the problems of book production and printing. It seeks to co-ordinate the activity of periodical publications which treat the various phases of intellectual life.

The institute is strictly international in character. Its officials belong to 20 different nations: the section for general affairs, for instance, had as its first head an Englishman; the section for university relations a Pole; the information section an Italian; the section for artistic relations a Belgian; the section for literary relations a Chilean, a woman; the section for scientific relations a German; and the legal section a Spaniard.

The staff, drawn from all parts of the world, represent the most varied intellectual interests. But all of them, from the French director down, are moved by the same desire: to seek in each individual problem submitted to them, with all the exactness and modesty of experts who understand the clear limitations of a given task, the methods best adapted to reconcile the interests of each nation with those higher interests of the mind that govern the broad sphere of intellectual life.

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(J. Lu).

INTELLIGENCE, ANIMAL (*see* 14.680).—A broad distinction is commonly drawn between instinctive and intelligent behaviour in animals, and it is necessary therefore to frame some definition of what is meant by intelligent action. In this matter McDougall (1923) writes as follows:—

> The definition and demarcation of instinct and intelligence have been much debated of recent years; but no general agreement as to the precise use of the words has yet been reached nor can be reached until agreement as to the nature of the facts denoted shall have been achieved. But the great majority of all parties would agree that we may properly call "instinctive" those actions of animals which seem to be purposive (*i.e.*, exhibit the marks of behaviour) and which are performed by any animal independently of previous experience of similar situations. . . . Intelligent action, on the other hand, is generally defined as one which seems to show that the creature has profited by prior experience of similar situations, that it somehow brings to bear its previous experience in the guidance of its present action. Instinct (abstractly conceived and with a capital letter) is native or inborn capacity for purposive action; intelligence is the capacity to improve upon native tendency in the light of past experience (pp. 70, 71). (*See* PSYCHOLOGY.)

Some authors, particularly Fabre and Bergson, have attempted to make the distinction between instinct and intelligence an absolute one, attributing to instinctive animals psychical powers of an almost miraculous kind. This view is not widely accepted by those who have studied most carefully the manifestations of instinct. The fact is that neither form of behaviour appears "pure." Glimmerings of intelligence may be awakened in even the most stereotyped of instinctive actions, and intelligent action is often merely an extension and embroidery of instinctive behaviour. Their resemblances are more important than their differences—both are forms of purposive activity, adapted to fulfilling some end connected with the maintenance and continuance of life, and finding their driving force in the primary hormic impulses of the living thing (E. S. Russell, *The Study of Living Things*, 1924). The contrast is between the accuracy and mechanical undeviability of instinctive behaviour, inborn in the animal, and the probing tentativeness of intelligent action, which seeks to modify in the light of individual experience and to adapt to changing circumstance the blind impulsions of instinct.

Definition.—If we adopt this broad criterion—modifiability of behaviour in relation to past experience—we may say that intelligence in this sense is practically coextensive with animal life, for even the Protozoa alter their mode of reaction if their first response fails, and show the beginnings of "learning by experience" (Jennings 1906).

Animal Behaviour.—Since about 1900, much attention has been paid to the study of animal behaviour, both by zoologists, who have studied particularly the sensory physiology of animals and have tried to analyse their behaviour in terms of tropisms and reflexes (see, for instance, Loeb 1919), and by professional psychologists, who have studied particularly the intelligence of the higher animals (and some of the lower) by means of highly developed and ingenious mechanical contrivances, such as puzzle boxes, mazes, and the like. Nor should one omit to mention the good work done by field naturalists like Beebe and Miss Frances Pitt upon the behaviour of animals going about their ordinary business in their natural environment.

Experimental Work.—With respect to the question of the intelligence of animals, particularly of the higher forms, in the works of Yerkes, Thorndike and Hunter, and in the useful general account by Miss Smith (1923) and Kafka (1922), details are given of elaborate experimental researches carried out on habit-formation, the processes of association, sensory discrimination and so forth. Generally speaking, these experiments afford little evidence of anything like reasoning power even among the higher vertebrates. Learning appears to be a rather mechanical process, in which little intelligence, in the ordinary acceptation of the word, is shown. The objection may, however, be fairly made to many of these experiments that the animals are placed in unnatural conditions which inhibit them from developing the full range of their capacities. Of quite special interest in connection with the general problem of the intelligence of the higher animals are the experiments and observations of the distinguished German psychologist Köhler, on a number of chimpanzees which were kept at an experimental station in Teneriffe under very easy conditions of captivity. The apes had the run of a large open-air enclosure, and were allowed to develop a normal social life without undue interference.

The tests applied were simple and based upon a thorough and sympathetic knowledge of their normal behaviour. They consisted generally in setting the animal the problem of attaining a coveted object, say an attractive fruit, which was placed beyond their reach—outside the bars of the enclosure, for instance, or suspended high up from its roof. The use of a stick, or of anything which might function as a stick, to draw the object within reach was grasped at once, and one ape learned to join two sticks together if both were too short. The use of a short stick to draw within reach a longer stick with which to attain the objective also presented little difficulty to the more gifted individuals. Many learned to pile one box upon another in order to reach a high object—the best effort in this direction being a (somewhat ramshackle) construction of four boxes one on top of the other. What was really striking and significant about the experiments, however, was that the apes did not come by the solution of their problems by a random method of trial and error, but by suddenly grasping the situation after a longer or shorter period of puzzlement, and applying a correct solution straight away. Köhler argues very convincingly that these apes must possess a certain power of insight or judgment of the visual situation as a whole; their problem-solving is accordingly a very different thing from the gradual beating out of a solution through undirected effort and chance associations, which is found in the experiments of Thorndike and his school.

Thinking Animals.—In conclusion, a brief reference may be made to the so-called "thinking animals"—the Elberfeld horses, the Mannheim dog and others—which by means of signs can apparently spell out answers to questions and give the solution of mathematical problems. While the phenomena are not yet fully explained, there is a general consensus of opinion that these animals do not really reason, but are in some way guided unconsciously by their trainer—and perhaps by the

spectators also. On the question of trained animals in general the works of Hachet-Souplet should be consulted.

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INTELLIGENCE, HUMAN (*see* 14.680).—This name is among the most widely used and hotly disputed in the psychology of today. To call any one "intelligent," or one of its synonyms, as "bright," "sharp," "brainy," or one of its antonyms, as "stupid" or "dull," is a universal custom, alike in scholastic work, industrial management and familiar conversation. The word has also long played a very conspicuous part as denoting the alleged distinguishing privilege of the human species.

But by far the greatest excitement has arisen from the claim raised that any person's intelligence can actually be measured by means of mental tests. After some important theoretical work by others (see later on), the first great practical success with these tests was effected by Binet and Simon in 1905. The test-scale devised by them was applied in a great many schools, and it still to this day—with radical revision—continues to be the standard scale, at any rate for young children. But the most startling achievement of the testing (chiefly by means of another scale) was its application to nearly 2,000,000 men of the American Army in 1918. The results proved to be so useful as to elicit a very high eulogy from the American Secretary of War. Since then, the application of one or other of the multiplying scales to schools, universities and other institutions has in most civilised countries extended so widely as to comprehend the greater part of the juvenile population.

What the Tests Measure.—Despite all this outward success, however, there has sprung up much and vehement criticism. The main source of trouble has been that those who are making such mental measurements cannot agree as to what they are measuring, or even as to what they ought to measure. For example, some think that intelligence should include memory, and they therefore introduce into their scales a certain amount of memorizing. But other testers rigidly exclude any such thing. Many—as Binet himself—first declare that memory does not appertain to intelligence, and then nevertheless proceed to make memorizing a conspicuous part of their actual tests. Similar confusion and inconsistency reign about imagination, about attention and about sensory perception; both theory and actual practice are at loggerheads as to whether the tests should include any or all of these. Some authorities go the length of wanting intelligence to embrace, not only the co-ordination of ideas, but equally that of movements. In short, this state of affairs can without exaggeration be called one of complete chaos.

Historical Development.—The key to understanding the situation appears to be supplied by historical considerations. With the old Latin-writing philosophers, intelligence (intelligentia) meant the using of the intellect (intellectus); and the latter word was their rendering of the still older *νοῦς*. This and sensory perception (*αἴσθησις*) were regarded as the two great faculties of man. The sensory perception was his evil genius, tricking him with all manner of appearances and illusions, whilst the intelligence opened his eyes to the real truth. But in course of time other philosophers and psychologists brought into this theory various complications. By some a further faculty of memory was added on. By others, imagination was honoured in this way. By yet others, attention, and even movement. Moreover, alongside of this tendency to set up various faculties outside of intelligence, and thus curtail the sphere of the latter, there also occurred some change in the opposite direction of expanding its sphere; in this way, it was sometimes made to comprehend even sensory perception,—which had originally been regarded as its very antithesis.

With lapse of time, these diversified doctrines, each fairly distinct as handled by the school which advocated it, began to percolate down to wider and less instructed circles. In so doing they became more and more intermingled. What the word eventually evoked in the mind of the man in the street—never too nice about logical consistency—was a confused reverberation of all the different views. The last phase of the history was when modern psychologists—instead of properly moulding clear ideas for themselves—complacently took over this old notion of intelligence from the popular usage. All went well enough until they began to examine what they had really got into their hands, which proved to be a word with so many meanings as practically to have none.

Definitions.—To cure such equivocality, the natural course would seem to be a definition. Accordingly, there have been many attempts at this. Most adherents appear to have been gained by the proposal to define intelligence as *conscious adaptability to new situations* (W. Stern). But, unfortunately, nothing could be more equivocal than the term "adaptation" itself. Admittedly it means a change that fulfils some purpose; but as to whose purpose, and of what kind, nothing is usually said; widely divergent interpretations are possible, and actually given. The next most favoured definition has been as *the capacity to learn* (Buckingham). But this "*learn*" is at least as bad as the "adapt." By the dictionary, it signifies the acquirement of any skill or knowledge. But most advocates of this definition evidently mean neither the acquiring of skill nor many forms of acquiring knowledge (*e.g.*, memorizing). What they do mean is left unstated.

Education.—Another interpretation of intelligence has been extensively advocated, namely, as the power to perform what is called "*eduction*" (Spearman). This is said to have two forms, of which the first consists simply in the perceiving of relations between any two given ideas (taking "idea" in its broadest possible sense). The other form is when an idea and a relation are given, and from these two there has to be found the correlative idea. Now, eduction in this sense does escape the bane of equivocality. Also, it has shown itself to be a power of paramount importance, especially as contrasted with the only other possible ways of obtaining ideas (namely, by sensation and by reproduction). Moreover, this eduction does seem to indicate something which most persons will admit that they, in using the word intelligence, are really "driving at."

Difficulties of Measurement.—Any way, even after fitting the term intelligence with the most irreproachable definition there still remains a great difficulty in accepting the far-reaching claims to have *tested and measured it.* The rub consists in the fact that such a mental power—whichever of the definitions we may choose for it, even the last—always admits of being subdivided; hence, a separate measurement would seem to be indispensable for each subdivision.

Thus, Binet himself admitted that the intellect breaks up into several different faculties, and wrote about these: "The mental faculties of each subject are independent and unequal; with a little memory there may be so associated much judgment. . . . Our mental tests, always special in their scope, are each appropriate to the analysis of a single faculty" (*Les idées modernes sur les enfants*, Paris, 1910). If he thought this, then why did he not, why do not his followers, measure each of these independ-

ent faculties, memory, judgment, etc., one by one? Furthermore, each faculty itself can be divided up. For instance, why should not a person have a good memory for some things and a bad one for others? And if we push this argument far enough, the required measure- ments would seem to become infinitely numerous, and therefore incapable of ever being really executed.

Tests by Samples.—For this difficulty of measurement there have been only two solutions so far proposed that deserve serious consideration. The first and most widely known—especially associated with the name of Thorndike—is that the current tests measure *a representative sample* of the subject's abilities. But this view, plausible enough at first sight, does not bear scrutiny. In order to pick any genuinely representative sample of anything, every portion of this must be represented fairly (*see* LOGIC). For example, the sampling of a field of potatoes would be far from representative if we selected many from some particular areas and few or none from others; we ought to divide the field into equal parts, and pick an equal number from each. But in the case of mental abilities there seems to be no possible method of settling what parts are really equal.

Test Scales.—In a well known test-scale (Yerkes), judgment is made to supply three test-elements, whereas ideation supplies only one. On what conceivable ground can we settle whether judgment is or is not three times as large a faculty as ideation? Other test-scales no less arbitrarily reverse this ratio. As for the scale of Binet, this even within itself gives the most widely divergent ratios between different test-elements when the scale is applied to children of varying ages.

Coefficients of Correlation.—There remains the other serious attempt at solution (Spearman). If a large number of people are submitted to two tests, the degree in which the same persons tend to excel in both cases can be expressed numerically by what is called a coefficient of correlation. If several tests are used, there will of course be a correlation for each different pair of tests. Now, proof has been given that, when the magnitudes of all these correlations satisfy certain mathematical conditions, then and only then the score of each person in each test can be divided into two factors, of which the one has always the same value (for the same individual), whereas the other varies independently from one test to another. These two factors have been symbolised as "g" and "s" respectively.

Measurement of "g".—Further evidence has been furnished that, with suitable tests (of "eduction," *see* above), these mathematical conditions are actually fulfilled. It is easy to see, then, that if the tests are made sufficiently numerous, the independent values of the "s" must tend to neutralise one another on an average, leaving the "g" as a value uniformly characteristic of the individual. This "g" it is that has actually been measured —more or less accurately—by the mental tests now in usage. It is not in the least equivocal, for we know exactly under what conditions it always occurs. But there still remains the task of interpreting it; herein it resembles electricity, which was measured with great exactitude long before its intrinsic nature was even approximately understood. In both cases, too, the illumination does not arrive in a flash, but accumulates gradually.

At the present moment, "g" seems to be best conceived as a person's "general mental energy," whereas the "s" varying from test to test represents so many different mental "engines," into any of which (alternatively) the energy can be switched. In this "g," then, the "intelligence" receives yet another possible interpretation. Here, it would not consist in any entire ability whatever, but constitute a factor that enters into multitudinous (eductive) abilities. But whether or not the "g" be invested with this title of intelligence, it at any rate furnished the original inspiration for the miscellaneous mixture of test-elements that currently claim to measure it (in this respect, Binet appears to have been an unconscious borrower). Also, it supplies such tests with their sole genuine justification.

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(C. SP.)

INTELLIGENCE, MILITARY AND NAVAL.—Under this designation may be considered the work of obtaining, collating, interpreting and distributing information, in peace and war, about foreign powers, the countering of foreign powers' efforts to obtain intelligence, and the organisation which performs these duties. Information as to actual or potential enemies, allies and theatres of war, has always been required and obtained by governments and commanders in the field; the employment of spies, the questioning of prisoners, date from the earliest times in history, but never have the scope, and what might be termed the technique of military intelligence, reached such a high degree of development as in the World War.

I. INTELLIGENCE IN PEACE TIME

In time of peace, the relative military power of a nation with regard to other foreign powers, and in particular to its immediate neighbours, necessarily affects its foreign policy. Every government therefore maintains an intelligence system, which generally forms a section of the headquarters staff of its military forces (known in most countries as the General staff), for the purpose of:—

(*a*) Providing its Government with all necessary information regarding the military power of foreign nations;
(*b*) Devising means whereby, in case of war, all essential information concerning the enemy, allies and theatre of war may be placed at the disposal of the commander and troops, and the supply of further information continued throughout the campaign;
(*c*) Preventing the acquisition of information by the enemy.

Type of Information Required.—The fighting power of a nation can only be gauged when accurate and detailed information is available on certain factors, the most important of which are the organisation, strength and power of expansion, armament, tactics and morale of its armed forces, the characteristics of its leaders, its defensive works and fortresses, its communications, such as road, railway, waterway, aerodrome, cable, telegraph and wireless telegraphy systems, its physical and political geography, climatic conditions and economic and industrial resources in relation to military requirements. This information also enables the General staff to prepare, and keep up to date, plans for offensive and defensive operations, together with estimates of the forces required for their execution against any power or combination of powers, with which the particular power, either alone or in co-operation with other powers, might be brought into conflict.

Sources and Value of Information.—The main sources from which information is derived in peace time are statistics and economic data obtained from foreign government publications, from the Press and technical works, foreign training manuals, military and geographical publications and from information procured by the Secret Service.

When war breaks out, this intelligence system provides the commander and troops about to take the field with maps and all available information regarding the theatre of war, the armed forces and military resources of allied and hostile powers, with their special characteristics; this information forms the basis of the plan of campaign, but requires to be supplemented with information concerning the enemy's mobilisation, concentration and order of battle in general. For this purpose preparations must be made beforehand and an intelligence organisation provided for the troops in the field; the intelligence section therefore lays down the foundation of the intelligence organisation required in war and makes arrangements for expansion by training the special personnel required.

II. INTELLIGENCE IN WAR TIME

In war, the greatly increased activities of the home or headquarters intelligence service are mainly directed to areas outside the theatre, or theatres, of operations. In the latter, the armies in the field are provided with intelligence services of their own, who form an additional source of information for the home intelligence service, which is responsible for the further collation and distribution of the information thus received.

Field Organisation.—In the field, the intelligence section of the General staff collects and collates all information regarding the enemy's forces and intentions and the theatre of war, supplies to the commander, staffs and fighting troops all information which will assist them in preparing and carrying out plans for the defeat of the enemy and endeavours to prevent the acquisition by the enemy of similar information. To be of practical value, the information supplied must be relevant, furnished in time to be of use and in such form as will admit of its immediate application by those concerned. These conditions require the closest co-operation and mutual understanding between the intelligence and operations sections of the General staff. The developments, technical and otherwise, of modern warfare have placed at the disposal of the intelligence section many resources for collecting information which were not available prior to the 1914–9 campaign. Intelligence in the field has become a large and intricate organisation, the varied and complex nature of whose duties necessitates the employment as assistants to the General staff proper, of a large number of highly trained specialists.

Knowledge of the enemy's intentions is of supreme value to a commander, and the intelligence section should therefore possess throughout the campaign early, accurate and continuous information regarding the enemy's " order of battle," his movements of men and war material, his tactical method, armament and equipment, the organisation of his defences and rear services, the topography of the theatre of war. The relative value of these different classes of information varies with circumstances; the character of the operations may change at any moment from open warfare to stabilised warfare, or the reverse; an intelligence service must therefore be elastic both in method and organisation. Method, accuracy and speed are essential for the collection, reception, transmission and collation of information, but this work is of no value unless timely deductions can be made from the evidence available. The making of deductions, appreciations and forecasts both as to the probable action of the enemy and the prospect of successful operations undertaken by its own troops is the most important duty of an intelligence section. Its true function, in fact, is to represent the operations section of the enemy, for broadly speaking it provides all information concerning the enemy, the allies and the theatre of war, whilst the operations section provides similar information regarding the troops of its own army.

Scope and Nature of Information.—Information regarding the enemy's " order of battle " is of paramount importance. It includes the organisation, composition and strength of hostile formations, the direction of their initial concentration and subsequent movements, their distribution, morale and fighting efficiency, the characters of their commanders, methods of recruiting and man-power available to replace wastage. The identification of units is the foundation of all " order of battle " intelligence. Movements of men, supplies and material on a large scale normally portend some important development or a change of the enemy's plans, but as they must take place along organised lines of communication are difficult to conceal. Detailed knowledge of the enemy's system of communications and means of transport is therefore essential; the capacity of railways, quality of roads, navigability of waterways at different seasons, system of aerodromes and auxiliary landing grounds must be carefully studied if reliable conclusions are to be arrived at regarding the size of any movement and the time required for its execution.

Full information regarding the tactics and armament of the enemy at the outbreak of war is usually available by the study of his peace training and organisation; but his methods of employing troops and their weapons in the field must be followed very closely in order to discover new developments as early as possible. In the World War full knowledge of each others' pre-War tactics and armament was possessed by the opposing armies, but almost from the beginning of hostilities modifications and new ideas were introduced, which frequently provoked counter measures. Instances were the employment of poisonous gases, flame and gas projectors, " storm troops," Stokes mortars and tanks. All the economic resources of a State may be required to meet the strain of a prolonged campaign, and accurate knowledge regarding these resources is one of the means of gauging the enemy's staying power.

Sources and Means of Collecting Information.—The main sources of information are prisoners, deserters, local inhabitants, captured documents and material, land reconnaissance and observation, hostile signalling communications, air reconnaissance and photography, the enemy and neutral Press and agents; the principal agencies for its collection are the fighting troops, the signal service, aircraft and secret service. The information, whether positive or negative, acquired by contact with the enemy is that on which every commander mainly relies in making his tactical plan. Hence, to keep the enemy under such close and continuous observation that he can make no movement without being detected is the primary object of all reconnaissance, whether on the ground or from the air.

Ground reconnaissance may be purely topographical, *e.g.*, the acquisition of unmapped information about the ground; it may be tactical, *e.g.*, to discover the enemy's positions, the strength and distribution of his defences, his tactics, movements and intentions; or for the purpose of obtaining " identifications," *i.e.*, information about the hostile troops in line, their morale, armament and equipment, by the capture of prisoners or documents. These objects are achieved by sending out mobile troops, patrols or raiding parties, or by observation from fixed points. The latter may be visual or instrumental.

Visual observation for intelligence purposes is an organised system for the observation of all enemy activity within the range of vision of its observation posts by trained observers provided with a special equipment of maps, telescopes, periscopes, etc., its elements being generally so placed and co-ordinated that the exact location of the enemy activity recorded can be fixed by intersection, *e.g.*, " flash-spotting." Instrumental observation is mainly automatic, by instruments disposed to receive, transform and transmit impulses from outside, *e.g.*, sound-ranging installations, electrical listening posts, wireless interception and direction-finding apparatus.

Air Reconnaissance.—Information from the air is derived from balloon observation, aeroplane reconnaissance and air photography. The development of air reconnaissance and photography has to a great extent revolutionised the whole service of military intelligence in the field; not only are aircraft capable of assuming the duty of strategic reconnaissance, but the camera has made it possible to obtain, particularly in position warfare, a far more detailed and exact knowledge of the enemy's system of defence, communication and supply than has ever been possible before. The principal weakness of air reconnaissance and photography, however, lies in their necessary dependence on the weather.

Balloon observation is used principally for the observation of movement by road, railways, and in back areas, of defence works, the location of hostile batteries and the observation of hostile artillery activity. Aeroplane reconnaissance is used at the beginning of a campaign to locate the direction of the enemy's main concentration, to report on the movements and activities of the enemy's troops; and subsequently to supply information on the latter's tactical dispositions, the construction or destruction of bridges, the construction of new defences, etc.

Strategical reconnaissance involves long distance reconnaissances, extending frequently to distances exceeding 100 m.; they are usually carried out by single aeroplanes flying at such an altitude as to minimise the chance of hostile interference; at this height, movements of troops on the ground are unnoticeable, and the information gained is largely confined to reports of railway movements, activity at important junctions, formations of large camps, etc. It is often necessary to fly at medium altitudes and to employ formations of aircraft capable of dealing with air opposition, to obtain more detailed strategical information. Tactical information can only be obtained in sufficient detail by aircraft flying low (close reconnaissance) who can be expected to distinguish troops in the open and artillery in action, can dive near enough to the ground to clear up a definite point, such as the existence of a machine gun emplacement or whether a trench system is occupied or not.

Photography forms an essential part of all air reconnaissance. Even in the cases of reconnaissances at high altitudes photographs may be expected to show road movements, tracks, camps, new

works, battery positions, dumps, hospitals, light railways, telegraph lines and other signs of military activity, while in the case of close reconnaissance carried out at lesser altitudes, photographs taken in favourable weather enable experts to discover the smallest details of the enemy's defences.

III. THE SECRET SERVICE

The secret service supplies information regarding matters behind the enemy's front, and in his home territory, including strength and location of reserves, rear defences and lines of communication, internal conditions in the enemy's country and the state of his resources in man power and material.

Secret Service Methods.—The methods employed in this branch of intelligence work can only be referred to in general terms. Broadly speaking, its duties are:—

1. Offensive, in the acquisition of information by means other than those described in Sections I. and II. above;
2. Defensive, in the prevention of the acquisition by foreign powers of information regarding the forces of its own country.

The duties of the offensive section, to which alone the name of secret service is popularly applied, are similar in peace and war, but war increases the importance, and with it the difficulties and dangers of the work of secret agents or spies.

Agents work *à poste fixè*, on definite missions or on general roving commissions; they penetrate into enemy territory through the ports, in the guise of peaceful neutrals armed with all the necessary papers, or get there by other means, which in war include penetrating the enemy lines, either in uniform or mufti, during the progress of an action; landing behind them from an aeroplane or free balloon or crossing a frontier guarded by sentries and electrified wire. False papers, disguises, secret ink and all the other tricks beloved of the spy novel may form part of their equipment, but in practice, the most dangerous and efficient spy is the least sensational in his methods; when arrested he invariably has all his papers in order, and is the most plausible person alive. An espionage system in war involves the employment of many thousands of men, women and even children of all grades of society and of all professions: post-boxes, smugglers, guides, train watchers, pigeon men, couriers, runners, etc. All have their part to play, and that part, far from being ignoble, may be, if actuated by patriotism, as noble, as dangerous and as heroic as any played in the armies in the field.

Contre-espionnage.—The duties of the defensive section, popularly described as *contre-espionnage*, are also the same in peace or war, but the machinery and methods vary when carried out in home territory, in occupied enemy or allied territory.

The *contre-espionnage* section in home territory commands in peace and war all the assistance of trained police, censorship, port control, hotel registration, the erection of arbitrary barriers such as prohibited areas and of all the preventive measures which are the outcome of years of experience in combating enemy espionage under all conditions. In occupied territory, intelligence in the field equally enjoys these powers, and, in addition, the arbitrary powers of an occupying army, but the whole population is potentially hostile. In allied territory the difficulties are greater, as it is the ally who controls in his own home territory all the real preventive machinery.

The object of *contre-espionnage* is, first and foremost, prevention. Information may be gained by the enemy's agents equally from one's own troops and from the civil population; the former may sell or convey information deliberately, but will more probably convey it to the enemy's agents through indiscretion.

"Leakage" may occur in several ways; gossip about impending operations among the troops, especially when on leave and out of the line; indiscreet conversations, messages and misuse of code on field telephones and telegraph; marking of railway trucks, transport and billets, with inscriptions giving identifications of units; indiscretion in correspondence; careless handling of confidential papers and books; taking orders, codes, books, papers of any kind, even private letters into the front line; wearing of badges and numbers, which reveal identifications and in many other analogous ways.

The *contre-espionnage* section is also responsible for the control of the civil population. This involves the control of circulation, of the use of telegraph, telephone and other methods of communication, which might be utilised by enemy agents.

(T. G. G. H.)

INTELLIGENCE TESTS.—An intelligence test or intelligence examination is an instrument to measure the amount of intelligence shown by a human being or a lower animal. The instrument consists of a series of questions to be answered, or directions to be followed, or things to be learned, or intellectual tasks of any sort to be performed. Intelligence or intellect may be defined as the ability to perform intellectual tasks; and an intelligence test is a specially instructive sampling of such tasks.

Sample Tests.—The tasks shown below are representative of those used in standard intelligence tests.

"Show me your nose. Put your finger on your nose." Same with eyes, mouth and hair. Three responses out of four must be correct.

What is the difference between: (*a*) Laziness and idleness; (*b*) Evolution and revolution; (*c*) Poverty and misery; (*d*) Character and reputation.

Repeating three digits. After some explanation and practice, the person tested is asked to say 6-4-1, then to say 3-5-2, then to say 8-3-7. The test is passed if one series out of three is repeated without error, after a single hearing.

Repeating six digits reversed. The series used are 4-7-1-9-5-2, 5-8-3-2-9-4 and 7-5-2-6-3-8. The test is passed if one series out of three is repeated without error.

Tom runs faster than Jim. Jack runs slower than Jim. Which is the slowest of the three?

John said: I heard my clock strike yesterday, 10 minutes before the first gun fired. I did not count the strokes, but I am sure it struck more than once, and I think it struck an odd number."

John was out all the morning from the earliest hours; and his clock stopped at five to five the same afternoon.

When do you think the first gun was fired?

After some explanation and practice, the person tested is asked to "Finish what I say." At night you sleep in . . . . Mary has a ring on her. . . . You wear gloves on your. . . . You wear a . . . on your head.

The . . . of character is its ability to . . . liberty . . . from licence. Judicial decisions are of . . . or less authority as precedents . . . to circumstances.

A person who has been tested in respect of an examination consisting of from 50 to 200 such tasks may be given a score, and so be put in comparison with all others who have been tested with the same collection of tasks.

Intelligence Quotient.—Subject to certain limitations, the score may be expressed in terms of a mental age, that is, the age at which the average child is able to attain it. Thus if John Doe, aged 12·0, scores 118 in the national intelligence examination, and if the average child of age 13·1 attains a score of 118 in this examination, John Doe has a mental age of 13·1 years. John Doe's intelligence quotient, or I.Q., is his mental age $\times 100$ divided by his chronological age, that is $\frac{13\cdot1\times100}{12\cdot0}$, or 109.

This form of statement is useful for individuals whose scores are not higher than those made by the average child of 14, and whose chronological ages are not over 18. For higher levels and later ages the method is of doubtful value.

The score may also be expressed in terms of the percentage of some defined group who would attain lower scores than it. Thus, if 71% of persons aged 12·0 score lower than 118, and 29% score higher, in the national intelligence examination, John Doe may be recorded as in the 71 percentile for his age. This method is especially useful in the case of the higher levels of intelligence and adult ages. A more refined measure of this type expresses any individual's score as a plus or minus deviation from the average for some defined group in terms of the variability of that group as a unit. The technique by which this is done is beyond the scope of this article.

Systems in Use.—There are 30 or more such intelligence examinations now in use. Some, like the Pintner-Cunningham Primary Tests, are adapted to measure very young children aged two to five years. The National Intelligence Examination is designed to fit the intellects of the level of ordinary children from nine to 15. The Terman Group Test is especially suited to measure young people from 14 to 20. Some, like the Thorndike Examination for High-School Graduates, are adapted to measure gifted adults. Some, like the Army Group Examination Alpha, require an ability to read and write; some, like the Binet, are given orally; some, like the Army Beta, are largely independent of language. Some, like the Otis group Intelligence Scale, measure chiefly intellect as it operates with words and numbers and abstract relations; some are more concerned with information

about things and persons. In some, the speed of response counts a great deal in determining the score made; in others, it counts very little, the time allowed being sufficient to permit almost everybody to do almost everything of which he is capable.

Historical Development.—Existing instruments for measuring intelligence developed from three roots: the tests of sensory acuity, memory, attention and the like devised in the early history of psychology; the interview, as of physician with patient or employer with candidate for employment; and the school examination. Galton, Cattell and Binet were pioneers in this field of psychology. Sir F. Galton's *Inquiries into Human Faculty* (1883) presented the general problem of the measurement of individual differences; and he soon thereafter set up in the South Kensington Museum in London a laboratory where any person could be measured in a series of physical and mental traits. Under the influence especially of Cattell, many short examinations or " tests " of special mental powers were devised and rather widely used in the United States from 1890 on. Important work was done by Kraepelin and Ebbinghaus in Germany. An eminent French psychologist, Alfred Binet, using the general form of an interview between physician and patient, enriched by suggestions from psychological tests proper, produced in 1905 what may be called a standardised interview, consisting of 30 questions and tasks, many of which were chosen from the tests of special powers now familiar to all psychologists. This " metric scale of intelligence " was further improved and divided into age levels in 1908, and finally revised in 1911. Many variations of it have been used in different countries.

While Binet was developing a scientific interview and record and score, various psychologists in America were testing children in groups by means of printed collections of tests. The next step was the arrangement of such a collection in a standardised unitary examination, after the general plan of written examinations in school subjects. One of the earliest and by far the most influential of such arrangements was the group examination Alpha prepared in 1917 for measuring recruits in the U.S. Army. This examination was taken by nearly 2,000,000 men, large groups (sometimes over 1,000) being sometimes examined at one time and place.

Modes of Use.—Since then, intelligence examinations have increased rapidly in number, have become diversified in nature, and have been much improved in respect of convenience in giving and scoring. They are widely used, especially in the United States, as an aid in the proper grading and classifying and treatment of school children; and in studies of special groups such as defectives, delinquents and dependents. The methods used in conducting intelligence examinations are also being applied to examinations in school subjects, producing the so-called " new-type " examinations and educational achievement tests. At least 1,000,000 such examinations were made in the case of school children alone in the year 1925. Some of the leading American universities require an intelligence examination as a part of the general admission requirement.

In spite of notable improvements during the last 20 years, existing instruments for measuring intelligence suffer from serious deficiencies. Just what they measure is not known; how far it is justifiable to treat the scores by ordinary arithmetic is not known; just what the scores signify concerning intelligence in general is in dispute. An intelligence examination is still a more or less undefined collection of tasks, its score is still a somewhat arbitrary summation of credits, and the correspondence of the scores to the abilities which they purport to measure is still far from perfect. Psychologists are working to supply these deficiences, seeking to replace the undefined collections of tasks by tasks rigorously defined in nature and graded by a true scale of intellectual difficulty, so that the score may mean the precise height of intellectual difficulty which the person in question can master (*see* EXAMINATIONS).

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INTERNAL COMBUSTION ENGINES.—For the evolution of the internal combustion engine from its first appearance in practical form as the Otto Silent Gas Engine of 1876 down to the year 1910 *see* the articles GAS ENGINE and OIL ENGINE (11.495 and 20.35).

The essential feature of all internal combustion engines is the exceedingly rapid combustion, or explosion, within the working cylinder itself, of a mixture of air and some inflammable gas or vapour; great heat is liberated by the explosion and this causes a correspondingly great rise of pressure in the working mixture which then drives the piston forward, so performing the working stroke. All present-day internal combustion engines operate upon either the Otto (de Rochas) four-stroke, or upon the Clerk-type two-stroke cycle; in the first of these only one working stroke, per single-acting cylinder, occurs in every alternate revolution at the crankshaft, while in the second a working stroke is obtained in each revolution.

The types from 1910 are conveniently referred for descriptive purposes to five groups, viz.:

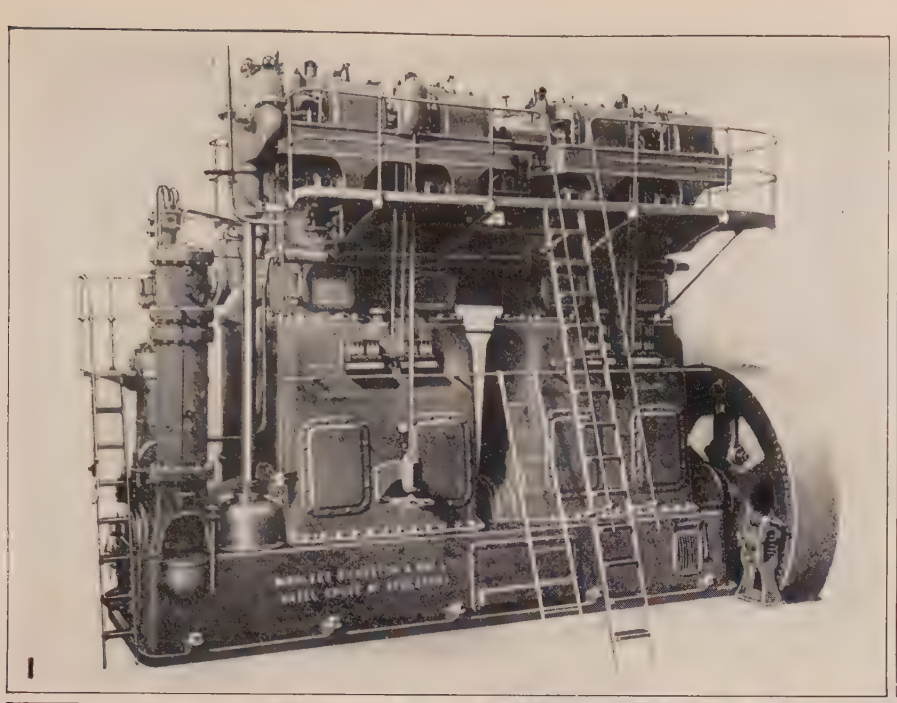
Large gas engines (exceeding, say, 400 H.P.).
Medium gas engines (less than about 400 H.P.).
Engines using heavy oils as fuel.
Engines using light oils as fuel.
Special types.

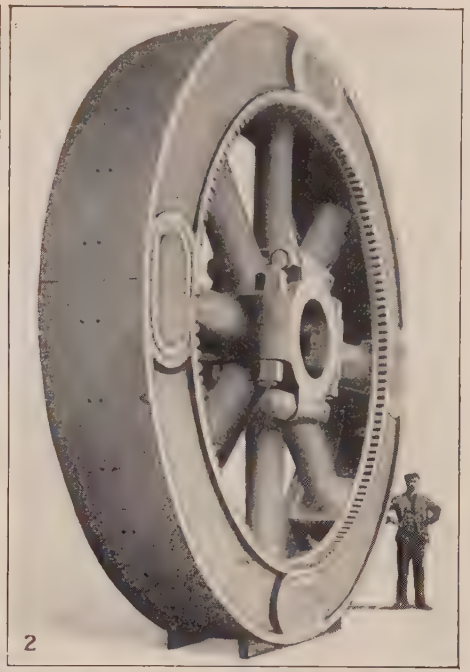
Large Gas Engines.—The changes in this class between 1910 and 1925 consisted almost wholly in improvements in detail; in the extended employment of waste substances as fuel for the gas producers; in the employment of high-tension electrical methods of ignition; in better cooling and governing arrangements, etc. The increase in the number of gas engines of the inverted-vertical multi-cylindered, quick-revolution, floor-space-saving type is also noteworthy.

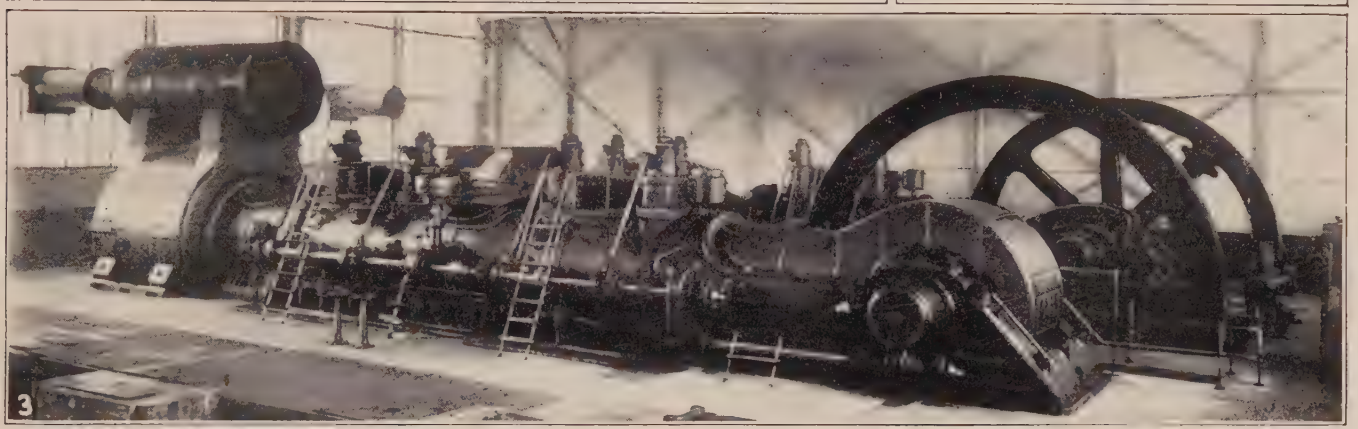
The large, horizontal, slow-speed type is illustrated by the Nürnberg, or M.A.N., four-stroke, single-cylinder or tandem, or twin-tandem, double-acting engines commonly using as fuel producer gas, coke-oven gas, blast-furnace gas or natural gas. One notable installation in Japan includes four horizontal tandem double-acting, single-crank, four-stroke cycle engines, each direct-coupled to a 1,500 kw. alternator.

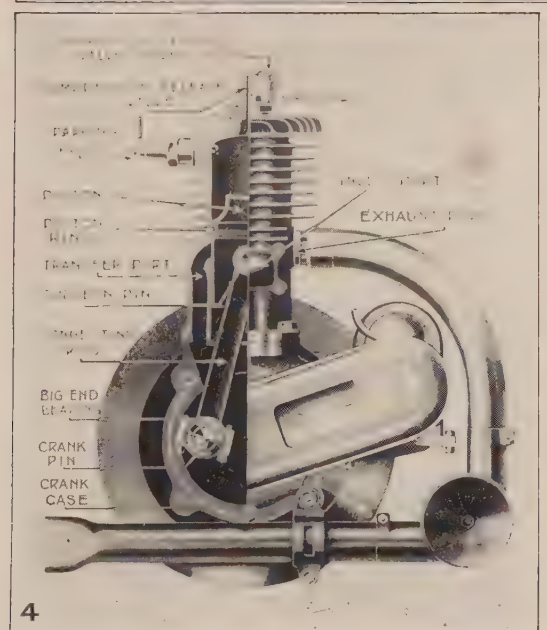
The cylinders are $47\frac{1}{4}$ in. diameter and the stroke is $51\frac{1}{8}$ in.; each engine is capable of developing 2,500 H.P. at 100 r.p.m.; the fuel used is Mond producer gas, the producers (with ammonia recovery) yielding 111,000 cu. ft. of gas per ton of Japanese coal. These engines are very massive; each cylinder weighs 25 tons; the fly-wheel 100 tons (see fig. 2 on plate) and the complete engine about 400 tons. At full load the consumption of fuel was about 1·8 lb. per kw. hour. Among other similar installations is that at the San Mateo power station of twin-tandem, double-acting, horizontal four-strokers, each unit containing four cylinders, 42 in. diameter x 60 in. stroke, and developing 5,400 B.H.P. at 90 revolutions per minute. The M.A.N. type, though large and heavy and occupying considerable floor space, is exceedingly reliable and economical; thus, a 2,000 H.P. M.A.N. engine using blast-furnace gas ran day and night during 19 months; in 13,870 consecutive hours the engine actually ran during 13,687 hours, *i.e.*, 98·6% of the whole time; and the stoppages were due not to the engine but to repairs necessary to the blast furnace. A third noteworthy large installation has 17 horizontal, twin-tandem, double-acting, four-stroke M.A.N. type engines, capable of an aggregate output of over 50,000 horse-power.

Large Two-stroke Gas Engines.—The large two-stroke Clerk cycle engine has also found considerable favour in the horizontal designs at Koerting and Oechelhauser. (*See* 11.499–500.)









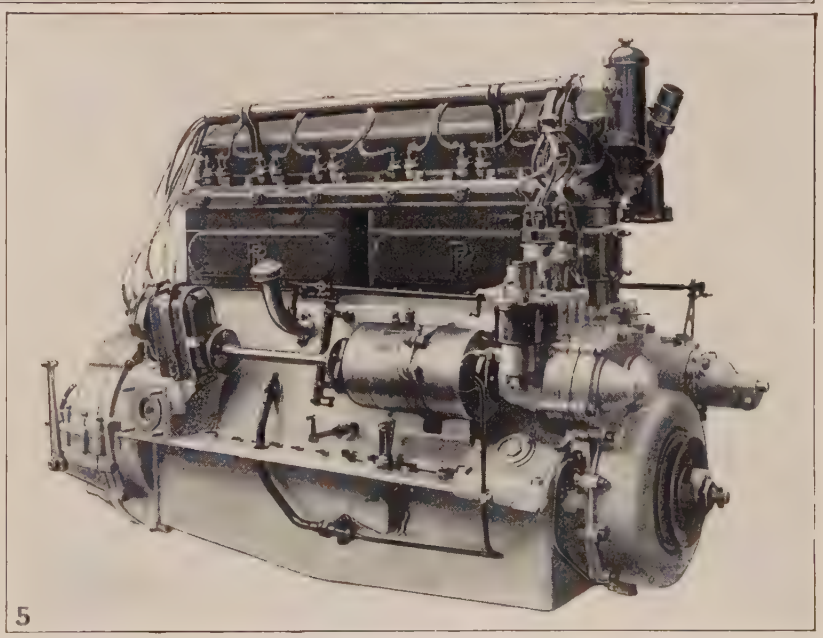


FIG. 1. 500 B.H.P. 4-cylinder Diesel engine. FIG. 2. Flywheel of 2,500 B.H.P. horizontal gas engine; approx. weight, 100 tons. FIG. 3. 3,000 B.H.P. Galloway twin-cylinder horizontal gas engine. FIG. 4. Part sectional view of modern air-cooled single-cylinder, two-stroke engine, with principal parts named. FIG. 5. Latest type Rolls-Royce 40–50 H.P. car engine.

(Fig. 4. By courtesy of "The Motor Cycle." Fig. 5. By courtesy of Messrs. Rolls-Royce Limited.)

Koerting.—The double-acting, two-stroke Koerting engine, with its characteristic very long water-cooled piston and central ring of exhaust parts has been built in England in units of up to 1,000 H.P., with cylinders 37⅜ in. diameter x 63 in. stroke, running at 70 r.p.m., while on the continent of Europe units giving 2,000 H.P. per cylinder 42 in. diameter x 55 in. stroke x 80–90 r.p.m. have appeared; the Koerting type engines installed at Buffalo aggregate 40,000 horsepower. The American Worthington Co.'s first large inverted-vertical, cross-head-type, double-acting, two-stroke engine, built in 1924, using oil as fuel in the Diesel manner, employed the Koerting type piston.

Oechelhauser.—The manufacture of this type of single-acting, two-stroke, opposed-piston, open-cylindered, internal combustion engine has been greatly stimulated by the ingenious arrangement adopted by Mr. Fullagar, who has retained the characteristic advantages of the type and has obtained in addition marked economy in space, weight and production cost by associating two Oechelhauser cylinders side by side with cross-over piston coupling rods, as his power unit. The Fullagar engine is built in England mainly for marine purposes, using heavy oil as fuel in the Diesel manner.

Vertical Gas Engines.—The considerable bulk and weight of the horizontal slow-revolution large gas engine has caused much attention to be devoted to the faster-running, multiple-cylindered, inverted-vertical type occupying much less floor space and of diminished bulk and weight. Prominent among builders of this type is the National Gas Engine Co. of England, who build a series ranging from a 4-cylinder, 2-crank, single-acting four-stroke, inverted-vertical tandem design of 300 B.H.P. at 300 r.p.m. to a 12-cylinder, 6-crank similar design of 1,500 B.H.P. running at 200 revolutions per minute. One installation of these National engines aggregates 11,500 horsepower. Horizontal multiple-cylindered engines are also built; one British installation includes six 500 H.P. four-cycle, four-crank, single-acting, horizontal, four-stroke engines running at 190 revolutions per minute. Fig. 3 on plate illustrates a horizontal gas engine with two cylinders in tandem, working on a four-stroke cycle.

Medium Gas Engines.—In gas engines of less than about 400 H.P. no essential change has occurred; there is a steady output by many builders of a practically standard type of four-stroke, horizontal, single-acting, single- or double-cylindered engine using coal gas or suction-producer gas as fuel, and employed in a great variety of services by the smaller classes of power users. Designs of two-cylindered engines range in power from about two up to some 300 H.P. or over. The gaseous fuel is provided by many more or less waste substances, including bituminous slack, peat, scrap wood, sawdust, straw, cocoanut husks, etc. These smaller gas engines, in conjunction with modern plant producing gas from industrial and vegetable refuse, are very valuable in enabling complete power plants to be installed and successfully operated by native labour in situations remote from civilised centres.

Engines Using Heavy Oils.—It is in the entirely successful use of heavy oil (petroleum oils having a flash point exceeding about 73° F.) as fuel in internal combustion engines that the greatest advance was made from 1910–25; this applied to all types of engines, from the smallest to the greatest, and particularly to the exceedingly important and rapidly extending marine applications where, owing to their relative compactness and the absence of boilers and bunkers, the space occupied by the propelling machinery is greatly reduced.

The earliest heavy-oil engines as, for example, those of Priestman (1885), Samuelson, Thornycroft, Gardner and others, included a vaporiser, heated by an external blow lamp, in which the fuel was gasified, and then, mixed with a suitable volume of cool air, exploded within the working cylinder by a hot tube. Compression pressures were necessarily low to prevent detonation, and the fuel consumption was correspondingly high. Next came Akroyd Stuart's (1886–90) epoch-making invention, successfully embodied in the Hornsby-Akroyd oil engine, of utilising the hot walls of an unjacketed vessel (communicating through a restricted passage with the water-cooled combustion chamber of the working cylinder) first to vaporise the charge of oil fuel pump-injected into it during the air-suction stroke, and then *automatically* to ignite the resulting charge of oil, vapour, and air at the end of the compression stroke. Equally important was the progress made by the Diesel engine (see fig. 1 on plate) from 1893 in both four-stroke and two-stroke designs; the essential feature of the true Diesel is defined as the injection of the oil fuel directly into the water-cooled combustion chamber at, or about, the end of the compression stroke; air alone is compressed to a pressure of some 500 lb. per sq. in., the resulting high temperature automatically igniting the explosive mixture of air and oil spray; the fuel feed is so regulated that combustion proceeds at approximately constant pressure during a small part of the working stroke.

The oil fuel was for long sprayed into Diesel engines by an air blast at a pressure of up to 1,000 lb. per sq. in., involving compressing plant costly in production and maintenance; moreover, the high compression pressure employed necessitated extremely strong and heavy parts, and an extraordinary refinement in workmanship in order to achieve permanently satisfactory running. The efficiency attained was, however, remarkable, and considerably greater than that of any other form of internal combustion oil engine. These practical drawbacks soon resulted in the production, for smaller powers, of a large, varied and important class of engines usually termed semi-Diesels, in which the charge of heavy oil fuel is sprayed, usually by a small force pump, into the combustion chamber at or about the instant of maximum compression. The heat of an uncooled portion of the combustion chamber wall, aided by the heat generated by the moderate compression of the air, then ignites the charge automatically as in the well-known Ruston C.C., and in the two-stroke Bolinder " hot-bulb " marine engine, as used in so many trawlers, and in ocean-going boats of up to 1,000 H.P. in two units. The semi-Diesel engines combine many of the advantages of the Akroyd and Diesel types in a practical manner, and show considerable economy in running.

More recently, about 1924, it was discovered that the " hot-bulb " or " hot-spot" in the combustion chamber could also be dispensed with, allowing the whole to be water-cooled as in the vertical, Vickers-Petter, two-stroke, two-part, heavy-oil, C-type engines which are built in sizes up to 500 H.P. running at 250 r.p.m., with six cylinders. In these the charge of oil is pump-injected into a completely water-cooled combustion chamber of approximately spherical form about one-half the diameter of the working cylinder; the compression employed, though much lower than that usual in the Diesel engine, is yet great enough to cause automatic ignition of the charge, and to ensure an economical use of the fuel; the cheapest grade fuel oils are used in these engines, having a flash point above 150° F., and otherwise also in accordance with B.E.S.A. specifications. The consumption of oil at full load in the larger engines is stated to be not more than 0·43 lb. per B.H.P. hour (*see* MARINE ENGINEERING). The progress evidenced in the application of the internal combustion engine to marine purposes of all types was of a revolutionary character during the period here contemplated, and continued at a constantly increasing rate; at the end of 1925 all the great British marine engineering companies had taken up their manufacture.

Engines Using Light Oil.—This comprises the petrol motor now applied universally to the propulsion of all types of road and land vehicles, aircraft, small motor-boats, farm tractors and miscellaneous small services. For road, land and air service they were still, in 1925, almost all four-strokers, with the exception of cars in the United States, where the six-stroker is equally popular except in the lightest classes, *e.g.*, motor-cycles, small motor-boats and a few light cars in which the simple three-port two-stroker had become well established. The progress of the petrol engine from 1910 consisted mainly in the perfecting of details of design, improved carburation, charging and ignition, in lighter moving parts, and in the commercial production of fuel mixtures free from liability to cause detonation or " pinking," thus enabling much higher revolution speeds to be maintained and greater mean effective pressures reached. The success attained

is indeed remarkable, tiny petrol engines rivalling in efficiency large, high-powered engines of almost any other type. Small engines of racing type have been run in contests at well over 6,000 r.p.m., *i.e.*, upwards of 50 complete cycles per sec.; and tiny four-cylinder four-stroke engines of only 2·2 in. bore and 3 in. stroke were in extensive use in small "occasional four-seater" motor cars capable of speeds, on the track, of fully 80 m. per hour! A number of very encouraging attempts have recently been made to increase power outputs still further by aid of supercharging devices. At the British Motor Car Show of 1925, 65% of the vehicle engines were four-cylindered: 27% six-cylindered: and 5% eight-cylindered. Side by side valves were fitted in 45% and overhead valves in 44% of the exhibits.

Producer Gas Lorries.—A post-War development of much interest and potential value is that of driving heavy motor lorries by small high-speed internal combustion engines of the usual type, but using as fuel gas supplied by specially designed very

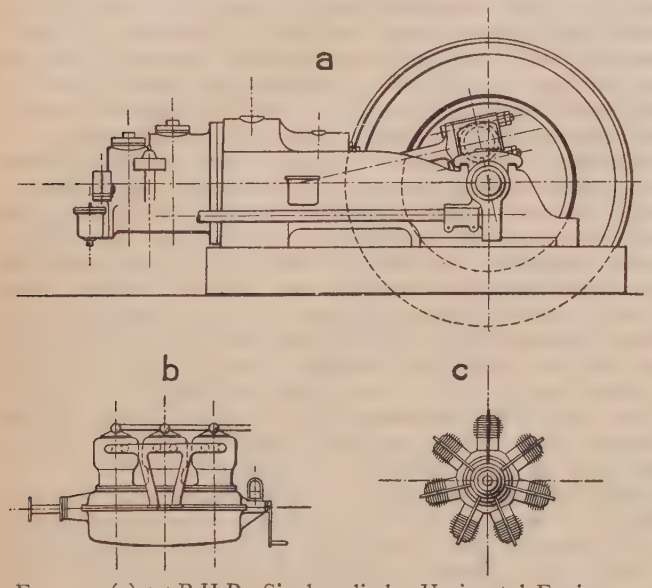


FIG. 1.—(*a*) 75-B.H.P., Single-cylinder Horizontal Engine. 200 R.P.M. Weight 200 lb. per B.H.P. Total 15,000 lb. (*b*) 75-B.H.P., 6-cylinder, Vertical, Water-cooled Aero Engine. 1,200 R.P.M. Weight 5½ lb. per B.H.P. Total 410 lb. (*c*) 75-B.H.P., 7-cylinder, Rotary, Air-cooled Aero Engine. 1,200 R.P.M. Weight 2¾ lb. per B.H.P. Total 205 lb.

small suction producers mounted upon the vehicle, and using anthracite, coke, charcoal, etc., as their fuel; encouraging progress has been made in this direction.

Engines for Aircraft.—Characterised by their extreme lightness, these internal combustion engines display the utmost skill in design and refinements in manufacture, and important advances have been made in all details since 1910. (*See* AERO ENGINES; AERONAUTICS.)

Special Types.—Among special types of internal combustion engines may be mentioned the Humphrey pump. In 1913 an installation of five large Humphrey pumps at the Chingford reservoir of the Metropolitan Water Board commenced operations; this plant is capable of dealing with 180,000,000 gal. daily, a quantity exceeding the whole daily supply of Greater London. At the end of 1925 these pumps continued in regular service, and a second similar installation was in course of erection in Australia. The construction of a 1,000 million-gallon-per-day plant near Alexandria (Egypt) was commenced, but was not completed on account of the outbreak of the World War.

A second recent design of internal combustion engine of much interest is the Michell crankless engine oil-operated in the Diesel manner. In this engine the working cylinders are grouped symmetrically around the driving shaft, with their axes all parallel to the shaft axis, and the rotation is effected through a "swash-plate," or inclined disc affixed to the shaft upon which the several pistons act through a bearing "pad" of the well-known Michell thrust-bearing type. Engines of three, four, five, seven and eight cylinders have been built, both of single-ended and double-ended type. An eight-cylinder Michell engine of 50 H.P., recently built, showed on test a mechanical efficiency of 86% at full load. The extremely great difficulties of the internal combustion turbines still remain to be overcome, and little or no real progress can be recorded in this type of motor during the period herein reviewed. (G. A. BU.)

INTERNATIONAL LABOUR ORGANISATION, THE.—This organisation was created in 1919 by Part XIII. of the Treaty of Versailles, headed "Labour." This part was reproduced in all the later peace treaties, appearing as Part XIII. of the Treaties of Saint Germain, Neuilly, Trianon, and Part XII. of the Treaty of Sèvres. These treaties are the first known to history to contain articles dealing with labour.

I. ORIGIN AND CONSTITUTION

The idea of protecting labour by international conventions is in reality not a new one. Strictly speaking, its origins might be traced back to the humanitarian theories of a handful of thinkers who over a century ago foresaw the necessity of establishing economic co-operation among the nations in order effectually to remedy the evils which might spring from the development of modern industry. The name of Robert Owen is often quoted as a pioneer of international Labour legislation on account of the two memoranda which he submitted to the Congress of Aachen in 1818. In reality, although Owen was indisputably a pioneer of protective legislation for national, wage-earning Labour, his memoranda do not contain the idea of an understanding between governments for the establishment of identical protective measures in favour of their wage-earners. A French industrialist, Daniel Le Grand, attempted to promote this idea between 1840–60. But it was only after 1890 that certain governments began to show an interest in it. A conference was held in Berlin, convened by the German Govt., but it confined itself to enunciating a few very general principles. At last, in 1900 the idea took form when a private organisation, encouraged and subsidised by certain governments, was formed under the name of the "International Association for Labour Legislation" (Assn. Int. pour la prot. légale des Travailleurs) with headquarters at Basel.

In 1903 a technical conference summoned by the Association worked out two draft labour conventions, the one dealing with the limitation of night work for women in industry, the other with the prohibition of the use of white phosphorus in the match industry. In 1906 a diplomatic conference adopted these drafts and a few states ratified them. A new technical conference was convoked in 1913 to regulate by new conventions the prohibition of night work for young persons employed in industry and to fix a 10-hour working day for women and young persons. The second diplomatic conference was due to assemble in the autumn of 1914. Meanwhile, the World War broke out. This is the work which was taken up again and officially consecrated by the peace treaties which concluded the War of 1914–8.

Labour in the Peace Treaties.—It may be asked why clauses dealing with the protection of labour were inserted in the peace treaties. The pre-War movement in favour of protection of labour was not in itself strong enough to enforce it. In most countries it was the work of intellectuals, legal experts, or politicians. With few exceptions (*e.g.*, Germany), the workers' organisations took little interest in it. But in almost all the belligerent States the War brought into prominence the share taken by the working classes in national defence and national life. The workers became conscious of this fact. As early as Sept. 1914 a manifesto of the American Federation of Labour declared that peace should not be signed without the participation of representatives of Labour. In July 1916 at a conference at Leeds, of the trade unions of the Allied countries, again in Oct. 1917 at a conference of the trade unions of the neutral countries and the Central Powers at Berne, then again at the conference of the inter-Allied Socialists at London in Sept. 1918 the same idea was again taken up.

"The Treaty of Peace which will end the war and will assure to the peoples political-economic liberty and independence;" said the London Manifesto, "must also safeguard the working

class of all countries from the attacks of international capitalist competiton and assure it a minimum guarantee of moral and material order as regards labour legislation, trade union rights, migration, social insurance," etc.

Immediately after the War these tendencies grew far more pronounced. Revolutions had broken out in the conquered countries and their character had been invariably social. In the victorious countries the leaders of the governments pronounced, in accordance with the general feeling, that "the old world must end" and that the working classes must receive a new place in the national communities. In Feb. 1919, at Berne, the trade unions of all European countries, allied, neutral, or defeated, claimed a labour charter and suggested that the old association, with its labour office, should be transformed into a great official organisation of international labour legislation. A few days earlier (Jan. 29 1919) the peace conference had resolved to constitute a commission for international labour legislation under the presidency of Samuel Gompers, and had called on it "to enquire into the international means necessary to secure common action on matters affecting the conditions of employment." The commission sat from Feb. 1–March 24 1919. It worked out a text which, having been adopted by the peace conference on April 11 and 28 1919, became Part XIII. of the Treaty of Versailles.

Principles and Procedure of the Organisation.—A preamble at the head of Part XIII. defined as follows the principles which gave birth to the organisation.

1. Universal peace, which it is the object of the League of Nations to establish, can be established only if it is based on social justice, and social justice implies the working out of equitable conditions of labour, which it is urgently necessary to apply.
2. The regulation of labour conditions can be accomplished only internationally because "the failure of any nation to adopt humane conditions of labour is an obstacle in the way of other nations which desire to improve the conditions in their own countries."
3. The equitable conditions of labour, and the "humane conditions of labour," which must be applied were defined: the establishment of a maximum working day and week, the prevention of unemployment, the provision of an adequate living wage, the protection of the worker against sickness, disease and injury arising out of his employment, the protection of children, young persons, and women, provision for old age and injury, protection of the interests of workers when employed in countries other than their own, recognition of the principle of freedom of association, the organisation of vocational and technical education and other measures.

In another article (427) of the Treaty of Peace, these principles are formulated afresh and in a more precise form and recognised as "well fitted to guide the policy of the League of Nations" in industrial matters. These principles having been laid down, the Peace Treaty prescribed that a permanent organisation should be established for their promotion. The commission, on meeting in Paris, was approached with proposals emanating from workers' representatives and even from certain States (such as Italy) which aimed at permitting a sort of international Parliament to decree labour conditions which every State would be compelled to adopt. Such proposals appeared incompatible with the idea of national sovereignty as entertained by most states. The International Labour Organisation, it was thought, should not form a "super-state," any more than the League of Nations. The Commission adopted as a basis of its deliberations a British draft which was more modest and, above all, more elastic, and attempted to reconcile the independence of individual States with the authority of an official organisation.

The system adopted was as follows: The International Labour Organisation consists of two essential organs: the General Conference of Representatives of the Members, and an International Labour Office controlled by a Governing Body. The conference meets "from time to time as occasion may require and at least once in every year." It is composed of four delegates of each of the member States, of which two are government delegates and the two others represent respectively the employers and the workpeople. These last two delegates must be chosen by the governments in agreement with the industrial organisations, if such organisations exist, which are most representative of employers or workpeople, as the case may be, in their respective countries. This shows a characteristic feature of the new organisation. In the Assembly of the League of Nations only Government delegates have seats, but here delegates representing the employers and the workpeople of the member states intervene. This indicates the solidarity of economic and protective forces which has imposed itself on the world since the War.

The conference deals with questions which have been included in its agenda by the governing body, and the agenda is transmitted to the member governments four months before the meeting of the conference. At the close of its discussions it may adopt Recommendations or Draft Conventions by a majority of two-thirds of the votes cast by the delegates present, but not otherwise. The member states undertake that, within a year at most from the closing of the Session of the Conferences, or if special circumstance prevent this, in no case later than eighteen months, they will bring the Recommendation or Draft Convention before the authorities within whose competence the matter lies, for the enactment of legislation or any other action. In the case of a Recommendation the member states will inform the Secretary General of the League of the action taken. In the case of a Draft Convention the member will, if it obtains the consent of the proper authorities, communicate the formal ratification of the Convention to the Secretary-General and will take all necessary action to make the Convention effective. In the case of a Convention the obligations which are assumed by member states on ratification are far stricter.

It is necessary to consider the exact weight which the system carries. The States, under the Peace Treaty, have not undertaken to ratify automatically all draft conventions adopted by the international Labour conference. They have simply undertaken to submit the drafts to the authorities competent to enact the legislation. Here lies the essential innovation. Finally, they are still free to ratify or not. But when there was only the International Association for Labour Legislation, before the War, the States which had sent plenipotentiaries to the diplomatic conferences were not even bound to approach their Parliaments with the resolutions adopted. Now they have undertaken this obligation. This obligation may seem to carry little weight, since each State remains free, within its sovereign rights, to ratify or not. But in essence the whole system rests on an appeal to the public opinion of each of these States, and an appeal to Parliament, which is, so to speak, the authoritative expression of this opinion. The whole mechanism invented by the negotiations of the treaty constitutes an act of faith in the feeling of justice which should animate corporate humanity.

Once the conventions have been ratified the mechanism of their application instituted by the Peace Treaty develops in the following manner: by the act of ratification the States contract a mutual agreement to respect equally all clauses contained in a convention. They must allow mutual supervision of their application of these clauses. By Art. 408 of the Treaty of Versailles they undertake to send an annual report to the conference in which they give a list of the measures for their application. Comparison of these reports may always form the subject of discussion at the conference. If one of the ratifying States fails to apply the convention, or applies it imperfectly, other ratifying States, or even industrial associations of employers or of workers may file complaints. When such complaints are received, the governing body of the international Labour office is charged to deal with them. If necessary it may submit the complaint to a commission of inquiry (Art. 409 and 414). In the last instance, the Permanent Court of International Justice can be called on to pronounce judgment. This court may even, under Art. 418, indicate the measures, if any, of an economic character which it considers to be appropriate and which other governments would be justified in adopting against a defaulting government.

II. THE I.L.O. IN OPERATION

The first conference was convoked at Washington in Oct. 1919. The international office was not yet constituted. The programme of the conference had been fixed in the peace treaty itself. A committee of organisation had been entrusted with its preparation. Six draft conventions were voted concerning:—

1. The limitation of hours of work in industrial establishments to eight hours a day and 48 hours a week.
2. Unemployment.
3. The labour of women before and after child-birth.
4. Night work for women.
5. The maximum age for the admission of children to industrial labour.
6. Night work for children in industry.

The Washington conference constituted the International Labour Office, and nominated its first governing body. This governing body appointed the director, M. Albert Thomas. In 1920 a conference was held at Geneva, which was devoted to maritime questions and passed three draft conventions. The first fixed the age of admission to work at sea, the second dealt with unemployment benefit in case of loss by shipwreck, the third dealt with finding employment for sailors.

In 1921 the third session at Geneva voted seven draft conventions dealing with:—

1. The age of admission for children to agricultural labour.
2. The right of combination and coalition of agricultural labourers.
3. Compensation for accidents incurred during work in agriculture.
4. The use of white lead in paint.
5. The application of the weekly rest to industrial establishments.
6. The age of admission of young persons to employment as trimmers or stokers.
7. The compulsory medical examination of children and young persons employed on board ship.

Each of these sessions voted at the same time a number of recommendations.

The fourth session at Geneva in 1922 only voted a recommendation concerning statistics and documents relative to emigration and immigration. The fifth session at Geneva in 1923 also voted only one recommendation concerning general principles for the organisation of inspection services destined to ensure the application of laws and regulations for the protection of workmen. The sixth session at Geneva in 1924 instituted the procedure of giving the conventions two readings, at intervals of one year. Some conventions were thus given a first hearing, most of them being voted in 1925. The session of 1924 only definitely passed one recommendation concerning the utilisation of the spare time of workmen. The seventh session, Geneva 1925, finally voted four draft conventions concerning (1) compensation for accidents arising out of employment, (2) compensation for sickness arising out of employment, (3) equality of treatment for workmen when employed in countries other than their own as regards compensation for accidents incurred during work, (4) night work in bakeries.

In all, then, not counting recommendations, twenty international Labour conventions were submitted to the States for ratification between 1919 and 1925. These conventions dealt with industry-commerce and in some cases navigation and agriculture. As regards agriculture a dispute arose in 1921. It was maintained that the international Labour organisation had not the right, under the Peace Treaty to deal with the protection of agricultural labourers. On this point the advice of the Permanent Court of International Justice was taken through the mediation of the League of Nations under Art. 14 of the Peace Treaty. The permanent court gave a judgment recognising the competence of the International Labour Organisation.

Ratifications.—In what proportion have the States ratified these conventions by the procedure indicated above? In March 1926 the League of Nations had registered 194 ratifications. This figure has given rise to much discussion. It is important to gain a just estimate of its worth. The International Labour Organisation includes 56 States. If one excepts the four last conventions of 1925, which could not be ratified by the time of writing, about 900 acts of ratification could in theory take place for the other 16 conventions. There are only 194—that is, about one-fourth. But this low figure calls for certain remarks. The same value cannot be attached to all ratifications.

1. There are a certain number of conventions which could not be ratified by all States, despite their general character. The maritime conventions, for example, do not interest the States which have neither coasts nor fleets. Similarly, there are countries of small proprietors where the number of wage-earning agricultural labourers is quite insignificant. There are others, again, where certain unhealthy industries against which conventions are directed have not established themselves.

2. There are numerous States in which industry is of little importance and where national labour legislation hardly exists. The Hedjaz, Siam and other States have indicated that the measures laid down in certain conventions are inapplicable to the conditions under which the wage-earning labourers in these countries work.

3. International action is only beginning, and all sorts of reasons delay ratification; not merely the inexperience and inattention of the great national administrations, for which the international conventions are often matters of secondary importance, but also the hesitation to contract obligations which sometimes appear to threaten the output or at least the competitive capacity of the country on the international market. But in spite of these delays important results have been obtained.

In the eight years preceding the War the two conventions of Berne had only been ratified by a very few States. When to-day such conventions as that which forbids night work for women or that which attempts to cope with unemployment obtain the ratification of 16 or 20 states, including great industrial countries like Great Britain, France or Italy, many thousands of workmen are definitely assured of the enjoyment of the benefits of reform. For, under the text of the conventions, the contracting States cannot, for a period of 10 years, go back on the obligations which they have assumed, even in crises where they would be tempted to do so. The effect of the ratifications has been also particularly important in certain countries, for example in India, where the conditions of labour have been greatly improved by the application of the measures contained in the international conventions such as that of Washington.

But even when the conventions are not ratified, they become the model on which the new national legislations form themselves. A country such as Belgium, for example, has established the eight-hour day, which was voted in 1921 in strict conformity with the clauses of the Washington Convention. Similarly, all the young States of Central and Eastern Europe which were formed or resuscitated in 1919 have modelled their entire labour legislation on the general rules laid down by the International Labour Organisation. It seems, then, that despite the difficulties inherent in its first constitution and despite the economic crises which most nations have gone through since 1920, the work accomplished by the unification of labour conditions on a relatively high level by the organisation has had appreciable results.

A Centre of Information.—The work of the International Labour Organisation is not confined to preparing the international conventions, to seeking to obtain their ratification by the States, or to watching over their application. Art. 396 of the Peace Treaty also assigns it further functions which include the "collection and distribution of information on all subjects relating to the international adjustment of conditions of industrial life and labour." Also "the conduct of such special investigation as may be ordered by the conference." It has "to edit and publish in French and English periodical publications." The conference may even assign to it, besides the functions mentioned above, "such other powers and duties" as it chooses.

Thus, since 1919, the International Labour Organisation has become a sort of great clearing house of all information on social questions. It has a library of 150,000 volumes. The ideal would be to make of it a centre where workers would be certain of finding all publications of all countries touching on the regulation of labour. This office collects by means of corresponding offices in Paris, Rome, Berlin, London, Washington and Tōkyō, and collaborators in other capitals, periodical information on social developments in most great countries. It publishes two general periodicals: the weekly *Industrial and Labour Information*, the task of which is to give an exact account of important news in the various branches of social life, and a scientific monthly review, the *International Labour Review*. It further publishes the *Industrial Safety Survey*, which reports all new measures taken and all experiences obtained regarding security of labour; and a *Monthly Record of Migration*. It publishes reviews or bulletins giving a summary of all these publications for the information of different countries, in German in Berlin, in Italian in Rome, in Spanish in Madrid and in Japanese in Tōkyō. Carrying on the tradition inaugurated before the War by the Basel office, it publishes an annual collection, in French, English and Italian, of the documents of social legislation promulgated every year in different countries (*Legislative Series*). Since its formation it has undertaken enquiries on a large scale in all matters of particular importance. Among them may be mentioned the great *Enquête sur la Production* which deals with the economic situation of the world between 1918 and 1925; an inquiry into the conditions of labour in all the coal

producing countries; inquiry into legislation and labour conditions in Russia; another into labour conditions in Asia, etc. It publishes quarterly a *Bibliography of Industrial Hygiene.*

The I.L.O. has also attempted to simplify and unify methods of labour statistics used in different countries. Two conferences of labour statisticians have already been convoked under its auspices. Every year more demands for information are addressed to it by different governments. Corresponding committees, consultations of experts and special commissions permit the Office to maintain contact with technicians and scientists of the branches of social life.

Internal Organisation of the Office.—In order to deal with its twofold task of keeping up daily contact with the governments, and especially with the Ministries of Labour with which it corresponds directly under Art. 397 of the treaty, and with the organisations of workers or employers, the office has to equip itself with a sound internal organisation. Under the Peace Treaty it is administered by a governing body nominated for three years by the Conference. The governing body consists of 24 members, of which 12 represent the governments, six the employers and six the workers. Of the 12 governmental representatives eight belong *ex officio* to the most important industrial countries (Germany, Belgium, Canada, France, Great Britain, India, Italy and Japan). If any dispute arises regarding relative industrial importance, this must be settled by the Council of the League of Nations. A system of indexes has been adopted (based on population, working population in relation to the total population, steam horse-power, length of railway lines, etc.) which makes it possible to decide this point. The six workers' representatives are nominated by the delegates to the conference representing the workers, and the six employers' representatives by the employers' delegates. The conference has proposed to enlarge the Governing Body, but this will need the amendment of the Peace Treaty, and it has not yet been done on account of the slow procedure of ratification of the amendment, necessary under Art. 422 of the treaty.

The Governing Body nominates a director and gives him his instructions. The director nominated in 1920 was M. Albert Thomas, formerly a French Minister of State. He is assisted by a deputy director, who is an Englishman, Mr. Harold B. Butler. The personnel of the International Labour Organisation amounted in 1926 to about 370 employees of all ranks, who were drawn from 30 different nationalities. Under Art. 395 of the Peace Treaty the director "shall as far as possible, with due regard to the efficiency of the work of the office, select persons of different nationalities." The nations chiefly represented among the personnel are France and Great Britain, because French and English are the two official languages used by the office; next, Switzerland, because the executive personnel is recruited locally.

The budget of the International Labour Organisation varies between 7,000,000 and 8,000,000 gold francs. This budget is introduced annually by the governing body before the Assembly of the League of Nations. It is supplied for the most part by contributions from the states which are members of the organisation. This contribution is fixed under a scale adopted by the League of Nations for its own contributions.

Relation to the League.—The International Labour Organisation is in fact part of the organisation of the League. For this reason, since 1920 it has been established at Geneva. It was first installed in an old college. In 1922 the sum of 3,000,000 gold francs was voted for the erection of a suitable building on a site which had been given for this purpose by the Swiss Federation. The I.L.O. is attached to the League of Nations and entitled to its assistance, when required, and receives the funds granted it by the states through the League, but is nevertheless, like the Permanent Court of International Justice, an autonomous institution. Its decisions are not subject to the control of the Council of the League. The Director of the office is in no way subordinate to the Secretary-General of the League. Indeed, if membership of the League carries with it membership of the I.L.O. (Art. 387), it was decided by the persons who negotiated the Peace Treaty as by the Assembly of the League of Nations in 1921, that states which are not members of the League can become members of the I.L.O. Thus, since 1919 Germany has belonged to the I.L.O. with equal rights without being a member of the League. A representative of the German Govt. has always sat on the governing body; the workers' group has regularly elected a German member, and the employers have also, since 1922, had a German member in the governing body. There are German employees throughout the office.

In order to gain general information and to carry through scientific research, the I.L.O. remains in almost daily contact with the U.S.A. and with Russia, the only two great states which, for various reasons, do not belong to the organisation.

Conclusion.—The organisation has often been criticised and attacked. It has been reproached with the desire to exceed the limits of its competence. The Permanent Court of International Justice decided, at least in the case of agriculture, that this criticism was not justified. It has also been reproached with being exclusively guided by the workers' interests, and even with being guided by Socialist thought. Yet, no instance has taken place which could justify such an accusation against the director or even less against the governing body. But one fact must not be forgotten, which was brought out in 1921 by a report of the Commission of Inquiry and Organisation of the League of Nations, that the International Labour Office is not simply an organ of conciliation or of keeping the balance between various industrial interests; it must look for conciliation only in order to attain a definite end, which is to realise the programme drawn up in the preamble to Part XIII. of the Peace Treaty. Experience also shows that measures protecting workmen are never fully carried through unless they are made by agreement with the workers and unless the workers are interested in their application.

It is one of the merits of the International Labour Organisation, as conceived and conducted since 1919, that it has been able to keep the sympathies and confidence of the important workers' mass organisations. It is true that the Communists, the leaders of the Third International, violently attack the collaboration of workers in the work of Geneva. But the International Federation of Amstersdam, with its 20,000,000 members, the Christian Unions, the Italian Fascist organisations, take regular part in the conferences of Geneva, and demand that the conventions be applied. It is equally remarkable that the employers continue to be represented at the conferences and on the governing body.

The office of the International Labour Organisation, while it aims at bringing about the "physical, moral and intellectual well-being of the wage-earners," attempts at the same time to take account both of the interests of production, and (to quote Art. 427 of the Peace Treaty) of the differences of climate, habits and customs of economic opportunity and industrial tradition, which make strict uniformity in the conditions of labour difficult of immediate attainment." Further, from the general point of view, the International Labour Organisation has helped to popularise among the industrial masses both of the workers and even of the employers the idea of a definite peace based on an economic understanding and the social solidarity of the nations. It is already the great centre of international collaboration. It is recognised as being one of the great factors of peace. Its history bears witness to all the difficulties attending new international creations. The life of a nation enjoys the natural support of geographical contiguity, of racial community and of age-long tradition. An international organisation can only come to birth and live if public opinion and the judgment of the governments favours a common programme. It appears that the programme of social justice drawn up in the Peace Treaty has sufficient authority and sufficient reason to assure the existence of the International Labour Organisation.

BIBLIOGRAPHY.—See *The Treaty of Peace between the Allied and Associated Powers and Germany*, Part XIII. (H.M. Stationery Office, London, 1925). A list of publications of the International Labour Office can be obtained from the Publications Department of the Office at Geneva, or from their correspondents in different countries.

(A. TH.*)

INTERNATIONAL LAW (*see* 14.694).—The outstanding developments in international law since 1910 are so distinctive that it has been considered expedient to deal with them under separate headings, rather than to attempt to present them in any one general article. The attention of the student is especially

drawn to the following articles: Arbitration, International; Blockade; Covenant; Inland Water Transport; International Labour Organisation; League of Nations; Mandates; Migration; Minorities; Permanent Court of International Justice; Sanctions and Guarantees; Treaties; Washington Conference.

INTERSTATE COMMERCE (*see* 14.711).—Since 1910 Acts of the United States Congress and decisions of the Supreme Court have extended the scope of Federal control over interstate commerce. The regulation of railways was made more complete, the Federal authority being widened to cover railway rates on traffic within the states when such rates affect interstate commerce. The Anti-Trust Act 1890 was broadened and strengthened by the decisions of the Supreme Court in the oil and tobacco cases in 1911 and by the Clayton Act 1913. In the adjustment of labour disputes between employers and employees engaged in interstate commerce the Government assumed a constantly larger rôle.

Railway Regulation.—The Interstate Commerce Commission was given authority by the Hepburn Act 1906 to establish reasonable maximum rates on interstate traffic, but could act on complaint only. The Mann-Elkins Act 1910 authorised the commission to establish reasonable rates after hearings initiated by itself. This Act also made the Interstate Commerce Act apply to telegraph and telephone companies, and gave the commission authority to suspend proposed increases in rates. While such proposed increases were to become effective in 30 days, the commission might suspend the increase for 120 days, and, if necessary, for an additional period not exceeding six months. The Mann-Elkins Act provided also that no carrier might charge more for a shorter intermediate haul than for a longer haul until he had applied to the commission and permission had been granted because of special circumstances. The Supreme Court subsequently decided that a shipper who, in violation of this provision, has been charged the higher rate for the shorter haul is entitled to the full amount of his resulting damages, but not the difference between the rate paid and the lower rate published for the longer haul (*Davis v. Portland Seed Co.*, 1923, 264 U.S. 403).

The Panama Act 1912 made it unlawful for any railway company or common carrier subject to the Interstate Commerce Act to secure control of any common carrier by water operating through the Panama Canal or elsewhere, provided the carrier by water and the railway company did or might compete with each other. Any questions of fact as to competition were to be decided by the commission. If the commission should be of opinion that the public interests would be served and competition would not be prevented or reduced by the continuance of a control exercised by a railway company over a competing carrier by water, the commission might extend the period of control. In enforcing this provision, the commission compelled the trunk-line railways operating passenger and freight lines on the Great Lakes to dispose of them, but railways were permitted to continue the operation of steamships coastwise between New England ports. The use of the Panama Canal by vessels owned by a competing railway was absolutely prohibited. Any rail carrier that had entered into through arrangements with a carrier by water operating from a United States port to a foreign country was required to enter into like arrangements with any or all other lines of steamships operating from the same port, a provision designed to ensure to shippers from interior points the benefits of competition by through routes to foreign destinations.

The most important legislation affecting carriers enacted after the passage of the original Interstate Commerce Law in 1887 was the Transportation Act 1920, by which the railways, after 26 months of government operation, were returned to their owners. This Act provided for a more comprehensive regulation of carriers by the commission and established new principles in the regulation of rates, revenues and capital expenditure of the carriers. The commission, already the final authority as to rates, was further empowered and directed to adjust rates with a view to enabling carriers, as a whole, to earn as nearly as may be 5½% on the aggregate value of their property devoted to the public service. The commission might also authorise the carriers to earn one-half of 1% per annum additional, the amount thus earned to be devoted to improvements without capitalising the amount so invested. Individual carriers whose net operating revenues exceeded 6% were to devote one half of the excess to building up a company reserve fund until the amount reached 5%, the other half of the excess being turned over to the Government and placed in a fund from which advances might be made to the carriers. At the end of two years after the passage of the Act the commission was to determine the reasonable rate of return on the aggregate value of the railways, and the commission fixed the rate at 5¾% per annum. The Act also authorised the commission to regulate railway securities, and amended the laws against combinations so as to permit railway companies to consolidate with the commission's approval.

Intrastate Rates.—The power of the Federal Govt. over intrastate rates was extended by important decisions of the Supreme Court and by the Transportation Act 1920. In the Minnesota Rate Case (*Simpson v. Shepard* (1914), 230 U.S. 352), the Supreme Court upheld the action of the State of Minnesota establishing railway rates within the state, although the facts showed that these intrastate rules affected the rates on interstate traffic and the revenues of the carriers engaged both in interstate and intrastate traffic. In 1914 the Supreme Court was also called on to consider the validity of the order of the Interstate Commerce Commission in what is known as the Shreveport Case. The business interests of Shreveport, La., had complained to the commission that rates within the State of Texas, which had been fixed by the state commission of Texas, were so much lower than the interstate rates that it was not possible for the merchants of Shreveport to do business in northwestern Texas. The commission decided that the wide difference between the interstate and intrastate rates constituted an unreasonable discrimination, and the carriers were ordered to correct this. On appeal, the Supreme Court upheld the order of the commission (*Houston, East and West Texas Co. v. United States*, 234 U.S. 342).

The principle established by this decision was embodied in the Transportation Act 1920, which provided that when the Interstate Commerce Commission finds that any intrastate rate constitutes an unjust discrimination against interstate or foreign commerce, the commission may prescribe the maximum or minimum intrastate rate thereafter to be charged. Another important decision of the Supreme Court, rendered in 1922, affirmed an order of the Interstate Commerce Commission on this point in connection with what is known as the Wisconsin Passenger Fares. The order of the commission required a horizontal increase of intrastate passenger fares and excess-baggage charges to correspond with fares and charges fixed for like interstate service in the same state. The Wisconsin Railroad Commission sought to have the commission's order overruled, but the petition was denied (*Wisconsin R. R. Comm. v. C. B. and Q. R. R. Co.*, 257 U.S. 563).

Amendments to the Anti-Trust Act of 1890.—Prior to 1911 the Supreme Court by a series of decisions (*see* 14.711) had defined the scope of the Anti-Trust Law of 1890, but the net effect of the interpretations had been to limit its effectiveness. However, in the oil and tobacco cases decided in 1911 (221 U.S. 1 and 193) the Supreme Court adopted a "rule of reason" formulated by Chief Justice White, which gave greater flexibility to the Act and promised to make the law more effective. The court held, in effect, that the purpose of the law was to prevent undue restraint of every kind, and that it did not deny to individuals the right to enter into contracts when the right was not improperly exercised. This interpretation of the Anti-Trust Law was unsatisfactory to the extreme opponents of industrial combinations, and in response the Clayton Act was passed in 1914, prohibiting, under specified provision, discriminations in prices. Labour unions and organisations of farmers were exempted from the provisions of this law. Interlocking directorates of banks were prohibited, and it was made unlawful for a corporation, engaged in interstate commerce, to acquire control by stock ownership of another corporation engaged in interstate commerce when such acquisition would lessen competition. Carriers engaged in interstate commerce were prohibited, after two years from the passage of the Act, from dealing in securities or supplies and from making construction contracts amounting to more than $50,000 with a corporation, firm or partnership having on its board of directors or as one of its officers a person who was at the same time a director or officer of the common carrier. This

provision was suspended until after the conclusion of the World War, but was in force in 1921. An important decision of the Supreme Court subsequent to 1911 was its finding, in *United States v. U.S. Steel Corporation*, March 1 1920, that the largest of all industrial combinations was not a violator of the Anti-Trust Act (251 U.S. 417). It reached the conclusion that the public interest would not be served by requiring the dissolution of the Steel Corporation, but that, on the contrary, its dissolution might result in a material disturbance to American foreign trade.

Adjustment of Labour Disputes.—The Erdman Act 1898 was amended by the Newlands Act 1913, which provided for a board of from five to nine men, and also created a board of mediation and conciliation composed of a commissioner and two other officials designated by the Government. By 1916, however, the railway employees had become dissatisfied with the results of arbitration, and demanded the establishment of an eight-hour day and a general increase in wages. The carriers resisted, and the resulting deadlock was broken by the passage of the Adamson Act 1916, establishing the standard eight-hour day in the railway service and providing for a commission to decide upon wages. The Supreme Court held the law to be constitutional (243 U.S. 232). The Transportation Act 1920 substituted new machinery for the adjustment of disputes as to wages and working conditions in the place of the provisions of the Adamson Act. By the Transportation Act it became the duty of employers and employees to endeavour to settle their differences by negotiation. If negotiation failed, disputes as to working conditions might be referred to boards of adjustment composed of an equal number of representatives of both sides. These boards might be either local, district or national. Provision was also made for the appointment by the president of a railroad labour board of nine men: three representing the public, three the employees and three the companies. Such a board was constituted in 1920.

In 1926 Congress enacted the Railway Labor Act which substituted new machinery in place of that created in the Transportation Act of 1920. It makes it the duty of the carriers and their employees to exert every reasonable effort to make and maintain agreements. All disputes are first to be considered in conferences between the parties directly concerned; and adjustment boards either on individual lines, or regional, or national are provided to adjust disputes arising under such agreements and to interpret and apply them. Disputes that cannot be so adjusted may be referred to a board of mediation by either party, or the proposed board may intervene on its own initiative, and if an amicable adjustment cannot be attained in this manner, an effort is to be made to induce both parties to agree to voluntary arbitration. Should such effort be unsuccessful and an interruption of commerce be threatened, the President is then authorised, in his discretion, to create a board to investigate and report to him within the next succeeding thirty days, and a proviso is included to the effect, that, in the event that all steps leading up to the appointment of this emergency board fail to bring about a settlement, transportation may not be interrupted for a period of 60 days. It is understood that this act had the approval of large groups of railway executives, and employees, and is the result of a series of joint conferences.

United States Coal Commission.—In 1922 an Act was passed declaring that a national emergency existed in the production, transportation and distribution of coal and other fuel. It gave supplementary powers to the Interstate Commerce Commission to issue, in transportation of coal or other fuel, orders for priorities in car service, embargoes and other suitable measures, and to take any other necessary steps for the priority in transportation, and for the equitable distribution, of coal or other fuel and prevent their purchase or sale at prices unreasonably high. In 1923 an Amending Act established the U.S. Coal Commission of not more than seven members for the purpose of securing information in connection with questions relative to interstate commerce in coal and all questions and problems arising out of and connected with the coal industry. The commission's report contained a full account of economic conditions in the coal-mining industry. (E. R. J.)

INVENTION.—Nothing is more significant of the activities of human ingenuity than the tale of the inventions which reach the national patent offices for record and official approval. The stimulus of social conditions and economic necessity are marked most significantly here. Why some inventions succeed is often obvious. Many inventions fail to achieve commercial success though valuable and useful in themselves, sometimes because existing processes adequately satisfy the need, sometimes because they are too advanced and the need for them has not yet arrived. Indeed, analysis of the causes of failure is full of interest. The phenomena of cultural lag deserve serious study.

Previous Knowledge.—All inventions, in a sense, are conditioned by existing knowledge, nearly all depend directly or indirectly on previous conditions. The motor-car, the aeroplane, wireless telegraphy, the steam turbine, could not have reached their present stage of development without a long series of prior inventions. The science of the metallurgist, the chemist, the physicist, has made it possible to produce materials which combine strength with lightness, which possess properties in the required degree—magnetic, electric, chemical—so that even the simplest product represents the sum of a series of minor inventions and contributions to knowledge.

The range of problems presented to the inventor is well shown by the progress of invention as applied to the motor-car. The development of the internal-combustion engine entailed improvements in the magneto, in carburettors, in the "timing" gear, in the valves, improvements due to advances in electrical science and metallurgy. With increase of power comes the necessity for greater brake power. Night travel demands better lighting. Popular demand requires mass production. That in turn involves standardisation and that is impossible without prior advances in the manufacture of machine tools (*q.v.*) and measuring instruments (*q.v.*). Here pure science is called in to solve the problems which underlie modern economic activity. Then there is the need for simplification and strength. The car must be made safe and foolproof. The tendency to elaboration is constantly checked by the need for simplicity.

Key Inventions.—There are, of course, key inventions which open vast ranges of further development. These attract attention and are, in every sense, of the highest importance. Nevertheless, there may be as much ingenuity and utility in a single device which simplifies some elaborate process or meets some widespread human need. Such inventions as these, too, deserve, even if they do not always achieve, success.

Every Patent Office throughout the world when its records are studied broadly on these lines tells the same tale. Thus, in Great Britain since 1910, the trend of invention has varied considerably owing to important changes in social conditions. The inventions of the years 1910–4, when social conditions were normal, present a trend very different from that of the War period and different from that of the years 1919–25, which was a period of recuperation and reconstruction. These three periods, however, have one important common feature, viz., that the numbers of inventions relating to locomotion and intercommunication were exceptionally great.

Inventions of the Period 1910–4

Motor-cars, etc.—The first application of self-starters to motor-cars seems to have been made by the Adams Manufacturing Co., of Bedford, in 1911 and was followed by many inventions for mechanism of this kind. There were also numerous inventions for variable-speed gears, lighting sets, detachable rims and spring wheels. In motor-cycles, the replacement of belt or chain variable-speed gearing by toothed gearing and the introduction of the kick starter determined the modern form. Many forms of lifeguards for use on trams and omnibuses were patented and, after the taxi dispute in 1911, there were many inventions for registering "extras" (*see* Motor Vehicles). Inventive activity was very marked in connection with internal-combustion engines, especially those of the fixed radial, revolving cylinder and "valveless" types, and in carburettors (*see* Internal Combustion Engine).

Aeronautics.—Many of the aeroplane inventions related to details of machines which, like the Farman biplane and the Morane monoplane, were well known. The use of these inventions eliminated, to a large extent, unsuitable flying-machines. Directly driven tractor screws and rear elevators became more generally adopted. The

importance of aircraft as an auxiliary in warfare was appreciated and, in 1911, inventions for launching aeroplanes from the decks of battleships were patented. The airships "Beta" and "Gamma," built at Farnborough, made several successful flights; they were inflated with hydrogen generated in Oerlikon electrolysers, which usually employed a pure solution of potash. About the year 1912, the seaplane, provided with floats, was brought into use (*see* AEROPLANE; AIRSHIP; SEAPLANE).

Railway Signalling.—A series of inventions for automatic signalling to prevent trains from being signalled into a section containing a standing train was patented in 1911, after the accidents at Hawes Junction and Pontypridd. In 1913, there were many inventions for automatically signalling and stopping trains and in 1914 for locking carriage doors from the guard's van (*see* RAILWAY SIGNALLING).

Life Saving.—Following the disaster to the "Titanic" (*q.v.*) in 1912, there were many inventions for life-saving appliances for personal wear, detachable ships' fittings to serve as rafts, and boat-lowering gear; there were also inventions for enabling a ship to receive wireless distress signals when the operator was off duty.

Transmission Gear.—The Constantinesco system of transmitting power by means of a pulsating column of water was applied to rock drills and other apparatus.

Water Supply.—In the year 1913, the Metropolitan Water Board brought into use, at their Chingford reservoir, a powerful pump of the pulsometer type, the Humphreys internal combustion pump (*see* PUMPS).

Telephones.—The first automatic telephone exchange for public use in England was opened at Epsom, in 1912. Following this, there were many inventions relating to junction and trunk line working for facilitating the gradual introduction of automatic systems (*see* TELEPHONES).

Fixation of Nitrogen.—Many inventions for the synthetic production of ammonia from the nitrogen of the atmosphere were patented, some of the most important being those of the Badische Anilin und Soda Fabrik, developing the catalytic Haber process. (*See* NITROGEN, FIXATION OF.)

Medicine.—Ehrlich's invention of Salvarsan, introduced in 1910, for the treatment of venereal and other spirochaetal diseases, has been of great value (*see* PHARMACOLOGY).

Rubber, etc.—In 1911–3, there were many inventions relating to the synthetic production of isoprene and of rubber, the coagulation of rubber latex and the cold process of vulcanisation by using sulphuretted hydrogen and sulphurous acid gas in succession (Peachey's process). The use of accelerators, *e.g.*, piperidine, was also introduced in vulcanising (*see* RUBBER).

In 1913, there were series of inventions for converting heavy oils into motor spirit and for obtaining light oils from coal by carbonising at a low temperature.

Stainless steel, a chromium-steel alloy, was brought into use toward the end of the period.

Electric Lamps.—In connection with filaments for incandescent electric lamps, many inventions related to the production of osmium, tantalum, niobium, molybdenum, and tungsten and to apparatus for swaging and wiredrawing these metals. One of the most important inventions of the period was the half-watt lamp, British Patent Specification, No. 10918 of 1913 (*see* ELECTRIC LIGHTING).

The thermionic valve for use in wireless was another very important invention.

In the textile industry, there were many inventions relating to collecting dust in and ventilating cotton-mills and to mechanical means for shuttle-threading. There were numerous inventions for gyro-compasses (*see* GYROSCOPES), artificial horizons, gyro-stabilisers, and other apparatus depending on the application of the gyro principle. The selection and intermittent exposure of advertisements and the projection of cinema pictures in natural colours were important subjects of invention. There were also many inventions for slider or "lightning" fastenings for corsets, boots and pouches.

INVENTIONS OF THE WAR PERIOD

The numbers of inventions connected with industries, other than those of importance in warfare, fell off considerably. Inventions connected with military and naval operations were brought into use in rapid succession; periscopes (*q.v.*), Mills bombs (*q.v.*), the Lewis gun, the paravane (*q.v.*) for protecting ships from mines and torpedoes, camouflage (*q.v.*) systems, depth charges and other means for use against submarines, Pomeroy and other explosive and incendiary bullets for use against Zeppelins, the tanks (*q.v.*), body armour, and combination knives, forks and spoons are only a few examples.

Aircraft.—The inventions connected with aircraft were of outstanding importance and their use resulted in the production of many highly efficient machines. The Fokker monoplane had an all-metal fuselage and a tractor screw through which a Maxim gun was arranged to fire by means of a synchronising gear. The D.H.2, a British single-seater biplane with pusher screw and a wide range of fire was used successfully until it was superseded by machines with a tractor screw through which a Vickers machine-gun was arranged to fire by means of Constantinesco's hydraulic synchronising gear. The twin-engined Gotha was a long-distance German bombing-machine and was provided with a sighting-telescope capable of being used with scientific accuracy.

Thermionic Valves, etc.—Thermionic valves (vacuum tubes) for use in telephony and wireless receivers (*see* VACUUM TUBES; WIRELESS), the recovery of benzene, toluene and other hydrocarbons in gas and coke manufacture, and the synthetic production of ammonia received a great deal of attention.

Michell Bearings.—The segmental pivoted thrust blocks known as Michell bearings were used on a large scale, especially in submarines (*q.v.*). These bearings were first made in 1905 and, in 1913, were fitted in the cross-channel steamer "Paris." Michell bearings take up a comparatively small space and are easily lubricated.

There was a large number of inventions for toys and games of a warlike kind and for the manufacture of dolls' heads and eyes which, before the War, had been imported in large quantities.

INVENTIONS OF THE PERIOD 1919–25

The trend of invention reverted to a large extent towards improvements of commercial importance. It resembles the trend of invention for the period 1910–4, but presents the additional feature that rapid and extensive developments have been made possible by utilising inventions brought into use under war conditions. This is exemplified in aeronautics by the long-distance flights to many countries during the past few years; in long-distance wireless telephony and broadcasting (*q.v.*) made possible by the use, during the War, of efficient thermionic valves in telephony from aeroplanes; and, in the chemical industry, in the recent successes in the commercial production of ammonia from the nitrogen of the atmosphere, following the improvements made during the War (*see* NITROGEN, FIXATION OF).

The Autogyro.—A remarkable form of aeroplane, the Autogyro, patented by Señor de la Cierva, of Madrid (British Patent Specification, No. 196594), is capable of descending vertically or nearly so with safety. It differs fundamentally from the Helicopter in that its windmill is not driven by power but, as its name indicates, turns freely upon its shaft (*see* AEROPLANE).

Internal Combustion Engines.—The use of the Diesel and other oil motors in place of steam-engines has made great progress. A recent invention by the Vulcan Co., of Stettin, introduces a hydraulic transmission gear between the motor and the ship's propellor to minimise the effects of vibration (*see* TRANSMISSION GEAR).

Turbines, etc.—During the last few years, there have been inventions for the application of turbine engines for driving locomotives and many inventions have had for their object the increasing of the efficiency of steam engines by using steam at very high pressures. In the Blonquist steam generator, producing steam at about 800 lb. per sq. in. the generator elements are horizontal steel tubes rotating rapidly so that the water in each tube forms an annulus. A boiler at Weymouth, Mass., operates at a pressure of 1200 lb. per sq. in. (*see* BOILER; STEAM ENGINE; TURBINE).

Motor-car Problems.—An inertia gear, invented by Constantinesco, is designed to adjust automatically the power developed by the motor of a vehicle in accordance with the varying resistance on inclined roads or on roads having surfaces of varying quality. For the supply of petrol to motor-cars and other vehicles on the road, there have been brought into use many forms of petrol pumps and other delivery apparatus; these have been mostly of American origin (*see* MOTOR VEHICLES).

Shipbuilding.—In the construction of ships, a combination of the longitudinal and the transverse systems of framing has been brought into use and there is a tendency toward the use of the longitudinal for the bottom of the ship and the upper deck and the transverse for the sides (*see* SHIPBUILDING).

Gyroscopes.—There has been great attention devoted to the application of the gyroscope in the arts, especially in connection with automatic-steering apparatus, ship stabilisers, gun-control apparatus and aerial photography (*see* GYROSCOPES).

Vacuum Tubes and Thermionic Valve.—For the efficient working of thermionic valves, the use of high *vacua* is important and there have been inventions for obtaining these *vacua* by eliminating from the bulb or other vessel not only the air but also residual mercury vapour. These *vacua* have also been of great importance in X-ray tubes for shortening the time of exposure (*see* VACUUM TUBES). Thermionic valves have also been used in gramophones to replace the ordinary amplifying means; large diaphragms have also been used recently in gramophones for amplifying purposes.

Activated Carbon.—A form of carbon with an exceptionally high degree of porosity has been invented. It is called "activated carbon" and its gas-occluding, catalytic and filtering properties are very powerful; it is of great value in sugar refining.

Flotation Processes.—Oil and other flotation processes have been applied for the recovery of clean coal from coal residues and also for separating molybdenite and various metals from their ores.

Ore Deposits.—The location of ore deposits by means of electric and magnetic apparatus has also received a great deal of attention.

Stainless Steel.—There have been many inventions for improving the manufacture of the chrome-steel alloy used in making stainless steel (*see* RUSTLESS STEEL) for cutlery and other articles; a very recently proposed use of stainless steel is for making the metal fittings of road vehicles.

Alcohol.—For obtaining methylic and higher alcohols (*see* ALCOHOL) from carbonic oxide and hydrogen, the Badische Anilin und Soda Fabrik has brought into use processes similar to their high-pressure processes for the synthetic production of ammonia.

The same company is also experimenting with processes for converting coal into oil (*see* FUEL PROBLEMS).

Artificial Silk.—Many inventions for improving the manufacture of artificial silk (*q.v.*) have been patented. The dyeing (*q.v.*) of acetate silk, the artificial silk usually called celanese, by the use of ionamines and by adding a protective colloid, which may be obtained by grinding an insoluble dye with sodium sulphoricinoleate, to the dye baths has received attention during the past few years.

Rubber Processes.—There have been many inventions for the use of accelerators capable of powerful action in the vulcanising process (*see* RUBBER), *e.g.*, aldehydes, amines and *p*-nitroso dimethylaniline. The treatment of rubber latex which has been delivered in large quantities by the rubber producing companies, has received a great deal of attention. A recent invention (Hopkinson's British Specification No. 157978) is for spraying the latex so as to atomize it; the water in the sprayed latex is evaporated and crude rubber remains.

Artificial Foods.—Many inventions relate to the production of artificial foods containing large percentages of vitamins (*q.v.*) selected to favour healthy development or to counteract tendencies towards rickets, beri-beri and other diseases. Many of the vitamins introduced are of the fat-soluble A (cod-liver oil) type or of the water-soluble B (yeast) type.

One of the most active subjects of invention has been the manufacture of artificial limbs, the efficiency and value of which have been considerable. Destructible receptacles, intended for use once only and produced in vast numbers at a low cost have been patented in many forms. These receptacles, for use in serving jellies, ices, etc. are made of cardboard or other cheap material.

Photography.—Photographic surveying from aircraft, employed largely during the War, has been utilised for topographic surveying. The method has been found by archaeologists to be useful in discovering and investigating traces of ancient encampments and other settlements, for the views obtained show details not visible at close quarters (*see* ARCHAEOLOGY: AIR SURVEY). Prof. Sir J. B. Henderson's gyroscopically controlled camera has been designed chiefly for use on aeroplanes. (T. E. L.)

IOWA (*see* 14.732).—The population of Iowa according to the state census was 2,419,927 on July 1 1925, as against 2,404,021 in 1920 and 2,224,771 in 1910. In 1920 the native whites of native parentage numbered 1,528,553; those of foreign or mixed parentage, 629,981; and the foreign-born whites, 225,647. The negro population was 19,005. There were in 1920 43·2 inhabitants per square mile as against 40 in 1910. In 1920 the urban population was 36·4% of the whole. There were seven cities having a population of over 25,000 as follows:—

	1920	1910	Increase %
Des Moines	126,468	86,368	46·4
Sioux City	71,227	47,828	48·9
Davenport	56,727	43,028	31·8
Cedar Rapids	45,566	32,811	38·9
Dubuque	39,141	38,494	1·7
Waterloo	36,230	26,693	35·7
Council Bluffs	36,162	29,292	23·5

Agriculture.—In 1925 the aggregate crop acreage in Iowa was 21,991,893 and the value of the farm lands and buildings was $4,961,427,734. In 1924 Iowa was first among the states in the acreage, production and total value of both corn and oats. Iowa's corn crop in 1909 was 341,750,460 bu., valued at $167,622,834, from 9,229,378 ac.; in 1924, 304,752,000 bu., valued at 283,419,000 from 10,884,000 acres. The number of cattle on Iowa farms in 1925 was approximately 4,507,000, of horses 1,229,000 and of sheep 891,000; while in the number of swine Iowa increased from 7,545,853 in 1910 to 10,539,000 in 1924, but decreased to 8,958,000 in 1925.

Manufactures, Mining and Transportation.—Meat-packing continues to lead manufacturing industries, the value of products of slaughtering and meat-packing having increased from $58,913,482 in 1909 to $152,631,945 in 1923. The second industry in value of products in 1923 was butter. In 1909 this product was valued at $24,440,715 and in 1923 at $67,972,113. Food preparations, including cereals and breakfast foods, were third, the value of these products increasing from $9,795,000 in 1909 to $37,698,210 in 1923. The value of all manufactured products was $259,237,637 in 1909; $690,042,714 in 1923. The most important mineral product in Iowa is bituminous coal; in 1910 the value was $12,682,106; in 1919 $16,903,358; in 1922 $16,119,000. The value of clay and clay products in 1919 was $8,127,000. Portland cement and gypsum products were also prominent. The railway mileage was 9,781.65 in 1910 and 9,843 in 1924. The mileage of interurban electric lines has increased from 373·92 to 946·49, or about 153%.

Education.—The Federal census of 1910 credited Iowa with the smallest percentage of illiteracy of any state in the Union (1·7 %.) In 1920, with a percentage of 1·1% it still maintained first place. State aid became an important factor in the development of public schools in the period following 1910. Legislation granted such aid to large, centrally located, consolidated schools, which replaced small scattered ones. At the close of 1920 there were 430 consolidated districts, including about 25% of the area of the state and taking care of approximately 50,000 pupils. In 1911 state aid was granted by law to high schools organising normal training of rural teachers of which schools there were, in 1918, 172. In 1917 a state board for vocational education was established to take advantage of the provisions of the Smith-Hughes Act offering Federal aid for vocational education. A law, enacted in 1919, provided for part-time schools for the benefit of children between the ages of 14 and 16 working on employment certificates. The establishment of these schools was required where there were 15 eligible pupils in the district, and attendance became compulsory.

Legislation.—The only constitutional change made during the period 1910–25 was an amendment ratified by the people in 1916 fixing the time of the general election for that year on the same day as the presidential election, the time of election thereafter to be determined by the General Assembly. In 1916 a constitutional amendment extending suffrage to women was submitted to the electors but was defeated. The Federal suffrage amendment was adopted in 1920. The vital portions of the "mulct tax" law of 1894 (*see* 14.734) were repealed by the General Assembly in 1915, thus restoring statutory prohibition in Iowa, but a prohibitory amendment to the state constitution was voted down by the electors in Oct. 1917. The Eighteenth (Prohibition) Federal Amendment was however ratified by Iowa Jan. 15 1919. The constitution of 1857 provided that in 1870 and every ten years thereafter the question, "Shall there be a Convention to revise the Constitution and amend the same?" should be submitted to a vote of the electors of the state, and in case of a favourable vote the General Assembly should provide by law for the election of delegates. In the election of 1920, for the first time, the vote showed a majority in favour of a convention.

The General Assembly in 1913 passed an Employers' Liability and Workmen's Compensation Act; and at the same session a Mothers' Pension Act was passed, providing for the granting to widowed and indigent mothers of sums not to exceed $2 per week for each child under 14 years of age. In 1915 the Perkins law was passed, providing free treatment for crippled children of poor parents. In 1917 an appropriation was made by the General Assembly for the erection and equipment of a hospital at Iowa City for such children. Two years later the General Assembly provided that adults as well might be sent to Iowa City for free medical and surgical treatment. In 1917 the General Assembly established at Iowa City a child-welfare station for the consideration of conditions and measures.

An important development was the farm bureau movement. By 1917 organisations among farmers in the state were numerous, and in that year the General Assembly passed an Act providing that where a farm-improvement association in any county had among its members 200 farmers or farm owners and had raised $500 in annual subscriptions, the county board of supervisors

was authorised to contribute $2,500 for the employment of a county agent. A law in 1919 modified the amount and terms of the payment by the county and made the contribution mandatory. The movement gained rapid headway, county associations being established for the betterment of both social and economic conditions and the improvement of agricultural methods. In 1920 there was a farm bureau in each county and two in Pottawattamie county, and a membership of over 100,000. There was also a considerable growth within the state of a farmers' educational and co-operative union which had over 20,000 members in 1920.

Government and Finances.—The commission plan of government, authorised in 1907 for cities of 25,000 or more inhabitants, was extended to cities of 2,000 or more inhabitants. By 1920, nine cities had organised under the commission plan: Burlington, Cedar Rapids, Des Moines, Fort Dodge, Keokuk, Marshalltown, Mason City, Ottumwa and Sioux City. In 1915 the General Assembly passed Acts allowing cities to organise their municipal government under city-manager plans, but they have not been generally taken advantage of. The General Assembly in 1913 provided that Supreme, District and Superior Court judges should be nominated and elected on a non-partisan ticket, but in 1919 the nomination and election of judges was restored to a party basis.

In 1911 the office of commerce counsel was created, the incumbent to be appointed by the Board of Railway Commissioners and to serve as expert counsel for that board. In 1913 the Department of Insurance was created, and in 1917 a state Banking Department was organised and the office of Superintendent of Banking created. In 1915 a state Board of Audit and a state Board of Accountancy were created, and the office of Document Editor was established to relieve the Secretary of State. The road administration was reorganised in 1913 when the General Assembly established a highway commission consisting of the dean of engineering of the State College of Agriculture and Mechanic Arts and two appointive members. Highway legislation in 1919 divided the highways into primary and secondary systems, and arranged for the distribution of Federal and state aid funds for the hard surfacing of primary roads.

In 1923 the assessed valuation of property in Iowa was $1,766,329,861 on which were levied taxes amounting to $12,523,228 ($5.09 *per capita*). The funded and floating debt of the state was $11,797,100; the net debt was $11,715,131 ($4.76 *per capita*).

History.—The history of Iowa in the years 1910–25 was marked by no economic or political changes of great importance. The state remained predominantly agricultural. Although its manufactures increased in importance, it was little disturbed by industrial controversies. The supremacy of the Republican party in politics was not seriously questioned. Owing to a split in the Republican party in 1912, the Democratic candidate for President received the electoral vote of Iowa, but the state returned to the Republican ranks in 1916, and in 1920 cast an overwhelming vote for Harding for President and for Nathan E. Kendall for governor. Throughout the period U.S. Senator Albert B. Cummins continued to represent the state. The death of Senator Jonathan P. Dolliver in 1910 caused a vacancy, filled temporarily by the appointment of LaFayette Young. In 1911, William S. Kenyon was chosen to fill the position; he was re-elected in 1913 and 1918. In 1920, Albert B. Cummins was again elected to the Senate, for the term ending March 4 1927. On Feb. 24 1922, William S. Kenyon resigned his office of Senator, Gov. Kendall appointing Charles A. Rawson of Des Moines to fill the vacancy until the next election. At the primary election held in June 1922, Smith W. Brookhart of Washington, Iowa, was chosen as the Rupublican candidate, and at the general election following was elected for the unexpired term. In 1924, Mr. Brookhart was nominated and elected for the term ending March 4 1931. Republican governors were elected or re-elected every two years, incumbents being: Beryl F. Carroll, 1909–13; George W. Clarke, 1913–7; William L. Harding, 1917–21; Nathan E. Kendall, 1921–5; John Hammill, 1925–

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'IRAQ (*see* MESOPOTAMIA, 18.179), a mandated Arab kingdom in Asia Minor embracing the former Turkish vilayets of Baghdad, Basra and Mosul. Area 143,250 square miles. Population 2,849,282 (1920). 'Iraq is bounded on the west by Transjordan, on the southwest by Arabia, on the south by a neutral zone, on the southeast by Al Kuwait and the Persian Gulf, on the east by Persia, on the north by Turkey and on the northwest by Syria. The British Empire is the Mandatory Power.

The terms of the mandate were never formally laid down by the League of Nations, but the relations between Great Britain and 'Iraq were defined in a treaty concluded on Oct. 10 1922 and ratified on Dec. 19 1925. On Sept. 24 1924 the League accepted this definition as giving effect to the provisions of Art. 22 of the Covenant. The period of the treaty was extended to 20 years by a subsequent treaty executed on Jan. 13 1926, and ratified on March 30 1926. The 'Iraq Govt. is a limited monarchy on the Egyptian model, with a King, a senate of 20 nominated members and a lower house of 88 deputies. The country is divided into 12 liwas. The administration is in the hands of the 'Iraq Govt., represented in each liwa by a Mutasarrif who is assisted by a British official with advisory powers. The 12 liwas are Mosul, Erbil, Kirkuk, Sulaimaniya, Diyala, Baghdad, Dulaim, Kut, Karbala, Hilla, Ad Diwaniya, Muntafiq and Basra.

I. POLITICAL HISTORY

Nationalist Movement.—During the years from 1911 up to the outbreak of the World War, the Ottoman régime in the distant Mesopotamian vilayets showed marked deterioration. The last hope that any efficient administrative system might be established in Mesopotamia vanished with the fall in 1911 of Nazim Pasha, an energetic man of singular integrity, who had set himself to the intricate task before him with all the rude strength of a Turkish soldier of the old order. The Italian and Balkan wars had weakened the central Government, while in the Arab provinces, in particular, the disappointment of hopes born of the constitution of 1908 was leading to a recrudescence of racial aspirations. Damascus and Beirut had long been centres of nationalist movements, but already, at the end of 1913, the secret society called the Ahd (the league) embraced the three Mesopotamian vilayets as well as Syria. A prominent figure in the movement was Saiyid Talib Pasha of Basra. He had reached the stage in his career when nationalist enthusiasm seemed best calculated to serve his ambitions. He had, however, exhausted Turkish patience, and steps were about to be taken to dispose of him in true Turkish fashion when War was declared on Oct. 29 1914. Talib approached Sir Percy Cox, and offered to raise an Arab revolt in return for recognition as an autonomous local chief. The reply was not satisfactory; he fled to Al Kuwait, and thence to Ibn Sa'ud, who interceded for him. He ended by going to India, in voluntary exile, and, in 1917, was permitted to move to Egypt, where he remained till his return to Basra in Feb. 1920.

The Mesopotamian Campaign.—The declaration of war was followed on Oct. 31 1914 by a proclamation by the Political Resident in the Persian Gulf to local Arab rulers explaining that Turkey had entered the War at the instigation of Germany and promising the chiefs who had enjoyed the protection of Great Britain that no act of that country should threaten liberty or religion. With these assurances the princes of the Gulf were satisfied. Before military operations had begun, Sir Percy Cox, whose efforts had consolidated the British position in the Gulf, joined the army concentrated at Bahrein as Chief Political Officer. On Nov. 6, when the British took Fao fort, he issued a second proclamation repeating the assurances already given.

A determined attempt was made by the Ottoman Govt. to rouse fanaticism by preaching a *Jihad*, but the tribesmen gave the Turks less than half-hearted support. By Nov. 21 the Turks had abandoned Basra; the British position on the Shatt-al-'Arab

was secured, and the refinery of the Anglo-Persian Oil Company at Abadan was safe. On Nov. 22 British troops entered Basra and, in the name of the general officer commanding-in chief, Sir Percy Cox published a third proclamation assuring the inhabitants that Turkish rule was dead and that Great Britain was their good friend and protector. The British arrival at Basra was greeted with acclamation by the terror-stricken populace; civil administration was set up under the G.O.C., with Sir Percy Cox as Chief Political Officer. As success followed success, a large measure of law and order followed in the wake of the armies. The administration was well served by the revenue commissioner, Mr. Dobbs, now Sir Henry Dobbs, who made the first study of agrarian conditions. His profound knowledge of tribal custom enabled him to discern and account for agrarian phenomena and the accompanying tribal unrest and, not least, to draw up the tribal criminal disputes regulations, on a model which had

worked with success on the Indian frontier, thus solving the problem of administering to tribesmen justice which should be adequate and also comprehensible to their primitive understanding.

The advance from Basra to Baghdad is described under MESOPOTAMIA. A period of grave anxiety preceded the victory of Shu'aiba, on April 12 1915, when a reverse would have entailed the annihilation of the Indian Expeditionary Force " D.', After the retreat from Ctesiphon, Nov. 25 1915, and the fall of Kut on April 29 1916, the fate of 'Iraq hung in the balance, but the reorganisation of the force under General Maude laid the foundations of victory, and Baghdad was occupied on March 11 1917.

In the proclamation which General Maude issued upon the occupation of Baghdad a definite promise was given that alien institutions should not be imposed, that Arab aspirations should be realised and that on those grounds the collaboration with British political officials of Arab nobles, elders and representatives was required. A further development of civil administration was made when in July 1917, Sir Percy Cox was appointed Civil Commissioner. The country suffered great loss in the death in Nov. 1917 of General Maude, whose distinguished powers as a military leader had earned the respect and admiration of 'Iraqis, but under General Marshall the success of British arms was carried on. Late in Nov. 1917 the northern Euphrates was occupied up to Ramadi, and in March 1918 up to 'Ana. In the same month, a serious incident occurred on the middle Euphrates. The holy towns of Karbala and An Najaf were not only racked by internal feud, but both they and the adjacent tribesmen owned the sway of Persian divines to whom the secular interests of 'Iraq counted nothing. In the first years the British government of occupation was fortunate in finding in the recognised leader of these Mujtahids a man of singular personality who, while consistently refusing to give open advice on political questions, tacitly backed the Power which had been placed in command by the vicissitudes of war. Nevertheless, the holy towns presented a fertile field for intrigue, and when the government of occupation showed a determination to check the rapacity of the local chiefs of An Najaf, a plot, engineered from without, came to a sudden head with the murder of the newly appointed assistant political officer.

Sir Percy Cox was on his way home to attend a conference in London, but the situation was handled successfully by Colonel Wilson, afterwards Sir A. T. Wilson, who was in charge. He was aided by the universal condemnation of the An Najaf rebels by public opinion elsewhere and by the friendly relations which were maintained with the chief Mujtahid. Though An Najaf was blockaded, not a shot was fired; but the pressure exerted resulted in the handing over of the guilty by May 1. A court of specially qualified officers condemned 13 of the men to death. Over 100 persons were sentenced to transportation for life or for shorter periods, but all these have since been permitted to return.

Northeast of Baghdad, progress was hindered by the Russian débacle, but when, at the end of June 1917, the upheaval which was taking place in Russia obliged the Russians to retire, the British force gradually drove the Turks from the vacated positions, occupying Khanaqin in Dec. 1917, and Kifri in April 1918. The first task of the British administration was to save these provinces from the destitution and famine into which they had been plunged by the flux and reflux of Turkish and Russian armies, but again the British advance was impeded by the rapid dissolution of the Russian forces in Persia and the necessity of guarding northern Persia from Turkish attack. It was the more unfortunate, as nowhere was the establishment of administration effected more smoothly than among the Kurdish and Turkoman elements with which the British forces now came into touch. Kirkuk was reached in May, and immediately a provisional government under a local magnate, Shaikh Mahmud al Barzanji, was set up voluntarily in Sulaimaniya in friendly co-operation with the British. But the exigencies of the Persian situation made it impossible for the General Staff to maintain the position so easily acquired; the British, accompanied by a large number of the Christian population, abandoned Kirkuk, which was not reoccupied until the final advance, in Oct. 1918, ended in the occupation of the whole of the Mosul vilayet.

Liberation of 'Iraq.—On Nov. 7 1918, 10 days after the signature of the Turkish armistice at Mudros, the British and French governments issued a joint declaration of vital importance to the occupied Arab territories, stating their aims in the East to be:—

> The complete and final enfranchisement of the peoples so long oppressed by the Turks, and the establishment of national governments and administrations drawing their authority from the initiative and free choice of native populations.

The proclamation went on to promise encouragement and help in the establishment of native governments and administrations in Syria and Mesopotamia. General Maude's pronouncement had been made while the upshot of war was still doubtful, and was therefore discounted as a natural mode of propaganda, whereas the Anglo-French declaration was published after victory had been achieved. Together with President Wilson's Fourteen Points, it gave unbridled play to political speculation, which was further encouraged when the British Govt. directed Colonel Wilson to hold an inquiry as to whether the people of 'Iraq were in favour of a united Arab State from the northern boundary of the Mosul vilayet to the Persian Gulf under British tutelage, whether they desired that this state should be placed under an Arab Amir and if so whom would they suggest. In the light of experience it can safely be said that public opinion was not ripe to reply to these questions which, in the provinces, at any rate, were nothing but a bewilderment to tribesmen, landowners and cultivators. Save on the first point, which was unanimously approved, no definite answer was given. In Baghdad the representative Moslems assembled by the Sunni and Shi'ah Qadhis asked for an Arab State under a son of the Sharif Hussein. Elsewhere every variety of reply was given.

No action could be taken on replies so conflicting, but during the year 1919 some progress was made towards the appointment of local subordinates in an advisory capacity. Other factors had, however, come into play. The first of these was the establishment of an independent Arab State in Syria, largely the handiwork of a number of eager and adventurous 'Iraqis who were anxious to return home and enjoy the same powers as those of which they stood possessed in Damascus or Aleppo. They carried on an active propaganda in 'Iraq, and when, in March 1920, the Amir Faisal was proclaimed King of Syria they responded by electing the Amir 'Abdullah King of 'Iraq.

The movement in 'Iraq which led to the rebellion of 1920 was part of a general resentment against the policy of the British and their allies. In India, Persia, Egypt and Turkey, no less than in Syria and 'Iraq, a crisis was reached during the years 1919 and 1920, and the political credit of Great Britain fell low in the Eastern world. 'Iraq was in the centre of this hostile vortex, and was specially affected by the Persian Shi'ah divines, who were domiciled in the holy towns but were responsive to every shade of feeling in their own country. While the administration was still patently alien, British forces had been cut down to a minimum, and when, in May 1920, the British Govt. announced their acceptance from the League of Nations of a mandate over 'Iraq, the Damascus Govt. had already, in the absence of the Amir Faisal and contrary to his orders, begun its encroachments. In answer to objections raised against the mandate by a self-chosen committee in Baghdad, it was announced (June 20) that Sir Percy Cox would return in the autumn to establish a provisional Arab Govt. and call an Assembly, freely elected by the people, in consultation with which he would prepare an organic law. But nothing would then have satisfied the claims of the Nationalist leaders, and on July 2 1920, the turbulent Shi'ah tribes, encouraged by their religious leaders, broke into open revolt.

To restore peace and order was the first necessity. Troops were drafted in from India, and when Sir P. Cox reached Basra (Oct. 1), as High Commissioner, the rebellion in its main centres, the middle Euphrates, the Diyala and the adjacent part of Kirkuk district was already doomed to failure. By Nov. 10, a provisional Council of State was formed under the Naqib of Baghdad. It included Saiyid Talib Pasha as Minister of Interior, Sasun Effendi Haskail, the best known member of the Jewish community, as Minister of Finance, and Ja'far Pasha al 'Askari, distinguished for his services during the War and in the Syrian administration of King Faisal, as Minister of Defence. The Council of State, some of the members of which were without portfolios, represented all classes and sects of society; at its request some of the leaders of the rebellion who had been interned at Henjam were released at once. It gave immediate attention to the repatriation of 'Iraqi officers from Syria and the Hejaz; to the reorganisation of civil government under 'Iraqi officials, greatly facilitated by the return of many experienced men from Turkey; and to the preparation of an electoral law and the formation of an army. It was the arrival of 'Iraqi officers who had served under the Amir Faisal which set on foot a movement in his favour in 'Iraq. He had been driven from Syria in July 1920, and had since resided in England. To this movement Saiyid Talib was opposed, and during the absence of Sir Percy Cox in Feb. and March 1921, to attend the conference summoned at Cairo by Mr. Winston Churchill, Saiyid Talib's ambitions developed, and he assumed a menacing attitude towards the British efforts to secure a free discussion of the future government of 'Iraq by its people. In April, after a direct threat on the part of the Saiyid, the High Commissioner secured his deportation to Ceylon, and the political atmosphere cleared.

The first result of the Cairo Conference was the publication of a general amnesty in May, and at the same time an attempt was made to ascertain the wishes of the Kurdish provinces as to their inclusion in the 'Iraq State. The net result was that Sulamaniya remained under the control of the High Commission, but the rest of the Kurdish population was content with the promise of Kurdish officials, under the 'Iraq Govt., and the local use of the Kurdish language.

Choice of a King.—Towards the end of June, the Amir Faisal arrived in Baghdad, as a candidate for the throne. This candidature was known to be acceptable to the British Govt., and on July 11, the Council of Ministers passed a resolution declaring him King of 'Iraq, on condition that his government should be constitutional, representative and democratic. But Sir Percy Cox fortified himself by consulting the people, and a referendum was carried out, through the Ministry of Interior, throughout the country, with the exception of Sulaimaniya, with the result that 96% of the votes were cast in favour of the Amir Faisal; outside Baghdad most of the townships and districts stipulated for the continuance of the British mandate. The Amir was crowned on Aug. 23 1921, and entrusted the Naqib with the formation of his first cabinet.

Troubles on Turkish and Arabian Frontiers.—The early years of King Faisal's reign were troubled without and within. To the north, Turkish nationalism had taken a turn distinctly hostile to 'Iraq. Turkish garrisons on the frontier had increased, the tribes were flooded with propaganda, and a Turkish official with a small party of irregulars had occupied Ruwāndiz in June 1921. From that advantageous position the Turks kept the whole of southern Kurdistan in a ferment till they were finally ejected in the spring of 1923. Turbulent chieftains roused some of the tribes of Sulaimaniya in the spring of 1922, and a general cry was started for the return of Shaikh Mahmud, who had been defeated by the British and deported in 1919. The British administration evacuated the province in 1922, and Shaikh Mahmud was reinstalled in the autumn, under binding assurances that he would be loyal to the British and 'Iraq governments. He entered at once into correspondence with the Turks.

On the Arabian frontier, since the beginning of 1921, the operations of Ibn Sa'ud against Ibn Rashid had profoundly disturbed the tribes. As early as April 1921, the Shammar of Ibn Rashid began to seek safety in 'Iraq where a large section of the tribe resides. Their presence embittered relations between 'Iraq and Nejd, and after the fall of Ibn Rashid's capital, Hail, in Nov. 1921, Ibn Sa'ud's pretensions increased, and he claimed the allegiance of the 'Anizah on the eastern side of the Syrian desert, who had always been attached to 'Iraq. In March 1922 he permitted the leaders of his Akhwan, or Brethren, to attack the 'Iraq desert camel corps and the shepherd tribes grazing under its protection about 30 m. south of the railway between Baghdad and Basra. Heavy loss was inflicted.

Anti-mandate Agitation and the Preliminaries of the 'Iraq Treaty.—These dangers on the frontiers coincided with a serious divergence of views between the British and 'Iraq governments as to the nature of their relations with one another. King Faisal and his Prime Minister asked for the complete abrogation of the mandate and its substitution by a treaty of alliance, whereas the British Govt. were aiming at a treaty within the scope of the mandate. The difference was largely technical, but it gave rise to grave misunderstandings and embittered controversy. It was alleged that the attack by Ibn Sa'ud, who was at that time in receipt of a subsidy from Great Britain, had been instigated by the latter in order to show the 'Iraq Govt. its weakness. At this point the Shi'ah divines took a hand in the matter and summoned a conference at Karbalā, nominally to consider measures of defence against the Akhwan, but with the underlying object of protesting against the British mandate. The conference assembled, but the Sunni shaikhs held off, the wiser among the Shi'ahs nipped any subsidiary intentions in the bud, and the meeting confined itself to petitioning King Faisal to take steps against the Akhwan. But the heat engendered was not extinguished, the anti-mandate agitation continued through the summer, though in June the Council of Ministers accepted the treaty with Great Britain, subject to its acceptance by the Constituent Assembly. On Aug. 16 the Cabinet resigned, and Sir Percy Cox, when attending a levee, was greeted by an anti-mandate demonstration. He demanded and received an instant apology, but at the same moment it was announced that King Faisal was struck down by a dangerous attack of appendicitis, and an immediate operation was necessary.

Thus, by a singular combination of circumstances, the country was left with no authority but that of the High Commissioner. He issued a proclamation explaining the situation, arrested and deported certain agitators, and induced two of the Shi'ah divines to leave voluntarily for Persia. By Sept. 10 1922 the agitation had died out. On Oct. 10 1922 Sir Percy Cox and the Naqib signed a treaty of alliance between Great Britain and the 'Iraqi for 20 years (British Treaty Series No. 2), but ratification was delayed and negotiations over the subsidiary agreements dragged on until 1924.

No sooner was the internal situation stabilised than the north-eastern frontier again demanded attention. With Shaikh Mahmud in Sulaimaniya and the Turks in Ruwāndiz and its neighbourhood, effective administration had ceased east of Erbil, Kirkuk and Kifri. In Oct. 1922 a measure decided on at the Cairo Conference was put into force and the Air Marshal, Sir John Salmond, assumed charge of all imperial forces in 'Iraq, ground troops, levies and air force. By his vigorous action he forced the Turks to retire to Ruwāndiz. But the autumn of 1922 was the period of Mustafa Kemal's great triumph over the Greeks. It influenced both the Shi'ahs of the Euphrates and the tribes of the north. On Oct. 21 1922 the King issued an Iradah ordering elections for the Constituent Assembly to begin; it was countered by a fatwah, signed by the Shi'ah divines of Karbala and Kadhimain forbidding participation in elections. In Nov. the Naqib resigned, and 'Abdul Muhsin Beg al Sa'dun formed a new Cabinet. In the same month elections were held in Great Britain, during which a campaign was conducted against the fulfilment of the pledges to 'Iraq. Mr. Bonar Law's Cabinet came in under obligation to consider the question, and Sir Percy Cox was summoned to London in Jan. 1923, to take part in the discussion. He left in charge Sir Henry Dobbs who had come out as Counsellor in the previous December. The position of the British Govt. was extremely difficult. A solution was found in the reduction of the term of the yet unratified treaty from 20 to a maximum of four years after the ratification of peace with Turkey,[1] with the prospect of renewal at the end of that period. The treaty would lapse in the event of 'Iraq becoming a member of the League of Nations. The protocol embodying this agreement was brought back by Sir Percy Cox on March 31 1923, and signed on April 30. Sir Henry Dobbs, who had acted since January, became High Commissioner in Sept. 1923.

Operations in Mosul.—Meantime, in March 1923, Sir Henry and the Air Marshal had been obliged to take steps against the Turkish threat in the north. The Amir Zaid, who had arrived in Baghdad in the previous autumn, went to Mosul, where he superintended the formation of a force of Arab irregulars to operate in the plains if necessary. The strong stand taken by Lord Curzon at Lausanne reacted on 'Iraq. Shaikh Mahmud, who was in league with the Turkish band at Ruwāndiz, was dealt with, and in April, by a brilliant military movement, supported by air action, the Turks were ejected from Ruwāndiz, and a Kurdish chief put in as Qaimmaqam under the Mutasarrif of Erbil. With a force of Assyrian levies behind him, Saiyid Taha had closed Ruwāndiz to Turkish influences. Though it was found impossible to set up a local administration in Sulaimaniya, the outlying parts were placed under the 'Iraq administration and Shaikh Mahmud was allowed to return to Sulaimaniya town and the mountains between the town and the Persian frontier, till in 1924 his intrigues made it necessary to eject him from Sulaimaniya town. This was done by a column of the 'Iraq Army, with levies and air force support; the Sulaimaniya liwa was included in 'Iraq in March 1924, and sent representatives to the Constituent Assembly. Shaikh Mahmud, with small robber bands, was still lurking on the frontier at the close of 1925; he had incurred the hostility of the Persian Govt. as well as that of the Govt. of 'Iraq.

The Elections.—In July 1923, King Faisal authorised his government to deport the chief obstructionist among the Shi'ah divines, Shaikh Mahdi al Khalisi. This act was followed by the voluntary exodus to Persia of a number of other religious leaders, all Persian subjects. They were allowed to return after the Constituent Assembly had ratified the treaty, and have since passed out of political history. After its decisive handling of the Mujtahids, for which the 'Iraq Govt. deserves the greatest credit, the elections went forward without a hitch. From the Kurdish mountains to the Persian Gulf, primary electors enrolled themselves with surprising alacrity, and, in marked contrast to their practice in Turkish times, the tribal chiefs pressed their followers to come forward in great numbers. Secondary elections began in Feb. 1924, and all results were declared by the middle of March.

Settlement with Nejd.—During the winter of 1923–4 an attempt was made to settle the growing differences between 'Iraq and Nejd by a conference of representatives held at Al Kuwait under Colonel Knox. The main point of difference was the repatriation of Nejd tribes which had taken refuge in 'Iraq. The 'Iraq representatives rightly pointed out that, apart from the violation of tribal custom involved, they had not the requisite force to constrain these unwelcome guests to return to their own country, but they agreed to abide by stipulations considered satisfactory by the British Government. Though on lesser matters agreement was reached, Ibn Sa'ud proved obdurate on the major issue, and just as the conference was about to reassemble in March 1924, his followers carried out a brutal raid on the 'Iraq shepherd tribes. The conference thereupon broke up. Other raids occurred during 1924–5, and, as a result, the 'Iraq Govt. made a determined effort to remove the tribes from the vicinity of the frontier and Ibn Sa'ud gave orders to his Akhwan leaders to discontinue raiding. Finally, at the conference held at Bahra in the Hejaz between the Sultan and Sir Gilbert Clayton, in Nov. 1925, a treaty was drawn up between 'Iraq and Nejd on the lines proposed by H. M. Govt. and the 'Iraq Govt. at Al Kuwait.

Ratification of the Treaty.—Sir Henry Dobbs and the 'Iraq Govt. had been engaged during the winter of 1923 in discussing the provisions of the agreements subsidiary to the treaty. The resignation of 'Abdul Muhsin Beg, in Nov. 1923, occurred in the midst of these discussions, which were carried on with the new Cabinet presided over by Ja'far Pasha al 'Askari. The agreements were signed on March 25 1924, and the instrument of alliance being thus complete, the Constituent Assembly was opened by the King on March 27.

The debates on the treaty and agreements continued until June 10. There was much misrepresentation and some solid ground for dissatisfaction at the heavy burdens imposed on 'Iraq by the obligation simultaneously to expand the army, redeem the capital cost of the railways and shoulder a large share of the Ottoman Debt. H. M. Govt. gave an undertaking that after the ratification of the treaty they would be prepared to reconsider certain of the financial obligations of 'Iraq towards Great Britain, and the debates were brought to a close by the announcement of the determination of the British Govt. to raise before the League of Nations at the June session the whole question of the continuance of their mandate, and the warning that if the Assembly had not passed the treaty by June 10, it would be taken as a rejection. King Faisal and his government clearly discerned the attendant risks, the Cabinet called on its followers for support, and the treaty and agreements were accepted before midnight on the appointed date. The instrument was accepted by the League of Nations on Sept. 27 1924, as giving effect to the provisions of Art. 22 of the Covenant of the League for the regulation of the relations between 'Iraq and the mandatory Power, and was ratified by King George and King Faisal in the winter of 1924. The Constituent Assembly then passed the Organic and Electoral Laws, and was dissolved on Aug. 2 1924. Ja'far Pasha and his Cabinet having concluded their work, resigned office, and Yasin Pasha al Hashimi formed a new Cabinet.

The question which now overshadowed all others was the settlement of the northern frontier with Turkey. (*See* LEAGUE OF NATIONS; MOSUL.)

It had not been considered advisable to disturb the proceedings of the Frontier Commission sent by the League of Nations to Mosul in the spring of 1925 by the holding of elections; on

[1] This took place on Aug. 6 1924.

March 21 1925, however, the Organic Law was promulgated and elections for the first parliament began. Yasin Pasha's Cabinet had previously passed four notable measures, vital for the further prosperity and stability of 'Iraq. The first was the signature with the Anglo-Persian Oil Company of an agreement for the dredging of the Shattal-'Arab bar. The second was a trade transit agreement with Syria. The third was the granting to an international group, known as the Turkish Petroleum Company, of a concession for the development of oil in the Baghdad and Mosul vilayets, while the fourth was the signature of long term contracts with over a hundred experienced British advisers and officials.

The visit in April 1925 of the Secretaries of State for the Colonies and Air gave opportunities for frank and valuable exchange of views, and also resulted in the adoption of a scheme which should provide for the speedier training of the 'Iraq army, so that it might eventually assume responsibility for internal security and external defence.

Elections were completed by June 23 1925, but before parliament met Yasin Pasha resigned, owing to differences of opinion in his Cabinet, and 'Abdul Muhsin Beg was again charged with the formation of a government. Parliament, consisting of two chambers, a Senate of 20 members, appointed by King Faisal, and an elected house of 88 members, met on July 16 in extraordinary session to consider the budget and certain necessary amendments to the Organic Law. Its debates were characterised by earnestness and good sense, and when its task was finished it was prorogued, on Oct. 28, by the Amir Zaid, acting as Regent during King Faisal's absence. The second session was opened formally on Nov. 1, but was postponed for six weeks and met definitely on Dec. 20.

The New Treaty.—The settlement of the question of Mosul (*see* LEAGUE OF NATIONS) was accepted by 'Iraq with relief, and negotiations for the signature of the new treaty were initiated before the end of 1925. The treaty was signed by the representatives of the two governments on Jan. 13 1926, and accepted by the 'Iraq Parliament on Jan. 18 and by the British Parliament on Feb. 18. It is contracted for a maximum period of 25 years or until 'Iraq shall be permitted to become a member of the League of Nations. When the delimitation of the northern frontier along the Brussels line and of the Syrian frontier, which is as yet only provisionally fixed, has been completed, it will remain for 'Iraq to satisfy the League that the conditions of membership laid down in Article I of the Covenant have been fulfilled. The arrangement was not accepted by the Turks until June, 1926. (*See* MOSUL.)

Since 1920 great progress nas been made in this direction. A police force, which compares favourably with any in the East, does its part in preserving internal order; a body of responsible 'Iraq civil officials is coming into being; communication by rail and road are opening up the country, the trans-desert route, in particular, having brought 'Iraqi into much closer touch with Syria, Egypt and Europe; the tribal leaders are stepping into their place in public life, thus tending to reduce the former gulf between tribesmen and the effendis of the town. Justice is on the whole satisfactorily administered; the Ottoman Law still remains the principal system of law in use in the civil courts, while the criminal codes are founded on those of Egypt and the Sudan. Good hospitals exist in Baghdad, Basra and Mosul and smaller establishments in other provincial towns; the Baghdad hospital is as well equipped as any in Asia and is able to deal with and stamp out recurrent epidemics. Education has perhaps seen the greatest revolution since Turkish times. Arabic is now the medium of instruction, or the local vernacular in Kurdish or Turkoman districts. Great efforts have been made to provide a sound grounding. Four secondary schools are all that the Government can yet afford, but teachers are being trained, recruits engaged in Syria and the quality of education shows a marked improvement. The desert route has enabled many boys to seek higher education abroad. The agricultural department is raising the level of husbandry by providing selected seeds and has given special attention to the growing of cotton, which bids fair to become one of the most valuable crops of the country.

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II. FINANCIAL AND ECONOMIC HISTORY

The truth about the public revenue and expenditure of 'Iraq is very hard to determine. Figures dating back to the period of Ottoman rule bear small resemblance to fact, and during the War period fancy played a large part in the preparation of figures relating to the "civil administration." To draw a distinction during that period between military and civil expenditure, between the activities of the Expeditionary Force and those of the Civil Service, and to analyse the respective liabilities of the Imperial Govt., the Government of India and the civil administration of Mesopotamia were tasks which provided abundant exercise for a lively imagination.

Revenue and Expenditure.—The average revenue during the two years 1910–2 was made by the Treaty of Lausanne the determining factor in 'Iraq's liability for the Ottoman Public Debt, and the total figure for the three vilayets of Baghdad, Basra and Mosul was £T. 1,492,953. 'Iraq was no source of profit to the Ottoman Empire. Basra, in spite of a complete lack of harbour facilities, was an important gateway, and customs receipts there were heavy. But 'Iraq was to all intents and purposes a foreign dependency in which other revenues were only collected by means of minor military operations, the cost of which exceeded their proceeds.

The Review of the civil administration of Mesopotamia which the British Govt. published in 1920 (Cmd. 1061 of 1920) gave figures showing a large balance of revenue over expenditure for each of the four years ending with March 31 1919, and only a comparatively small deficit for the following year, and stated that for the whole period of five years "the aggregate civil expenditure was approximately £8,000,000 . . . while the receipts amounted to about £10,000,000." 1920–1 was a bad year, with a rebellion in progress, little revenue coming in and expenditure inevitably heavy. In 1922 Parliament was asked to vote money to make good the "civil deficit" in Mesopotamia on March 31 1921, from which date responsibility for the finances lay with the 'Iraq Government. The figure was put at £1,087,000, but ultimately only £559,000 was required. Even this figure, although supported by appropriation accounts and audits, hardly represents the real facts. There was expenditure in Persia and in Nejd, expenditure on refugees from Armenia and from Russia, and expenditure in connection with fantastic War-time enterprises, which had no real connection with the public services of 'Iraq. The financial mission which reported to the British and 'Iraq Govts. in 1925 (Cmd. 2438) quoted the figures as follows:—

	1921–2	1922–3	1923–4	1924–5 (Revised Estimates)
	(In lakhs of rupees)			
Expenditure	572	479	418	460
Revenue	528	475	508	520
Surplus	..	..	90	60
Deficit	44	4	..	..

The mission pointed out that for the year 1925–6 'Iraq was faced with a liability of about 80 lakhs for the Ottoman Public Debt and an increase in expenditure on the army of 34 lakhs, and that the cost of these two services was beyond the present financial capacity of the country. They maintained that a reduction of one or the other was inevitable, and in fact the Ottoman Public Debt contribution has not been paid, the actual determination of an amount not having resulted from the Treaty of Lausanne. The position of the public finances of 'Iraq affords no ground for pessimism. "History," says the report of the financial mission, "probably shows no instance of a state expected to do so much so soon."

The public revenue and expenditure are not a safe index of the resources of a country even when, as in 'Iraq, a large proportion of the revenue is derived from the Government's share in the agricultural output. The machinery of assessment and collection is primitive and defective; and the Government gets far less than its theoretical share, which over a large part of the country is as high as 40%.

Agriculture and Irrigation.—'Iraq is a country within which are found records and traces of very ancient civilisation. Great centres of population were in existence thousands of years ago in places which are now desert, and these great centres depended for their existence on a highly-organised system of agriculture based on irrigation. Down to the 13th century 'Iraq was an agricultural country made wealthy by the proceeds of its harvests and its pastures. Those harvests and pastures depended on the Tigris and the Euphrates rivers which, thanks to an ancient and elaborate system of irrigation canals, fed vast areas which to-day lie derelict. The destruction of that system is definitely traceable to the Mongol invasion of the 13th century. To that supreme catastrophe succeeded a long period of upheaval and unrest, and then the alien rule of the Ottoman Turk, inimical to all attempts at reconstruction, and destructive not only of material resources, but also of the initiative and capacity by which such resources are fostered and developed.

The irrigation problem in 'Iraq was made the subject of an elaborate series of enquiries and reports in Turkish times by Sir William Willcocks, and he was responsible for the one important engineering enterprise which has been carried out in the country, the Hindiyah barrage across the Euphrates, which regulates the supply of water to an elaborate series of canals. The completion of the programme which he sketched out would entail a capital expenditure far beyond the present resources of 'Iraq; and the increased difficulty of raising large sums of money for such enterprises after the Great War inevitably postpones the fulfilment of even a more modest programme. The whole question of irrigation in 'Iraq requires further study and experiment before ambitious schemes are undertaken. Irrigation without drainage may be a danger, and may even do more harm than good; for irrigated land easily becomes salt and water lavished on one area may leave other areas, which need it equally, dry and unfertile. But the subject is now receiving close study, and it may be prophesied with confidence that the productivity of the country will be increased by a better use of the water available. The immediate need is for a systematic examination of possibilities and a rigorous avoidance of pretentious schemes inadequately prepared.

Population.—The population which once cultivated vast areas of arable land has disappeared, and its restoration must depend less upon immigration from other Arab areas—for the national spirit of 'Iraq will not tolerate an alien immigration—than upon a lowering of the death-rate, and especially of the rate of infant mortality, which will give the 'Iraqi nation the numbers for which the cultivation of such areas calls. The difference between desert and fertile land is summed up in this part of the world by the single word "water;" but fertile land will not be productive unless there is a population to cultivate it. Nowhere else in the world will peace, order and good government so surely find reflection in economic development. Improved conditions of health, education and social well-being mean quite definitely in 'Iraq increased productivity.

Cotton and Oil.—There are well-grounded hopes that new sources of wealth will be found in cotton and oil. A concession was granted in 1925 for the development of the oil resources of the Mosul and Baghdad Vilayets to the Turkish Petroleum Company, which represents a combination of international oil interests and is a development of the company which had obtained a promise of a concession from the Ottoman Govt. in 1914. The Anglo-Persian Oil Company enjoys similar rights, in virtue of the original Persian concession of the D'Arcy Exploration Co., in the "transferred territories" which were formerly part of Persia, and here boring for oil has already been successful. The British Cotton Growing Association have interested themselves actively in the development of cotton cultivation. The production is, as yet, comparatively small, but the possibilities have been effectively proved, and with the improvement of public security the investment of more capital may be anticipated. There is therefore every reason to expect that a country which was once the chief granary of the eastern world will once more become a great grain-exporting land.

Communications.—To-day 'Iraq derives much profit from the transit trade with Persia. The route through Russia has been practically closed for some years, and its reopening must be dependent upon the most incalculable of all factors, the political and economic future of Russia. The 'Iraq railways, which have grown out of an emergency War-time line of communications, nearly reach the frontier of Persia, a country undeveloped as regards railways. Baghdad is the *entrepôt* of Persia and Basra its gateway, and the importance of fostering this transit trade is fully appreciated in 'Iraq. The motor service across the desert via Damascus to the Mediterranean at Beirut, due to the enterprise of a New Zealander, has already had far-reaching consequences, and an air service as yet in its infancy has possibilities which can hardly be gauged. 'Iraq looks West to-day, after looking East for thousands of years, and Baghdad is only a week from London.

Port of Basra.—'Iraq has inherited one asset of great value from the War period in addition to its railways—the port of Basra, where vessels of the deepest draught can lie alongside fine wharves fully equipped with railway connections, electric cranes and warehouses. Work is now in progress, and it is hoped nearing completion, which will provide a deep-water channel across the bar of the Shatt-al-Arab and thereby enormously improve the speed and reduce the cost at which vessels can be berthed and cleared. The Shatt-al-Arab is the way not only to the wharves of Margil and the navigable Tigris, but also to Abadan, where the refinery of the Anglo-Persian Oil Company is situated, served directly by a pipe-line from the oil-fields.

Imports and Exports.—Figures of imports into and exports from 'Iraq are as follows (in lakhs of rupees—re-exports excluded):—

	1922–3	1923–4	1924–5
Imports . .	969	879	890
Exports . .	370	422	423

They appear to indicate a heavy "adverse balance of trade," but like most figures relating to 'Iraq, they are misleading unless they are analysed. The expenditure of H.M. Govt. in 'Iraq on the maintenance of the garrison must be accounted an "invisible export," and there has also been a large export of currency—Indian rupees and rupee-paper—since the steady reduction of the garrison reduced the amount of currency needed for internal circulation. There is some reason for believing that the adverse balance has now almost reached vanishing point, and this view is confirmed by the latest movements of the exchange-rate with India. The percentage (in values) of imports from the United Kingdom in 1924–5 was 33, and of those from British India 30. Textile goods formed by far the largest item, sugar and carpets and tea coming next. All these items represent largely articles in transit between Europe and Persia. The principal items of local produce figuring among the exports were dates (183 lakhs in 1924–5), raw wool (84 lakhs) and grain (54 lakhs). (R. V. V.)

IRELAND, JOHN (1838–1918), American Roman Catholic prelate (*see* 14.742), died at St. Paul, Minn., Sept. 25, 1918.

IRELAND (*see* 14.742).—The first part of this article deals with the history of Ireland from 1910 to the creation of the Irish Free State, while the second discusses its agricultural development. Its history subsequent to that date is dealt with under IRELAND, NORTHERN; IRISH FREE STATE.

I. POLITICAL HISTORY

FROM 1910 TO THE OUTBREAK OF WAR

The year 1910 saw the opening of the most important period in the relations between Great Britain and Ireland since the Act of Union. The relative strength of the two great English parties in Parliament as the result of the general election in December made the Liberal Govt. dependent on the assured support of the Irish Nationalists; and this support could only be secured by a genuine effort to pass a Home Rule Bill into law.

Nationalist sentiment was by no means universal. There was a formidable minority for the maintenance of the Union. The line between Nationalists and Unionists coincided roughly with

the line between Catholics and Protestants, though a certain number of persons of either religion held the political views generally identified with the other. The Unionist minority existed in every part of Ireland, but was more concentrated in the North. Even in the Unionist North there was a respectable Nationalist minority in Belfast, and in the predominantly Unionist counties of Antrim, Down, Armagh and Derry; in Fermanagh and Tyrone and in the city of Derry Unionists and Nationalists divided the population; in Donegal, Cavan and Monaghan Unionists were in a minority.

All over Ireland, but more particularly in the North, the political cleavage was deepened, and differences exasperated, by the difference in religion. In such circumstances it would not have been reasonable to expect a compromise on the political question; and the Nationalist party as a whole hardly attempted to secure one, or to face the issue of the position of the Unionist population under Home Rule. They seemed to expect that the minority, after violent protests, would accept a position which they would be no longer able to alter. Some of the Nationalists, notably Mr. William O'Brien, saw the necessity of attempting to conciliate the minority; and the All for Ireland League was inaugurated in Cork on March 31 1910, its declared object being to combine " all the elements of the Irish population in a spirit of mutual tolerance and patriotic goodwill."

The Rise of Sinn Fein.—Outside the Nationalist party a small but earnest body of Irishmen, led by Mr. Arthur Griffith, had been for a dozen years[1] declaring that the Nationalist party was upon entirely wrong lines. Their policy was to assert the position that Ireland was a separate and independent kingdom united to Great Britain by only one link, that of the Crown. They went further than the most advanced Nationalists, and claimed for Ireland in the United Kingdom the same position that Franz Deák had claimed for Hungary in the Austro-Hungarian Empire. This party, afterwards known as *Sinn Fein*, had for years insisted that the National movement should include all classes of Irishmen; they recalled the fact that some great leaders of Irish Nationalism in the past, such as Henry Grattan, Wolfe Tone, Robert Emmet and Charles Stewart Parnell, had been Protestants, and tried to enlist Protestant Irishmen in a comprehensive National movement. They repudiated and ridiculed the parliamentary policy of the Nationalist party; they would have the Irish members withdraw from Westminster and devote themselves to building up a national culture and economic life, and to developing Irish industry and commerce, in the hope of ending the economic dependence of Ireland upon Great Britain.

This party, though more intellectually vigorous than the Nationalist party, was small and without any very wide influence in 1911. Its importance lay in its almost fanatical earnestness and in the fact, not then apparent, that a revolution in the affairs of Europe was at hand in which the most drastic constitutional changes would be regarded as almost normal occurrences. But while the Sinn Fein party proposed a peaceful, though extra-constitutional, policy for the immediate future, it did not refuse to contemplate the possibility that Ireland, strengthened by years of perseverance, might in the end find herself strong enough to assert her freedom by force of arms. This brought it much nearer to the revolutionary elements in Ireland than to the parliamentarians.

Republican feeling was represented by the Irish Socialist Republican party founded in Dublin by James Connolly in 1896. It was not till 1911 that this party became active in Irish politics, but during the next few years its influence through Connolly's paper, *The Workers' Republic*, became more and more marked upon the Republican side; and the Irish Transport and General Workers Union founded by him, though not professedly Republican, could always be depended on to cast its weight upon the side of the more " advanced " political parties.

The Ulster Protest.—During the year 1911 Nationalist Ireland was practically undisturbed, but the Northern Unionists were in a ferment of unrest and apprehension. The introduction of the Home Rule Bill was imminent; and while Nationalist Ireland awaited events in comparative quiet, Unionists were aware that, so far as Parliament was concerned, their cause was lost. They were convinced that they had an unassailable case. They held that Ireland as a whole had benefited by the Union, and that in particular the industrial development of Northern Ireland had been made possible by it. They believed that a self-governing Ireland would prove an irreconcilable enemy of the British Empire, and, by its hostility in the case of a future war, would menace the safety of Great Britain. Ireland was, they argued, a strategic position which on naval and military grounds alike it would be madness to abandon.

Mr. John Redmond's prophecy that the grant of Home Rule would produce in Ireland a demonstration of " imperial loyalty " fell upon deaf ears, and it was not hard to produce statements of a very different tenour, not only from the acknowledged leaders of Irish Nationalism of a previous generation but even from other speeches of Mr. Redmond. Finally, they raised the religious objection to a Parliament which would be composed mainly of Roman Catholics, and declared that they would never sit in it or submit to any laws which it might pass. Their ideals as Protestants differed essentially from those ideals which would command the respect of a Parliament of Irish Catholics, and to force them to submit to the decrees of such a body would be tantamount to religious persecution.[2] They refused to credit any assurances from any quarter designed to allay their apprehensions, and declared that, in spite of any legislation to the contrary, they would retain the constitutional position in which they had stood for more than a century.

The views of the Irish Unionists had often been proclaimed, but their complete sincerity was called in question. The rest of Ireland had not forgotten the United Irishmen, a body that arose and had its chief strength in Northern Ireland, and they could not believe that the interval that had elapsed since 1798 had completely extinguished in the North the love of independence and the spirit of religious toleration which had once distinguished the Protestants of Ulster. They hoped with some confidence that this spirit would revive or that at the least Home Rule would be accepted under protest. And the British Govt. seemed to regard the often vehement defiance of their policy in Irish Unionist circles as but another example of Hibernian hyperbole.

On Sept. 23 1911 a great Unionist demonstration of protest against Home Rule, said by the Belfast newspapers to have been attended by 100,000 persons, was held at Craigavon near Belfast. It was addressed by Sir Edward (Lord) Carson, the leader of the Irish Unionist party. In the following week the Ulster Unionist Council, strengthened by representatives of the Unionist Clubs and the Orange Lodges, resolved to frame a constitution and appoint a Provisional Govt. for the province of Ulster, to come into operation when Home Rule should become the law of the land. This bold step aroused the Govt. to a sense of the nature of the resistance they might expect, and early in 1912 Mr. Winston Churchill decided to explain at a public meeting in Belfast the general principles underlying the government policy. The Unionist party organisers in Belfast decided that he should be prevented, by force if necessary, from speaking in the public hall which had been engaged for his meeting.

No steps were taken by the Govt. to meet the challenge, and their inaction was interpreted in Belfast as weakness. Mr. Churchill spoke (Feb. 8) under military protection, in a marquee erected on a football ground, and explained that any measure of Home Rule would be part of a general scheme of devolution, not in any sense inconsistent with the federation of the Empire. But nothing he could then say would have had the least effect; he was mobbed on his way to the meeting, and had to slip out of the town the moment it was over. A month later the Unionists

[1] Mr. Griffith's paper, *The United Irishman*, first appeared in 1899. The National Council of Sinn Fein was founded in 1905.

[2] The quite recent promulgation of the *Ne Temere* decree in Ireland did much to harden the attitude of Protestant Unionists, being interpreted as an attempt to subordinate the law of the land to the decrees of the Church.

held a great counter-demonstration at Balmoral, a suburb of Belfast, over which the Protestant Primate presided. It was addressed by Sir Edward Carson and Mr. Bonar Law, the latter of whom declared that Protestant Ulster formed a separate "nation" which it would be unjust to force into any political combination with the rest of the population of Ireland. From this time on resistance to the Home Rule bill took more and more the form of the assertion of the distinct nationality of the Ulster Protestants, and it was this which finally led the Ulster Unionists to dissociate their cause from that of the Southern Unionists.

Home Rule Bill of 1912.—In April 1912 the Home Rule bill was introduced in the House of Commons by Mr. Asquith. It proposed to establish in Dublin a parliament strictly subordinate to Westminster (a large number of services being reserved for the exclusive control of the British Parliament); it did not confer upon Ireland fiscal autonomy, nor did it propose to establish a separate Irish Treasury; and Ireland was still to be represented in the Imperial Parliament as an integral part of the United Kingdom. The bill was so far from an attempt to repeal the Act of Union, that it might have been expected to appease Unionist opposition: but it was received with uncompromising hostility. No one in Ireland was entirely satisfied, although a Nationalist convention officially endorsed the bill as satisfactory on April 23. It was at best regarded as an instalment, while the extreme Nationalists and the Republicans denounced the acceptance of it as a surrender of Ireland's national rights. An amendment to exclude the four counties of Antrim, Armagh, Down and Londonderry put forward on June 11 was defeated, both the Prime Minister and Mr. Redmond declaring that Ireland must be treated as a national unit; but the amendment was a sign of the direction in which Ulster Unionists were moving.

The Southern Unionists, who would have been placed in a hopeless position by the acceptance of the amendment, or by any solution of the controversy along similar lines, continued to protest against any form of Home Rule; and English Unionists in a great demonstration held at Blenheim on July 27 pledged themselves through the mouth of Mr. Bonar Law to an almost unconditional support of Ulster in resisting the bill. Fortified by this assurance the Ulster Unionists took still another step. On Sept. 28, amid scenes of great enthusiasm, the "Ulster Covenant" was signed by large numbers, who pledged themselves to defend their political position by the use of any means which might be found necessary to defeat the imposition of Home Rule upon Irish Unionists. This pledge was at the time understood to be a pledge on the part of the Ulster Unionists to resist Home Rule for the whole of Ireland. Undeterred by the temper of Ulster, and the opposition of the English Unionist party, the Govt. pressed on with their bill, its repeated rejection by the House of Lords serving only to delay its final enactment.

Resistance of Ulster.—Meanwhile the Ulster Unionists decided upon a final defiance. They had begun to form companies of Volunteers, who were drilled and practised but not yet armed; and on Sept. 25 1913 the Ulster Unionist Council formally took upon itself the duties of a Provisional Govt. for Ulster, and appointed Sir Edward Carson as head of that Government. Gen. Sir George Richardson, an officer on the retired list, was appointed to command the Volunteer force, which was formally inspected by the head of the Provisional Govt.; committees were formed to manage the various public services, posts, customs, excise; and the administration of justice and even education were entrusted to the care of their special committees.

Ulster Unionists drew a distinction between loyalty to the Crown and submission to Parliament. In general they acknowledge both; as adherents of the Act of Union, they could not but admit the right of Parliament to legislate for every part of the United Kingdom. But they held that the Imperial Parliament could not, without the consent of the Protestants of Ulster, alter an Act which had conferred upon them the position which by its terms they held in the United Kingdom. If Parliament passed an Act giving Home Rule to Ireland in any form which they did not approve, then their duty to submit to its decrees ceased to exist, and nothing remained but their loyalty to the King. When the royal assent to the Act was given some persons declared that the King had taken a step which put his authority upon a level with that of Parliament. But with the exception of momentary outbursts, the Ulster Unionists protested their entire loyalty to the Crown. This constitutional doctrine would be subjected to a delicate test if the King's army were called upon to support the decrees of Parliament, but it was hoped that the application of this test might be averted.

The proceedings in Ulster were not without effect on the rest of Ireland. The Parliamentary party and its supporters, with an easy optimism, assumed that the difficulty would settle itself, or that Parliament would in the last resort assert its own authority by force. But some elements hostile to the Parliamentary party held that what was happening was the just Nemesis of the policy which, they asserted, had persistently ignored the duty of persuading the Ulster Protestants to accept Home Rule under safeguards for their special interests and guarantees for their special rights. Nationalists of a more advanced type saw in Ulster's passionate repudiation of the authority of Parliament an assertion by a body of Irishmen that Irishmen had the right to the final decision of the terms upon which they would consent to be governed; and they were content to overlook the particular ground of the quarrel between Ulster and Parliament for the sake of the principle logically involved. The official Nationalists were not aware of the complete sincerity of the vast majority of Ulster Unionists, nor did they attach enough weight to the formidable objections to any attempt on the part of Parliament to enforce its authority; while the Nationalists who applauded Ulster overlooked the fact that Ulster's quarrel with Parliament was due not so much to the proposal to govern them in a particular way as to the proposal to divest itself of part of the functions of governing them.

The National Volunteers.—The example of Ulster was contagious. On Nov. 25 1913, at a meeting in the Rotunda in Dublin called by a Provisional Committee representing Sinn Fein, the Irish Republican Brotherhood and the Gaelic associations, it was decided to inaugurate the National Volunteers "to secure and maintain the rights and liberties common to all the people of Ireland, without distinction of class, creed or politics." This formula was a direct challenge to the Ulster Volunteers who held that, Ireland having no separate political existence, there were no rights and liberties which Ireland was specially called upon either to secure or maintain. The formation of the National Volunteers was not at all palatable to the Parliamentary party, who were still confident that Parliament would give adequate protection to any rights and liberties that might be endangered.

After the great strike which paralysed Dublin during the autumn of 1913, the Citizen Army[1] began to be enrolled, with headquarters in Liberty Hall, the property of the Irish Transport and General Workers Union. Though comparatively few in numbers, the Citizen Army, composed of men who with their families had suffered during the strike and were prepared to take great risks, played a very important part in later political developments.

The Govt. in Ireland, now awake to the possibilities of disturbance, proceeded to seize arms consigned either to Dublin or Belfast; and in December a proclamation was issued, in spite of the repeal of the Arms Act by Parliament in 1910, prohibiting the importation of arms into Ireland. The validity of the proclamation was immediately challenged in Belfast, and it was not until June 15 in the following year that the Court of King's Bench in Dublin ruled on appeal in favour of its validity. Meanwhile small consignments of arms were making their way into the country, and preparations were being made upon both sides for the wholesale purchase of arms on the Continent.

Proposals for Compromise.—A conference between representatives of the Govt., the two Irish leaders and the leader of the English Unionist party led to no result, Sir Edward Carson being now confident of his ability to beat the Govt., and Mr. Redmond being unwilling to consider the exclusion of any part

[1] The character and aims of this body are set out in *The Citizen Army* by P. O'Cathasaigh (Dublin, 1919).

of Ireland from the scope of the bill. The Prime Minister, however, on March 9 1914, proposed a compromise of his own, that six counties of Ulster should be excluded for five years, on the understanding that unless Parliament, at the end of that time, should otherwise determine they should be included without further delay. Both Irish leaders publicly refused to consider the expedient, Sir Edward Carson on the double ground that the security offered to his followers was insufficient, and that he could not agree to abandon the Unionists of the rest of Ireland. After his speech in Parliament he and the other Irish Unionist members withdrew from the House, and crossed to Belfast, where he issued his final challenge to the Govt.: "Give us a clean cut or come and fight us." The policy of the "clean cut" thus became the official policy of the Ulster Unionists as offering the best chance of success, but its adoption, nevertheless, was more or less a disappointment to Irish Unionists outside of Ulster.

The Curragh Incident.—It was clear now that Ulster Unionists were prepared, if necessary, to resort to arms, and the Govt. took measures to protect the military stores in Ulster from being seized. On March 20 the attitude of the army was brought into sudden prominence by the "Curragh incident." Gen. Hubert Gough, with a large number of the officers stationed at the Curragh in Co. Kildare, on being asked whether if ordered to Ulster they were prepared to go, replied by tendering their resignations, some of them (at least) on the ground that such a question should not have been put to an officer. Their refusal, though their resignations were subsequently withdrawn as the result of mutual explanations, led the Ulster Volunteers to believe that the army was with them, that it had yielded to the insistent appeals to refuse to be made the instrument of "coercing loyalists."

But the Ulstermen did not relax their vigilance, or countermand their orders for arms, on that account; and on the night of April 24 there was landed, under the superintendence of the Volunteers, at both sides of the mouth of Belfast Lough a consignment of nearly 50,000 rifles and 3,000,000 rounds of ammunition. The fact that the naval squadron, stationed at Lamlash for the purpose of supporting the army in the event of a conflict in Ulster, had not intercepted the vessel conveying the rifles was interpreted in Belfast as an indication that the sympathies of the navy, as of the army, were with Ulster.

On June 9 1914 Mr. Redmond identified himself formally with the Volunteers already in existence in Dublin and the South. The original committee, with some reluctance, for Mr. Redmond's policy was increasingly divergent from their own, allowed him to nominate additional members of the committee. The National Volunteers were still unarmed, but their arms were already on the way.

Meanwhile the Home Rule bill was nearing the end of its course. It passed its third reading on May 25 1914. The Govt. were considering an amending bill, as certain to be as strenuously opposed by the Upper House as the bill which it was intended to amend; and as a last resort a conference was called by the King at Buckingham Palace to see whether some compromise could be arranged. After three days the conference broke up on July 24, each party adhering stoutly to its original position. Two days later the National Volunteers landed a consignment of arms at Howth in broad daylight. The Deputy Commissioner of the Dublin Metropolitan Police, hearing of the landing, called upon the military for assistance, and intercepted the Volunteers who had superintended the landing as they marched back with their arms. After some parley, however, the details of which are uncertain, the Volunteers were allowed to retain their arms, on condition of disbanding before they reached Dublin, and the soldiers marched back to their barracks. On the way they were assaulted by a jeering mob, on which they turned and fired, killing three persons and wounding a considerable number. This occurrence caused a profound sensation. The Govt. decided to dissociate itself from the Dublin incident, and the Assistant Commissioner, whose zeal had brought it about, was eventually dismissed on the ground that he had exceeded his authority.

The War Period

When a few days later war was declared against Germany, Mr. John Redmond, in a moving speech in the House of Commons, declared that all quarrels between Great Britain and Ireland were at an end, that Ireland ranged herself on the side of England and her Allies, that English troops might with safety be withdrawn from Ireland, whose shores during the War would be "defended by her armed sons." His attitude aroused great enthusiasm in England, but in Ireland the response was less warm. On his own side the more advanced of his followers thought that he had failed in his duty to Ireland by this unconditional declaration, and the Northern Unionists, though they received his words with respect, were inclined to wait before committing themselves. It was not long before party passion was again aroused. The Cabinet had to decide upon their policy with regard to Home Rule in the new circumstances. They chose to proceed as usual to the royal assent (Sept. 1914), but of postponing the operation of the Act for a year (or to a date after the termination of the War to be fixed by Order in Council), with a promise to introduce, in the interests of Ulster, an Amending bill when the War should be over.

Their action was denounced by the Unionist party both in England and in Ireland as a breach of the war-time truce in party politics; in Nationalist Ireland the promise of an amending bill robbed the provisional enactment of Home Rule of much of its value. The members of the committee in control of the National Volunteers divided into two sections, those in favour of Mr. Redmond's policy and those who adhere to the original principles of the Volunteers. The latter seceded and formed a distinct body, the Irish Volunteers, opposed to enlistment in the British Army and to any compromise upon the principle of the unity and independence of Ireland. But this party was in a minority, and the appeals of Mr. Redmond and the Prime Minister (who came to Dublin to address a recruiting meeting) met with considerable success. Southern Unionists united cordially with Irish Nationalists in the efforts to enlist Irish soldiers; many of the National Volunteers joined the army, and it seemed as if Mr. Redmond's enthusiastic support of the Allies was to prevail.

In Ulster recruiting was more successful. The Ulster Volunteers did not (any more than the National Volunteers) flock to the colours. They retained their arms, and they kept up their organisation. They found themselves faced by a double duty, that of protecting the Empire and that of securing their own political position. The Ulster Division, formed out of those Ulster Volunteers who enlisted and other Ulster recruits who did not join the Irish regiments of the line, did not readily admit Nationalists or Catholics to its ranks; the Ulster Catholics who enlisted were as a rule sent South to join the Division formed out of the Nationalist recruits of the other three provinces; and Sir Edward Carson refused to address a recruiting meeting in company with Mr. Redmond.

During the year 1915 the Ulster mills and shipyards were working at high pressure on Govt. orders and the farmers were extremely prosperous. A period began in which constant employment at good wages was open to the workers and large profits could be made by the manufacturing and commercial community. As the War progressed this tended to check recruiting for the army. In Southern Ireland recruiting was at first fairly satisfactory, though the percentage of able-bodied men who enlisted was not so high as in Northern Ireland, and agriculture began as in Northern Ireland to enter on a period of great prosperity.

The political situation was peculiar. Nationalists and Unionists in the South had sunk their old political difficulties in the task of inducing men to enlist, but their efforts were checked and in the end nullified from two opposite quarters. The War Office in England made no concessions to the national feelings of the Irish recruits, who desired to be allowed to carry the national colours on service and were refused permission to do so. Difficulties were thrown in the way of the formation of an Irish Div. (though one was eventually formed), while the Ulster Div. was

said to be favoured by the authorities. The Nationalist Irishmen who volunteered for the army resented this the more because it seemed to imply that the national claim was to be ignored in spite of the service which Mr. Redmond's trustful policy had done to the cause of England.

The Easter Rebellion.—The Sinn Fein party and the Irish Republican Brotherhood had been long opposed to Mr. Redmond and his policy. The more belligerent spirits revived the old maxim that "England's difficulty was Ireland's opportunity," and, pointing to the increasing difficulties of the Allies, asked whether the time had not arrived for a vigorous attempt to secure what it might not soon again be possible to claim with such apparent hope of success. These arguments were enforced with growing boldness in a number of papers, *Sinn Fein*, *The Workers' Republic*, *Irish Freedom*, *Eire* and *The Irish Volunteer*. These were suppressed three months after war had broken out, and the importation of two American papers which proclaimed the same policy, *The Gaelic American* and the *Irish World* was prohibited. But other papers sprang up to take their place, such as *Scissors and Paste* and *Nationality*. Pamphlets, some of them written with considerable ability, in favour of the same policy, were widely circulated. Organisers formed branches of the Irish Volunteers, spoke against recruiting, and spread the doctrines of Sinn Fein and the Republican Brotherhood. Arms, ammunition and explosives were imported. The Govt. arrested and deported some of the most active of these organisers and attempted, not always with success, to secure the punishment by the courts of men arrested on the charge of breaking the regulations made by the Defence of the Realm Act, 1914.

This party had agents and correspondents in the United States, and early in the war Sir Roger Casement had gone to Germany, with the knowledge of the Irish Republican leaders, to induce the German Govt. to lend armed assistance in the event of an Irish rising. Most of these facts were known to the authorities, but the Chief Secretary, mistaking the significant for the accidental, took no drastic or immediate action. The Volunteers drilled, paraded and practised war-like manoeuvres under the eyes of the police.

As early as May 1915 the project of an immediate rising had been discussed by the Committee of the Irish Volunteers, but it was not till the early part of 1916 that there was general agreement that the right moment had arrived. America was still neutral, and the friends of the Volunteers there could assist them with comparative freedom. Germany was, it is true, unwilling to send help in the shape of an invading force, as Sir Roger Casement had requested, but was ready to send a vessel with warlike stores. It was hoped that Sir Roger Casement would arrive with these late in the week preceding Easter, and Easter Monday was fixed as the date for the rising. The Volunteers throughout Ireland were ordered to be ready for a "very interesting series of manoeuvres at Easter." The German vessel, the "Aud," arrived with her stores, but sighting no signals from the land and being accosted by and requested to follow a British gunboat was scuttled by her crew. Sir Roger Casement landed from a submarine on the Kerry coast; but by mistaking their directions, the occupants of one of the two motor-cars told off to capture the submarine cable station at Valentia drove into the sea and were drowned; no one met Sir Roger Casement, who was captured by the police and hurried across Ireland to prison in London.

The news reached Volunteer headquarters on the Saturday before Easter. The chairman of the committee, Prof. John MacNeill, at once countermanded the order for the "manoeuvres" in Dublin, and sent messengers to warn the country battalions. But a section had determined to persevere with their plans at all risks, and, without the knowledge of the chairman, attempted on Easter Monday to carry out their original design. On Easter Monday they proclaimed the Irish Republic. They seized the Post Office, the Four Courts, Stephen's Green, Boland's Mill and Jacob's Biscuit factory, all strategical positions; they seized houses on both sides of the road in Lower Mount Street, commanding the route by which any troops summoned from England must have entered Dublin. But they failed to secure two very important points, the Castle and Trinity College; and though they held the telegraph headquarters in the Post Office, they did not capture the telephone exchange.

The authorities, civil and military, were for the moment paralysed. So complete had been their confidence that the officers of the Dublin garrison had been granted leave of absence to attend the Fairyhouse races. But on the evening of Easter Tuesday April 25 1916, the first companies of the 178th Infantry Brigade landed at Kingstown and fought their way past the fortified houses that lined their route. The light artillery shelled the Post Office, and on the evening of April 29 the Volunteer stronghold surrendered unconditionally to Sir John Maxwell. Outside Dublin City there was practically no fighting. The rising was foredoomed to failure; and there is some evidence to show that some of those who actually led it knew that this was so, and hoped for no more than that by the sacrifice of their lives they might, as other Irishmen had done before them, furnish to their countrymen an example which would not be forgotten in other days.

Of the leaders 15 were tried by court-martial and shot, 160 prisoners were sent to penal servitude for various terms and 1,841 were deported to England and interned there. From the date of these executions Sinn Fein and the Republican party began to acquire an influence and a following which in a short time made them the dominant factors in Irish political life.

Mr. Lloyd George's Conferences and the Convention.—Early in June 1916, Mr. Lloyd George was entrusted with the task of making another attempt to settle the Irish difficulty on the basis of the exclusion of six Ulster counties. Mr. Redmond and his party would have agreed to a temporary exclusion of them, provided that the Home Rule Act were put into immediate operation in the rest of Ireland; Sir Edward Carson and his followers claimed that the exclusion should be definite and permanent. No agreement was reached,[1] and at the end of July Mr. Duke became Chief Secretary for Ireland and Sir James Campbell, Sir Edward Carson's chief lieutenant, was appointed as Irish Attorney-General. It seemed as if a stern policy of repression were in contemplation, but the new Chief Secretary was more inclined to conciliation. In Dec. Gen. Maxwell, who had been in command since Easter, was recalled, and just before Christmas 600 of the prisoners interned in England were released.

The next year (1917) saw a revival of the irrepressible national feeling of which Sinn Fein became more and more the authoritative exponent. In Feb. the publication of the Sinn Fein paper *Nationality* was resumed, and two by-elections in Ireland in Feb. and May resulted in the return of Sinn Fein candidates. A statement by the Prime Minister (now Mr. Lloyd George) in Parliament on March 7, declining to consider any proposal for Home Rule which would place the Ulster Unionists under an Irish Parliament against their will may be taken as the final step in the process by which the Irish Nationalist party finally lost its influence both in Parliament and in Ireland. Later in the month Count George Plunkett, the newly returned member for North Roscommon, called a convention in the Mansion House, Dublin, to inaugurate an Executive for Sinn Fein; while in the middle of the following month the Prime Minister proposed to summon a convention representative of all shades of opinion in Ireland, including even Sinn Fein, to draw up proposals for an Irish settlement.

Mr. Lloyd George's proposal was accepted by all parties except Sinn Fein, who were offered a representation unequal to their importance in the country and whose principle—Irish independence—would not have been even considered by the other parties. The Ulster Unionists, while sending delegates, insisted that they should have no power to agree to any proposal which

[1] Mr. Redmond asserted that Mr. Lloyd George had led him to believe that the exclusion contemplated was only temporary; even on this understanding he had great difficulty in persuading his followers (especially in Ulster) to agree to it. Sir Edward Carson claimed that he had understood Mr. Lloyd George to offer permanent exclusion, the only basis upon which he would negotiate; he was strengthened in his position by the attitude of prominent members of the House of Lords who, still opposed to Home Rule on principle, were likely to upset any arrangement with which the Ulster Unionists were not satisfied.

had not been communicated to and endorsed by the Ulster Unionist Council. As the Prime Minister had intimated that the Govt. would not be bound by the findings of the convention unless there was " substantial agreement " the Ulster Unionists were thus in a position practically to veto any finding which was not their own. On June 15, to provide an atmosphere of general goodwill for the convention, the remaining Irish prisoners were released and returned to Ireland. In July the vacancy in east Clare, caused by the death in action of Maj. Willie Redmond, resulted in the return of Mr. de Valera by an overwhelming majority. Mr. de Valera had been in command of a company during the Easter rising in Dublin and had just been released from prison.

But in the autumn the atmosphere of goodwill was disturbed. The Volunteers began again to drill and the Govt. began again to arrest. And on Aug. 15 the military raided the barracks of the National Volunteers throughout the country and carried off their arms. This action, coupled with the complete immunity from disturbance enjoyed by the Ulster Volunteers, was significant. On Oct. 25 Sinn Fein summoned a convention of its own, at which Mr. de Valera was elected President, in place of Mr. Arthur Griffith, who had been till then the sole acknowledged, as he was still the ablest, leader in the party. The election indicated the final amalgamation of the Sinn Fein and the Republican parties and the formal acknowledgment by Sinn Fein of the service done by the leaders of the Easter rising. But the inexperience of the new leader was, fortunately for Sinn Fein, still allied to the ripe wisdom and real ability of its older chief. Mr. Lloyd George's convention reported on April 8 1918, but there was no " substantial agreement." It was decided therefore that the report furnished no basis for legislation and the situation in Ireland remained where it was.

But the Cabinet had by this time decided upon the application of conscription to Ireland. It was a most serious decision. The Parliamentary party joined with every other section of Irish Nationalist opinion in resistance to it, and the decision in consequence could not be enforced. Mr. Redmond did not live to see this final collapse of all his efforts for peace between Great Britain and Ireland, for he had died on March 6, the very day on which an Irish district (the Co. Tipperary) had been named a " special military area."

Military Rule in Ireland.—On May 1 Mr. Edward Shortt succeeded Mr. Duke, the viceroy (Lord Wimborne) was replaced by Lord French and the viceregal court was transformed into the headquarters of a military administration; at the same time Sir James Campbell was raised to the office of Lord Chancellor of Ireland. The new administration began by arresting prominent Sinn Fein and Republican leaders, and Sinn Fein, the Republican Brotherhood and their allied societies were " proclaimed." Conscription was not put into force; voluntary recruits, who were promised grants of land after the War, were called for in a viceregal proclamation and recruiting continued with some degree of success until the end of the War. At the General election of 1918, out of 106 members for Irish constituencies, Sinn Fein returned 73, who immediately refused to take their seats in Parliament, formed themselves into the Assembly of Ireland (Dáil Eireann) and elected Mr. de Valera as President of the Irish Republic, with a number of ministers of departments, answerable to the Dáil. From this date until the conclusion of the Anglo-Irish Treaty the history of Ireland is the record of one long struggle between two forces, the British Govt. in Ireland relying upon the right of possession, the existing law and the troops, and Dáil Eireann, claiming to be representative of Ireland's right to freedom and adopting the usual methods of insurgent peoples.

From the Armistice to the Treaty

During the year 1919, a large portion of the country was portioned off into " special military areas." The plan usually adopted was to proclaim any district in which an officer of the Crown had been shot. But efforts were not wanting to bring about a peaceful solution. The Irish Centre party, later changing its title to that of the Irish Dominion League, in which the most prominent members were Sir Horace Plunkett, Gen. Sir H. Gough, Capt. Stephen Gwynn and Capt. Henry Harrison, endeavoured to press upon both English and Irish opinion through their organ, *The Irish Statesman*, the necessity for a solution of the Irish question along Dominion lines.

The Republican party on their side endeavoured in vain to have the case of Ireland brought before the Peace Conference by President Wilson. This hope had finally to be abandoned when on May 31 the American Peace Delegation in Paris refused to receive the Irish Republican envoys. In March the Govt. tried to placate Irish opinion by releasing their prisoners, and Mr. de Valera, who had succeeded in Feb. in escaping from Lincoln jail, was able to proceed to America to put the case of Ireland before American statesmen and the American public and to raise a republican loan in the United States. Shortly after he left the policy of boycotting the families and dependents of the police began to be put into force with the object of bringing about wholesale resignations from the police force. Later in the year (on Sept. 12) the Govt. retaliated by proclaiming Dáil Eireann as " a dangerous association." This did little to ease the situation, and from the beginning of winter raids for arms, the burning of barracks and courthouses and the shooting of police became matters of weekly occurrence. The first " reprisal " took place on Sept. 17, when the soldiers at Fermoy wrecked the shops of tradesmen who, as members of a coroner's jury, had brought in an open verdict in the inquest on a soldier who had been shot on leaving church by a number of armed men who deprived the church party of their arms.

The Last Home Rule Bill.—Towards the end of the year the Govt. introduced the last Home Rule bill, providing for two separate Parliaments in Ireland, one for six counties in Ulster, the other for the rest of Ireland; each Parliament was to have control of the government of its own area, while customs and excise, the army and navy, foreign relations and the Post Office were reserved for the Imperial Parliament, Ireland contributing as its share of the cost of their upkeep an annual sum of £18,000,000. The Act also contained provision for the amalgamation of the two Parliaments by mutual consent. It fell far short of what the Republicans claimed; it was regarded with dismay by those Southern Unionists who still wished to continue the fight against Home Rule and with still greater dismay by the Unionists of the three Ulster counties which were not to come under the Northern Parliament. The Unionist party in the six counties agreed to accept it.

Repression in Ireland, 1920.—By April the Govt. had decided to make a final effort to suppress by force the Republican party and its sympathisers. On the 4th of the month, Sir Hamar Greenwood was appointed Chief Secretary for Ireland, and the activities of the " Black and Tans " and the Auxiliaries, under the control of Maj. Gen. Sir Henry Tudor, began. In July Gen. Macready was appointed commander-in-chief in Ireland with an army of 60,000 men under his control. But on May 4 the corporation of Dublin formally acknowledged the authority of Dáil Eireann, and its example was followed pretty generally throughout Southern Ireland. On May 19 the Sinn Fein courts began to function, and in a short time had replaced the King's courts over a large area of Ireland. The conflagration spread to the North; on Aug. 8 the shooting of a district inspector of police in Lisburn (Co. Antrim) was the signal for the burning by a Protestant mob of the shops and houses of prominent Catholics, and on Sept. 25 the shooting of a detective in Belfast led to similar excesses there. Four days before this the town of Balbriggan had been partially sacked as a reprisal for the shooting of two policemen in a public-house.

During the course of the year reprisals of this kind took place in nearly 20 towns, culminating in the serious conflagration in Cork on Dec. 18. These reprisals, except in the cases of Belfast and Lisburn, were the work of the Crown forces. But in the case of the "Black and Tans" and the Auxiliaries, recruited among ex-service men, it had been understood from the first that they were to be allowed a considerable freedom. Their excesses

became notorious; roaming the country, armed to the teeth, they terrorised the countryside.

On the other side the Irish Republican Army, moving about by night or in lonely places, sheltered and protected by the favour, and in some cases by the fear, of the inhabitants, laying ambushes, shooting spies or persons believed to have furnished information to the Crown forces, picking off small parties of their opponents, made life a nightmare to any members of the police and military who found themselves outside their barracks. Both sides fired or threw bombs at the members of the other at sight, often in crowded streets, to the danger of the civilian population. One of the most horrible of the incidents of the struggle took place on the morning of Nov. 21, when 21 officers were shot at an early hour in their lodgings, without opportunity of defence or escape. Such was the condition of Ireland when on Dec. 23 the bill for the Better Government of Ireland became an Act of Parliament.

Policy of Reconciliation.—But early in 1921 it became apparent that the true facts of the state of Ireland could no longer be concealed. The tide of opinion in Europe and America was beginning to set steadily against Great Britain. The policy of "reprisals" was checked and exchanged for one of "official reprisals." Gen. Macready issued an order that in future houses in the vicinity of an ambush laid for the troops, whose inhabitants might be presumed to have known of it and had not given information, were to be burned. But public opinion in England began to be roused.

On April 21 Lord Fitzalan was appointed Viceroy of Ireland, the first Catholic to hold the position, and so great was the universal desire for peace that early in the following month Sir James Craig, who had succeeded Lord Carson as the leader of the Ulster Unionists, held a conference with Mr. de Valera with a view to a settlement. During the same month, the elections for the two new Parliaments were held. In Southern Ireland out of 128 seats, 124 fell to the Republican party; in Northern Ireland out of 52 seats the Unionists secured 40, the others being divided between the Nationalists and the Republicans. In Southern Ireland the Republicans refused to acknowledge the new Parliament which, in consequence, could not meet. On May 25 the Customs House in Dublin with all its records was burned to the ground by a party of the Republican Army, and on the following day the Government resolved to send more troops to reinforce its army of occupation.

Meanwhile preparations went on for the formal inauguration of Home Rule in the six counties of Northern Ireland, which by the irony of fate were the first to accept a measure which a few years before they had repudiated with anger. On June 7 the Northern Parliament was opened by the Viceroy, and on June 22 the King and Queen visited Belfast, when His Majesty addressing the new Parliament urged upon them and the rest of Ireland the necessity for harmony and goodwill. But the Govt. had resolved to yield, and on July 8 at a conference in the Dublin Mansion House between Gen. Macready and the Republican leaders and representatives of the Southern Unionists, invited by Mr. de Valera, a truce was signed by which the trial of strength which had lasted for so long was finally to be at an end.

The Irish Treaty.—The relief in Southern Ireland was intense. It was hoped that the details of an agreement would be settled at a conference between the Prime Minister and the Republican envoys: but after seeing them on July 14, the Prime Minister had a meeting with Sir James Craig, who made it clear that the six counties would not under any circumstances agree to a union with the rest of Ireland, though they would endeavour so far as possible to co-operate on a basis of mutual independence. Mr. Lloyd George thereupon offered the Republican leaders for the 26 counties the status of a Dominion with certain reservations, mainly with regard to the military, naval, fiscal and financial interests of Great Britain. On returning to Ireland and consulting Dáil Eireann and the Executive of Sinn Fein, Mr. de Valera intimated to the Prime Minister, both on his own account and as the spokesman of the Republican party, that these proposals could not be entertained, and to this decision, in spite of advice and threats, the party adhered firmly.

Long negotiations followed, in which it seemed at every step that a break was inevitable; until finally on Sept. 30 the Republican leader accepted, with no other comment than the words "our respective positions have been stated and understood," an invitation to send envoys to London "with a view to ascertaining how the association of Ireland with the community of nations known as the British Empire may best be reconciled with Irish national aspirations." The Irish envoys were Mr. Arthur Griffith, the founder of Sinn Fein, Mr. Michael Collins, who had chiefly organised the military policy of the Republicans and had been Finance Minister of Dáil Eireann, Mr. R. C. Barton and Mr. G. Gavan Duffy, with Mr. Erskine Childers as their secretary; they met the Prime Minister, Mr. A. Chamberlain, Mr. Winston Churchill, Lord Birkenhead, Sir Gordon Hewart, Sir L. Worthington Evans and Sir Hamar Greenwood.

After protracted discussions there was signed on Dec. 6 a treaty by which Ireland was accorded the constitutional status of a Dominion; the right of Northern Ireland to intimate its desire to remain under the Act of 1920, provided it did so within one month of the ratification of the treaty by Parliament, being secured and provision made in that event for a commission finally to decide upon its boundaries. The new Dominion was to have complete fiscal autonomy, the right, within certain limits, to maintain an army and was to have its financial obligations to Great Britain regulated by mutual agreement or arbitration. The treaty was ratified by the British Parliament on Dec. 16. It was not till Jan. 7 that a debate, which had begun on Dec. 14 in Dáil Eireann, concluded by a division in favour of the treaty, Mr. de Valera, who disapproved of it, ceased to be President of Dáil Eireann and his place was taken by Mr. Arthur Griffith, Mr. Michael Collins becoming head of the new Provisional Govt. appointed to carry the provisions of the treaty into effect; and on Jan. 16 1922, Mr. Collins formally took over from the Viceroy Dublin Castle and all the offices of Govt. in the name of the Irish Free State.

BIBLIOGRAPHY.—It is impossible to name all the books and pamphlets which have appeared on the Irish history of the years 1911–22. Current Irish events may best be studied in the files of the leading Irish newspapers, *The Irish Times* (Unionist), *The Freeman's Journal* (Nationalist) and the *Belfast Newsletter* (Ulster Unionist). The last named may be consulted for the manifestoes of the Ulster Unionist party and for the expression of the aims and feelings of the party. The Sinn Fein standpoint can best be studied in its newspapers, mentioned in the preceding article, files of which are preserved in the National Library, Dublin, and in its various pamphlets (to be found in the same library). The writings and pamphlets of Patrick Pearse, the intellectual author of the rising in 1916 and one of its principal leaders, furnish the best key to an understanding of the motives which gave rise to it. There are many official publications which should also be consulted, such as the *Report of the Royal Commission on the Rebellion in Ireland*, Cd. 8279 (1916); *Documents relative to the Sinn Fein Movement* (1916); *Report of the Proceedings of the Irish Convention* Cd. 9019 (1918), etc. On the conditions in Ireland during 1920 and 1921 the anti-Republican account is given in *The Administration of Ireland in 1920* (1921) and *Ireland in 1921* (1922) by I. O. (C. J. C. Street) published by Philip Allan & Co.; while the Republican account may be studied in the files of the *Irish Bulletin*. These should be supplemented by the *Report of the Labour Commission to Ireland* (London, 1921) and *Evidence on Conditions in Ireland* (American Commission, Washington, 1921).

(R. M. H.)

II. AGRICULTURAL CO-OPERATION

The main interest and importance of the co-operative movement in Ireland since the beginning of the World War consists in the struggle of its promoters to preserve and develop it as the chief agent for implementing a certain philosophy of rural life and evolving an agricultural policy consonant therewith. The movement had been initiated a quarter of a century before the War by men who were not themselves farmers, and its inspiration has ever since come from practical idealists. These men realised that in a country dependent upon a sound agricultural economy for the well-being of every section of the population, a technically educated and efficiently organised rural community was of the first importance.

In countries highly industrialised, agriculture could be neglected without disaster; in a country predominantly agricultural

the efficient production and economical distribution of food was what mattered most. Yet those who saw that these ends could best be obtained by the application of the co-operative principle and system to the occupation of farming were chiefly concerned for the building of a rural civilisation which would provide intellectual interests and social amenities calculated to counteract " the lure of the city." For the solution of the modern rural problem as they saw it, they invented the formula: " Better Farming, Better Business, Better Living." To use a New World phrase, the " pivotal " thing was Better Business and Better Business was co-operation.

Agricultural Organisation Society.—The post-War civil disturbances in Ireland might well have wrecked the movement. War prices and a demand which ignored quality had considerably demoralised the dairy societies. The movement was in no condition to meet the sudden decline in prices which set in in 1920–1. It became clear that its future success—perhaps even its survival—would depend upon the ability of the Irish Agricultural Organisation Society to continue its service as guide, philosopher and friend of the societies. This central body had always derived from the farmers it served and from philanthropic individuals a large part of its funds. In the circumstances of the country, these subscriptions were bound to fall off. While the Development Commission, which was authorised by its Act to treat " the organisation of co-operation " as one of the ways of " aiding and developing agriculture," functioned in Ireland it subsidised the I.A.O.S. for this purpose. Under the Anglo-Irish Treaty the Commission transferred its functions and a proper proportion of its funds to the two Irish Governments. The I.A.O.S. had to be partitioned, an Ulster A.O.S. being formed to operate in the six northeastern counties.

The Govt. of the Irish Free State has from year to year continued the grants to the I.A.O.S. and for its first year the Govt. of Northern Ireland continued it to that part of the organisation movement which came within its territory. This, however, was not renewed, and in Northern Ireland the movement in consequence had greatly to restrict its work. But that the farmers there have come to realise its value is evident from the fact that of its total funds in 1925 more than two-thirds came from societies' contributions, so that it was able to end the year without a deficit.

The new Free State Govt. wished to reconstitute the agricultural policy of the country. This was to be expected in a land which, itself purely agricultural, had just obtained independence from a union of countries mainly industrial. The department was merged in a new Ministry of Lands and Agriculture, and a commission on Agriculture was set up which made many far-reaching recommendations, especially emphasing the importance of agricultural education and commending the development of co-operation as well as an increased subvention to the I.A.O.S. At present the Ministry and the organisation society are engaged in negotiations pointing towards increased Government aid.

Statistical Position.—In the country signs are not lacking of a renewal of co-operative enterprise. The largest trade federation of the movement, the Agricultural Wholesale Society, which made great progress in the more prosperous years, participated to the full in the country's economic depression; but " Irish Co-operative Meat, Ltd.," established in 1920, with headquarters in Waterford, is now preparing to work on a large scale. It was unable to function during the years of civil disorder, but has already a membership of 5,793, with a share capital of some £175,000, of which £65,000 has been paid up, the source of the capital being farmers or farmers' co-operative societies. The shipment of pigs was begun in 1925, and the society proposes shortly to deal weekly with 100 cattle, 1,000 pigs, and to be able to cold store 200 tons of butter (or equivalent produce) at one time. The Irish Co-operative Agency Society, which markets the butter of the creameries, had in 1924 a trade turnover of £555,649, representing a quantity of butter only slightly exceeded by the years 1920 and 1922, the highest recorded.

A further development took place in 1925. The credit societies were doing a dwindling business, largely because the I.A.O.S. could not pay for propaganda and inspection, but the Commission on Agriculture had recommended that this aspect of co-operative business be specially endowed; two winters disastrous for farming (1923–4 and 1924–5) had resulted in severe losses of live stock through fluke, etc., and the Dáil of the Free State, at the instance of the Minister for Agriculture, passed a vote for loans not to exceed £100,000, for restocking of lands, to be advanced to credit societies approved by the I. A. O. S., to whom the administration of the scheme was entrusted. Thus were re-established satisfactory relations between the state aid and the self help parts of a movement which may encourage other countries to adopt the device of an " organisation society," working in close co-ordination with the governmental Departments of Agriculture. There was, too, during the winter of 1925–6 a revival of energy among the dairying societies.

The organisation of about 150,000 farmers (in a country containing about 4,250,000 people) into a movement whose aggregate business for the decade 1914–23 (inclusive) was well over £80,000,000—to which creameries contributed about one-half—is not an unimportant factor in Irish economics.

Education.—The need of all co-operative movements is always education, and the higher the development the greater is that need. The hampered condition of the Central Organisation Society is probably the true cause of the halt of the movement as a whole. Up to the present, the I.A.O.S. has had to render many services, notably technical advice to creameries and other societies, which the Govt., through the Ministry, are now rendering under the Dairy Produce Act and the Agricultural Produce (Eggs) Act. To ensure the future of co-operation, technical instruction in itself is not the chief desideratum. When it can leave that to the Ministry, the Organisation Society will concentrate on educating the farmers not only in credit and the technique of co-operation, but in the co-operative spirit—without which loyalty and solidarity, essentials to success, must always be lacking. The standard of efficiency required of the modern farmer is only to be attained by an educated man.

The Govt. of Northern Ireland, like that of the Irish Free State, through its Dept. of Agriculture, enforces egg-grading; but the Ulster Organisation Society, with an income of £913, 3s. 6d., cannot do the work necessary to educate the farmer up to a standard which the Govt. can only punish him for failing to reach. The work, therefore, cannot be expected to show immediate spectacular results, but that, it must be understood, is as much due to the width of the aim as to the narrowness of the resources. And these two have another connection. To-day the central society's funds are largely drawn from the fees the farmers will willingly pay it for technical instruction, which is not a co-operative but a manufacturing technique. When that function is transferred to Govt. and the Organisation Society is devoted to its educational but less remunerative purposes, the farmers' financial support will for some time be considerably lessened.

Nevertheless, the founders of the movement were convinced that nothing less than a continual extension of the study of the rural problem—the regarding of agriculture as an *industry*, as a *business* and as a *life*—could bring the country population even to the standard demanded under modern economic conditions. The next step, therefore, in this concerted advance was to gather and distribute knowledge of every side of agricultural co-operative evolution the world over, and to provide a centre at which students and organisers could study and compare the progress of local developments. To provide this, the Co-operative Reference Library had been founded in Dublin in 1913. One of the founders of the Irish movement has endowed a trust (which the trustees christened the Horace Plunkett Foundation) for the purpose of extending the Irish philosophy of rural life throughout the British Commonwealth.

Under its auspices there was convened at Wembley in July 1924, a conference on agricultural co-operation in the British Empire. The delegates, who were thoroughly representative of agriculture in this vast area, approved the Irish policy, and called upon the Foundation to establish an office in London to act as a clearing-house for the exchange of experiences and opinions of all organisations which were putting the co-operative principle into practice. This has been begun by opening a London centre which, when the Carnegie United Kingdom Trust promised to defray the cost of maintenance, naturally offered hospitality to the Co-operative Reference Library, an offer which the Carnegie United Kingdom Trust approved. Thus the Foundation is in a favourable position to see that Ireland is kept fully informed of the progress of similar movements in other countries.

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IRELAND, NORTHERN (*see* IRELAND, 14.742), a part of the United Kingdom of Great Britain and Ireland, with a certain measure of local self-government. The population at the census of 1911 was 1,250,531; at the census of 1926 it was 1,255,881, an increase of 5,350. The population of Belfast, the capital, in 1926 was 414,844. The area of 3,351,970 statute acres consists of the six counties of Antrim, Down, Londonderry, Armagh, Tyrone and Fermanagh, and the county boroughs of Belfast and Londonderry.

I. POLITICAL AND CONSTITUTIONAL HISTORY

Under the Govt. of Ireland Act, 1920, the Lord Lieutenant, in the name of the King, summons, prorogues and dissolves Parliament. He gives and withholds the Royal Assent to Bills passed by the Senate and House of Commons, subject to the following limitations:—

(1) He shall comply with any instructions given by His Majesty in respect of any such bill or order; and

(2) He shall, if so directed by His Majesty, reserve any such Bill or Order for the signification of His Majesty's pleasure, and a Bill or Order so reserved shall not have any force unless and until within one year from the day on which it was presented to the Lord Lieutenant for His Majesty's assent, the Lord Lieutenant makes known that it has received His Majesty's assent.

The Senate consists of the Lord Mayor of Belfast, the Mayor of Londonderry and 24 senators to be elected by the members of the House of Commons; the House of Commons consists of 52 members; 13 members are returned to represent Northern Ireland in the Parliament of the United Kingdom. The members of the House of Commons are elected by the same electors and in the same manner as members returned by constituencies in Northern Ireland to serve in the Parliament of the United Kingdom, except that, in any contest election of the full number of members, the election is according to the principle of proportional representation, each elector having one transferable vote. All election laws relating at the time of the passing of the Act to the Commons House of Parliament of the United Kingdom and the members thereof were, so far as applicable and subject to the provisions of the Act, to extend to the House of Commons of Northern Ireland.

Money bills can only originate in the House of Commons and may not be amended by the Senate. If the Senate reject, or fail to pass, or pass with amendments to which the House of Commons will not agree a public bill which is sent up to the Senate at least one month before the end of the session, and if the House of Commons in the next session again pass the bill, with or without any amendments which have been made or agreed to by the Senate, and the Senate reject or fail to pass it, or pass it with amendments to which the House of Commons will not agree, provision is made for the holding of a joint session.

Subject to the provisions of the Act, the Parliament has power generally to make for the peace, order and good government of Northern Ireland, with the limitations that it shall not have power to make laws except in respect of matters exclusively relating to the portion of Ireland within its jurisdiction. The Crown, armed forces, defence of the realm, relations with foreign States and certain other matters were excluded from its power. The Parliament cannot make laws interfering with religious equality, taking property without compensation, etc

All executive power in Northern Ireland continued vested in the King, but exercised by the Lord Lieutenant or other chief executive officers for the time being appointed in his place. Certain taxes, such as customs and excise duties, were reserved to the Imperial Parliament; the postal service, post office savings bank, etc., were reserved temporarily, pending the formation of the proposed Irish union. The Act abolished the Supreme Court of Judicature for Ireland, and established the Supreme Court of Judicature of Northern Ireland, consisting of two divisions, the High Court and the Court of Appeal.

Developments After 1920.—A proclamation was issued by the Lord Lieutenant of Ireland (Viscount FitzAlan of Derwent) on May 4 1921 summoning a Parliament of Northern Ireland to meet in Belfast on June 7 following. The election of members of the House of Commons was held on May 24, the Unionists securing 40 seats to 6 Nationalist and 6 Sinn Fein. Elections for the Senate were held on June 12, and 24 Unionists were returned unopposed. The Ulster Unionist Council had on Feb. 4 unanimously elected Sir James Craig as leader of the party. The Nationalist and Sinn Fein members did not attend the opening of Parliament. The Hon. Hugh O'Neill was elected as Speaker of the House of Commons and the Marquess of Dufferin and Ava as Speaker of the Senate. On June 22 Parliament was formally opened by King George V. The first Cabinet was constituted as follows:—

Prime Minister, Sir James Craig.
Minister of Finance, Mr. H. M. Pollock.
Minister of Labour, Mr. J. M. Andrews.
Minister of Home Affairs, Sir R. D. Bates.
Minister of Education, The Marquess of Londonderry.
Minister of Agriculture and Commerce, Mr. E. M. Archdale.

Sir James Craig immediately made it clear that his policy was to preserve the existence of Northern Ireland as an integral part of the United Kingdom, and, while willing to contemplate common action with Southern Ireland under the Government of Ireland Act, to resist union with the rest of Ireland in any system which would involve separation from Great Britain and the abandonment of the representation of Northern Ireland in the Imperial Parliament.

The first task of the Government was to restore internal order. Political and religious animosities, to which unemployment arising from post-War decline in trade and industry had added fuel, had been kindled to a dangerous heat. Outbreaks of civil disorder leading to murder and arson had taken place. The anti-British party in Southern Ireland had undoubtedly contributed to increase the difficulties of the Government, presumably in the hope of forcing an all-Ireland form of government by making government under the Act of 1920 impossible. However, the disruption of this political party, which followed upon the Irish agreement of the winter of 1921–2, accompanied as it was by an outbreak of civil war in Southern Ireland, actually eased the situation in Northern Ireland, as it caused the withdrawal of certain elements of disorder which had been organised and introduced from outside and which were now called off to take part in the quarrels of their leaders.

After the setting up of the provisional Govt. in Southern Ireland, the Royal Irish Constabulary was disbanded under the Constabulary (Ireland) Act, 1922, which received the Royal Assent on Aug. 4 1922 and modified the provisions of the Govt. of Ireland Act by providing for the disbandment of the constabulary, in lieu of the transfer to the Govt. of Northern Ireland of the members of the forces serving in that area. Before this disbandment was completed the Parliament of Northern Ireland had established a new police force, the Royal Ulster Constabulary, and a considerable proportion of disbanded members of the Royal Irish Constabulary received appointments in the new Ulster force. A large body of auxiliary police was also organised and, thanks to vigorous measures both in and out of Parliament, order was restored in a comparatively short time.

The Irish Free State (Agreement) Act, 1922, affected Northern Ireland (although she was not a party to the agreement thereby given legislative sanction) in the following respects:—

(*a*) it purported to give Dominion status to Ireland as a whole;
(*b*) it put a stay upon the exercise of the powers of the Parliament and Govt. of the Irish Free State, as respects Northern Ireland, until the expiration of one month;

(*c*) it enabled Northern Ireland to vote herself out of the Free State by means of an Address presented to His Majesty by both Houses of Parliament of Northern Ireland, before the expiration of the month above referred to, and it attached to the presentation of such an Address the consequence that a Commission was to be set up consisting of three members, one to be appointed by the Govt. of the Irish Free State, one to be appointed by the Govt. of Northern Ireland, and one (who was to be the Chairman) to be appointed by the British Govt., in order to " determine in accordance with the wishes of the inhabitants, so far as may be compatible with economic and geographic conditions, the boundaries between Northern Ireland and the rest of Ireland ";

(*d*) it expressly preserved the Council of Ireland and the Irish Free State representation thereon, whilst depriving the Council of any powers in that State; and

(*e*) it offered to Northern Ireland, as an alternative to going out of the Free State, a continued existence under the Govt. of Ireland Act, subject to an overriding jurisdiction of the Parliament and Govt. of the Irish Free State, in all matters in respect of which legislative power is withheld from the Parliament of Northern Ireland under that Act.

The majority of the points in which the Constitution of Northern Ireland was affected by the setting up of the Irish Free State received attention from the Imperial legislature in the Irish Free State (Consequential Provisions) Act, 1922, which came into force on the same day as the Act providing for the

Free State Constitution. This Act contained various provisions which were to take effect in the event of Northern Ireland voting herself out of the Irish Free State under Article 12 of the original Agreement. This voting out was immediately accomplished, and thus authority was given for various constitutional changes. Subject to the provisions of the first schedule (Modification of the Govt. of Ireland Act, 1920, etc.) to the Act, the Govt. of Ireland Act was only to apply to Northern Ireland. This schedule provided for the appointment of a Governor of Northern Ireland, and for the application of the provisions of the Govt. of Ireland Act, 1920, with respect to the Lord Lieutenant, to him. Further references in any other enactment to the Lord Lieutenant, were in their application to Northern Ireland, to be construed as references to the Governor of Northern Ireland. A Privy Council of Northern Ireland was to be established and there was to be a Great Seal of Northern Ireland. On Dec. 9 1922 the Duke of Abercorn was appointed Governor of Northern Ireland.

During 1923, in spite of continued trouble with the Free State over the failure to agree on the boundary question, Northern Ireland progressed. The most important legislative achievement of the year was the Education Act, which came into operation, in the face of condiderable hostility, on Oct. 1 1923. Based largely on the recommendation of a committee of enquiry appointed in 1921 under the chairmanship of Sir R. Lynn, M.P., the Act marked a new departure in Irish educational administration by establishing the principle of popular control. Provision was made for the establishment of local education authorities, to be formed by the county borough councils and county councils, with power to appoint administrative sub-areas under regional committees. The fiscal separation from the Irish Free State, dating from April 1 1923, had an adverse effect on trade between Northern and Southern Ireland owing to customs duties levied by the Government of the Irish Free State on certain goods crossing the land frontier.

Boundary Question.—The chief obstacle to the development of better relations with the Irish Free State during the years 1923 and 1924 was the boundary question. The Govt. of Northern Ireland declined to appoint a Commissioner under Article 12 of the Irish Free State (Agreement) Act, 1922, and, as a consequence of this refusal, the Irish Free State (Confirmation of Agreement) Act, 1924, was passed by the Imperial Govt., whereby, in the event of the continued refusal of the Govt. of Northern Ireland to appoint a Boundary Commissioner, the power of appointment residing in that Govt. was to be transferred to, and exercised by, the British Govt., any Commissioner so appointed being deemed to be a Commissioner appointed by the Govt. of Northern Ireland. The British Govt. and the Govt. of the Irish Free State had, in the meantime, appointed as their respective Commissioners, Mr. Richard Feetham, a Judge of the High Court of the Union of South Africa, and Prof. J. McNeill. Upon the passing of the above Act, the British Govt. appointed Mr. J. R. Fisher, barrister-at-law, as the Commissioner for Northern Ireland.

The Boundary Commission occupied upwards of a year in visiting, and hearing evidence in, the various border districts in Ireland, and in considering the information so obtained. In Nov. 1925, on the eve of the promulgation of the report of the Commission, the Free State Commissioner withdrew. A conference was then held in London between the three Govts. represented on the Commission, and a further Agreement was concluded on Dec. 3 1925. By this Agreement, the Ireland (Confirmation of Agreement) Act, 1925, the three Govts. " being united in amity " and " being resolved mutually to aid one another in a spirit of neighbourly comradeship " achieved at length the settlement which is set out in Article 1:—

The powers conferred by the proviso to Article 12 of the said Articles of Agreement on the Commission therein mentioned are hereby revoked, and the extent of Northern Ireland for the purposes of the Govt. of Ireland Act, 1920, and of the said Articles of Agreement, shall be such as was fixed by sub-section (2) of Section one of that Act.

The Act also provided that April 1 1926 should be the date as from which the powers in relation to Northern Ireland, which by the Govt. of Ireland Act, 1920,were made powers of the Council of Ireland, were to be transferred to the Parliament and Govt. of Northern Ireland. The Constitution of Northern Ireland could not, before the consummation of this last Agreement, have been described as being settled with finality. The establishment of a separate legislature has not led to a further differentiation of the law in Northern Ireland from that in other parts of the United Kingdom, but to the assimilation of the laws in Northern Ireland to the law in Great Britain, and to the enlargement of the status of the subject in Northern Ireland to that of the subject in Great Britain. It is, perhaps, to this undertaking above all that the Parliament of Northern Ireland, on a study of its statute-book, will be found to have addressed itself with vigour from its earliest inception. (Lo.)

II. FINANCIAL AND ECONOMIC HISTORY

Finance.—The financial provisions of the Govt. of Ireland Act, 1920, were necessarily of a very intricate and comprehensive character, as not only did that Act completely overthrow the whole system of finance in force since the Act of Union of 1800, but went further and set up in Ireland two Exchequers, each under an entirely separate jurisdiction. Subsequent events have considerably modified the operation of the 1920 Act and it is therefore not necessary to deal in this article with

Northern Ireland's position as regards the Irish Free State but simply to consider the relationship which exists under the Act between Northern Ireland and Great Britain, and the financial system which has been built up in Ulster since 1921.

The newly constituted State was not granted absolute financial autonomy. The Act of 1920 contemplated two distinct classes of revenue, and two classes of expenditure, (1) purely local revenue and expenditure and (2) taxation and expenditure which by reason of the wider issues involved, should not be delegated to a subsidiary authority. Under the first heading fall such duties as stamp duties, death duties and licence duties, together with expenditure on services such as old age pensions, police, education, etc., while included in the second category are the more important duties of income tax and customs and excise, and expenditure on the higher administration of justice, the Land Commission and certain other services.

Revenue.—Approximately 90% of the taxes are imposed and collected by the Imperial Government. In the year 1922–3 the revenue yielded by taxes under the control of the Imperial Govt. amounted to £10,700,000, while the ordinary " transferred " tax revenue amounted to £923,000. This revenue, after deducting from it the cost of the various services reserved to the Imperial Govt., together with Ulster's contribution towards Imperial expenditure, is remitted to the Exchequer of Northern Ireland, and is used in the ordinary way to meet expenditure on local services. As a further source of revenue to meet the " additional expense incidental to the severance of the two Irish Govts.," it was provided that the produce of the Land Purchase Annuities payable by those agricultural tenants who had bought out their holdings under the Land Purchase Acts (and who had effected their purchases by the payment of annuities extending over a period of 65 years) should be transferred to the Northern Government. After making provisions for a sinking fund with the object of ensuring a permanent revenue from this service, these land annuities produce a net revenue of £550,000 which should be added to the figures given above.

Fiscal Uniformity.—The control by the Imperial authority of the main sources of revenue requires almost complete fiscal uniformity between Ulster and Great Britain, and necessarily ensures that the industrial and general economic policy of the Province must, in practice, largely conform to that of the Imperial Govt., not only in a local sense, but also as regards its commercial relations with foreign countries. Hence no tariff barriers can be erected between Northern Ireland and Great Britain, and the normal flow of merchandise between the two areas has continued without the inconveniences and hindrances resulting from the imposition of customs duties.

Contribution to Imperial Expenditure.—The Act of 1920 enacted that the Province should make a fixed statutory contribution to " Imperial " services, but this proving unworkable, it was eventually agreed to set up an arbitration committee which, after sitting for two years and having heard expert evidence on both sides, issued its final award in March 1925, settling the principles upon which Ulster's contribution is in future to be assessed. In brief, the contribution will be the balance of revenue over expenditure; for the purpose of making this calculation the taxes over which Ulster has control are to be presumed to raise a sum proportionate to the yield of similar taxes in Britain; while on the expenditure side the Province is allowed for development and social service a sum proportionate to the amounts required by Britain for similar purposes.

Reduction in Revenue.—The reductions in taxation made by the Chancellor of the Imperial Exchequer from time to time in the intervening years between 1922 and 1925 have had their reaction on the revenues of Northern Ireland resulting in an annual diminution in revenue of approximately £1,889,000. The severe depression in trade has also been responsible for a further diminution in revenue; the actual yield of the taxes levied in Northern Ireland by the Imperial Govt. falling from £10,562,000 in 1922 to £8,217,000 in 1925. These reductions were naturally reflected in a corresponding decrease in the contribution which Northern Ireland was able to make towards the cost of Imperial services.

Public Debt.—Unhappily the establishment of the Government of Northern Ireland synchronised with the beginning of a period of profound commercial and industrial depression, with its natural reaction on employment. The principal industries of the Province—shipbuilding and the linen trade—suffered to an unwonted degree, thus compelling the newly-formed Government to finance the Unemployment Insurance Fund to an extent quite disproportionate to that of Great Britain, whose varied industries scattered over a wide area ensure a greater degree of solvency for its insurance scheme. At the end of the financial year—1924–5—the accumulated deficit of the unemployment fund was approximately £2,300,000.

Capital Funds.—On its establishment the Government of Northern Ireland had received its apportioned share of the different capital funds previously set up in Ireland for administrative purposes, and including amongst others the Church Temporalities Fund, Teachers' Pension Fund, Development Fund, etc. It had in addition created certain other capital and sinking funds. To a very considerable extent the requirements of the Unemployment Insurance Fund and of Local Authorities and others to whom loans were made have been met by the temporary utilisation of this available capital. These sources were, however, insufficient to meet all the demands made on the Government, and a public debt was therefore created by the issue of Ulster Savings Certificates in April 1922, followed by an Ulster Loan Stock issue of £2,000,000 in Nov. 1925. The former issue, guaranteed by the British Govt. and providing a remunerative investment for savings, met with an immediate and sustained response throughout the Province. By March 31 1925 a sum of £1,500,000 (after deducting repayments) had been invested in this way. The proceeds of the Ulster Loan Stock issue are available only for the purposes mentioned in the Government Loans and Exchequer Provisions Act (N.I.) 1925, which do not include the making of advances to the Unemployment Fund. Of the stock £1,000,000 was reserved for the investment of Government funds, the remaining moiety being taken up by public subscription.

The Budget.—Statistics regarding the public finances of Northern Ireland for the year ended March 31 1925 showed a total revenue, including Post Office receipts, of approximately £11,336,000; the total expenditure for the same period amounted to £7,713,000, leaving a balance of revenue over expenditure of £3,623,000. Of this £3,472,000 was contributed to Great Britain, leaving a net surplus of £151,000.

Production and Industry.—Agriculture is one of the principal industries of the country and large quantities of butter, eggs and general agricultural produce are exported to Great Britain. Considerable quantities of flax are also grown and it is expected that the research work now being undertaken in this branch of agriculture will not only improve the quality of the flax but will also greatly stimulate general interest in this product.

During the post-War period the trade in live stock greatly increased. Up to 1926 Ulster had escaped the ravages of foot-and-mouth disease, and indeed was particularly free from outbreaks of animal diseases generally. During 1924 a total of 424,000 cattle, etc., were exported, chiefly to Great Britain.

The main industries of Northern Ireland are the manufacture of linen, shipbuilding, engineering, rope making, and distilling. The linen industry normally employs directly or indirectly approximately 120,000 workers. Over 1,000,000 flax spindles are in use, representing one-third of the world's entire flax-spinning capacity; 40,000 looms are engaged in weaving. The major portion of the shipbuilding industry is located at Belfast, where a large number of the world's most famous vessels have been built, including the well-known " Titanic " and " Olympic." During 1923, 12 mercantile steam vessels with a total tonnage of 75,782 were launched in the North Irish yards.

Over 50 important firms are engaged in Belfast and the immediate vicinity in the manufacture of textile machinery of all kinds; heating, ventilating and drying plants and almost every variety of equipment for factories. There are some 12 modern distilleries operating in Ulster which together produced during the year ended March 31 1924 a total of 2,534,426 proof gallons of spirits. A number of other industries are carried on. Belfast possesses the largest ropeworks in the world, which employ over 3,500 persons and can produce 350 tons per week of all classes of ropes and twines. Tobacco, soap, woollen goods, felt and aerated waters are also manufactured.

Trade.—Northern Ireland carries on a very considerable export trade. Statistics for 1923 show that the value of the exports for that year to Great Britain and foreign countries totalled £66,000,000, while the imports for the corresponding period amounted to £65,000,000.

Finance.—There are three banking companies having their head offices in Northern Ireland, viz.: the Belfast, Ulster and Northern banks. In addition there are several other banks operating in Ulster. The purely North Irish banks have all a close working agreement with one of the leading English Joint Stock Banks. The deposits in these three banks amounted in 1924 to over £48,000,000 while the advances of various descriptions totalled £31,000,000. In addition to these deposits the sums deposited in Trustee and Post Office Savings banks amounted to almost £9,000,000 in 1924. On Dec. 31 1924, there were approximately 1,350 living companies registered in Northern Ireland with a nominal capital of £71,000,000 and a subscribed capital of £59,000,000.

An analysis of the registered capital produces the following results:—

Banking, etc.	£11,000,000
Brewing and distilling	2,250,000
Shipbuilding	13,500,000
Textile manufacturers	21,000,000
Engineering	10,000,000
Others	13,250,000
	£71,000,000

Communications.—The principal ports of Ulster are Belfast, Londonderry, Coleraine and Newry, while in addition there are Royal Harbours at Donaghadee and Ardglass. Of these Belfast is the most important. Belfast Harbour covers 2,287 acres and possesses a total lineal quayage of 26,512 feet. There are in addition, five graving docks, the largest of which is 850 ft. long and 96 ft. wide at the entrance. During 1923 the number of vessels arriving at ports in Northern Ireland totalled 12,383 with an aggregate tonnage of 4,872,225.

Northern Ireland is exceptionally well provided with roads and a very marked increase in the use of motor transport has been noticeable in the post-War period. There were altogether 12,892 m. of roads in 1925 consisting of:—

Main trunk roads and the more important inter-town routes	1,023
Less important inter-town routes	1,111
All other roads	10,758
	12,892

There are seven private railway undertakings situated wholly in Northern Ireland and five others extending into the Irish Free State. The total mileage in Northern Ireland in 1925 was as follows: standard gauge 815 m., narrow gauge 301 miles. The authorised capital of the railways wholly in Ulster is £1,888,757 and of those partly in Ulster and partly in the Free State £11,141,356. The total receipts in 1923 amounted to £1,090,526 in the case of Ulster railways and £2,395,285 in respect of the others. (H. M. P.)

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IRISH FREE STATE (SAORSTAT EIREANN).—The Irish Free State, with the status of a British Dominion, came officially into being on Jan. 15 1922, when the Irish Peace Agreement, signed in London on Dec. 6 1921, by the British and Irish Delegations, already ratified by the British Parliament on Dec. 16, was adopted by a meeting of elected members of the Parliament of Southern Ireland convened by Mr. Arthur Griffith. In 1923 the State was admitted a member of the League of Nations. The New State is composed of 26 of the counties and four of the county boroughs of Ireland, and is divided into 269 baronies, 2,165 civil parishes and 51,158 townlands. Its area is 17,019,155 statute ac., and its estimated population in 1925 was 3,163,000.

I. POLITICAL HISTORY

The treaty which led to the creation of the Irish Free State was concluded by the British Govt. with representatives of an Irish Govt. which Great Britain had never recognised. From Jan. 1919, onwards, a large majority of the members of parliament elected for Irish constituencies had styled themselves Dáil Eireann—the Assembly of Ireland—had declared the Irish Republic in existence and had chosen a president and Ministers. In May 1921, when elections were held under the Government of Ireland Act 1920, Republican candidates were returned unopposed for all constituencies outside of Northern Ireland (except that of Dublin University) and for several constituencies in Northern Ireland. The Irish war was then at its height; there was no civic life in the country and the members chosen were simply nominees of the Republican Govt., which was in effect a council of the republican army.

This, the second Dáil, met for the first time after the truce at the Dublin Mansion House on Aug. 16 1921. All its members took the oath to the Republic. Negotiations with Great Britain, at first conducted by E. de Valera, were resumed by a delegation headed by Arthur Griffith, "Vice-President of the Republic," and Michael Collins, its Minister of Finance. Great Britain's definite refusal to recognise an independent Irish Republic had been publicly repeated with emphasis.

When the terms of the treaty were published on Dec. 6 1921, Mr. de Valera's announcement of his opposition came as a shock. In the Dáil's debate, prolonged until Jan. 8 1922, it was generally admitted that the country at large was for acceptance. But some speakers declared that their oath bound them to the Republic; some that the desire for acceptance was merely due to fear of renewed war; some, that to compromise was dishonourable, and that the democracy had no right to do what was morally wrong. Many who advocated acceptance made the suggestion that it was a step to the Republic. The majority for acceptance was 64 to 57, and when Mr. de Valera resigned the Presidency, Griffith was elected only by two votes. The wording of the decision hardly accepted the facts of the situation; Griffith was chosen President of the "Irish Republic."

The Provisional Government.—Under Article 17 of the treaty it was necessary to appoint a provisional government, and this was done at a meeting in which all members elected for constituencies in Southern Ireland were summoned. Opponents of the treaty absented themselves exactly as they had absented themselves from the British House of Commons; but the four members for Dublin University attended, and declared that they and those whom they represented were now "on a common basis with other citizens of the Free State" and could act whole-heartedly with them for the good of Ireland. Eight men were named members of the Provisional Government, Collins being chairman. Griffith remained outside it. So did Gen. Mulcahy, who had been chief of staff of the Republican Army and who now succeeded Cathal Brugha as Minister for Defence. In theory the army was still the army of the republic and the Provisional Govt. had no force at its disposal.

The old constabulary was at once disbanded; it had since 1920 ceased to be in any true sense a police force. Collins and his colleagues decided at once to form a new police, the Civic Guard, but it necessarily took time to organise, and its creators had decided in principle that it should be unarmed. British troops were rapidly evacuating the country, and those who had won the treaty felt it impossible to use support from this quarter. There was the Irish Army, now largely in uniform; but it soon became clear that the Army was a source of danger.

With the exception of Collins, only one man in the Provisional Govt. was widely known in Ireland. This was Professor Eóin MacNeill, for many years vice-president of the Gaelic League, who gained a new prominence at the close of 1913 as chief promoter of the Irish Volunteers and afterwards, from Sept. 1916, as their chief of staff. Of the others, Mr. William Cosgrave, Minister for Local Govt., had been a prominent member of the Dublin Corporation from 1913 on, and in 1917 was returned as a Sinn Fein Member of Parliament. Mr. Duggan had been one of the signatories to the treaty. The others, Mr. K. O'Higgins, Mr. J. Magrath, Mr. F. Lynch and Mr. P. J. Hogan were still young men with their careers yet to come. Mr. O'Higgins has thus described the situation: "The Provisional Govt. was simply eight young men in the City Hall" (where they met at first) "standing amidst the ruins of one administration, with the foundations of another not yet laid, and with wild men screaming through the keyhole."

Collins, a man of immense resource and energy, sought to strengthen his position by the success which would have most appealed to popular sentiment—the reunion of Ireland. Under the treaty, if Northern Ireland consented, all powers retained in

that province by the Parliament at Westminster would pass to the Parliament of the Free State. Interviews with Sir James Craig, the Ulster Prime Minister, were arranged. Settlement was desirable for North as well as South, since in Belfast there raged a murderous strife between Catholic and Protestant; but no accommodation proved possible. The birth of the Free State was thus not unattended with difficulty.

Both Griffith and Collins desired a general declaration from the country by an election. But the republicans, knowing as well as they what the result would be, resisted this, and Mr. de Valera called instead, on Feb. 21, a convention of delegates of the whole Sinn Fein organisation. At this meeting, Collins, seeing that a vote would go against him, consented to delay the election for at least three months and not to hold it till the draft of a constitution, based on the treaty, had been published.

There was some disorder. Control of the republican movement did not rest with Mr. de Valera; a section of officers in the army, headed by Mr. Rory O'Connor, who had directed engineering operations in the campaign of destruction during the guerrilla war, demanded the right to be consulted on the terms of any settlement. Meetings of this body were held in express defiance of orders in Dublin. Mutinous action was taken at Clonmel, where a store of arms was seized. This was followed by a sharper outbreak at Limerick, where a body of troops occupied the barracks in the name of the republic. The officer commanding for the Free State in the region was ready and anxious to act, but Collins, desirous at all costs to avoid war, caused an accommodation to be patched up.

Meanwhile, Mr. de Valera proclaimed at meetings that there was only one legitimate Government in Ireland—that of the republic. There was no law, and in parts of the south much violence was offered to Protestants, nominally in reprisal for attacks on Catholics in Belfast, while raids across the border into the north intensified the danger of war. In March, Sir Henry Wilson, who on retirement had entered Parliament for an Ulster seat, was put in charge of the Ulster defences, and organised the whole Protestant male population as an armed police. In Southern Ireland, the extremist Republican party definitely desired renewal of war with England. They would stop at nothing in their efforts to smash the treaty and their armed bands still moved uncontrolled, levying toll from banks and commandeering motor-cars.

It appeared from his public utterances that President Griffith desired drastic action; but Michael Collins, the head of the Provisional Govt., whose personal hold was stronger still, compromised, and on May 20 announced that he had reached agreement with Mr. de Valera. An election was to be held, but Free Staters and Republicans were to put forward a joint panel of candidates, so arranged as to reproduce the distribution of views in the existing Dáil. After the election a coalition ministry was to be formed, giving Mr. de Valera four seats in nine. The result of the election was not to be considered as a vote on the treaty. Appeal was made jointly that no other Candidates be selected. But organised Labour insisted on putting forward candidates, and other interests took courage to follow their example. Michael Collins, at Cork, publicly advised the people to vote as they chose. There resulted some appearance of a free election in some constituencies, where the polling took place on June 16. Thirty-four candidates not on the agreed panel were elected—all supporting the treaty. The Republican defeat was evident.

Civil War.—Aggressive actions by the mutinous section of the army followed, and on June 22 Sir Henry Wilson was murdered in London by two Irishmen who had served in the British army. The British Govt. made it clear that the Free State must act. A definite cause of action was afforded when the mutineers captured in Dublin the assistant chief of staff of the Free State Army and held him as a hostage. On June 28 the Four Courts headquarters were summoned to surrender, and on refusal siege was laid. So the disturbance began. After eight days' fighting—so local in character that the city's ordinary life went on—the struggle in Dublin was over. Rory O'Connor was captured after he had blown up the Four Courts with all their records. Mr. de Valera, who had joined the insurgents, escaped, but Cathal Brugha, after ordering his post to surrender, dashed out firing and was shot down.

Some districts of the country south and west was held by Republicans. The Government's army had neither a trained staff nor a system of supply: it had to improvise. But it had a few field guns to which, when brought into action, no resistance was offered. It was able to enlist practically as many ex-soldiers as it chose, but it refused to accept the offered service of professional officers who had held high command. Some ex-subalterns and company commanders, who had joined the I.R.A. in its fight against the British police, became generals. But the main successes in the field were due to General Murphy, a county surveyor who had got a commission early in the World War and ended by commanding a brigade.

To civil administration was now added military activity; five members of the Government took rank as generals, and Collins himself, flinging his whole energy into the struggle which he had so long sought to avoid became commander-in-chief. But on Aug. 12 Arthur Griffith died suddenly. Ten days later, on the 22nd, Michael Collins was killed in an ambush in the Co. Cork. Thus the task of establishing the Free State fell not to any man but to a group, representing a fraction of one section of the Irish people—the right wing of Sinn Fein.

Framing the Constitution.—It was necessary under the treaty that the third Dáil should as a provisional parliament frame a constitution which should also be adopted by the British Parliament before Dec. 6 1922. On Sept. 9 it was possible to summon this body to meet in Leinster House, the premises of the Royal Dublin Society, which contained a fine semi-circular concert hall. In the newly built College of Science, almost contiguous, the Government had established their offices. The block of buildings was placed under guard. None but carefully scrutinised representatives of the Press assisted at the nominally public debates. Under these conditions the Irish Parliament and Irish Govt. operated for nearly a year. Ministers lived as in a fortress.

At the Dáil's first meeting Mr. Cosgrave was elected President of the Irish Free State and he assumed the Ministry of Finance. Eleven ministers, proposed by him, were elected by the Dáil. The Dáil sat persistently to fulfil its task. The clauses of the constitution, which defined the relations between the Irish Free State and the British Crown and imperial defence, had been settled in discussion between Arthur Griffith and the British Govt., and to this extent freedom was limited. Ministers had the task of persuading the Dáil to accept the limitation; they had also to put forward their own proposals for all that was left free. Mr. Cosgrave entrusted exposition and defence very largely to Mr. Kevin O'Higgins, assisted by Mr. Ernest Blythe, who had become the minister for Local Govt., and Mr. Hogan, Minister for Agriculture. For legal advice they depended on the Attorney General, Mr. Hugh Kennedy, who was not then a member of the Dáil. The only constitutional lawyer in the assembly was Mr. Gerald FitzGibbon, one of the four members for Trinity College. His intervention in the debates was always received with great respect, and Mr. Cosgrave more than once recognised the steady goodwill of this little group of ex-unionists.

The constitution followed extreme democratic lines. Adult suffrage was adopted. But the political thought of the Dáil resented any departure from British models. Ministers desired to introduce the Swiss system of individual responsibility for ministers; a compromise was reached establishing one class of "extern" ministers who should be nominated and appointed by the Dáil at large, holding office for the duration of parliament, and at the same time a statutory executive council of not less than five nor more than seven, which must include the President and the Minister for Finance. Members of the executive council were vested with collective responsibility, and would fall as a body if the Government failed to obtain the support of Parliament while the "extern" ministers would remain in their posts. The referendum and power to initiate legislation by a popular vote were incorporated in the constitution, but without any sign of enthusiasm for these novelties.

The Restoration of Public Order.—The Dáil's real importance was that it brought back to Ireland some habit of public discussion by its criticism of the action of the executive. From 1919 onwards there had been a grave upset to civic life. The civil courts did not sit outside of Dublin; the press existed under a dual censorship—that of the British Govt. and that of the I.R.A. The old police force had been transformed into an irregular military force when the Free State came into being, for so long as open civil war could be said to exist the public and the Parliament acquiesced in the fact of military rule. But by the end of Sept. 1924 at latest, there were no formed forces of the irregulars in the field, and all towns were held for the Government. Demand began to be heard for courts to which men could bring their causes. But the essential was to restore order. Property of all kinds was assailed. Whole bands of men in the name of the Republic were commandeering what they required. Much private robbery followed. More serious than all, a trouble which had broken out in 1920, and had been repressed by Sinn Fein, now appeared again. The permanent land-hunger awoke, and even holdings which had been purchased under the Land Acts were invaded by rival claimants.

Courts were long in being framed, partly because the Govt. sought to find competent magistrates able to use Irish, which the constitution had declared to be the national language. The Civic Guard was being organised; but gunmen flouted, beat and in certain cases killed, members of this unarmed force. Mr. O'Higgins, Minister for Justice, however, stood resolutely to his principle: Ireland must be taught to regard the police, not as the agents of an outside power, but as its own servants, needing and deserving public assistance. He took a long view, and the issue has justified it; but for immediate purposes this body was useless. The irregulars were adopting against the Irish Govt. those tactics which the I.R.A. had used to make British Govt. impossible. The Government on its side was driven like the British to enrol a large force of soldiers, which finally exceeded 40,000. Its recruits joined a force without tradition of discipline; indeed, at the outset it professed semi-officially to condemn the ceremonies of saluting and other formalities. Such a force, hastily levied, with officers as untrained as the men, was not over trustworthy, and did not always give satisfaction by its conduct to the public for whose protection it was raised.

Neither was Ireland, at the close of a movement extending over more than 40 years, a country easily able to support government in the face of terrorism; and terror was applied. The ministry was slow to counter this menace. Trial by jury was futile in such a state of things. The gaols were crammed with prisoners, untried and unpunished. Power to try and to punish most drastically by court-martial was given by an act of the Dáil; yet till Nov. fear of the irregulars was stronger than fear of the Govt. throughout the country. At last a proclamation was posted announcing that four men had been tried, convicted and executed—in each case for having a revolver without licence. In the following week seven men were sentenced, on precisely the same charge, to long terms of penal servitude. Thus the right of Government to deal at its will with persons in arms against the state had been asserted. But the irregular campaign of wreckage went on. More executions followed, among them that of Erskine Childers, who had been the most powerful influence over Mr. de Valera. There was no improvement perceptible by Dec. 6, when the Irish constitution was formally ratified by both parliaments.

Formal Inauguration of the Free State.—Immediately this ratification was complete, Northern Ireland notified the British Govt., by address of both Houses of Parliament, that exercising its right under article 12 of the treaty, it refused to come under the Free State, and desired to retain its position created by the Act. The Free State being now formally constituted as a "Dominion," sensation was created by the appointment (Dec. 1922) of Mr. T. M. Healy, K.C.—so notable in the land war which preceded Home Rule—as its first Governor-General. He was duly sworn in on Dec. 7 by the new Lord Chief Justice. Next day, when the Dáil assembled to choose a senate, as provided by the constitution, President Cosgrave announced that one member of the Dáil had been shot dead and another wounded on the way to the meeting. The man killed, General Hales, was a popular hero of the guerrilla war, and next morning four of the leading irregulars who were in prison were shot without trial by way of reprisal. Among them was Mr. Rory O'Connor. All these had been arrested long before the proclamation of martial law. Mr. FitzGibbon deplored the action. Let the Government ask for what powers they liked and he would support them, but let them abide within their legal rights. General Mulcahy's justification of the step was not given till some months later, when he pointed out that no other member of the Dáil had been attacked. In fact, the counter-terror succeeded. It was largely carried out with the assistance of a criminal investigation department, armed police operating in plain clothes, over whom, as representing Cabinet responsibility, Mr. Joseph Magrath, the Minister for Labour, presided.

The activities of the Free State Government were thus as vigorous and drastic as those of the British police in Sir Hamar Greenwood's régime, but there was this difference. The country might now be terrorised into silence by the irregulars, but it gave them no such willing support as it had given to the I.R.A. Information came, surreptitiously but steadily, to the Free State troops. Further, in Dublin, where courts were now in session, juries did their duty fearlessly. Evacuation by the British military, which had been suspended in early summer when the worst dangers threatened, was now completed; the division, concentrated near Dublin, embarked in Dec. 1922 among demonstrations of affectionate goodwill from the populace.

In forming the senate, President Cosgrave nominated one half of the 60 members; the Dáil elected the other 30. The President made good the promise given by President Griffith to leading Irish Unionists that they should be generously treated; his nominations comprised several leading landlords and other prominent Protestants. The Senate when constituted chose as its chairman Lord Glenavy, who as Sir James Campbell had been Sir Edward Carson's chief lieutenant.

No cleric of any denomination was included in the body. From the first, self-governing Ireland ignored the power of the Church. A few days after the Provisional Govt. assumed office, without any public announcement or legislative act, the two nominated boards which had controlled primary and secondary education were notified that they were dispensed with. This was the more significant, because the Catholic hierarchy as well as the Protestant churches were represented on both. Thus, in the midst of revolution, education was taken out of the hands of the clergy, who had (by a series of compromises) indirectly controlled it under the British administration.

There was not the least opposition to these steps. Public criticism had virtually ceased to exist; the clergy were dumb as the laity, but all men doubted whether the new government could secure obedience. The most hopeful factor in the situation was that since the irregulars had been forced to concentrate their forces against the Free State Army, and provocation from them in Ulster no longer afforded justification for outrageous attacks on Catholics, Sir James Craig's government had succeeded in establishing order, though under a strict military control. Patrols of police enforced curfew all over the six counties.

In the rest of Ireland, the gravest danger was that forseen by Michael Collins when he pointed out that criminal folly might destroy "our belief in ourselves as a nation." There was an orgy of destruction, which almost paralysed communication by road and rail: houses were burnt or bombed by dozens, and the Government, once started on their path of severities, pursued it ruthlessly. By the end of Jan. executions had risen to 50, and the prisoners to ten thousand. No government could be popular under such conditions. Yet signs of weakening began to show. By May 1923, Mr. de Valera called upon his followers to abandon hostilities and dump their arms in concealment. The sound of firing was no longer heard in the streets, and public meetings were once more held. When Aug. brought the annual Horse show, ministers were seen moving freely in the crowd. The resumption of normal civic life may be dated from this time.

In April a marking fact had occurred: the Free State, still maintaining and collecting the British system of taxes, found it necessary to set up a customs system at the ports and along the Ulster border. The first object was merely ascertainment of revenue, but the machinery for a protective tariff existed. In June the Minister for Agriculture introduced a measure for the completion of land purchase, and this was carried through hastily. The third Dáil, which had passed the constitution, still existed, but a general election on the new register with adult suffrage was demanded and it was fixed for the last days of August. The result of this trial of strength was curious. The Government's action had exposed it to much odium. Some 10,000 prisoners were detained in gaol, mostly untried, and over 70 men had been executed. Yet President Cosgrave, Mr. O'Higgins and General Mulcahy were each returned by huge majorities at the head of the group in which they stood. But Mr. de Valera also headed the poll in County Clare (Professor MacNeill being second on the list) and his deputy in County Mayo defeated another minister, and the republicans returned no less than 44 members out of 128. Government had in its own following less than half the Dáil. But the various groups of Independents were notably increased. All these supported the treaty and the constitution. By Oct. the new parliament was formally opened with a speech from the Governor General. His predecessor, Lord FitzAlan, the last lord lieutenant, had given assent to the action of ministers while framing the constitution and crushing civil war. It was Mr. Healy's lot to represent the Crown during the reorganisation.

The New Government.—Ireland's accession to her new status was practically signified on Sept. 10 1923 when her representatives took their place with acclamation in the council of the League of Nations. A month later Mr. Cosgrave attended the Dominion Conference in London, where he was warmly welcomed. At home the executive council was for the first time constituted, consisting of seven. Four other ministers were chosen as " extern," having individual, not collective, responsibility. These included the Postmaster General and the Ministers for Agriculture, for Fisheries and for Local Government. The last post was vacated by Mr. Ernest Blythe, who now became Minister for Finance. His successor, Mr. Burke, was little known.

The new Minister for Finance had at once to face a serious situation. It had become clear that the State would not be destroyed by violence—there was fear lest it should be bankrupt. Civil war had produced damages, then reckoned at £50,000,000, though, when compensation came to be paid, the bill reduced itself to about ten. But the army was costing over £14,000,000 a year, and taxation stood at the peak point to which Great Britain had raised it. Business men in the Senate urged that the financial situation should be regularised. In Dec. the Government came to the country for a loan of £10,000,000 at 5%—the issue figure being 95, repayable at par in twenty years. It was oversubscribed in ten days, the subscribers numbering over 22,000. This demonstration of confidence greatly cheered the country, and rounded off the satisfaction felt in comparing the settled order of Christmas 1923, with the ruinous anarchy in which the year opened.

Yet this optimism did not last. The year 1924 was a very unhappy period. Organised resistance to the State was withdrawn but the threat of it remained. Mr. de Valera's followers refused to surrender or hand in their army. More than this, Ireland was forced to realise how profoundly demoralisation had spread during a period in which law was defied and secret organisations enforced their mandates. There was much crime, especially robbery with violence. The army, so rapidly raised, was reduced, for motives of economy, with equal rapidity, and men were suddenly thrown out of employment. A bad harvest in 1923 had left acute financial depression, and work was scarce. Meanwhile many political difficulties threatened. Hitherto no steps had been taken to give effect to the provision in article 12 of the treaty under which, if Northern Ireland decided to remain outside the Free State, a commission of three was to be appointed to " determine in accordance with the wishes of the inhabitants, so far as may be compatible with economic and geographic conditions, the boundaries between Northern Ireland and the rest of Ireland." But with the cessation of civil war Mr. Cosgrave's Government was pressed to demand its application. Immediately threats came from Ulster of resistance by force to the cession of a single inch of territory. Mr. MacDonald's Government attempted to settle the matter by private negotiation, but this failed. The Free State named Professor MacNeill as their representative on the commission; but Northern Ireland refused to make any appointment or recognise the commission in any way. In these circumstances, Mr. J. H. Thomas had much difficulty in finding a chairman. A pledge had been given that he should be a citizen of one of the dominions. Finally, Mr. Justice Feetham, a South African judge, consented to act. But Northern Ireland contended that in that representation, unless they themselves appointed a member, the constitution of the commission would in fact be void.

Threatened Mutiny.—A still more menacing situation arose in March 1924. A group of highly placed officers in the army issued a public demand to the Government that their opinions and interests should be consulted in framing public policy, and they withdrew themselves from duty. Steps were taken to place them under arrest as mutineers, and a fresh outbreak of fighting was narrowly averted, mainly by the personal efforts of Mr. Joseph Magrath, Minister for Labour. Angry debate followed in the Dáil, in which General Mulcahy declared that a secret society had for over a year existed in the army, and that the mutinous officers belonged to it. Mr. Magrath reported that the Fenian Society, or I.R.B., had also its adherents in the army, who influenced promotion in their own interest. The upshot was the resignation of Mr. Magrath, followed by that of General Mulcahy. Mr. Cosgrave in person assumed the post of Minister of Defence. The chief of staff, adjutant-general and quartermaster-general were dismissed. General Mulcahy as a private member moved a vote of censure on the government for these dismissals, but got no support in the Dáil. Mr. Magrath, followed by several other members, who had been prominent first against the British and later against the irregulars, resigned their seats — thus presenting to the country the spectacle of dissensions in the army and dissensions in that section of the original Sinn Fein party which provided and supported the government.

Legislation.—Added to all this was the unpopularity of the government's measures. Mr. Blythe reduced old age pensions from ten shillings to nine shillings. Taxation was severely levied; tenants in default with their land purchase annuities were forced to pay up; citizens who had withheld their income tax during the last years of the British administration, with Sinn Fein's approval, were now called upon for their arrears. More widely felt was the innovation of a customs barrier, causing delay in the delivery of goods; and, in addition, Mr. Blythe decided to embark experimentally on a measure of protection, its main function being a duty of 15% on imported boots.

In this, as in all else, government virtually acted entirely on their own initiative. The Oireachtas (or parliament) indeed had to endorse their acts, but since the republican delegates did not take their seats there was no powerful opposition nor any sustained criticism. Ireland had been traditionally concerned with politics in the abstract; concrete questions (except concerning land tenure) had never occupied the public mind. Thus, legislation was the work of the government, not of the parliament; and there was a great deal of it. Long before his second year of office was completed the Governor General had given his assent to over 100 bills. Many of these were temporary and provisional, but some were of the first importance. One of them indeed was not solely the work of the executive. In framing the new judicial system, government had the advice of a committee over which Lord Glenavy presided. The number of judges and their salaries were reduced, the office of Lord Chancellor disappeared; a supreme court was constituted and a high court, both sitting in Dublin. High court judges no longer went on circuit; a new order of circuit judges was instituted. As regards the magistracy, unpaid justices of the peace were abolished, and stipendiary district justices were appointed to cover the whole country.

Judges of the previous régime were free to retire on rather more than four-fifths of their salary, and most of them did so. In making the new appointments the Government showed a fine disregard of political record, and totally ignored religious differences. By 1925, five out of the nine high court judges were Prostestants and several had been strong Unionists—for example, Mr. FitzGibbon, who became Lord-Chief Justice. The effect of this was to confirm the allegiance already promised by the minority in the Free State; and from leading members of it, notably from divines of the Church of Ireland and of the Presbyterian Church, testimony was offered to the impartiality of the Government.

Yet one part of the legislative and administrative programme occasioned protests from the minority. The constitution had declared that the national language was Gaelic, which perhaps 10% of the existing population used in their homes. The Ministry of Education endeavoured to revive the national language by an intensive campaign in the schools, offering a much higher rate of endowment to those schools where Irish was not only a subject of teaching but the medium of it. Protestants, even when they desired to see Irish studied and preserved, regarded these provisions as unfair. Many of them, however, considered the whole study as a waste of time and money; and unquestionably many Catholics were of the same opinion. This was one great cause of the Government's growing unpopularity.

Yet the more unpopular the Government grew, the more people were forced to see that no alternative to it existed, and there was agreement on the necessity for some force to stand between the citizens and a relapse into anarchy. Ministers showed little disposition to win support by conciliating public feeling. They had succeeded by desperate courage in coming through when the State reeled about them, and they persevered in following out their own ideas. Mr. O'Higgins forced on a drastic bill to restrict the facilities for buying and selling drink; at another moment, with half a score of by-elections pending, he suppressed "goose clubs," a widespread form of Christmas sweepstakes. Mr. Burke, the new minister for local government, by simple administrative act suppressed the corporations of Dublin and Cork and put civic affairs into the hands of commissioners, young men not very well known. There was some outcry, but the country had got into the habit of taking orders; and presently, when the commissioners produced improved administration and reduced the inordinate rates, this experiment was approved. Outside the towns, the ministry abolished district councils, thus throwing more work on the county councils. A tendency to centralisation and even to bureaucratic administration showed itself in all directions.

Such a policy made enemies everywhere, and the weather was no friend to Mr. Cosgrave. A second bad season in 1924 hit the farmers hard, and Mr. Blythe was still levying taxes that were now actually higher than the British scale; for the reduction of income tax from 5/– to 4/6 in 1924 was not followed in the Free State. Also the post office had always been a losing service in Ireland. The new postmaster greatly cut down the public facilities, and kept the stamp at 2d when it was 1½d in Great Britain, and therefore in Northern Ireland. In short, if there had been any alternative ministry the Government would have fallen, but there was none: and the bellicose protestations of republicans kept them in power. Another thing assisted them: when a turn in English politics replaced a Labour Ministry by a strong Tory Government, English ministers kept faith absolutely with Ireland. The difficulty about constituting the boundary commission had been referred by Mr. MacDonald's Government to the Judicial Committee of the Privy Council, which found that without a new Act of Parliament enabling the Imperial Government to appoint a commissioner to represent Northern Ireland nothing could be done.

Parliament was summoned on Sept. 30 instead of on Oct. 28, as had been originally intended, in order to pass through its stages the Irish Free State (Confirmation of Agreement) bill, which had been introduced by the Government at the end of the session. The defeat of the Labour Government on another issue was not allowed to prejudice the Irish settlement, and just before the dissolution the bill was passed by the House of Lords and received the Royal Assent. In the House of Lords, Lord Carson had moved an amendment that confirmation of the bill also be required from the Parliament in Northern Ireland, but in the interests of peace was persuaded to withdraw the amendment, and contented himself with the fact that his protest had been entered in the records of the House. A well-known publicist, from Ulster, was appointed; and the commissioners after long preliminaries in London proceeded to investigate opinion on the border itself during several months in 1925 without the least disturbance. In the meanwhile, from many quarters, but notably from Mr. Cosgrave and his ministers, came utterances to the effect that there was no intention of coercing Ulster. She must choose her own time for uniting, if she chose, with the rest of Ireland. This indicated a departure from the expectations held out by Michael Collins after the treaty was signed, for he led Ireland to hope that the commission's award would transfer so much territory to the Free State that Northern Ireland would not be able to maintain its separate status.

At the opening of 1925 a group of by-elections showed definite support for the Government, and Mr. Blythe's budget of April marked an advance. He reduced the income tax by a shilling and he extended materially the area of protection, claiming that the tariffs already imposed had led to increased employment in the boot trade and minor industries. Broadly, all clothing imported ready made was now subjected to taxation.

This budget really marks the beginning of normal finance. The liabilities for compensation for damage were at last ascertained, amounting to less than £10,500,000, of which under £4,000,000 remained to be paid. The army charge was reduced to something over £3,000,000. Mr. Blythe considered anything over £2,000,000 as abnormal, but necessary in view of the continuing republican menace. The State's normal expenditure he estimated at £24,000,000 and the revenue at £26,000,000. Abnormal expenditure for compensation and the rest he proposed to meet by borrowing.

But it soon became apparent that the ministry were not proposing a mere negative policy of economy, and early in 1925 they committed themselves to a project of utilising the Shannon (*see* SHANNON) for a vast electric power scheme. Nor did this stand alone. By promise of a subsidy amounting to a total of over £1,000,000 a Belgian firm was induced to start the sugar beet industry on a large scale, Carlow being chosen as the site for the central factory. Simultaneously came a whole group of proposals for the development of Irish industry and Irish agriculture, which had been interminably discussed in and out of Parliament during the British régime. They stood committed to a policy of industrial development, having as the pivot of the whole an enterprise so colossal that its possibility had never even been seriously considered under the old order. In the meantime tranquillity returned to the country so completely that it seemed dull. Tourists refilled their old haunts in summer; the Dublin Horse Show enlarged its scope.

The Boundary Question.—In the late autumn a new crisis threatened not only its prestige but its existence. The report of the boundary commission was awaited without emotion, though a London newspaper published a forecast of its decision differing widely from any anticipations that had been formed in the Free State. No plebiscite had been taken;[1] the article gave no instructions for holding one; and it was (rightly) assumed that the commissioners would take it Roman Catholics desired inclusion in the Free State and Protestants inclusion in Northern Ireland. Three important towns, Derry, Enniskillen and Newry had been regarded as possible subjects of transfer to the Free State because in all three Catholics were in a majority. In Newry the proportion was 70%. In two of the border counties, Tyrone and Fermanagh, Catholics were about 55% of the whole. The forecast showed that all the three towns were left as they

[1] Under Article 12 of the Treaty the wishes of the inhabitants were to be considered subject to geographic and economic considerations.

were: no county was transferred as a whole; and the cession to the Free State of districts (for the most part very poor) in Armagh, Fermanagh and Tyrone was offset by the transfer of a rich part of East Donegal. There was a fierce outcry, and President Cosgrave in response to it reiterated the Free State's contention that the commission was only entitled to transfer to their natural destination those parts of the six counties whose inhabitants desired to be in the general body of Ireland. He emphasised also that the claim to Newry was in his opinion indefeasible. These declarations were followed by the announcement that the Free State representation had withdrawn from the commission. Professor MacNeill followed this up by resigning his post on the executive council, and in the Dáil explained that after hearing the evidence he had agreed, for the general good, to sign a unanimous report whose terms were "not dissimilar" to the unauthorised forecast. He had never taken his colleagues in the ministry into his confidence at any point in the work of the commission. But now in view of the expression of opinion he felt that adding his signature to such a finding would only embarrass his colleagues and not produce a settlement.

Both the Government and Professor MacNeill were attacked with great violence in the Dáil and outside it. The Republican leader came into new prominence. Mr. Cosgrave refused to commit himself publicly to any line of action, and went to London. Meanwhile it came to be generally admitted that no member of the commission could invalidate the finding by refusing to sign the report; that the award then issued had immediate effect as law, and that the Free State minority had declared willingness in advance to accept the award. On the other hand, it was loudly declared that any attempt to transfer Free State territory to Northern Ireland would be resisted by arms.

In London, however, negotiations proceeded, and Sir James Craig was summoned from Ulster; and on Dec. 3, a fortnight after Professor MacNeill's resignation, a new agreement was concluded and made public, to which not only Great Britain and the Free States were parties, but Northern Ireland also. It was agreed that the award of the commission should not be published and that the existing boundary should stand. This gave to Ulster all that Ulster claimed, but it gave to Ireland the repose of finality. Further, the treaty was altered by the cancellation of Article 5, under which Ireland assumed liability for the public debt of the United Kingdom as existing in 1921 "in such proportion as may be fair and equitable, having regard to any just claims on the part of Ireland by way of set off on counter claims." This at once liberated the Irish exchequer from an undefined hanging liability injurious to its borrowing power, while it wiped off the British books what most people regarded as an irrecoverable asset. Ireland, however, undertook to repay to Great Britain compensation already paid for war damages in the period 1919–21, and to add 10% to the compensation awarded to claimants for damages suffered in the civil war from 1922 on. The total cost to Ireland was estimated at under £5,000,000.

Legislation embodying the terms of this agreement was carried without difficulty in Great Britain, and the Northern Parliament expressed its satisfaction. But in the Dáil President Cosgrave was angrily opposed by the Labour party and by some of his own followers. Attempts were made by Labour to induce Republican members to come into the Dáil for the purpose of wrecking the agreement, but they failed, and after much talk the Bill was carried by 71 to 20. Business men as a whole regarded the issue as fortunate for Ireland, which now definitely became a country with a total national debt of under £20,000,000 and less than a gross revenue. Other sections found their chief satisfaction, as did President Cosgrave, in the changed relation of the government concerned, indicated in the preamble:—

> The British Govt. and the Government of the Free State being united in amity with the Government of Northern Ireland and being resolved mutually to aid one another in a spirit of neighbourly comradeship, hereby agree . . .

An immediate consequence was the disbandment of the Ulster special police in two of its three branches. There could be no clearer proof that a great cause of danger to Ireland has been definitely removed. It is also plain that while the conduct of this business by President Cosgrave and his colleagues has been criticised, the policy of those who desired to tear up the settlement ran counter to the public desire. The Irish Govt. has been therefore strengthened by a difficulty which threatened its destruction.

Bibliography.—S. L. Gwynn, *The Irish Situation* (1921); D. Figgis, *The Irish Constitution* (Dublin, 1922); W. O'Brien, *The Irish Revolution and how it came about* (1923); A. C. White, *The Irish Free State: its Evolution and Possibilities, etc.* (London, 1923); American Commission on Conditions in Ireland, *Evidence on Conditions in Ireland* . . . (with Interim Report), 2 pts. (Washington, 1921); Dáil Eireann: *Parliamentary Debates;* Saorstát Eireann: *The Public General Acts, 1923* (Dublin, 1925). (S. G.)

II. THE CONSTITUTION

The present political status of the Irish Free State is that of a co-equal member of the community of nations forming the British Commonwealth. It has a written constitution which rests on the provisions of an Act passed by Dáil Eireann sitting as a constituent assembly in the autumn of 1922, entitled an "Act to enact a constitution for the Irish Free State (Saorstát Eireann) and for implementing the treaty between Great Britain and Ireland signed at London on the 6th day of Dec. 1921."[1]

It is provided in this Act that the Constitution shall be construed with reference to the Treaty and that if any provision of the constitution or of any amendment thereof or of any law made thereunder is in any respect repugnant to any of the provisions of the treaty, it shall, to the extent of such repugnancy, be void and inoperative. It is also provided that to the extent to which they are not inconsistent with the constitution all laws in force in the Free State at the time of passing of the constitution are to continue to have full force and effect until repealed or amended by the Oireachtas.

In conformity with practice in the British Commonwealth the executive authority is vested in the King. The governor-general represents and fulfils the functions of the Crown. He is appointed "in like manner as the governor-general of Canada and in accordance with the practice observed in the making of such appointments"—which ensures that the Government of the Free State shall be consulted before any appointment is made. His powers are strictly limited as in the case of the Sovereign in Great Britain, all executive acts being done on the advice of the executive council. The latter consists of not more than seven nor less than five ministers, and is directly responsible to Dáil Eireann, retiring from office when it has ceased to retain the support of a majority of deputies.

Dáil Eireann may not at any time be dissolved except on the advice of the executive council, and Article 53 of the Constitution provides that the Oireachtas shall not be dissolved on the advice of an executive council which has ceased to retain the support of a majority in Dáil Eireann. The Parliament of the Free State cannot therefore be dissolved except with its own consent. The maximum life of a parliament is four years. The president of the Executive council, who is appointed on the nomination of Dáil Eireann, nominates the vice-president and the other ministers who form the Executive Council. The council is collectively responsible for all matters concerning the departments of state administered by its members.

Other ministers, however, who shall not be members of the executive council, may be appointed on the nomination of committee of Dáil Eireann, and these ministers are directly and individually responsible to the Dáil for the administration of their departments. Members of the executive must be members of Dáil Eireann, but this provision does not apply to other ministers. The legislature, known as the Oireachtas, consists of the King and two Houses, Dáil Eireann (the Chamber of Deputies) and Seanad Eireann (the Senate). In the Oireachtas is vested "the sole and executive power of making laws for the peace, order and good government of the Irish Free State."

[1] The Royal Assent was given to the Act passed by the Imperial Parliament to give effect to the Irish Free State Constitution on Dec. 5 1922, and on the next day the King signed the proclamation announcing the adoption of the Constitution.

The Senate.—Seanad Eireann is composed of 60 members, the term of office of each member being 12 years. One-fourth of the members are elected every three years by proportional representation, the whole of the Free State forming one electoral area. At every election a panel of candidates is formed, consisting of three times as many persons as there are senators to be elected. Two-thirds of the panel is nominated by the Dáil, and one-third by the Seanad. In addition to these all persons who have at any time been senators have a right to be added to the panel if they so desire. Candidates, who must have reached the age of 35 years, are chosen on the ground that they "have done honour to the nation by reason of useful public service or that, because of special qualifications or attainments, they represent important aspects of the nation's life." Casual vacancies in the Seanad are filled by co-option, and co-opted members retire at the next triennial election.

The Chamber of Deputies.—Dáil Eireann (the Chamber of Deputies) is composed of members directly elected by constituencies determined by law. The number of members at present is 153. This number may, however, be varied from time to time, but shall not be fixed at less than one member for each 30,000 or more than one member for each 20,000 of the population of the State. In addition each university elects three members. As in the case of the Seanad, election to the Dáil is carried out on the system of proportional representation.

All citizens, without distinction of sex, who have reached the age of 21 years and who comply with the electoral laws, have the right to vote for members of Dáil Eireann, and all citizens who have reached the age of 30 years and who similarly comply with the electoral laws have the right to vote for members of Seanad Eireann. Voting is by secret ballot, and no voter may exercise more than one vote at any election.

Members of both Houses receive an allowance for expenses which is fixed at £360 per annum. Every member of the Oireachtas must take the following oath before taking his seat:—

I.....do solemnly swear true faith and allegiance to the constitution of the Irish Free State as by law established, and that I will be faithful to H. M. King George V., his heirs and successors by law, in virtue of the common citizenship of Ireland with Great Britain and her adherence to and membership of the group of Nations forming the British Commonwealth of Nations.

Powers of the Senate.—The powers of Seanad Eireann are limited. It has no authority to amend a money bill, but may make recommendations to Dáil Eireann regarding such bill within 21 days after a bill certified to be a money bill has been passed by Dáil Eireann. The definition of a money bill given in article 35 of the constitution is adopted from the United Kingdom "Parliament" Act of 1911. There is a proviso that the decision of the chairman of Dáil Eireann as to whether the bill is or is not a money bill may be appealed against before a committee consisting of three members of each House presided over by a judge of the Supreme Court. The Seanad may reject or amend all other bills, and may initiate legislation, but a bill passed by the Dáil which has not been passed by the Seanad 270 days after it was first sent to the Seanad is deemed to have been passed by both Houses in the form in which it was last passed by Dáil Eireann. Any bill passed or deemed to have been passed by both Houses may be suspended for a period of 90 days on the written demand of two-fifths of the members of Dáil Eireann or of a majority of the members of Seanad Eireann presented to the President of the executive council not later than seven days from the day on which such bill shall have been so passed or deemed to have been so passed. During the period of suspension the bill shall be submitted to a referendum if so demanded by one-twentieth of the voters on the register or by three-fifths of the members of the Seanad. These provisions do not apply to money bills or to bills declared by both Houses to be necessary for the immediate preservation of the public peace, health or safety.

Defence.—The Oireachtas has the exclusive right of raising and maintaining armed forces in the Free State, but under the provision of the treaty the army shall not exceed in size such proportion of the army in Great Britain as that which the population of Ireland bears to the population of Great Britain. Save in the case of actual invasion the Irish Free State shall not be committed to actual participation in any war without the assent of the Oireachtas.

Nationality, etc.—Every person domiciled in the Free State at the time of the coming into operation of the constitution, who was born in Ireland or either of whose parents was born in Ireland, or who has been ordinarily resident in the area of the jurisdiction of the Free State for not less than seven years is entitled to citizenship in the Free State. No title of honour in respect of services rendered in the Free State may be conferred on any citizen without the consent of the executive council. Freedom of conscience and the free profession and practice of religion are, subject to public order and morality, guaranteed to every citizen. No law may be made to endow any religion or to give any preference or to impose any disability on account of religious belief. No discrimination may be made as respects state aid between schools under the management of different religious denominations.

Court of Appeal.—The constitution provides that the Supreme Court of the Free State is a court of final appeal and that its decision shall not be reviewed by any other court, tribunal or authority whatsoever, provided that nothing in the constitution shall impair the right of any person to petition His Majesty for special leave to appeal to His Majesty in council or the right of His Majesty to grant such leave. There is no provision, however, that decisions by the King in council shall be binding on Irish Courts.

The judges of the Supreme Court and of the High Court and of all other courts established in pursuance of the constitution can only be removed for stated misbehaviour or incapacity and then only by resolutions passed by both houses of the Oireachtas. See J. G. Swift McNeill, *Studies in the Constitution of the Irish Free State* (Dublin, 1925). (J. G. D.)

III. DEFENCE

The evacuation of the British garrisons from Free State territory began with the ratification of the Anglo-Irish Treaty by Dáil Eireann in Jan. 1922. Dublin was held until the treaty was finally confirmed 11 months later, and then handed over to detachments of the Irish Republican Army which had given adherence to the Provisional Government.

Administration.—As a result of an inquiry into the civil war which began in June 1922, and the mutiny of March 1924, changes were made in army administration. The command-in-chief is now vested in the executive council and exercised throughout in the name of the Minister of Defence who, however, may not allocate to himself any executive military command. He is assisted by a council of defence, composed of a civil member acting as Parliamentary Secretary to the Minister and responsible for the finance of the Defence Forces, and by three military members, the chief of staff, the adjutant-general and the quartermaster-general, whose business it is to deal with training, organisation, equipment and discipline.

The Army Vote for the year ending March 1926 was £3,076,774, and the strength of the forces amounted to 1,053 officers and 16,187 non-commissioned officers and men. The Free State is divided into four military districts—the Eastern, Western and Southern Commands, and the Curragh camp where all recruits undergo their training. Head-quarters of the three commands are at Dublin, Athlone and Cork, and are in charge of major-generals. There are nine brigade districts, and the infantry are organised in 27 battalions. The remaining services are air, artillery, armoured car, engineers, signal, military police, medical and transport Corks, a school of music and a military college. There is an Irish-speaking battalion and all officers and non-commissioned officers are instructed in giving and receiving executive words of command in both Gaelic and English. The strength of the Air Force is 18 officers, 131 other ranks and 18 machines.

Defence Provisions of the Treaty.—Under the Irish treaty it was agreed, with a view to securing the international limitation of armaments, that the Irish Defence Forces should not exceed in relation to military establishments maintained in Great Britain the proportion which the population of Ireland bears to that of Great Britain. The treaty also provides that defence by sea of Great Britain and Ireland shall be undertaken by Imperial forces. After five years from the date of the treaty (Dec. 6 1921) a conference is to be held with a view to Ireland undertaking a share of her own coastal defences. Harbour defences at Berehaven, Queenstown and Lough Swilly remain in charge of British care and maintenance parties. In time of war or strained relations with a foreign power the Free State is pledged to afford such harbour and other facilities as the British Govt. may require for purposes of defence. (J. W. Go.)

IV. EDUCATION

Since taking control, the Government of the Irish Free State has carried through changes in the educational system.

The first step was to unify control over educational matters under a Minister for Education. This involved the abolition of the three independent bodies through which, previous to 1922, education in Ireland was financed. The powers exercised by the Board of National Education were at once taken over by the Free State Ministry. The programme for primary schools has been considerably modified with a view to making it simple, concentrated and national. Attention is concentrated on fundamental subjects, Irish, English, reading, writing and arithmetic. Provision is made for studying local needs in applying this programme in any given locality. The salary question had already been satisfactorily settled under the British régime.

As regards tenure and method of appointment of teachers the old managerial system, under which the power of appointment and dismissal lay, under certain limitations, with the manager of the school (usually a clergyman) has been retained. This system means that each religious denomination controls the appointment of teachers in schools attended by the children of that denomination. The old "National" system provided for combined literary and moral and separate religious instruction for pupils of different religions. The regulations provide that opportunities must be afforded to the pupils of all schools for receiving such religious instruction as their parents or guardian approve. Religious instruction is given at a time not counted when computing attendance, and does not come under the supervision of the officers of the Department. An outstanding defect inherited from the old régime, the absence of any real system of compulsory education, will be rectified at an early date. A bill described by the president of the Free State Executive as "of a drastic type" has been laid before the Oireachtas.

Important changes with regard to the training of teachers are being introduced. It is proposed to establish six preparatory colleges for candidates for the training colleges, five of these are to be situated in those districts in which Gaelic is still a living language, and staffed with teachers capable of teaching the secondary school programme entirely through the medium of Irish. In this way the future teachers will enter the training colleges as fluent speakers, and having passed through a complete secondary course given in Irish. Thus a supply of teachers will be secured capable of carrying through the Department's programme for primary schools, aiming at the restoration of Irish as the vernacular.

Secondary Education.—As regards secondary education a wider problem confronted the Government. The administration of the funds devoted to this branch was still hampered by the clause of the Intermediate Education Act of 1878 which prescribed that results fees were to be paid to schools on the results of a general public examination. A system, advocated by the Intermediate Board in its Report of 1916 and by the Viceregal Committee on Secondary Education set up in 1918, has been brought into operation by the present Government. Payment by results has been replaced by a capitation grant, dependent on the reports of inspectors, who will take into account every feature of the school. The old rigid system with its fixed programme has been replaced by freedom, and examinations have been reduced to their proper place.

A salary scheme for teachers in secondary schools has been put into force. Under it, men teachers are to receive from state funds 10 annual increments of £12 each, and subsequently six annual increments of £15 each, while women receive 12 annual increments of £10 each. Holders of an honours degree of an Irish or British university receive additional increments.

The Intermediate Education Board was replaced by two commissioners in June 1923; and as from April 1 1925 their functions were transferred to the Minister for Education. The funds provided by the Act of 1878 and subsequent Acts for secondary education were transferred to the Department of Finance. In future education in the Free State will be financed out of sums annually voted by Parliament. Technical instruction has been placed under the control of the Minister for Education, retaining the organisation under local committees.

In 1925 there were 5,636 primary schools in the Irish Free State, with a total of about 500,000 pupils, and 286 secondary schools providing for 25,600 pupils. There were also 60 technical schools, with 21,800 pupils; 5 training colleges for primary teachers, with 820 teachers in training; while the names on the register of secondary teachers numbered 2,083.[1] (W. F. B)

V. ECONOMIC AND FINANCIAL HISTORY

The area of the Free State is 17,019,155 statute acres, made up as follows in 1918:—

Area under	Statute acres
Crops	4,406,105
Grass	7,775,137
Mountain lands, grazed	2,124,190
Mountain lands, barren	466,272
Woods and plantations	248,878
Turf bog	766,353
Marsh	339,297
Water, roads, fences town and building ground, etc.	892,523

In 1914, the valuation of the rural districts was £8,741,631 and of the urban districts £2,391,170, the total valuation being £11,132,801.

Population.—The last census of Ireland was taken in 1911. In 1911 the population of the 26 counties composing the Free State was 3,139,688, being 71·5% of the total population of Ireland; in 1925 it was estimated at 3,163,000.

In 1924, the number of marriages registered was 14,822, being 4·69 per 1,000 of the population, the number of births was 63,402, being 20·06 per 1,000 of the population, and the number of deaths was 45,180, being 14·29 per 1,000 of the population. While the reduction in the mortality from tuberculosis has been steady and continuous for many years, the death rate from cancer is increasing. Of the total deaths at all ages 15·2% were deaths of children under five years of age, and the number of deaths of infants under one year was equivalent to a rate of 7·2% of the birthrate. Infantile mortality is decreasing year by year.

Practically no emigration took place from Ireland during the War. It is estimated that the number of emigrants to "places out of Europe and not within the Mediterranean Sea" was 15,000 in 1922, 20,570 in 1923, and 19,077 in 1924. Of the emigrants in 1924, 12,016 were bound for the United States, 5,237 for British North America, 1,138 for Australia, 192 for New Zealand, 160 for British South Africa, 112 for India and 222 for other countries. The population of the Free State is overwhelmingly rural. There are only two towns with more than 50,000 inhabitants, namely, Dublin and Cork, and two others with more than 20,000, namely, Limerick and Waterford.

In 1911 the population of the 26 counties now forming the Free State contained 2,812,509 Roman Catholics, 249,535 members of the Church of Ireland, 45,058 Presbyterians and 3,805 Jews. The great majority of the population were English-speaking, but 16,869 spoke Irish only, and 536,848 were bi-lingual. Of persons aged nine years and upwards, 260,694 could neither read nor write, and 74,001 could read but could not write. The number of houses in the 26 counties in 1911 was 642,541, or one house for 4·88 inhabitants.

Agriculture.—The total acreage under crops was 3,832,240 in 1922; 3,739,146 in 1923; and 3,783,823 in 1924. The following are figures of acreage under crops and numbers of livestock in the Free State in 1922–3–4:—

Crops	1922	1923	1924
Wheat	34,469	31,764	27,465
Oats	813,970	785,939	756,313
Barley and bere	167,765	151,309	163,642
Rye	6,142	6,414	6,424
Beans and peas	447	428	408
Flax	4,915	8,066	10,499
Fruit	10,924	10,795	10,652
Hay	2,062,694	2,026,841	2,099,639
Live Stock	**1922**	**1923**	**1924**
Cattle	4,326,294	4,215,253	4,194,189
Sheep	3,067,473	2,994,420	3,127,921
Pigs	919,449	1,555,905	937,814
Goats and kids	192,298	195,022	193,484
Horses used in agriculture	306,552	312,410	308,552
Unbroken horses	122,549	96,888	79,988
Mules and jennets	25,276	23,919	23,160
Asses	221,991	220,468	218,439

There are 442,606 agricultural holdings, of which 86,033 are less than one acre, 223,991 above one and not exceeding 30 acres, 130,807 above 30 and not exceeding 500 acres and 1,775 above 500 acres.

[1] *Annual Report of the Department of Education* (April 1926).

Unpublished official figures show that the percentage of land ploughed varies inversely with the size of the holding; that for equal acres of crops and pasture, the number of livestock (especially milch cows, pigs and poultry, and excepting sheep) rapidly increases as the size of the holding diminishes; and that the larger the percentage of land tilled, the larger the number of animals supported.

The cultivation of cereal crops plays a comparatively unimportant part in the agricultural economy of the Free State, and the bulk of the attention of the farmer is devoted to the raising of stock. As between the production of beef and of dairy produce, conditions vary in different parts of the country. In certain areas the soil, climate and type of holding favour the production of dairy breeds; in others beef breeds are predominant.

In accordance with detailed recommendations made by the Commission which reported in 1924, an Act was passed (No. 35 of 1924) providing for the testing, grading and packing of exported eggs, for the prohibition of the export of dirty or bad eggs, and for the registration of all premises where grading, packing or preserving is carried on. Another Act (No. 58 of 1924) made elaborate provision for the regulation of the butter trade. Butter can now be exported only by registered creameries, factories or exporters, and must be packed and marked in a specified manner. The most minute regulation of creameries and factories is insisted on, and provision is made for the establishment at a later date of a national mark or brand for creamery butter. The licensing of bulls was made compulsory by another statute (No. 3 of 1925). This measure, together with the Government's scheme for providing premium bulls and boars and for subsidising the purchase of pedigree rams, has resulted in levelling up the standard of the livestock in the country. Owing to the acute agricultural depression in 1924, power was given to county councils to abate rates on agricultural land for the year ending March 31 1925 and the budget of 1925 provided for the doubling of the agricultural grant.

Early in 1925 serious losses were sustained by farmers in many districts as a result of the prevalence of fluke disease. The Government supplied farmers in the affected areas with cheap supplies of suitable medicine and granted credit facilities to assist in the restocking of farms. £100,000 was provided from public funds for the purpose of making loans through the channel of co-operative credit societies in the districts concerned.

Land Purchase.—The total amount of the purchase money for which advances have been made under the Land Purchase Acts of 1870–1909 in respect of lands in the Free State is £99,110,046, the total area comprised in the sales being 11,159,356 acres. In addition, there are pending proceedings for which agreements for purchase had been entered into under the acts of 1903–9 representing a purchase money of £830,000 and an area of 120,000 acres. The British Govt. assumed responsibility for the completion of all sales pending at the date of the Treaty.

The Land Act of 1923 aimed at attaining the dual object of completing land purchase and relieving congestion. This Act provided for the creation of land bonds, bearing interest at the rate of 4½% in which all payments to landlords and encumbrancers were to be made. These bonds were later guaranteed, as to principal and interest, by the British Government. Advances made to purchasers were to be repaid by an annuity at the rate of 4¾% of the amount advanced, and the price to be paid was roughly equal to about 15 years purchase of the value of the holding, of which the Government contributed 10% in relief of the tenant. Very wide powers were given to the Land Commission to acquire untenanted land for the creation of holdings in relief of congestion, and to consolidate and exchange holdings with the same object.

The area of untenanted land already acquired by the Land Commission and the late Congested Districts Board and utilised for the relief of congestion amounts to 820,000 acres. Advances were authorised to be made to tenants of uneconomic holdings, tenants exchanging their holdings, persons who had been evicted and labourers who had lost their employment through the progress of land purchase. The money required by the Land Commission for making roads, fences, drains, etc., and for erection of buildings on newly created holdings is provided out of public funds, and so much as the Land Commission decides can be repaid by the purchasers is made repayable by them along with their purchase annuities. All arrears of rent due before the first gale day of 1920 were wiped out; but rent due after that date (subject to 25% reduction) was made recoverable.

It is estimated that advances amounting to £30,000,000 will be required to complete land purchase under the 1923 Act. As regards tenanted land, holdings situated on 6,000 estates have to be dealt with, while as regards untenanted land, the Land Commission has inspected or is making inquiries in respect of 750,000 acres, with a view to their acquisition for the purpose of distribution; and of this area the Land Commission has acquired or entered into agreements for the acquisition of over 100,000 acres.

Congested Districts Board.—The Congested Districts Board was dissolved in 1923 and its functions transferred to the Irish Land Commission. (Land Law, (Commission) Act, 1923, No. 27 of 1923.) By the Ministries Act of 1923 the agricultural and land branches of the Congested Districts Board were put under the Minister of Agriculture and the fisheries and rural industries branches under the Minister of Fisheries.

Fisheries.—The work formerly done by the Department of Agriculture and the Congested Districts Board in connection with the fisheries and with rural industries has now been transferred to a separate Ministry, whose policy is to develop the deep sea fisheries and to organise the home demand for fish, which is at present very small. The Government is helping the fisheries by making loans for boats and gear, erecting and maintaining curing stations, and subsidising fishery schools. A brand for mackerel has been instituted. One urgent requirement is being delayed for financial reasons, namely, a second patrol boat to keep the coast free from the numerous foreign trespassers who at present infest it.

Manufacturers.—Ireland was, even before partition, an overwhelmingly agricultural country, but the predominance of agriculture became greater than ever after the exclusion of the six counties. The Agricultural Commission reckoned that three-quarters of the real wealth produced in the Free State is farm produce. Too great dependence upon any one industry is always undesirable, and the government has taken steps to redress the unequal balance between the agricultural and manufacturing industries. The object aimed at by the government's policy is the development, not of large-scale urban industries, but of rural industries, especially those concerned with the working up of agricultural produce.

The treaty left the Free State at liberty to frame its tariff policy as it chose. There was a widespread popular belief that Irish industry could best be revived by the adoption of a high protectionist tariff, and the Government appointed a small committee of economists to inquire into the probable effects of protective duties. The report of this committee was strongly free trade in tone. It pointed out the numerous factors, besides external competition, that operated to retard the growth of industry in Ireland. The necessity for a dominantly agricultural country of the lowest possible prices of raw material and consumable commodities was pointed out. Nevertheless the Government proceeded to institute a number of experiments in protection.

The Finance Act of 1924 imposed a duty of 3⅜d per lb. on sugar confectionery, of 6d per lb. on cocoa preparations, of 10% ad valorem on candles, 15% ad valorem on boots and shoes, 33⅓% on glass bottles (not white glass) and 10% ad valorem on soap. The McKenna duties were altered so as to provide encouragement for the building of commercial motor bodies, and the imperial preference on manufactured tobacco was abolished. The Finance Act of 1925 went a good deal further in the same direction, but the Minister for Finance declared that the new duties were purely experimental in nature. This Act imposed a duty of 15% ad valorem on clothing, wearing apparel, blankets, and blanketing, and 33⅓% on bedsteads and wooden furniture; the duty on bottles was extended, and an additional duty of 10% was put on toilet soaps. On the setting up of the customs barrier in 1923 the manufacture of tobacco automatically secured a small measure of protection. The only corresponding steps taken in the direction of free trade were the repeal of the Dyestuffs Import Regulation Act, the Safeguarding of Industries Act, and the McKenna duties on gramophone records.

At the same time, some important revenue duties were abolished or reduced. It would appear, however, from the cost of living index numbers that the result of the new tariff (in conjunction with other causes, such as high wages and a bad system of retail distribution) has been to prevent the cost of living in the Free State from being reduced at the same rate as in Great Britain. This is shown by the following table:—

Cost of Living Index Numbers (Basis: July 1914 = 100)

Month	Free State			Great Britain and Northern Ireland		
	1923	1924	1925	1923	1924	1925
January	190	188	195	178	177	180
April	181	178	188	174	173	175
July	180	183	188	169	170	173
October	186	193	188	175	176	176

In addition to giving the protective assistance outlined above, the Government has endeavoured to encourage industry by means of subsidies, the development of cheap sources of power, and the pro-

vision of credit facilities. The growth of sugar beet and the manufacture of beet sugar were encouraged by the grant of a subsidy payable for 10 years to persons manufacturing in the Free State sugar from home-grown sugar beet. A large Belgian-Czechoslovakian group, encouraged by the subsidy, has arranged to open a sugar beet factory in Carlow.

An important attempt is also being made to provide the Irish manufacturer with cheap power. The Government sought the advice of Messrs. Siemens-Schückert, who drew up a scheme for utilising the great water power of the Shannon (*q.v.*). Another method by which the Government attempted to encourage industry was by helping enterprises to obtain capital on easy terms under the Trade Loans Guarantee Act (No. 41 of 1924). The maximum amount that might be advanced under Government guarantee under the Act was fixed at £750,000. The Minister was further authorised to grant or to guarantee loans proposed to be raised by any public authority or any association of producers or consumers "calculated to promote a reduction in the retail prices in Saorstát Eireann of essential commodities." The maximum grant under this action was limited to £50,000, and the maximum grant and guarantee together to £250,000. By an amending Act (No. 19 of 1925) the period in which this assistance might be rendered was extended; and the Finance Act of 1925 provided for the advance of £300,000 to the National Land Bank for the purpose of trade loan guarantees. Finally the Ministry of Industry and Commerce has set up advisory committees in more than 30 of the principal industries to assist the Government in acquiring information and in forming policy.

Banking.—All the banks having their head offices in the Free State have numerous branches in Northern Ireland, and two of the Belfast banks have numerous southern branches. Shortly after the treaty, the Belfast Bank, which is affiliated with the Midland Bank, sold its branches situated in the Free State to the Royal Bank of Ireland. The Free State Government holds all the shares in the National Land Bank. The Government's banking business, with a few minor exceptions, is transacted by the Bank of Ireland. The Agricultural Commission recommended the formation of a department for granting long term loans to farmers to be capitalised by the existing banks jointly, but this recommendation has not been followed. Recently, there has been formed a company known as the Industrial Investment Trust for the purpose of affording financial assistance to industry by means of long term loans. The National loan, both as regards principal and interest, is repayable in sterling, as are also the bonds created under the Land Purchase Act. The authorised issue of the six Irish banks of note issue is £6,352,000, and the average circulation of these banks' notes in May, 1925, was £16,364,000, against which £10,688,000 was in gold and silver coin.

Trade.—The customs barrier between the Free State and Northern Ireland was set up in April 1923, but it was not until the beginning of the following year that accurate values of imports and exports were obtained. The trade figures for 1924 are as follows:—

Class	Imports 1924 £	Exports 1924 £
1. Food, drink and tobacco	29,523,000	41,549,000
2. Other raw materials	6,314,000	2,499,000
3. Other manufactured goods	29,204,000	2,593,000
4. Live animals not for food	770,000	1,816,000
Totals	65,811,000	48,448,000

During the first nine months of 1925 the value of imports was £45,225,383, of exports £29,623,566 and of re-exports £814,034.

It is probable that, if a full account of the international balance of indebtedness were obtainable, it would appear that the invisible items would more than make up for the adverse visible trade balance. Very large sums are received from British and foreign investments, and from emigrants' remittances from America. On the other hand, the Free State remits large sums on account of land purchase annuities and pensions. There is no sign, as far as can be gathered from banking or stock exchange sources, that the Free State is living on its capital.

Communications.—In 1914, there were in Ireland 28 railway companies operating 3,454 miles of line. The Irish railways were placed under the control of the British Government in 1917 and were released in August, 1921, a few months before the treaty. During the control period, the net receipts for 1913 were guaranteed, and on the cessation of control the Government paid the railways £3,000,000 in full settlement of all claims. Meanwhile, wages had been raised by about 200%, while freight and passenger rates had been raised only by 120 and 100% respectively. The resulting difficulties led to the Railways Act of 1924, modelled on the British Act of 1921, for amalgamating all the lines situated wholly in the Free State. On Jan. 1 1925, came into being the new Great Southern Railway, comprising all the companies in the Free State but excluding the Great Northern Railway (Ireland), which is partially situated in Northern Ireland. The average weekly receipts of the Great Southern Railway in 1925 were £12,500 lower than in 1924, and the interim dividends on the ordinary and preference shares due to be declared in July were passed. All classes of stock have fallen heavily in the market. The conditions which prevail in the Free State render the competition of the road vehicle very formidable; the average journey is short, and many places in the country are several miles from a railway station. The number of motor vehicles and cycles increased in two years from 22,240 to 36,836.

Finance.—The following table shows the revenue and expenditure of the Free State from 1922 to 1925:—

Year	Revenue	Expenditure	Deficit
	£	£	£
1922–3	28,611,600	31,395,589	2,783,989
1923–4	31,869,628	42,792,312	10,922,684
1924–5	27,542,200	29,718,631	2,176,631

The Minister of Finance, in introducing the 1925 budget, stated that the total amount payable out of the public funds of the Free State in respect of compensation for property losses and personal injuries, both pre-truce and post-truce, would not exceed £10,300,000, a considerably lower figure than had been at one time anticipated. Compensation for pre-truce damage would amount to about £7,660,000, towards which Great Britain would contribute about £3,560,000; and the damage committed after the truce would account for about £6,100,000. When the abnormal army expenses had been reckoned, and the consequential losses to trade and industry taken into account, the civil war had cost the people at least £30,000,000. In view of the greatly improved condition of the national finances, he proposed to meet about £6,000,000 of the estimated expenditure of £30,000,000 for 1925–6 by borrowing, as it was of an abnormal and non-recurrent character, and to relieve the taxpayer by lowering the income tax and making large reductions in indirect taxation.

Public Debt.—In Nov, 1923, the Irish Free State floated its first loan. The nominal amount raised by this loan was £10,000,000. The interest offered was 5% and the issue prices 95, the flat yield being thus about 5¼%. The loan is redeemable at par between 1935 and 1945. The Minister of Finance authorised the statement that both principal and interest would be paid in sterling. The loan was a great success, being oversubscribed in the Free State; no part of it was underwritten or taken by the banks. Provision was shortly afterwards made for the satisfaction of persons who had contributed to the official Sinn Fein loans floated during the Anglo-Irish fighting. Irish subscribers were to receive savings certificates, and subscribers elsewhere were to have their holdings redeemed.

The indebtedness of the Free State on Nov. 28 1925, was £13,483,693, made up as follows: Ways and means advances by public departments, £1,530,000; annuities under Telegraph Acts, £202,944; savings certificates, £1,488,000; national loan, £9,760,859; compensation stock, £501,850. The price of the national loan on Jan. 9 1925 was 98¼ and of compensation stock 93⅜. The agreement made between the British and Free State governments in Dec. 1925, provided that the outstanding liabilities of the Free State under the treaty in respect of the British National Debt should be settled by an annual payment of £250,000 for a period of 60 years.

Taxation.—The system of taxation in operation at the time of the treaty was taken over and, owing to the difficult financial situation created by the civil war, no reductions were attempted for a couple of years. In the years 1923–4 and 1924–5 the income tax was maintained at the rate of 5s., and the corporation profits tax was retained. In both these respects, the Free State taxes were higher than the British. The budget of 1924 reduced the super tax on very high incomes, and reduced the tea duty from 8d. to 5d. per pound. In 1925 the income tax was reduced to the British rate of 4s., and the exemption limit to corporation profits tax was raised. The duty on sugar was considerably reduced and imperial preference in that commodity discontinued, and the duties on tea, coffee, cocoa and chicory were abolished. The relief which the taxpayer might have derived from these concessions was counterbalanced by the burden of the new protective duties.

In addition to the sums raised by national taxes, the following sums were raised by local taxation: Year ending March 1922, £6,762,672; March 1923, £4,153,060; March 1924, £5,327,341.

The total (national and local) taxation amounts to £8 19s. 5d. per head of the population and the public debt amounts to £4 5s. 3d. per head. The debt is equal to 58·4% of the annual revenue.

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European Reconstruction Series, *Ireland* (March 15, May 10, July 26 1923); *Report of the Fiscal Inquiry Committee* (1923); *Report of the Commission on Agriculture* (1924); *Annual Reports of the Registrar-General (Ireland) on Marriages, Births, and Deaths* (1924); *Merchant Shipping List and Postal Directory* (1925); *Official Customs and Excise Tariff* (1925); *Report of Committee on Economic Statistics* (1925).

See also E. J. Riordan, *Modern Irish Trade and Industry* (1920); W. L. Micks, *History of the Congested Districts Board* (1925).

(G. O'B.)

IRISH LANGUAGE (*see* 5.622).—It is difficult to say with any certainty how far the Irish language has maintained itself in Ireland since 1910. The action of Dáil Eireann in making it the official language of their first meeting, nothing else being spoken on that day, gave a great stimulus to it in popular estimation. The Dáil did not, however, live up to the headline thus set. Speeches there are seldom made in Irish, and practically never in the Senate, where not a dozen, perhaps not more than half a dozen of the 60 Senators could understand, much less speak it. It was decided, however, that all legislation must be passed in both English and Irish, and an efficient staff of Irish scholars and translators was retained for this purpose.

Several books written in Irish were translated into German, Swedish and Norwegian. Dr. Pokorny of Berlin published translations of some of Pearse's, O'Conaire's and O'Siochfhradha's stories under the not very felicitous title of *Die Seele Irlands* (Max Niemeter, Halle, Saale). From this book the reader will get a good idea of the short story in contemporary Irish literature. Dr. von Sydow of Lund University translated Father O'Leary's novel *Séadna* into Swedish. Käte Müller-Lisowski published, with notes and introduction, in 1923 a volume containing 39 Irish folk-tales. She had previously translated Dr. Hyde's "True Storyteller of the Week." Dr. Reidar Christiansen also published an illustrated volume of Irish folk-tales in Norwegian.

Irish was recognised as the national language by the Dáil, and a corollary to this recognition seemed to be that it should be taught in the primary schools of the Free State, and so far as the schools are concerned the Government made great efforts to Gaelicise them. Naturally one of the principal difficulties that the new Government had to face was the fact that the great majority of the teachers were not qualified to teach Irish, much less to use it as a medium for teaching. With a view to remedying this, annual courses for the training of teachers in Irish were established in 1922. The courses for primary teachers extended over eight weeks in 1922, five weeks in 1923 and four weeks in 1924. Approximately 12,000 teachers attended annually at about 180 centres or colleges. The cost in 1922 was £76,000; in 1923, £66,000; in 1924, £42,500; and in 1925 about £45,000. Similar courses were held for about four weeks in each of the years 1922–3–4–5, at a cost of between £3,000 and £4,000 per year, for teachers employed in secondary schools.

Formerly many people might have been noticed, especially young men and women, wearing a gold ring on their dress in the streets of the bigger cities and towns. This was to show that they spoke Irish and wished to be addressed in that language. It was observed that many of these people came to a violent end, and the wearing of this ring was consequently to some extent discontinued. It is significant that after the formation of the Free State the wearing of this ring was largely resumed. For examinations held under the auspices of the civil service commission in the Irish Free State Irish was made an essential subject. Indeed, it seems certain that a knowledge of Irish will be in future years a necessity for all aspirants to Government posts and that no young man who does not know something about it will be looked upon as properly educated. From 1927–8 forward Irish is to be compulsory in all secondary schools.

Finally, it may be said that whilst the reading, writing and speaking of the Irish language increased very much during this period in the towns, amongst the cultured classes in the north-west, west and south, where it was naturally spoken, it did not fare so well; in many of these places barely holding its own against English. (D. Hy.)

IRISH LITERATURE: ENGLISH (*see* 5.622).—The literary revival in Ireland was the first evidence of a resurgent national spirit. It had its origin in the study of the older heroic literature and of the folk poetry which still existed in Irish.

Poetry.—Its first expression was in poetry which retained the double mark of its origin set in W. B. Yeats' work to a standard of well-nigh perfect artistry and marked in George Russell's ("Æ") writings with a profound consciousness of the divine origin and destiny of man. In time the poets broke away from folk themes which were becoming a mannerism but not before Padraic Colum had written verses of grave, deliberate beauty and Joseph Campbell had used similar material effectively but not without sophistication.

By 1910 the group of young poets, whose association in *New Songs* (1904) gave the appearance of a school, had broken bounds. Seumas O'Sullivan had perfected his fastidious art and begun to show the shift of interest from country to town together with a new and mordant note. A transition to prose marked the passing of youth and the coming of age of the movement. Movement now it could hardly be called. It had become a diverse development of personality. James Stephens' *Insurrections* (1909) may be taken as the turning point. Passing indifferently from poetry to prose and back again, reincarnating in both forms and in a modern spirit the old prose sagas or the 17th century poetry of O'Bruadar, O'Rathaille and Keating, passing from *The Charwoman's Daughter*, a Dublin slum idyll, to the riotous invention of the *Crock of Gold* and *Demi-Gods*, and exhibiting at each turn the same leaping, exuberant fancy and the same wise and witty humanity, Stephens fitly represents the transition from the older generation and the growing attraction to prose.

One mentions the poets of the Rebellion, Pearse, MacDonagh and Plunkett, executed in 1916, the tragic intensity of Dora Sigerson Shorter and the name of Francis Ledwidge, killed in Flanders in 1917, whose verse is lit throughout with sudden glimpses of natural beauty. Since their date one powerful poetic talent has appeared with Austin Clarke, whose eager imagination is fitly exercised in epic subjects. F. R. Higgins has written some charming verses but his output is still too small to write of him with assurance. Equally limited but more derivative is the work of H. Stuart in whom the later rhythms of W. B. Yeats are faintly echoed.

Prose.—The transition to prose synchronised with growing pre-occupation with public affairs. Æ's prose of imaginative revery sharpened in his attempt, *The National Being*, to shape a national polity and to bring back the thoughts of his countrymen from the frontiers and surfaces of political controversy to their spiritual base. His book has left its imprint on the Irish Constitution. In *The Interpreters*, written when political controversy had come to an issue, he breaks away characteristically from the passing shows of things to track political moods back to spiritual origins and "to relate the politics of Time to the politics of Eternity." Here and in *The Candle of Vision*, a book of pure mysticism, where he explores the creative imagination in an attempt to discover the operation of the divine imagination in the mind of the individual artist, George Russell's prose reaches its height. The chief stimulating literary influence of his period, and always more interested in life than in the shadows of life. Æ's work reconciles the superficial conflict of national and universal art. The aim of the former was clearly expressed in the writings of Pearse and MacDonagh—Pearse in his *Irish Anthology* and in a remarkable series of pamphlets, the most effective political writing since John Mitchell's, and MacDonagh in his analysis of Gaelic verse-forms and the Irish way of speech on Anglo-Irish literature. This form of criticism, the result of the language movement, has been reinforced by Daniel Corkery in a study of the Irish schools of the 17th and 18th centuries and is a growing formative influence on the younger writers.

The rebellion of 1916 played an inevitable part in the novels of this period, of which Eimar O'Duffy's are the most notable, but the psychology of its participants is best studied in Corkery's short stories, wherein whoever cares for the artistic presentation of a passionate human struggle will find a clear glass. His single novel, *The Threshold of Quiet*, written before 1916, is a study in

futurity and self-immolation, a shadow-play in whose penumbra the characters dwell in intense if quiet reality. The other significant novel of this period is Colum's *Castle Conquer*. The premature death of Seumas O'Kelly was a grave loss to Irish literature; his *Weaver's Grave* is the best short story that has come out of Ireland. Succeeding disillusions born of civil war is expressed in the recent work of Liam O'Flaherty, where a powerful creative faculty atones for much brutality. There remains the unique figure of James Joyce, the delicately stepping grace of whose *Chamber Music* is in singular contrast to his experimental, amorphous prose.

Drama.—John M. Synge, the outstanding dramatist of the Abbey Theatre, died in 1910. He founded no school, his tragic imagination was not hereditable, and without that inheritance it would be grotesque parody to imitate his manner of imaged, highly coloured speech. Colum was the earliest of the peasant playwrights; his best play, *Thomas Muskerry*, was produced at the Abbey in the year of Synge's death, and it was to his idiom that the new dramatists returned. Colum studied the peasant in relation to his surroundings. His fable was always significant, his construction taut and solid, his dialogue unforced. St. John Ervine treated of certain situations peculiar to North East Ulster with some effectiveness, but most of the newcomers developed only the genre study of the individual, detaching him from his *milieu* and leaning too often to melodrama or farce. Lady Gregory has comic verve and inexhaustible invention, but to the Abbey repertoire her exuberant and uncritical talent added nothing save *The Image* (1910) to surpass her early *Spreading the News* and *The Rising of the Moon*. Her real work lay in the administration of the theatre through stormy days. The notable newcomers before 1923 were Lord Dunsany, T. C. Murray and Lennox Robinson. Dunsany's highly personal talent ranges from the grotesque horror of *A Night at the Inn* and the *Queen's Enemies* to the imaginative conception of *The Gods of the Mountain* and *The Tents of the Arabs*. He has singular inventiveness, verbal felicity and at his weakest can construct a charming fable. T. C. Murray's seven plays, of which *Birthright* (1910), *Maurice Harte* (1912) and *Autumn Fire* (1924) are the chief, show a strong sense of dramatic situation with a capacity for easy, beautiful prose. Lennox Robinson, *Harvest* (1910) *The Whiteheaded Boy* (1916), *The Lost Leader* (1918), possesses a less acute sense of dramatic construction, but has an unusual talent for inventing interesting character.

The period under review closes in Dec. 1925 with the coming of age of the Abbey Theatre. In its 21 years the Abbey has produced 216 plays, the work of 86 authors, of whom 72 are Irish contemporaries. This record does not include the entire Irish dramatic output, since certain secessions from the Abbey and an Irish-speaking Drama League have produced interesting results. That the vital impulse which was born in 1902 of the junction of the writers Russell and Yeats with the players W. G. and Frank Fay is not yet exhausted is proved by the advent in 1923 of Sean O'Casey, the most powerful talent that has come to the Irish theatre since Synge. His plays *The Shadow of a Gunman* (1923), *Juno and the Paycock* (1924), *The Plough and the Stars* (1926), measure the change of 25 years. The heroic play in verse or prose has given place to the drama of realism, Cuculain to the gunman. Casey has a consummate power of creating and energising character, a speech that holds rich local savour without losing rhythm, pity and humour that transcend the squalor of the slums. In these gifts and in his passion for truth, the fruit of enthusiasm and disillusion, lies his promise.

Bibliography.—As a brilliant and scandalous chronicle of the period George Moore's *Ave, Salve, Vale* (1911–4) is indispensable; Lady Gregory, *Our Irish Theatre* (1914) *Æ Imaginations and Reveries* (1915); Thomas MacDonagh, *Literature in Ireland* (1916); E. A. Boyd, *Ireland's Literary Renaissance* (1916); *id.*, *The Contemporary Drama of Ireland* (1918); Padraic Colum, *Anthology of Irish Verse* (1922); W. B. Yeats, *Plays and Controversies* (1923); Lennox Robinson, *Golden Treasury of Irish Verse* (1925).

(C. P. C.)

IRISH LITERATURE: GAELIC (*see* 5.622).—The decade following 1910 was a period of much activity in the publication of literature written in the Irish language. This activity took two forms, one the editing of older texts which had never seen the light before, and the other the creation of wholly new works. The Irish Texts Society in London, the learned magazine *Eriu* published in Dublin, the *Zeitschrift für celtische Philologie* published at Halle, the *Revue Celtique* of Paris and the *Celtic Review* of Edinburgh (which ceased publication after 1915) were the principal media for the publication of the older texts. The Irish Texts Society, in particular, published a number of handsome volumes, all *editiones principes* of important works. The veteran Dr. Whitley Stokes died in 1909. His last work, the Irish version of Lucan's Pharsalia, was published posthumously at Leipzig. Kuno Meyer died in 1919. The great native scholar Standish Hayes O'Grady had passed away in 1915.

The Gaelic Journal, which had been founded in 1882, came to an end in 1906 with the 197th number, and the want of a scholarly magazine dealing with the phases and difficulties of the more modern language was keenly felt. In 1912 T. O'Rahilly, later professor of Irish in Trinity College, Dublin, started a magazine *Gadelica*, to which he himself was the chief contributor, which reproduced all the best and most scholarly features of the old *Gaelic Journal*. Unfortunately this magazine came to an end in 1913. *Editiones principes* of valuable Irish texts published by various scholars are Manus O'Donnell's *Life of Columille* (Chicago, 1918), the first part of O'Clery's recension of the *Book of the Conquests of Ireland* (1916), *The Maguires of Fermanagh*, *The Flight of the Earls*, *The Book of the MacSweeneys*, *The Son of the Eagle*, Sean O'Neachtain's *Adventures of Edmund O'Clery*, the poems of *Pádraigin Hackett*, and others.

Perhaps amongst modern writers the name of Canon Peter O'Leary, parish priest of Castlelyons, must be mentioned above all others. Although he began to write late in life, after the rise of the Gaelic League, he produced an amazing number of excellent works, of which his first book, *Séadna* (1898) is nearly sure to live. His great merit is that he was the first to turn his back resolutely upon everything that was bookish and old and obscure, and to go for his mode of expressing himself to the folk speech of his native county of Cork. How suitable the speech of the people became in his hands to express the whole gamut of the emotions was to many a revelation. He died in 1920 and has left his trace upon the language more deeply than any other writer of his time. Father O'Leary stands for the most representative writer of the southern half of Ireland. The elder Pádraig O'Conaire (or Conry) would probably be regarded by many in 1925 as the best living writer of the northern half.

Irish literature got a great set-back during the political troubles following the rebellion of 1916. Two monthly magazines which published stories and folk-lore were burnt, one in Munster and one in Connacht (Connaught). The Connacht editor was "on the run" in the mountains, and of the joint editors of the southern paper one was "interned" and the other had his house burnt, with all the MSS. which he had spent half a lifetime collecting, and all the songs and music he had taken down from old people, now for the most part dead. Pádraig O'Conaire, too, had his little hut in the Dublin mountains burnt and several plays destroyed.

(D. Hy.)

IRON AND STEEL (*see* 14.801).—Developments during 1910–26 in iron and steel were improvements in processes and equipment rather than new methods. An increase in the *per capita* consumption, far greater than the remarkable increase of the preceding decade, forced attention to means of securing maximum outputs as well as to the ever-present effort to secure economies. Larger units of manufacture were generally favoured and so-called "duplexing" and "triplexing" were outstanding features in steel-making. The latter part of the decade was marked also by a marvellous growth in popularity of the electric furnace, until at the end of 1922 there were 1,175 such furnaces in the world for steel-making alone, against 114 in 1910. The World War gave an artificial stimulus in general to plant expansion to meet the demands for ships and shells and resulted in a realignment of national capacity. In the main the following

analysis is devoted to the economic side of the evolution of the period.

Iron Blast Furnace Construction.—Design was influenced by local experience of experts in the different iron-producing districts. Profiles depend on raw materials—quality of coke, nature and concentration of ores. Generally speaking, tendency toward greater bosh and shaft angles continued (bosh angle 75° to 80°; shaft angle 84° to 86°). The size of stack increased only in the districts treating low-grade ore, while with high-grade ore (50% to 62% iron) the 500- to 600-ton-per-day size became the standard and many old furnaces were enlarged. In the Minette district of Europe, where the ore charged contained between 30% and 35% iron, the 200- to 250-ton unit became popular in all new construction. The cubical capacity of a blast furnace ranged between 40 and 100 cu. ft. per ton of pig-iron blown in 24 hours.

Individual parts of blast furnaces received particular attention. The hearth construction became reinforced and often cooled to avoid breakouts of the molten metal, and greater attention was given to brickwork to limit the downward destructive action of the metal. Emergency tuyeres at mid-height of the bosh—standard in the Minette district—lost their popularity and disappeared in nearly all new furnaces. For the handling of the material—ore, limestone and coke—mechanical devices won increased favour owing to the enormous masses involved and to the growing scarcity of labour. In America, the simple skip hoist was almost universally adopted in new plants, while in Europe the drop-bottom bucket hoist became popular and its design was ingeniously varied. It is noteworthy that the drop-bottom bucket, which was originated in America (Duquesne works) and was perfected in Germany during the years 1905–10, was little used in the United States ten years later.

It had been supplanted by the cup-and-cone top with a rotary distributor (McKee); in Europe the double cup-and-cone construction, giving low drop height and assuring less breakage of the softer coke, was preferred. These two solutions were more or less linked to the hoist system adopted. The furnace interiors were bricked up, in America of standard-shaped refractories giving a multitude of joints, while it was customary all over Europe to use special large-volume brick, shaped to reduce the joints. Both systems seemed to give satisfaction to the operators, and comparisons were not possible owing to the difference in the operating conditions. Speaking generally, the American design with a plate lining involved less steel for construction, while the Luxembourg-Lorraine type of blast furnace was conservative and substantial.

Blast Furnace Operation.—General progress was marked; greater familiarity with the chemical problems and increased mechanical equipment made operation more easily controllable, results more positive and disturbances less frequent. The use of excessively fine ore was accompanied by a high-solution loss of coke, and agglomerating of ore was recognised as desirable. This led to increasing attention to sintering fine ore mixed with flue-dust, and recharging of dust without treatment seemed likely to die out. Higher temperature of the air blast was a noteworthy development, as each increase of 200° F. has been reflected by 4% to 5% reduction in coke consumption. In the Minette district 850° to 900° F. blast temperatures were quite common. The blast pressure, which remained without much change, varied according to districts and the forcing of the operation from 4 to 15 lb. per sq. inch. In case of a relatively cold spell within the furnace due to overfluxing, bad coke or dropping of a hanging, the introduction of kerosene (paraffin) through the tuyeres proved a quick remedy, although it necessarily required care and progressive application to avoid accidents. The use of this cure rendered superfluous the auxiliary tuyeres at mid-height of bosh. The use of the oxygen torch to burn out the iron notch in case of metallic incrustations, extremely difficult to remove, proved a great help to the working crews. Mechanical appliances in cast-houses were installed in increasing numbers to supplant hand work, especially in sand casting floors. Cranes equipped with lifting magnets and pneumatic hammers elastically suspended proved a step toward the best method of moulding, breaking and handling of sand-cast pig-iron. For all qualities of pig-iron the continuous casting machines continued to be the accepted standard. In plants adjoining steel-works transport ladles of larger size (30 to 50 tons) and designs assuring better insulation and easier skimming of slag were evolved.

Blast Furnace Gas.—Continuously increasing price of coal and coke affected the economies of the blast-furnace gas and made it a by-product of great importance. The fuel value of this original waste became more and more recognised in America. The first effort, to avoid all gas losses so far as possible, led to the installation of double furnace tops, which became universal. Next gas-cleaning processes were developed to remove dust impurities from the by-product fuel, thus increasing its adaptability to combustion and securing greater efficiencies in its utilisation. To facilitate operation and render supervision automatic, pressure-regulating devices were evolved and accumulators were installed to equalise supply and provide steady outflow. Gas-cleaning attracted the attention of operators in European countries greatly in need of fuel, because the calorific value of the gas counterbalanced the cost of purification. In America, the coal shortage, due to inordinate demand and dislocation of railway service, produced the same result. The first step in gas-cleaning was the installation of a dust collector close to the off-takes and the downcomers of each blast furnace. In it the coarse dust was deposited by a slowing-down of the gas flow and a sudden change in its direction. This apparatus was independent of all further cleaning methods.

To separate the fine dust particles two different processes were applied: (1) wet method; (2) dry filtration.

(1) By the wet method the gases were cooled by injection of water, and the dust particles, passing through the fog artificially produced, were arrested by scrubbers. Experience led to a subdivision of the operations, called medium cleaning and fine cleaning, with apparatus protected by patents. The sludge of dust and water was removed by the application of centrifugal force, separating gas and liquid in specially designed fans or washers (Theissen, Brassert, etc.). The disposal of the water created a problem, as contamination of rivers is against the law in most industrial countries. In deposit ponds the settling of the impurities was incomplete and its removal a tedious manual operation; and the Dorr thickener, developed in ore-concentration districts, was adopted, as assuring continuous service automatically by means of a special mud pump requiring little attention. A drawback of wet systems was that the sensible heat of the blast furnace gas was absorbed by the cleaning water and lost beyond recovery. On the other hand, it permitted the installation of smaller gas-piping and dispensed with the insulation of the lines against heat loss, thus saving appreciable capital outlay in the case of long-distance distribution. Another drawback of the wet method was that recovery of the dust required driving off the water from the heavy mud in any briquetting or concentrating process attempted.

(2) The dry methods of gas-cleaning had their advocates where every little economy was watched, such as retaining the sensible heat of the gas and saving the expense of water-handling in keeping the dust dry. To separate the dust out of the hot gases, filtration appeared to be the best process. With mechanical filtration, finely woven cloth or asbestos-fabric bags or slag-wool layers let the gas pass at low velocity but retained the solid dust, which was removed periodically by return currents of clean gas. The principle was adopted in the Beth-Halberg system in Europe and the Kling-Weidlein apparatus in the United States.

The chief ways in which blast-furnace gases were utilised were as follows:—

(*a*) *Cowper or Hot-blast Stoves.*—The absence of dust in the gas provided for rational stove design, as the complicating side issues of clogged-up passes and slagged-up checker holes disappeared, as well as the periodic waste of cooling, cleaning and warming-up of each unit. The clean gas meant a reduction of the area of heating surfaces and brick volume expressed by fewer stoves per blast furnace—three to four per furnace against four to five 10 years earlier. Then began a systematic study of the heat-transmission phenomena within the mass of checker work.

(*b*) *Boilers.*—Clean blast-furnace gas allowed for advantageous use in connection with steam boilers; first, through more efficient combustion, in effect less gas per pound of steam produced; second, higher ratings of boilers, in effect more steam per unit of boiler evaporating surface or fewer boilers for a given plant capacity; and, third, quick adaptation to any load required, in effect flexibility or ease of operation. Many efficient burners were invented and some were installed on a large scale.

(*c*) *Metallurgical Furnaces.*—The removal of flue-dust made possible a wider distribution of the blast-furnace gas, and in Europe use was made of the surplus gas with success in all kinds of furnaces.

The low calorific value coupled with the small amount of air required for complete combustion, opened fields where so-called mellow heating flames are demanded, such as core drying, mould drying, annealing, roasting and ore concentrating.

(*d*) *Gas Engines.*—The principle that clean gas was indispensable for internal-combustion engines was long recognised, but its practical application did not occur until after 1910. Also a cool gas was regarded as essential to secure adequate volumetric efficiency of each cylinder. Among gas engines, the four-cycle type outranked considerably the two-cycle type. Devices for close regulation were developed on the principle of qualitative-quantitative mixture. The built-up cylinder seemed to win greater favour than the one-piece casting. The safety of operation reached a parity with that of steam-engines or turbines, the gas being clean. The exhaust heat of the engines, representing some 40% of the energy, was utilised to generate steam, and 70% was thus recovered in some instances.

Of all the various uses made of the gaseous by-products of the blast furnace only the heating of the hot-blast stoves was universally applied. All experts agreed that 30% to 40% of the gases are best employed for that purpose. The surplus of 60% to 65% was utilised for the other purposes already mentioned. In the utilisation to produce blast pressure and to develop power, the battle for supremacy between the gas-engine using blast-furnace gas and the steam boiler using the gas to supply energy to engine or turbine remained undecided. Thermal efficiencies were not the only issues at stake. In Europe, the gas-engine had the firmer standing, while in America the boiler seemed to be the more in favour. Even for generating the blast pressures, the competition between gas-engine-driven air compressors, steam-engine blowing engines and turbo-blowers had gone on without absolutely proving the superiority of any one combination. Varying economic conditions in each country and different local considerations, as well as the purely technical aspects of the problem, were deciding factors. Europe, with its skilled workmen and more stabilised market conditions, presented a background different from that of America with its fluid trade conditions and its unsettled unskilled labour.

Plant Layout and Size.—A single blast furnace, built alone on a site, no matter how well chosen, proved not to be a logical industrial enterprise. The number of such plants existing was the result of competition, of fluctuating market conditions, and constituted an economic waste, speaking generally. With combined units the accessory equipment became cheaper in installation cost and in terms of iron output and more efficient in operation, through flexibility and insurance against breakdown. Three to six furnaces grouped in well-laid-out plants were established as an economic whole. To avoid the loss of the sensible heat of the molten pig-iron and to refine the metal without cooling, steel-works were logically joined to blast-furnace plants. The two separate departments were thus combined in one industrial unit, with the added advantage that the surplus of power available at the furnaces could be absorbed in the rolling-mills.

Electric Pig-Iron Furnaces.—Tests made at Trollhättan, Sweden, were conclusive only for high-grade pig-iron similar to the Swedish charcoal pig-iron. Since 1918, the Domnarfvet works in Sweden had operated several shaft-type furnaces (with gas circulation using 60% to 62% of iron ore and charcoal as a reducing agent). Mixtures of charcoal and coke up to 50% coke were found satisfactory. Per ton of pig-iron produced, 3,400 lb. of ore (containing 61·5% Fe), 120 lb. of lime and 740 lb. of charcoal were charged; 15,000 cu. ft. of gas at 240 B.T.U. per cu. ft. were captured at the top; 2,150 kilowatt-hours was the electric energy consumption per 2,000 lb. of pig-iron. The problem of using electric current for supplying heat in the blast furnace reactions had particular interest for the eastern Pyrenees in France, British Columbia, Brazil, Italy, as well as Sweden and Norway, where fuel is scarce and low-priced electricity might be made available.

The Steel Plant.—The usefulness of mixers as an important adjunct of the steel-making plant was universally recognised, as numerous installations attest. Their field was established in equalising qualitatively the successive outgivings of the blast furnaces and in desulphurising the molten metal. To accelerate the removal of sulphur, less than 0·5% of manganese proved most helpful. The shape of the mixer that gave best results was the simple cylinder rotating on its axis. The most popular size proved to be 1,000 to 1,400 tons' containing capacity. Simple oil or gas burners without regenerating chamber in the United States, with pre-heating checkers sometimes in Europe, completed the equipment. In Germany, a 2,000-ton-capacity mixer was reported built, but only after considerable discussion as to its size. The mixer was, of course, brought into being for receiving metal from the blast furnace and delivering to the ladle for transport to the steel plant as needed. Slag that floats on the top of the bath must be skimmed off from time to time.

Converter Plants.—No noteworthy development took place in the acid-operating (Bessemer) converter or in the basic-operating (Thomas) converter for making steel. The 20- to 25-ton-capacity vessel remained nearly universal. A 40-ton size was proposed in 1918 by a Belgian engineer. As between Europe and the United States, the hydraulic tilting mechanism of the former did not give way to the electric drive of the latter, nor did the gas-engine blowing units succumb to the turbo-blowers of American practice.

Open-hearth Plants.—Without radical change in type, sizes of open-hearth furnaces increased up to and above 100 tons' capacity, but the tendency was toward fully controllable sizes. The practice in the United States settled to 80 to 100 tons and in Europe 40 to 50 tons. Volumes of checker chamber increased to get better so-called flywheel effect. Greater attention was paid to port and head construction to lengthen life, and to a reinforced roof. Reversing valves were marketed for reducing flow resistance and waste of gas. Waste heat boilers were more generally installed, but not universally adopted because of their interference with concentration and general electrification of plants. Marked superiority or inferiority was not shown for the tilting construction of furnace when tested by use beside the stationary type. Natural gas disappearing in America, producer gas was the more generally adopted fuel. Powdered coal was tried with some success but without proved superiority; one difficulty was that checker chambers got clogged by ashdust. By-product tar and crude oil proved fuels well suited for the purpose if available at low price and in large quantities.

Electric Steel Furnaces.—The electric steel furnace for refining and melting iron and steel developed to a surprising extent in the decade 1910–20 in size and in number of installations. It proved ideally suited for quality products and high-grade materials, because no complication through fuel medium exists and because atmosphere and temperature are attainable practically at will. From 500-lb. capacity, single furnaces were built to 40 tons, with most of them of 5- to 8-ton capacities. (For electric furnace statistics, see *Iron Age*, Jan. 1 1921.) Of the 960 known electric steel furnaces in existence in Jan. 1921, 356 were in the United States, 150 in England, 100 in Germany, 60 in France and 43 in Canada. Of the total, 308 were Héroult arc furnaces, 102 Rennerfelt induction furnaces and 90 Greaves-Etchells furnaces. The electric furnace was adopted for making metal mixtures, ferro-alloys, special steels of high quality in large amounts—strict repetition being possible in an absolute positive way. A disadvantage was that the metal is not at rest but always in motion, through electric or magnetic influences. Though agitation was often desirable, the action hampered the separation of the slag and the rising of impurities out of the molten mass. A remedy for this was repeated skimming of slag and careful supervision. One unusual utilisation of the electric furnace was the making of pig-iron out of scrap, especially in the United States, to supply deficiencies in the amount of low-phosphorus pig-iron, particularly in the manufacture of ordnance. It amounted to a synthetic reconversion of steel into pig-iron. Fine coke was added to the slagged refined scrap for carburisation, and the method promised to be commercially feasible in regions having electric power but little local fuel available and situated so that delivered pig-iron was high in price. For deoxidation in the refining process and for recarburisation, ferromanganese and spiegeleisen retained their popularity in spite of high prices under erratic market conditions. In Europe pre-heating, often pre-melting, of the addition was the current practice, to save in the amount needed and to accelerate effects. In America the wasteful method of cold additions prevailed. Ferrotitanium, with carbon or carbon-free, was used, as well as ferrosilicon and aluminium in small quantities. Some steel plants made additions in the ladle, others finished the operation in the furnace.

Steel-making Operations.—The outstanding feature of steel-making operations was the recognition of splitting the refining process into two phases, or the two-slag method, to increase production and to lower production costs. The efforts of Bertrand-Thiel and Talbot recognised in effect this principle; and duplexing and triplexing were only operating variations of the same principle, to remove the impurities of the pig-iron stepwise in the furnaces best suited for each purpose. Thus sulphur and manganese pass out in the mixer; silicon and part of the carbon in the converter; the rest of the carbon and phosphorus in the open-hearth furnace; additions were made and alloys were added in the electric furnace. The plant necessitated considerable equipment, but it secured ease of operations, exact control of results and made possible quantity production. Below 1,600 tons per 24 hours, savings in operation were regarded as hardly possible, as in slack market periods overhead expense was too large. During the World War about 10 duplexing plants, refining in an acid converter and finishing in basic open-hearth furnaces, were built in the United States under the pressure created by an ammunition famine. Electric duplexing plants (meaning melting and preparing in open-hearth furnaces and finishing in electric furnaces) were built in large numbers, offering a special-quality product on a large scale. A number of new independent efforts were made to produce steel direct from the ore without the interpolation of the iron blast furnace, but none could be said to have been proved feasible on a scale beyond that of the laboratory.

The Shaping of Steel.—Rolling-mills (used if the demand for a product is large and if its shape lends itself to a continuous process, like rails, angles, plates, bars, etc.) and the forge-shop (if the shapes to be produced are complicated, short in length, unsuited for the rolling-mill), both change the shape of the metal heated at high temperature, about 2,000° to 2,300° Fahrenheit. Both require finishing departments to straighten, shear or bundle the rolled product or to clean off the fins, rough off the unevenness of the forging operations, and they may need annealing and pickling facilities to improve the quality of the product. A special process of milling the top and bot-

tom of rail blooms, to remove cracks and roughness from the semi-finished steel and also surfaces decarbonised in the heating furnaces, was put into use at the Lackawanna mills in America and resulted in a reduction in the number of finished rails classed as seconds.

In the period 1908–26 the development of the rolling-mill was influenced, first, by the great manufacturing principles of concentration and specialisation, and, second, by the electrification of the motive power. Concentration demanded large production in one

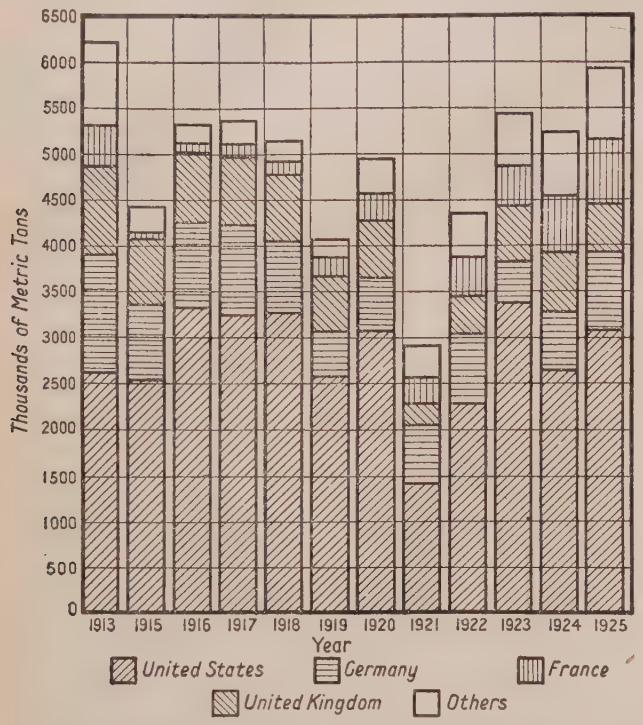

FIG. 1.—Diagram showing the production of Pig-iron in the principal producing countries, for 1913 and 1915–25 (monthly average). *Note:* "Others" include Luxembourg, Belgium, the Saar, Sweden, Canada, Poland and the Union of Socialist Soviet Republics.

unit and suitable equipment to attain that aim; in other words, mechanical devices in preference to hand operation. Specialisation was applied to the shape to be rolled as well as to the mill used for production. Standardisation of rails, beams and angles, the reduction of the number of profiles, and the simplification of shapes were consequences, as well as the installation of mills for specific purposes. The application of these rational principles was accelerated by the use of the electric motor. The advantages were recognised about 1905, but the next 15 years brought their practical realisation. The numerous little steam-engines disappeared and the electric motor revolutionised the handling of the material by cranes and overhead trolleys as well as the mill accessories, like tables, skids, transfers, etc. The first step was the creation of central power plants where electricity was generated either in turbine or gas-engine generators, preferably with the help of the surplus gas from the blast furnace. Many steel plants in 1920 were equipped with 20,000- to 40,000-K.W. power stations. The second step was the development of speed reducing devices made necessary by the high speed of electric motors. The advance of the gear-cutting industry and the advent of spiral-type teeth, single or herring-bone, and the development of new types of teeth giving less wear, more rolling surface, and, later, the use of special hardened, heat-treated steels were eagerly taken up by the designers of mill machinery to increase the quality of their product. Reduction gears transmitting up to 5,000 H.P. came into daily use, and the ratio of 10 or 12 to 1 in one reduction gave satisfactory service. The third step was the development of speed-regulating devices, especially in connection with alternating-current motors, to secure efficient operation for variable conditions. The fourth step was the solving of the load problem of large, intermittently operating motors, reversing their direction of rotation by means of the motor-flywheel set advocated by the Austrian engineer Ilgner in connection with suitable controllers of which the Ward-Leonard system was the prototype. Much work and inventive genius were concentrated on these difficulties to bring about in less than 15 years the high efficiency and great safety of operation by electricity of steel mills. The development of the rolling mills is still progressing.

For driving continuous mills electricity was preferred to the steam-engine. The uniflow steam-engine found favour up to 3,000-H.P. units, but installations were few. Where the effort was to bring about a complete electrification of the plant, steam-engines proved unpopular, possible economy being counterbalanced by complication of maintenance and other administrative considerations. For the reversing drive of large units, requiring loads up to 20,000 or 25,000 H.P., the electrical drive was not necessarily in the ascendancy. The high initial cost of the motor generator flywheel set with direct-current motor directly connected to pinion and mill was made the chief argument against universal adoption of electricity, and numbers of old plants were reluctant to change their somewhat obsolete steam equipment. In America only a few engines as large as 25,000 to 30,000 H.P. (Weirton and Lukens) were installed in new work, and in England large vertical engines were built. The electrical units, however, increased considerably in number and size and considerable progress was realised in the matter of manoeuvring capacity, in standardisation of winding and accessories, in records of output and efficiency of running. In 1925 the electrical industry was aggressively working on betterments, while the partisans of the steam-engine rested on past laurels. Parity existed on all points except first cost of installation. Even for smaller mills of the reversing type electrical drives were built, such as 24-in. mill (Mark, Indiana Harbor), 26-in. mill (Atlanta, Ga.). Two-high reversing plate-mills also disputed the field with the three-high type in the medium-sized equipment, and latest universal-mill installations were of

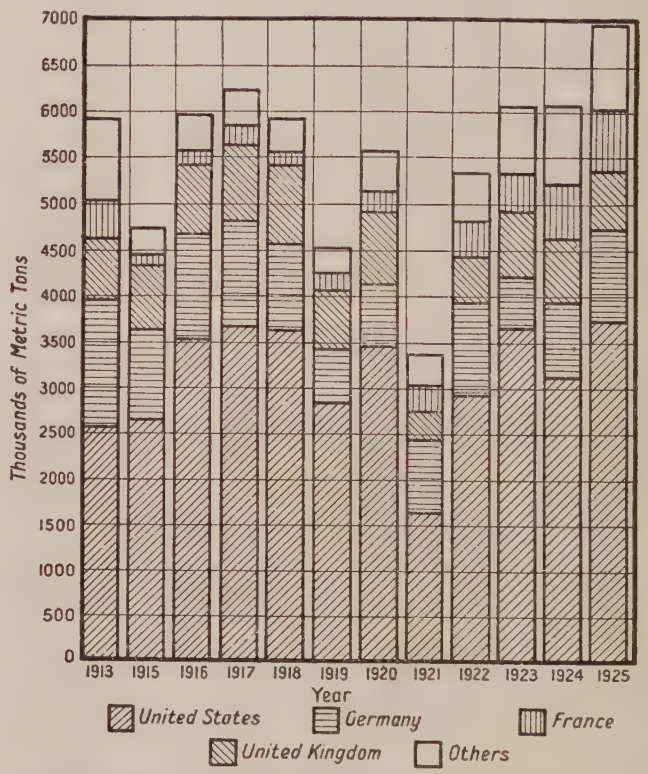

FIG. 2.—Diagram showing the production of Crude Steel in the principal producing countries, for 1913 and 1915–25 (monthly average). *Note:* "Others" include Luxembourg, Belgium, the Saar, Sweden, Canada, Poland, Italy and the Union of Socialist Soviet Republics.

the reversing type electrically driven. The largest mill for plates, 192 in. wide, at Lukens, Pa., which was completed in 1918, was of special design, reversing and steam-driven. (*Iron Age*, Jan. 2 1919.)

The concentration of production in large well-balanced plants with adequate resources and sales organisation permitted a logical subdivision of the rolling-mill programme with a subsequent reduction of production cost. The smallest bloom section, 6x6 in., had a tendency to grow toward 8x8 in., as some experts claimed that 50 sq. in. was the economic limit of the range of a large mill. To reduce the time required for roll changing, complete spare housings, completely mounted, came to be good mill practice, these being dropped on the shoeplates by the cranes. In some specialty plants sometimes two or three housings were changed together.

Furnaces.—The development of soaking, reheating and annealing furnaces was influenced by the increasing price of fuel and considerable efforts were made to boost heating efficiencies. In Europe gas-firing with recuperation and regeneration of waste heat was the favourite, especially because producer-gas firing was much used and remarkable results achieved. In America continuing shortage of natural gas for industrial purposes in regions such as the Pittsburgh district made a substitute market for crude oils, coke-oven gas and powdered coal. Especially since 1915, the use of powdered coal developed to a surprising degree for all kinds of metal-heating applications. Mechanical stokers were evolved in numerous designs to dispense with hand labour and to control by mechanical contrivances the combustion of coal in an efficient way.

Mill Equipment.—Roller tables, skids, transfers, cooling-beds and tilters were perfected and installed in increasing numbers owing mainly to the efficiency and handiness of electric motors. Variable-speed drives gained in favour. Straighteners, saws, punches and shears were made in conformity with the availability of electric power. Hydraulic devices were pushed in the background and electric drives supplanted engines in the field of these mill accessories.

Metallographic Progress.—Metallographic knowledge spread in the period 1910–25 from the university laboratory to the steel mill, outgrowing the narrow circle of students to become the helpmate of the operator. Pyrometers or temperature recorders and the scientific control of temperature came as a matter of course in numbers of steel mills. The variety of alloy steels offered for practical uses was due to the theoretical investigations of the metallograph. Chromium and vanadium, nickel and cobalt, tungsten and molybdenum added their special properties to steel, and improved heat-treating methods enhanced these qualities with a skill and positiveness hitherto unknown.

Beyond the realm of iron and steel making, properly regarded, but coming within the purview of the industry, the remarkable development of the period was the heat treatment of metals. It went hand-in-hand with the study (by means of the microscope, and thus of the photomicrograph) of grain structure and the transformations which take place in the so-called solid solutions, according to the degree of heating and cooling given to the metal. Practical applications of the investigations of the scientist were numerous, and the history of the temperature experience of a given metal product going into an article of commerce was accepted as equally important with the chemical constituents, for two pieces of steel, identical chemically, may be made to behave physically very differently according to their crystalline state. (*See* METALLOGRAPHY.)

Other developments which must be briefly enumerated were: Efforts to test a material's fitness or agreement to specifications without destroying it, as by X-ray photographs (sheets), or by magnetic analysis (by noting changes in permeability of an article of constant cross-section, as a rifle-barrel, wire or steel rail, by moving it through a magnetic field); these, however, were not definitely of commercial dependence, pending further investigation; success in making large chains of cast-steel links followed by heat treatment, such as annealing; efforts to cast in centrifugal moulds, such as cast-iron pipe by introducing molten iron into the rotating mould; commercial recovery of potash from blast-furnace flue-dust deposits at the base of hot stoves; making iron pipe by an electrolytic process of depositing iron on a rotating cathode in a ferrous-chloride electrolyte; commercial manufacture of a stainless steel having 10% to 15% of chromium, which, Harry Brearley in England discovered, gave amazing resistance to corrosion, so that it became the base of an important cutlery industry and offered a satisfactory material for rifle-barrels, turbine blades and steel articles subject to both erosion and corrosion; additions to the numberless varieties of alloy steels, largely to secure some desired physical characteristic for specific needs, such as increased tensile strength in terms of lighter members of a fabricated steel product; elements like cerium and zirconium entered the ferro-alloy circle, but a delineation of the various alloys and of their definite fields of usefulness was not completed.

Production.—The accompanying table shows the relative producing capacity of the leading industrial nations of the world. The figures are of actual production as well as capacity to produce. The world's steel-making capacity was put, in 1926, at 116,000,000 tons in round numbers. One-half was credited to the United States, which could make more than four times as much as Great Britain and more than three times as much as Germany. The United States' percentage of the world's pig-iron-making facilities was somewhat over 46%. More than one-third of the total annual output of iron ore in the world came from the United States, and of the American production 85% came from the Lake Superior district. The Lorraine ore-fields supplied about 25% of the world needs, 80% of its output going to France and Germany.

World statistics of the production of ore, pig-iron, and crude and finished forms of steel are obtainable from the National Federation of Iron and Steel Manufacturers, London.

Iron and Steel of the World

	Capacity to Produce		Largest Production Ever Made			
	Pig-iron	Steel Ingots and Castings	Pig-iron	Year	Steel	Year
United States	49,000,000	56,000,000	40,361,146	1923	45,430,000	1925
Canada	1,300,000	1,900,000	1,107,000	1918	1,695,000	1918
Mexico	300,000	300,000	..	..	..	..
North America	50,600,000	58,200,000	..	..	..	..
Great Britain	12,000,000	12,000,000	10,481,917	1913	9,553,715	1917
Germany	15,000,000	17,000,000	19,309,172[1]	1913	18,935,089[1]	1913
France	11,000,000	9,500,000	8,323,000	1925	7,289,700	1925
Belgium	3,500,000	3,500,000	2,781,000	1924	2,780,000	1924
Luxembourg	2,800,000	2,250,000	2,547,861	1913	2,053,100	1925
Holland	150,000	..	..	..	..	..
Russia	3,500,000	3,500,000	4,637,300[3]	1913	4,769,200[3]	1913
Poland	1,200,000	1,800,000	1,031,123	1913	1,648,533	1913
Rumania	350,000	250,000	..	..	..	..
Austria	600,000	900,000	384,000[2]	1924	541,000[2]	1924
Hungary	400,000	400,000	295,000[2]	1923	283,046[2]	1923
Czechoslovakia	1,300,000	1,800,000	1,050,000[2]	1924	1,350,000[2]	1924
Italy	600,000	1,600,000	497,000	1917	1,311,000	1917
Spain	600,000	600,000	497,726	1916	470,241	1917
Sweden	1,000,000	750,000	828,969	1917	614,111	1916
Europe	54,000,000	55,850,000	..	..	..	..
Japan	1,200,000	1,500,000	780,000	1919	845,036	1920
China	950,000	400,000	257,648	1920	120,000	1922
India	800,000	350,000	613,627	1923	215,465	1923
Australia	500,000	400,000	416,050	1924	284,669[4]	1924
South Africa	..	50,000	..	..	27,064	1923
The World	108,050,000	116,750,000	77,536,000	1913	80,308,000	1917

Figures in tons: gross, for England, United States, etc.; metric, for France, Germany, etc.

[1] Includes both Luxembourg and Alsace-Lorraine; 1913 pig-iron production of Luxembourg (2,547,861 tons) and of Alsace-Lorraine (3,864,000 tons), deducted from the reported figure, leaves 12,897,311 tons for Germany. Similarly, for steel, deducting the 1,336,263 tons of Luxembourg and 2,286,354 tons of Alsace-Lorraine, leaves 15,312,472 tons for Germany.

[2] Austria-Hungary in 1916 produced 2,380,000 tons of pig-iron and 3,278,000 tons of steel.

[3] Includes production of Poland.

[4] One plant only.

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(W. W. M.)

See Electro-Chemistry; Electro-Metallurgy; Internal Combustion Engine; Metallography; Metallurgy; Rustless Steel; Turbine, Steam.

IRRIGATION ENGINEERING (*see* 14.841).—During the present century development has continued at an accelerated pace; one of the many causes was and is the desire to meet the world's demand for cotton, particularly the more valuable long staple varieties.

Barrages and Dams.—Where areas to be served were large enough, barrages have been built; where rivers have a very irregular discharge, dams have been erected to impound water from the flood seasons to augment the supply in drier periods. From the barrages or dams high-level gravitation canals lead the water to the soil. Where the barrage system is not possible, modern water-lifting appliances serve new lands, or in many cases replace in areas already cultivated both the hand-worked water-lifting appliance known in Egypt as the *shadoof* and the cattle-driven water-wheel. Irrigation is thus serving an ever increasing area throughout the world in regions where suitable soil, climate and plain exist in combination.

Distribution.—With these extensions, in places approaching the limits imposed by the volume of water available, the problem of equal distribution becomes important. This, in turn, depends on an accurate estimation of the volume. Measurements were formerly made by means of data obtained from noting the speed of objects floating with the stream at various depths. In the last 30 years, current meters replaced floats and give more regular results, but it was not definitely known whether these results indicated actual volumes.

Measurements.—This doubt has now been settled through the full-scale measurements made since 1905 at Aswan by which the Nile discharge has been calibrated to within an error of 1% of the actual volume passing during all but the very highest levels, and it is hoped in time these will be measured also. Current meter discharges taken simultaneously with the measurement at the dam, repeated a few times and the mean taken, gave very similar results and thus proved the accuracy of current meters. The data obtained from small scale models can be depended upon to within a small percentage of error.

Work in Egypt

The cultivable area to-day in Southern or Upper Egypt, from Aswan to Cairo, is about 2,500,000 ac. of which 2,200,000 were cultivated in 1910, 1,000,000 ac. being under the perennial form of irrigation and 1,200,000 ac. under the older basin system. In the Delta there were about 3,000,000 ac. cultivated, all under the perennial system, out of a total cultivable area of about 4,800,000 acres.

The area of all Egypt is, however, over 500,000,000 acres. Thus only about 7,300,000 ac. of this vast extent can be cultivated from the waters of the Nile. All the remainder must continue in its present inhospitable state unless a climatic change occurs.

In 1902 the completion of the original and low level Aswan dam permitted 1,000,000,000 tons of water to be stored annually from the season of excess waters in the river, to be released again in the following spring and summer. In the few years following 1902 the need for an immediate increase in the volume of water available for summer irrigation became pressing if the area then cultivated was to be annually assured of an adequate supply in really low years, and if some new areas not hitherto cultivated were to receive water at all times. The work of storing more water at Aswan by heightening and thickening the original masonry dam and increasing its capacity to 2,400,000,000 tons, was completed in 1912. The need of existing areas for all the water available was accentuated by the phenomenally low flood of 1913, which was followed as a natural consequence by a poor spring and summer supply in 1914.

The 1913 flood was estimated to be the lowest for 150 years and except for the existence of the various barrages and the dam across the river, would have spelt famine as well as financial disaster to the country. The 1914 river, even when increased by the whole of the stored water from Aswan, was only just sufficient to ensure the safety of the cotton crop of that year. Additional supplies of summer water are needed for some of the still uncultivated areas in the delta, and the conversion of further areas in Upper Egypt from basin to perennial irrigation can only be satisfied by still greater control of the Nile.

The construction of a dam on the White Nile near Khartoum is now being taken in hand, forming another, though not the final, stage in the provision of water for Egypt. The very least quantity of water storable each autumn by the new dam will be greater than that now annually held up by the Aswan dam, and like it, the water can be used in the following spring and summer in Egypt. With a minimum of 3,000,000,000 tons thus provided, an additional 1,000,000 ac. of Egypt's waste lands may be given summer water.

Further Developments.—Further works must, however, be undertaken in the Sudd region of the Sudan and even beyond it, before the final stage of an Egypt cultivated to its capacity, with an adequate supply of water to meet all her requirements, is reached. These works will most probably consist of training the waters through the Sudd region to prevent waste and the erecting of a dam at Lake Albert.

The Sudd region lies on the White Nile and commences about 500 m. south of Khartoum and is in reality a vast plain through which the White Nile meanders for 250 m. with its water either at or just above ground level. As a consequence the whole forms a great reedy marsh interspersed with open lagoons; into it flow the flood season waters of the White Nile; they evaporate themselves away to such an extent that no great variation of volume is normally experienced at its outlet. The lost waters could, in great measure, be stored in Lake Albert and let out in such a manner as best to suit the requirements of Egypt. Conservation from evaporation when passing through the Sudd region can be secured by confining the flow to a definite channel. The increased acreage which it will then be possible to cultivate in Egypt will bring the total area up to its maximum of about 7,300,000 acres.

Developments in the Sudan

Previous to 1910, except for a few thousand acres served by pumps, all the crops grown in the Sudan along the main Nile from Wady Halfa to Khartoum and the White Nile from Khartoum to the Sudd region were sown on land naturally inundated on its low banks by the annual rise of the Nile. On the Blue Nile, rainfall alone was depended on to fertilise the crops grown.

About 1909 one of the uncultivated areas below Khartoum was turned into a perennial irrigation farm and was among the first to produce cotton in the Sudan, by means of water pumped from the Nile. Soon after that date the possibility of growing cotton in the Gezira, that huge tract which lies in the fork of the Blue and White Niles, became apparent. Here some 5,000,000 ac. form a gently sloping plain stretching along between both rivers for about 200 m. from Khartoum. From this point southward the plain is interspersed with small isolated granitic hills which, as a line south-east is traversed, increase in number and height. Of the 5,000,000 ac. plain probably 3,000,000 will form the maximum area cultivable. On the remaining 2,000,000 ac. near Khartoum the soil is said not to be so good, being of a more sandy nature.

Two experimental farms of a few hundred acres each were set down in the cultivable area and proved after a few years' trial the suitability of the soil for cotton growing. The summer climate, however, was found to be too trying, although below Khartoum and in Egypt cotton is entirely a summer crop. Cotton sown in mid-July in the Gezira and picked in the following spring gave a return on an average of 400 lb. per ac., a figure equal to the normal Egyptian production. This result was obtained at a season of the year when there is usually an abundance of water in the river.

The cotton plant in the Gezira is in the soil from mid-July, when it is sown, to final picking in April, or a period of about nine months.

In exceptional circumstances a final watering may be required as late as April 15, though normally the last watering is expected to be given by March 31. Long before either of these dates Egypt, notwithstanding her great reservoir at Aswan, in low river years requires all that the Blue Nile can supply. It became necessary, therefore, to devise the best method of lifting water from the Blue Nile on to the plain and of storing a sufficient volume of it to meet the demands in the Gezira in those months when Egypt requires all that flows in the river. The decision arrived at was to build a combined dam and weir at a point 5 m. south of Sennar, where a narrow belt of gabbro rock, which scarcely rises above the level of the plain on either side, runs across the river.

The construction of the combined dam and weir was proceeded with and completed in July 1925, at a cost of about £6,000,000, the canal system bringing the total up to about £9,000,000. The dam can store about 600,000,000 tons of water for use in the critical period, which extends from Jan. to March and possibly to April, when Egypt requires all that passes down in a very low year. The main canal leading from the dam is some 60 km. long before reaching the point where branch canals spread out from it on to the land to be irrigated. The area judged sufficient to form a commercial proposition in view of the cost of the works was 300,000 acres. It is now believed this area can be considerably increased without endangering Egypt's supply. Certainly if an amicable agreement can be arrived at between the two countries, greater areas can be cultivated in the Gezira in all other years than the phenomenally low one on which the 300,000 ac. scheme was based.

New Projects.—When still greater areas have to be brought into cultivation, and it is possible that 3,000,000 ac. may eventually be cultivated in the Gezira, either new storage works must be built or such further control of the Nile be organised as will permit Egypt to reduce her demands on the volume in the Blue Nile. Special storage works for the Sudan can probably be best built by permission of Abyssinia. At the exit of Lake Tsana in that country at the source of the Blue Nile, by storage in the lake, the annual flood waters can be controlled and about 3,000,000,000 tons of water conserved for use at a later period, thus permitting a great increase in the area cultivable in the Gezira.

There are possible alternatives, such as the building of a miniature Aswan dam somewhere near Roseires. Here a regulation of the river will not be quite such a simple matter as at Lake Tsana, as the flood waters at Roseires are heavily laden with silt. These must be allowed to pass and water only be abstracted at a subsequent but still high stage when little or no silt is still present, otherwise Egypt would be deprived of this valuable material. If collaboration with Egypt in works in the Sudan is adopted, then the White Nile dam will be made as large as is consistent with safety so as to store as much water as can be secured from the flood waters.

Whatever capacity be given to the White Nile dam Egypt must still provide herself with more water than even it can hold, and some regulation of the Sudd region must of necessity be one of the features of such a provision, coupled with a huge dam at the source of the White Nile and the mouth of Lake Albert. Besides the Gezira Plain the Sudan has other irrigation areas where great improvements have taken place, as at Tokar and Kassala.

Tokar.—The river Barakat rises in the rainy season in the Abyssinian hills and rushes as a chocolate-coloured thick stream on to the Tokar Plain where it eventually spreads out into a thin film which is sucked up by the thirsty soil. The plain, however, is much greater in extent than the water can cover, although some finds its way to the sea as recorded in 1921. Great anxiety is continually caused by the liability of the flood to break away into areas not hitherto cultivated or, even if cultivated, so far from Tokar as to be inconvenient for transport. In recent years designs were studied for the purpose of exercising some control over the direction of flow. These have been carried out and have so far been successful. The total area served varies greatly from year to year. In 1921–2 about 55,000 ac. were flooded, though not all were cultivated.

Kassala.—The river Gash rises in the Abyssinian foothills and becomes of considerable volume in the flood season by the time it reaches Kassala. Here it spreads itself over the plain in such a manner that none of its waters ever reach the Nile or its nearest tributary the Atbara. Some control has been exercised over the flow to keep the water annually to definite areas.

In a really good year with the supply of water at a maximum, 50,000 ac. of cotton might be cultivated. Owing to the poor flood of 1925 only 11,000 ac. have been sown.

Progress in India

Irrigation gives valuable aid in the fight against those periodic famines which always happened after rainfall failures, and it also causes an increase in production through its extension into new and suitable areas hitherto lying fallow. During 40 years, 1885–1925 in particular, developments have steadily progressed. 10,500,000 ac. were irrigated in 1878–9; 19,250,000 ac. at the beginning of the century, and 28,000,000 ac. in 1923–4. Additional works now under construction will add 2,500,000 acres. New schemes are contemplated which will add a further 4,750,000 acres. When completed they will bring the irrigated area of British India up to about 36,000,000 acres.

These figures exclude the water supplied from the Punjab canals to 650,000 ac. in the native states. The Sutlej Valley project, mainly for the benefit of the native states, will increase the total by a further 3,250,000 ac., making in the proximate future a grand total of about 40,000,000 ac. of irrigated land in all India.

Mileage of Channels.—In 1900–1, 39,142 m. of channels were in operation; by 1920–1 this had increased to 55,202 m. or an average addition of about 800 m. of channels per annum. The annual revenue return is between 7% to 8% on the capital invested in government irrigation works.

The following table shows the acreage of crops matured during 1923–4 by means of government irrigation systems compared with the total area under cultivation in the several provinces of India:—

Province	Net area cropped	Area irrigated by government irrigation works	Percentage of area irrigated to total cropped area	Capital cost of government irrigation and navigation works to end of 1923–4	Estimated value of crops raised on areas receiving state irrigation
	Acres	Acres	%	Lakhs of rupees	Lakhs of rupees
Madras	36,424,000	6,891,000	18·9	1,207	3,556
Bombay Deccan	39,000,000	418,000	1·0	881	538
Sind	4,134,000	3,427,000	82·9	479	1,054
Bengal	22,806,000	93,000	0·4	422	78
United Provinces	35,011,000	1,979,000	5·6	1,577	1,348
Punjab	26,731,000	10,207,000	38·2	2,543	5,505
Burma	13,857,000	1,730,000	12·5	363	812
Bihar and Orissa	24,665,000	954,000	3·9	627	622
Central Provinces	17,427,000	438,000	2·5	483	281
North West Frontier Province	2,583,000	359,000	13·9	276	226
Rajputna	281,000	16,000	5·7	35	5
Baluchistan	286,000	26,000	9·0	32	5
Total	223,205,000	26,538,000	11·9	8,925	14,030

Thus nearly 12% of the net area cropped was irrigated by government works. The annual value of the crop so irrigated amounted to 1½ times the capital outlay expended on the works.

New Schemes; Madras Presidency.—(1) The improvement of the, at present, somewhat irregular supply of water in the Canvey Delta canals will add about 301,000 ac. to the 1,000,000 ac. already served. (2) The Vengalapuran scheme will provide water for 50,000 acres. (3) The Kishna river storage will serve about 1,750,000 acres. The Lower Bhavari project will command 110,000 acres.

Bombay Presidency.—Although only 1% of the land cropped was irrigated in the Bombay Deccan district, its annual average of irrigated land is now about 418,000 acres. The Bhavari river works and the Nira right bank canal scheme will increase this area by 35,000 acres.

Sind.—The rainfall in Sind averages only about 6 in. per

annum. In one year out of five it is almost certain to be less than 2 inches. Sind, however, has the Indus carrying a supply of water which is capable of meeting her needs if properly utilised.

In 1926 inundation canals supplied what land is irrigated. There are no means of regulating the river level artificially and continuing the supply when the river falls, consequently these canals obtain a full supply only when the Indus is in flood. In the cold weather when the river is low, only the most fortunately situated obtain any supply at all and a minimum of 600 tons per sec. run to waste.

The cultivable area of the province is about 14,000,000 acres. The Indus is estimated to be capable of irrigating 12,000,000 ac. in the hot weather and 8,000,000 ac. in the cold season, or say 20,000,000 ac. in all of crop. In 1923–4 the net area cropped was 4,134,000 ac. of which 82·9 % or 3,427,000 ac. was irrigated; this is the highest percentage of irrigated to cropped area in the whole of India. The province naturally divides itself up into three main tracts, upper, central and lower Sind, and three large barrage projects are contemplated at an estimated cost of £50,000,000 to deal with them.

The main project now in hand consists of a barrage across the Indus just below Sukkur where the river passes through a deep gorge. From the barrage, seven canals (four on the left bank and three on the right) will run southwards and extend facilities for cultivation to the enormous area of 5,500,000 acres. 2,000,000 ac. represent the existing inundation irrigation area and will be given in addition an assured perennial supply by the new canals. The barrage when completed will measure 4,725 ft. between the faces of the regulators on either side. It will have a masonry floor across the river, above which an over-bridge of 66 spans, each of 60 ft., will be constructed. From this over-bridge shutters 60 ft. long and 18½ ft. high can be lowered on the floor when the river falls, thus pounding up the water to the level required in the canals; conversely, when the river rises, they can be lifted and the whole of the waterway of the bridge will be left free for the passage of the annual floods. These floods will be greater than those passing any other regulating structure in the world, at the maximum they will be nearly double the Nile flood.

The supply required by the whole system of canals will vary throughout the year from 22,600 cu. ft. per sec. in Jan. and Feb. to 46,000 cu. ft. per sec. from June to September. It is estimated that the annual net revenue after paying working expenses will be 10½ % on the capital expended. This is the return from water rates alone, but a further large increase in general revenues may be reckoned upon from the 3,500,000 ac. of waste land which will be brought under cultivation.

Bengal.—The percentage of 0·4 of irrigated to cropped area in Bengal is the lowest in the whole of India, the net area cropped being 22,806,000 ac. of which only 93,000 ac. are irrigated. The average rainfall is about 55 in. per annum. A project for a canal from the Damodar river is sanctioned which will irrigate 196,000 acres. Several minor works are being considered.

Punjab.—With the exception of Sind no portion of India is so favourably situated as regards its rivers, or so unfavourably as regards its rainfall, as the Punjab proper, expecially the tract between the Jhelum and the Sutlej—the greater portion of this district having less than 15 in. of rainfall per annum and much of it less than 10 inches. As a consequence great developments have already taken place in the irrigation scheme of the province. In all 10,207,000 ac. were irrigated in 1923–4. Further large works are contemplated which will increase the total and reduce to a minimum the waste areas.

The United States

One of the larger projects is that connected with the Colorado river which serves two distinct areas. The upper is at a considerable elevation above sea level and covers 4,500,000 acres. Of this about 1,500,000 ac. are now irrigated. In the lower basin there are 960,000 irrigable acres, of which about 670,000 are irrigated. When the works are complete the Colorado river will be controlled to a very large extent and thus reduce the dangers arising from excessive floods.

An interesting feature of U.S. irrigation works is the series of very high dams which have been built to control and conserve river supplies. The Elephant Butte dam has a height of 306 ft. and the reservoir has a storage capacity of 3,200,000,000 tons of water. So far this is the largest reservoir in the world. The Shoshone dam has a height of 328 ft. and has a capacity of 550,000,000 tons of water. The Roosevelt dam has a height of 280 ft. and the reservoir has a capacity of 1,650,000 tons of water. The Arrowrock dam has a height of 348·5 ft. and the reservoir has a capacity of 340,000,000 tons of water. The Pathfinder dam is 218 ft. high and the reservoir can contain about 1,300,000,000 tons of water. In all, the Bureau of Reclamation has 25 schemes either in operation or in process of construction.

Canada

Irrigation in Canada has been so far very partially developed and only in those provinces where extensive farming operations are in progress, such as Alberta, Saskatchewan and Manitoba. Developments are based upon the administration of the Federal Irrigation Act of 1894, under which the ownership of all surface water supply is vested in the Crown and the latter grants the necessary licences for its use.

Occasional droughts occur all over the wheat-growing belts; provision, however, is steadily and systematically being made to supply as much as possible irrigation water to counteract their effects. The government authorities are systematically obtaining data with a view to providing the maximum area financially possible with water and are yearly carrying out expensive systems of irrigation.

On the eastern section of the Canadian Pacific Railway Co., a census of the yields obtained and the water used by a group of 10 farmers during the past season, 1924, shows that the average yield of wheat on these 10 farms was 19½ bu. per ac. with one irrigation of 4 in. deep plus rainfall; with two 4-in. irrigations the yields received were from 30 to 35 bu.; and with three 4-in. irrigations were as high as 43 bu. per acre. In this district the total precipitation for 12 months was 11·24 in. of which 9·68 in. fell during the growing season. The water available for irrigation varies greatly in different provinces, some are much more favourably situated than others to receive it and certain provinces on the other hand hardly require irrigation. That the total water resources of Canada, however, are enormous can be gauged from the fact that it is estimated that there could be developed with it 41,400,000 H.P. of which only 3,227,414 h.p. was being used up to Feb. 1 1924. Some of the more important irrigation areas are mentioned below.

Alberta.—About 1,000,000 ac. were irrigated in 1923, of which 130,000 ac. were brought in about 20 years ago in the Lethbridge section.

Canadian Pacific Railway, Western Section.—A scheme has been in operation in this district for about 16 years, the area being 218,980 acres. The 1923–4 season was, however, so ideal for crop production, owing to favourable moisture conditions, that little irrigation was used, and only 3,074 ac. were irrigated, chiefly for alfalfa and meadow grasses.

Canadian Pacific Railway, Eastern Section.—Irrigation has been in operation in this section for about 10 years, the total irrigable area is 400,000 ac. which are gradually being developed, and of which 124,000 have been taken up. The conditions here render irrigation more necessary than in the western section owing to lower precipitation and slightly higher temperature.

Taber District.—Irrigation was established in May 1924, in the Taber district. Of 17,244 irrigable acres, 3,625 ac. have already been taken up and irrigated.

Lethbridge Northern Irrigation District.—This project was completed in May 1923. The irrigable area is about 105,000 acres.

United Irrigation District.—The irrigable area of this scheme is about 36,000 acres.

New West Irrigation District.—The irrigable area is 4,500 acres.

Bellaw Lomond Irrigation District.—The irrigable area is about 55,000 acres.

There are other smaller installations now working, and many more are proposed.

Irrigation in Australia

Owing to the lack of an adequate rainfall the advantages of irrigation appealed many years ago to Australians. At first the object aimed at was to develop in unoccupied territory. While these efforts generally proved successful, in recent years the policy has been to extend irrigation to existing pastoral settlements, and some very large conservation of flood water schemes have been carried out under which considerable areas of land are now in process of intenser settlement.

New South Wales.—The principal works in this state include:—

(1) *Murrumbidgee Gravitation Irrigation Scheme.*—The Murrumbidgee river is controlled by a dam 240 ft. high at Burrinjuck which can conserve about 960,000,000 tons of water. The scheme is to irrigate about 200,000 ac. of which 120,000 ac. were settled by June 1923. They are mainly devoted to vegetable and fruit-growing and dairying purposes.

(2) *Pump Irrigation Areas.*—(*a*) At Curlwaa on the Murray river about 2,000 ac., out of an area of about 10,600 ac., are receiving irrigation. (*b*) At Hay about 1,000 ac., out of an area of 4,500 ac. are receiving water from pumps on the Murrumbidgee river.

(3) *Projected Schemes.*—New South Wales is investigating schemes which will utilise its share of the Murray river waters and which it expects may amount to 150,000,000 tons. This should bring under irrigation an area of at least 100,000 ac. of land. It has also under consideration a number of smaller schemes affecting the Lachlan, Macquarie, Hunter, Namoe and Peel rivers, but it is not possible to give any estimate as yet of the areas which may be irrigated by them.

Victoria.—In Victoria the principal irrigation works are on the Goulbourne, Murray, Loddon, Werribee and MacAllister rivers. While the works for some of these schemes were completed before 1910, the areas to be irrigated are still only in process of settlement and extension of the works are from time to time taking place. In 1923, 350,727 ac. were irrigated.

Under the Goulbourne scheme, which comprises an area of about 850,000 ac. and where 800,000,000 tons of storage has already been provided for, a dam is being built at Sugarloaf in two stages, the first one of which was so far completed that storing of water took place in 1922. It may ultimately be 190 ft. high and may eventually contain about 1,100,000,000 tons of water. The Murray river scheme already serves an area of 340,000 ac. and is capable of expansion when the Hume storage reservoir is completed. This will form the largest sheet of fresh water in Australia, as it will cover 47 sq. m. and may contain about 2,500,000,000 tons of water. The Loddon river gravitation scheme serves 74,000 acres. The Werribee river gravitation schemes at Bacchus Marsh and Werribee serve 3,350 and 10,000 ac. respectively.

The Mildura pump irrigation scheme lifts water from the Murray river and serves 45,000 ac., of which 13,000 ac. are under intense cultivation. The MacAllister river scheme consists of a storage reservoir from which a gravitation supply will command about 80,000 ac. and is far advanced. These watering schemes are usually conjoined with domestic water supply schemes for towns and villages, and do not in the ordinary sense irrigate land, although they do, in fact, make great areas of land available for pasturing purposes. There are also some flood protection schemes, one of which at Kooweerup and Cardinia enabled 100,000 ac. of land to be brought into cultivation.

Queensland.—The Dawson valley scheme now under construction comprises a dam 140 ft. high at Nathans Gorge to impound about 3,100,000,000 tons of water. When completed it will be the second largest reservoir in the world. The area to be served is about 250,000 acres. The Inkerman irrigation area of 4,500 ac. is served by 230 shallow well pumps. Provision is being made to increase it to 10,000 acres. There are a number of smaller pump schemes at Townsville, Rockhampton, Bingera and Fairymead, which collectively serve about 4,000 acres.

South Australia.—The Rennearth scheme serves 7,850 ac., mainly fruit producing. The Murray river pumping plants serve 17,800 ac. and are being extended to serve a further 11,000 acres. The Cadett scheme serves about 1,200 ac. and is supplied with water pumped through 90 ft. of height. The Waikerie scheme serves about 9,800 ac. and has the water lifted through 150 ft. of head.

The Kingston scheme serves 500 acres. The Moorook scheme serves 1,000 acres. The Cobdoyla scheme is ready to serve about 3,600 ac. which can be increased to 30,000 ac. of irrigable land. The Berni scheme serves 7,700 acres. The Chaffey scheme will serve 14,000 acres. The Murray Swamp land scheme will eventually make available for irrigation 13,700 ac. of which 5,800 ac. are now cultivated. Smaller schemes serve about 10,000 ac. in all. In Western Australia the Harvey irrigation scheme serves 4,000 acres.

The Union of South Africa

Irrigation was at first confined to small schemes whose entire works usually lay within the boundary of one farm. Works of greater magnitude were made easier of accomplishment when the Govt. of the Cape of Good Hope, to encourage irrigation, passed the Act of 1876 known as the "Right of Passage of Water Act" in terms of which a proprietor was permitted to conduct water over the property of any other owner.

A further Act in 1877 provided for:—

(*a*) The establishment of Irrigation Districts and Boards,
(*b*) The granting of government loans to private individuals, and
(*c*) The repayment thereof at the rate of 8% per annum over a period of 24 years.

In the case of private schemes, both in the Cape and in the other provinces also, no complete record of the irrigable area has been made and even in the case of Board schemes such data as are available are frequently not based on actual surveys but are only estimates of the irrigable areas made during the earlier stages. Since 1916 great progress has been made with irrigation based upon conservation of water schemes.

The completed schemes, although numerous, are individually small in area, none exceeding 10,000 acres. Among those under construction or development are some of considerable magnitude. These latter include the Great Fish river scheme, where 75,000 ac. are to be irrigated, the Sundays river scheme of 36,000 ac. and the Kamanassie river scheme of 28,000 acres. The area of land under irrigation in South Africa as at March 31 1923 under Board schemes was about 130,000 ac. and the area to be served by works under construction is about 225,000 acres. Up to 1925 the state expended over £4,000,000 on completed schemes. Neither interest nor redemption can be paid on this sum until the land is wholly settled.

Work in China

China with its huge population of about 300,000,000 has no doubt a very large area of irrigated land but no statistics are available as to its extent except in a few small special districts where Europeans reside or have commercial interests. Hitherto engineering has been largely devoted to preventing the rivers in more than average floods overflowing their banks and inundating the land, an effect which has been many times accompanied by great loss of life. Commissions have studied river control and the conservancy boards in recent years have reported on and carried out important works with this end in view.

Quite obviously there is a large field in China for this form of development, and no doubt in time it will be followed by the more usual irrigation works. The following opinion of the engineer reporting on the Yangtse in 1923 gives a remarkably clear indication of the conditions there—it applies with equal force to the other great rivers of China.

> To anyone who has inspected the Yangtse from the Goyes to the sea, and who has given the faintest consideration to the question of restraining a river of this magnitude in its course through hundreds of miles of low-lying land, thousands of square miles of its area being below high water level, and therefore subject to inundation, it must be obvious that draining works, to be effective, would have to be constructed on a gigantic scale, and although the river is, in itself, and its tributaries and creeks, practically the one means of transport and communication serving a population of nearly 200,000,000 people with ever-growing transport requirements, it must be obvious that, unless improvement works can be made self supporting, it is futile seriously to embark upon them. Such are the conditions which prevail to-day and so they must remain for many years; in fact, until the growth of trade and growth of means which would follow thereon bring the necessity for works within the bounds of commercial possibility.

Developments in Other Countries

'Iraq.—The construction of the Hindia barrage was one of the first steps undertaken. In 1925 the Diala Cotton Co. inaugurated a great scheme whereby 108,000 ac. will be fertilised by water from the Diala river, a tributary of the Tigris. The company, it is understood, intends to extend its operations as fast as possible under its concession; and a time can be envisaged when adequate control of the Euphrates and Tigris, under conditions

of peace and good government, will allow of great areas of the arid plains of 'Iraq to be once again cultivated.

Spain and Portugal.—Irrigation has been developed in a number of places in the peninsula since the beginning of the century and schemes for further works are being considered. None of those so far completed are of any great magnitude, but among the proposals there is one for the irrigation of 120,000 ac. on the Guadalquivir. The possibilities of this river are being studied for other areas, and are great if by regulation of its excess flow in flood time its waters can be conserved for use in the drier periods of the year. On the Tagus a scheme near Villa Franca is now being surveyed which, if carried out, will enable 30,000 ac. to be irrigated.

Arabia.—An interesting irrigation development is the possibility of reviving agriculture by its aid in the Yemen. A syndicate is now (1926) studying a project to examine the many reservoirs which in ancient times controlled flood waters for the benefit of agriculture in that region.

Mexico.—In Mexico, and particularly in northern Mexico where the rainfall is negligible in the lower or plain country, strips of land are cultivated near the rivers by irrigation. The total area is considerable, but there are no records of its extent. The works are somewhat primitive but have been constructed entirely by private enterprise and good results in crop are obtained from them.

South America.—An irrigation scheme on the Rio Negro was carried out in 1914 whereby 230,000 ac. are being developed. There are other minor irrigation works in the country. There are irrigation works, carried out almost entirely by private enterprise, in the other South and Central American republics.

(M. Mac.)

IRWIN, EDWARD FREDERICK LINDLEY WOOD, 1st Baron (1881–), British politician, was born April 16 1881. The only surviving son of the 2nd Viscount Halifax, he was educated at Eton and at Christ Church, Oxford, being elected fellow of All Souls College in 1903. In Jan. 1910 he was returned to Parliament as Conservative member for the Ripon Division of Yorkshire, and retained his seat until 1925. During the World War he served in France 1915–7 with the Yorkshire Dragoons, in which he held the rank of major, being mentioned in dispatches, and was an assistant secretary to the Minister of National Service 1916–8. In April 1921 he was appointed Under-Secretary of State for the Colonies. In this capacity he made a tour of the West Indian colonies, and published his conclusions on the administrative and economic problems which he encountered in a report issued in June 1922. From Oct. 1922 to Jan. 1924 he was President of the Board of Education. In Nov. 1924 he became Minister of Agriculture and Fisheries in Mr. Baldwin's second Government. In Oct. 1925 he was appointed governor-general of India in succession to the marquess (then earl) of Reading, being raised to the peerage as Baron Irwin of Kirkby Underdale two months later. Like his father, Lord Irwin, who had been sworn of the privy council in 1922, took a keen interest in ecclesiastical affairs, and published a study of John Keble in the "Leaders of the Church Series." He married in 1909 Lady Dorothy Onslow, younger daughter of the 4th Earl of Onslow by whom he had three sons and two daughters.

ISHII, KIKUJIRO, Viscount (1866–), Japanese diplomatist, was born at Chiba, Japan. Like other members of his family, he was destined to enter official life. His intention was to become a lawyer, but his studies in international law gave him a deep interest in foreign affairs. His early days were full of incident: the Meiji reconstructions took place before his eyes, and the constant stream of foreign influences soon aroused in him a desire to see and understand other countries. Leaving the law faculty of the Imperial University in Tokyo in 1890, he was made attaché to the Japanese Legation in Paris. During his stay in Paris he applied himself to the study of European languages and became proficient in French and English. He was made third secretary in 1893, and about this time he devoted much attention to the problems of economics and international trade. He was distressed to observe that Japan did not hold such a position in the world's mart as in the opinion of most Japanese she deserved, and he set himself to find out the causes of the trouble. He endeavoured to form a Franco-Japanese mutual trade association, and although his efforts did not at first meet with the full success he desired, a certain stimulus was at once felt. Some part of the fruits of Ishii's labours were seen in the commercial mission which was sent from France to Japan in 1925.

In 1896 he was appointed Consul to Chemulpho (Jinsen) in Korea. After this he was made second secretary and later first secretary at the Japanese Legation in Peking. He was, therefore, in Peking in an official capacity during the Boxer rising. In 1900 he was appointed Secretary of the Head Office and chief of the telegraph section of the Home Office Department, which post he held until he became director of the Commerce Bureau in 1904. In 1907 he was sent to San Francisco and Vancouver in connection with the anti-Japanese riots there. His success in this matter was the direct cause of his appointment in the following year as Vice-Minister for Foreign Affairs. His love of France and understanding of French problems made him an easy favourite for the ambassadorship to Paris in 1912, and on his return he took over the portfolio for Foreign Affairs in the new Government. He was chief of the Foreign Office for the period 1915–6, and in the latter year he was created Viscount, having been made Baron in 1912. He played a great part in American-Japanese relations and was a special envoy to the United States in 1917. He was nominated a member of the House of Peers in 1916. In 1920 Viscount Ishii was for the third time officially delegated to Paris.

Perhaps Ishii's greatest claim on his country's gratitude was his work in connection with the so-called "Gentlemen's Agreement" made between Washington and Tokyo in 1907. Lansing was the United States representative in the negotiations, for which reason the arrangement is sometimes called the "Lansing-Ishii Pact." The western coast of the United States made representations to Congress deploring the increasing immigration of Asiatics, notably Chinese and Japanese. It was claimed that owing to the Asiatic standard of living being lower than that of Americans, there was a serious possibility of California becoming a Japanese colony, and the aid of legislation was invoked. The Lansing-Ishii pourparlers resulted in the postponement of suggested legislative measures, and a yearly maximum (tentatively fixed at 150) was proposed. Japan, through Ishii, agreed not to issue passports for more than this number annually to enter the United States as residents, and it was through Japan's alleged breach of faith in connection with this agreement that the Immigration Restriction Act was passed by Congress in 1924. In substance, this Act was one of the proposals originally shelved by the labours of Lansing and Ishii.

In Dec. 1920 Viscount Ishii became Japanese delegate to the 11th session of the Council of the League of Nations. In Aug. 1923 he became President of the Council of the League and in the following month was one of the Vice-Presidents of the Assembly. In Sept. 1925 he was again a Vice-President of the Assembly. In March 1926 he was President of the Council at its 39th session, and as such acted as President of the Assembly (March 1926) until the election of the new President. (A. N. J. W.)

ISLAMISM: *see* Pan-Islamism.

ISMET PASHA (1884–), Turkish statesman, was born in Smyrna of a Turkish family of Malatia. He received his education in the military schools of Turkey, and in 1903 graduated as an artillery lieutenant. Three years later he became a captain on the General Staff. After the Young Turk revolution of 1908, he was sent several times on military expeditions to Yemen. During the World War he served with distinction on the Syrian front, and at the close of the War held the rank of colonel, and commanded an army corps. During the Armistice he occupied important positions in the War Office. At the time of the occupation of Constantinople by the Allies he escaped to Angora disguised as a common soldier and was appointed by the Great National Assembly to be Chief-of-staff during the military opera-

tions of the Nationalists against the Caliphate army and Armenia. Later he became Commander-in-chief of the Turkish western front, and in this capacity insisted on the formation of a regular army in place of the irregular Nationalist forces. In the meantime, the irregular forces were unwilling to submit, and the Greek Army had taken the offensive. At Ineunu, Ismet defeated the Greeks, checked their offensive, subdued the irregular forces, and succeeded in completing the organisation of a regular army. He remained in command of the western front until after the battle on the Sakharia and the fall of Smyrna, in which events he was the right-hand man of Mustafa Kemal Pasha. In 1922 he signed the Armistice concluded at Mudania with the Allies, and succeeded in securing the evacuation of Eastern Thrace. In 1922–3, as Minister of Foreign Affairs and senior Turkish delegate to the Lausanne Conference, he most ably defended the interests of his country, and signed the Treaty of Lausanne.

During the autumn of 1923, at the time of the declaration of the republic, he became Prime Minister. After a short rest, due to failing health, he became Prime Minister a second time, towards the end of 1924, and shared in the suppression of the Shiekh Said revolt in Kurdistan. The abolition of the Caliphate, the closing of the medressehs (religious schools) and of the tekkes (monasteries), the abolition of the tithe, the adoption of the Swiss civil code, and the wearing of the hat are some of the momentous changes which were realised during Ismet's tenure of office.

ISONZO, BATTLES OF THE: *see* ITALIAN CAMPAIGNS.

ISOSTASY.—When the great Trigonometrical Survey of India was initiated, it was found that the deflection of the plumb-line by the Himalayas was much less than the calculated amount due to the theoretical attraction of the visible mass of the mountains. Sir G. B. Airy suggested that this might be caused by the presence of a mass of matter, of less than the average density, under the mountains; this explanation was further investigated by Archdeacon J. H. Pratt, who applied the term "compensation" to the negative effect of the underlying defect of density, in compensating the direct effect of the attraction of the visible mass of the mountains.

In 1892 Maj. C. E. Dutton, discussing the greater problems of physical geology, deduced a general principle that the weight of matter under any unit area of the earth's surface tended to become uniform, and suggested that this was brought about by an underground transfer of material to balance the visible surface transport from regions of erosion to those of deposition. To this principle he gave the name *isostasy* (*ἴσος* equal, and *στάσις* position), not as a synonym for Pratt's compensation, but as a name for the principle and process, by which it was brought about. In 1909 there appeared a very complete and elaborate investigation of the subject by J. F. Hayford, in which the word "isostasy" is used as synonymous with what Pratt called "compensation," and this use of the term has since become general among geodesists. Some inconvenience results from this twofold use of the word, to express either a measurable effect, or one theory of the cause by which this effect is produced; but the usage is too firmly established to be overcome, and the inconvenience is lessened as it has become recognised that the deep-seated variations in density, and consequently in bulk, to which Archdeacon Pratt gave the name "compensation," may be the primary phenomenon and cause of the major differences of surface level. (*See* also GEODESY; GEOLOGY.)

See G. B. Airy, *Phil. Trans.*, 1855, vol. 145, p. 101; J. H. Pratt, *Phil. Trans.*, 1859, vol. 144, p. 745; C. E. Dutton, *Bull. Phil. Soc. Washington*, 1892, vol. 11, p. 51; J. F. Hayford, *The Figure of the Earth and Isostasy, from Measurements in the United States* (Washington, 1909); W. Bowie, "Abnormal Densities in the Earth's Crust disclosed by Analysis of Geodetic Data," *Geog. Jour.*, 1924, vol. 63, p. 26.

(R. D. O.)

ISOTOPES (Gr. *ἴσος* equal + *τόπος* place), is the term first applied by F. Soddy in 1913 to substances which, though they had different atomic weights, yet had identical chemical properties and occupied the same place in the periodic table of the elements. Over a century earlier Dalton had postulated that atoms of the same element are similar to one another and equal in weight. A little later Prout suggested that the atoms of all elements were composed of atoms of a primordial substance which he endeavoured to identify with hydrogen.

If both these theories were right, the atomic weights of all elements would be comparable with each other as whole numbers. This the chemists soon showed was quite incompatible with experimental evidence. It is true that many were very nearly whole numbers, far too many for the effect to be pure chance, but others, like chlorine, were hopelessly fractional. Of the two alternatives Dalton's is much the simpler from the chemical point of view and was therefore quite rightly chosen as a working hypothesis. From this in course of time it developed into an article of scientific faith, and, despite the complete absence of positive evidence in its support, no serious questions as to its validity were raised until late in the 19th century. Of such speculations those of Crookes were founded on unsound evidence and were soon discredited. The question could not be settled by ordinary chemical methods, which employ countless myriads of atoms and could therefore only give a mean result, and it was only by the discovery of radioactivity and the development of accurate methods of weighing individual atoms that the existence of isotopes was disclosed. The two advances were nearly contemporaneous but the first definite convincing proof of isotopy was found among the radioactive elements and their products.

The Radioactive Isotopes.—In 1906 Boltwood discovered ionium and found that it had similar chemical properties to thorium. Further research using the most delicate radioactive methods failed to indicate the slightest chemical separation of these two elements once they had been mixed, and even more surprising their spectra appeared to be identical. Other pairs of elements in the radioactive group showed corresponding identities and later investigations on the chemistry of the products of radioactive disintegrations enabled the chemical law of radioactive change to be formulated (*see* RADIOACTIVITY). This stated that a radioactive element when it loses an alpha particle goes back two places in the periodic table; when it loses a beta particle it goes forward one place. An alpha particle is a helium nucleus of weight 4, whereas a beta particle is an electron of negligible weight. It follows that if a body loses one alpha and two beta particles it will be back again in the same place in the periodic table although it will have lost a mass equal to four units of atomic weight.

Isotopic Bodies Predicted.—Supported by this law, which he was the first to state in its most general form, Soddy boldly claimed that these "isotopic" bodies would be both chemically and spectroscopically indistinguishable. He also predicted that the lead produced by the disintegration of uranium would have an atomic weight 206, while that of the lead produced from thorium would be 208, and that consequently the atomic weight of the lead found in uranium minerals should be less than that of ordinary lead (207·2) while that of lead from thorium minerals should be greater. These predictions were amply vindicated during the War by the work of experts on atomic weights (Richards, Hönigschmid and others), and it was shown beyond all dispute that the isotopic leads, though they differed by the predicted amount in properties such as atomic weight, density, and solubility which depend directly on the weight of their atoms, in all others, which do not—atomic volume, boiling-point, melting-point, refractive index and spectrum—were quite indistinguishable.

Practical Utilisation of Indicators.—The impossibility of separating isotopes has been utilised in ingenious manner by Hevesy and Paneth. By the addition of a small quantity of a radioactive isotope to an ordinary inactive element, the latter is, so to speak, indelibly labelled and can be followed by the methods of radioactivity, which are incomparably more delicate than those of chemistry. In this way the solubility of very insoluble salts can be readily determined. By the addition of a little thorium B, an isotope of lead, valuable information has been obtained on the assimilation of the salts of the latter element by living plants. The use of such radioactive indicators affords a direct proof of the ionic dissociation theory, it has led to the discovery of certain metallic hydrides and to the deter-

mination of the velocity of diffusion of molecules among themselves, an otherwise insoluble problem.

Positive Ray Analysis.—It is clear that the reasoning which led to the discovery of isotopes among the radioactive elements is inapplicable to those much more abundant ones which do not exhibit this property. Among the latter the presence of isotopes can only be demonstrated by weighing their individual atoms. This can be done by the analysis of positive rays, also called *Kanalstrahlen* or mass rays, which are electrically charged atoms of matter moving with such high velocities that they can be detected by means of their impact on a fluorescent screen or photographic plate. The usual method of producing these is by the discharge in gases at low pressure. In the region of the Crookes dark space and negative glow in front of the cathode the gas is ionised; that is to say, its atoms are split up into positively and negatively charged parts. The latter are the same whatever the nature of the gas, they are electrons and fly away from the cathodes constituting the well-known cathode rays. The remaining positively charged particles will fly toward the cathode. Their masses may vary from that of the lightest atom to that of the heaviest molecule in the gas, and their energies from an indefinitely small value to a maximum expressed by the product of the charge they carry, multiplied by the total potential applied to the electrodes. If the cathode be pierced, the rays pass through the aperture and form a stream of particles heterogeneous both in mass and velocity, which can be subjected to analysis.

The "Parabola" Method.—In Sir J. J. Thomson's "parabola" method of analysis, the particles, after reaching the surface of the cathode, pass through a long and very fine metal tube. By this means a narrow beam of rays is produced, which is passed through electric and magnetic fields causing deflections at right angles to each other, and finally falls upon a photographic plate. It can be shown that, if the mass of any particle is m and its charge e, when both fields are on together, the locus of impact of all particles of the same e/m, but varying velocity, will be a parabola. Since e must be the electronic charge, or a simple multiple of it, measurements of the relative positions of the parabolas on the plate enable us to calculate the relative masses of the particles producing them—that is, the masses of the individual atoms or molecules. The fact that the streaks were definite, sharp parabolas, and not mere blurs, constituted the first direct proof that atoms of the same element were, even approximately, of equal mass. For some time the results of the application of this method of analysis appeared to support the hypothesis of Dalton, as the elements introduced into the discharge tube gave single, or apparently single, parabolas in the positions expected from their chemical atomic weights. (*See* GASES, ELECTRICAL PROPERTIES OF.)

Examination of Neon.—But when, in 1912, neon was examined, the trace obtained was definitely double. The brighter curve corresponded roughly to an atomic weight of 20, the fainter companion to one of 22, the atomic weight of neon being 20·20. The line 22 could only be explained as due to a hitherto unknown elementary constituent of neon. This agreed well with the new idea of isotopic elements which was just then emerging from the investigations on radioactivity, so that it was of importance to investigate the point as fully as possible. The first line of attack was an attempt at separation by fractional distillation, but the result was entirely negative. The second method employed was that of fractional diffusion through pipe-clay which gave a small, but definite, positive indication of separation. It therefore seemed probable that neon was a mixture of isotopes.

The Mass-Spectrograph.—By the time that research on the subject was resumed at the Cavendish Laboratory in 1919, the existence of isotopes among the products of radioactivity had been proved beyond all reasonable doubt by the work on the atomic weight of lead. This fact automatically increased the value of the evidence of the complex nature of neon and the urgency of its definite confirmation. It was realised that separation could only be very partial at the best, and that the most satisfactory proof would be afforded by measurements of atomic weight by the methods of positive ray analysis. These would have to be so accurate as to prove beyond dispute that the accepted atomic weight lay between the real atomic weights of the two constituents, but corresponded with neither of them. The parabola method was not equal to this, but the required accuracy was achieved by means of an instrument shown in diagram in fig. 1.

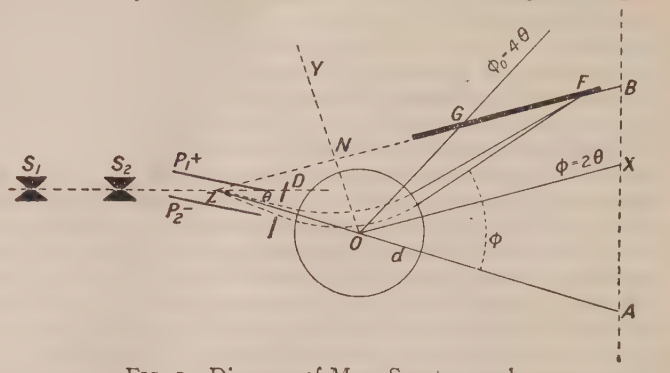

FIG. 1.—Diagram of Mass Spectrograph.

Positive rays are sorted out into a thin ribbon by two parallel slits S_1S_2, and are then spread into an electric spectrum by means of the charged plates P_1P_2. A portion of this spectrum deflected through an angle θ is selected by the diaphragm D and passed between the poles of a powerful magnet O, the field of which is such as to bend the rays back again through an angle ϕ more than twice as great as θ. The result of this is that rays having a constant mass (or, more correctly, constant e/m) will converge to a focus F, and if a photographic plate is placed at GF as indicated, a spectrum dependent on mass alone will be obtained. On account of its analogy to optical apparatus, the instrument has been called a mass-spectrograph and the spectrum produced a mass-spectrum.[1]

Mass-Spectra.—Fig. 2 shows a number of typical mass-spectra that are obtained by this means. The numbers above the lines indicate the masses they correspond to on the scale O = 16. It will be noticed that the displacement to the right with increasing mass is roughly linear. The measurements of mass are not absolute, but relative to lines which correspond to known masses. Such lines due to hydrogen, carbon, oxygen and their compounds, are generally present as impurities or purposely added, for pure gases are not suitable for the smooth working of the discharge tube. The two principal groups of these reference lines are the C_1 group, due to C (12), CH (13), CH_2 (14), CH_3 (15), CH_4 or O (16), and the C_2 group (24–30) containing the very strong line C_2H_4 or CO (28). These groups will be seen in several of the spectra reproduced, and they give, with the CO_2 (44) line, a very good scale of reference.

Mass Measurements.—Measurements of mass can be made with an accuracy of 1 part in 1,000. It must be remembered that the ratio of mass to charge is the real quantity measured by the position of the lines. Many of the particles are capable of carrying more than one charge. A particle carrying two charges will appear as having half its real mass; one carrying three charges as if its mass was one-third, and so on. Lines due to these are called lines of the second and third order. Lines of high order are particularly valuable in extending our scale of reference.

When neon was introduced into this apparatus, four new lines made their appearance at 10, 11, 20 and 22. The first pair (not shown in diagram) are second order lines. All four are well placed for direct comparison with the standard lines, and a series of consistent measurements showed that to within about one part in a thousand, the atomic weights of the isotopes composing neon are 20 and 22 respectively. Ten per cent of the latter would bring the mean atomic weight to the accepted value 20·20, and the relative intensity of the lines agrees well with this proportion. The isotopic nature of neon was therefore settled beyond doubt. Spectrum I. on fig 2 (*see* next page) shows the first order lines of neon and some of the reference lines with which they were compared.

Analysis of Chlorine.—The element chlorine was naturally the next to be analysed, and the explanation of its fractional atomic weight (35·46) was obvious at once. Its mass-spectrum is char-

[1] A full description of the Mass-Spectrograph is given in *Isotopes* by F. W. Aston, Cambridge University Press, pp. 44 *et seq.*

acterised by four strong lines 35, 36, 37, 38. The simplest explanation of the group is to suppose that the lines 35 and 37 are due to the isotopic chlorines, and the lines 36 and 38 to their corresponding hydrochloric acids. The elementary nature of 35 and 37 is indicated by their second order lines at 17·5 and 18·5, and also when phosgene was used, by the occurrence of lines at 63 and 65 due to $COCl^{35}$ and $COCl^{37}$.

Later it was found possible to obtain the spectrum of the negatively charged atoms of chlorine. This showed only two lines 35 and 37, so that the lines 36 and 38 cannot be due to isotopes of the element. These results show that chlorine is a complex element, and that its isotopes are of atomic weight 35 and 37. Spectra II., III. and IV. show the results with chlorine taken with different field strengths (*see* CHEMISTRY).

Other Elements.—As the work progressed with other elements further interesting results were obtained. Some elements, such as carbon and oxygen, were found to be "simple"; that is, not mixtures of isotopes. This was to be expected from their whole-number atomic weights. Even more proved "complex," some consisting of 7, and in the case of xenon possibly 9 isotopes. The complexity of mercury is indicated by the blur of its unresolved third and fourth order groups seen in spectrum IV. Its lines have been resolved by means of a more powerful instrument. Mass rays of the metallic elements, which are in the majority, cannot in general be produced in the ordinary vacuum discharge. They can be investigated by means of anode rays.

The constitution of the alkali metals was first discovered by the use of an anode consisting of a platinum strip coated with salts of the metals, and heated electrically. Dempster, at Chicago, produced mass rays of metals by heating the element in a furnace and ionising the vapour produced by electron impact. To analyse the rays so formed he used low velocities and an electrical method of detection. By this means he made the first analyses of magnesium, calcium and zinc, and also confirmed the results already obtained for the lighter alkali metals.

More recently a large number of elements, including some of the rare earths, have been successfully attacked by means of the special method of "accelerated anode rays," and in all 56 out of the 80 known non-radioactive elements have been analysed into their constituent isotopes or shown to be simple.

The Whole-Number Rule.—By far the most important general result of these investigations is that, with the exception of hydrogen, the weights of the atoms of all the elements measured, and therefore almost certainly of all elements, are whole numbers to the accuracy of experiment. With the mass-spectrograph, this accuracy is generally one part in a thousand. Of course, the error expressed in fractions of a unit increases with the mass measured, but with the lighter elements the divergence from the whole-number rule is extremely small. This enables sweeping simplifications to be made in our ideas of mass.

The original hypothesis of Prout can now be restated with the modification that the primordial atoms are of two kinds: protons and electrons, the atoms of positive and negative electricity. According to the modern theory of the nucleus atom (*see* ATOM; MATTER) all the protons and about half of the electrons are packed very close together to form a central, positively charged nucleus, round which the remaining electrons circulate, somewhat like the planets round the sun. All the spectroscopic and chemical properties of the atom depend on the net positive charge on the nucleus, which is the excess of protons over nuclear electrons. This is also clearly the number of planetary electrons in the neutral atom; it is called the "atomic number" and is actually the number of the element in the periodic classification: 1 for H, 2 for He, 3 for Li, and so on.

The whole-number weight of the atom, on the other hand, will be the total number of neutral pairs of protons and electrons it contains. This is also the number of protons in its nucleus, and is called the "mass-number" of the atom: 1 for H, 4 for He, 6 and 7 for the isotopes of Li, and so on. For the purpose of distinguishing isotopes it is customary at present to use the chemical symbol of the complex element with an index corresponding to the mass-number of the particular isotope, *e.g.*, Ne^{22}, Rb^{87}.

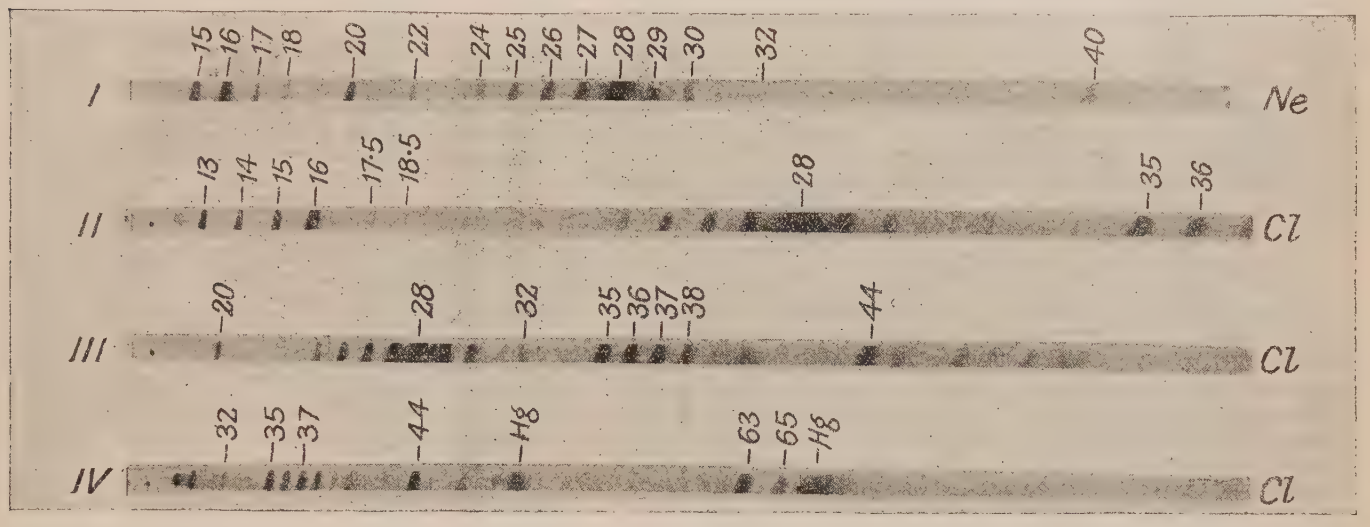

Fig. 2. Typical Mass Spectra

Packing Effect.—The whole-number rule is not mathematically exact, for owing to the extremely close packing of the charges of opposite sign in the nucleus, this will have a weight slightly less than the sum of the weights of its constituents. This loss of weight is called the "packing effect." Hydrogen, which has for its nucleus a single proton, will have no packing effect, and may therefore be expected to have an abnormally large weight. Comparison of this element with others by means of the mass-spectrograph, using special methods, shows that, within experimental error, the weight of its atoms on the chemical scale (O = 16) is indistinguishable from that obtained by chemical methods, namely, 1·0077.

The divergences of other elements are barely measurable at present, but the isotopes of lithium appear heavier than whole numbers by about 1 part in 1,000. Most of the heavier elements show a slight defect, which is to be expected if we take oxygen as having normal packing. The defect in the case of the isotopes of tin appears to be at least 2 parts in 1,000, which is 0·2 of a unit of atomic weight.

These considerations are of the greatest interest theoretically, for upon them rests the hope of the future liberation of the so-called "atomic energy." (*See* ATOMIC ENERGY.) The theoretical importance of chemical atomic weight has been somewhat reduced by the discovery that for so large a number of elements it merely represents a statistical mean. Its position as a natural numerical constant associated with an element has now been taken by the atomic number, which indeed defines the element, though from the point of view of chemical analysis, the mean

atomic weight is as important as ever. The anomalies shown by those elements which, by their atomic weights, appear out of their right order in the periodic table, are now open to the simplest explanation. Thus argon, in which the heavier of two isotopes predominates, has a greater mean weight than potassium, in which the reverse is the case. The same explanation applies to cobalt, nickel, tellurium and iodine.

Since the atomic number only depends on the *net* positive charge on the nucleus, arithmetically any element can possess an indefinite number of isotopes. The table herewith shows that those present in detectable quantity are restricted both in number and range of weight, though the causes of these restrictions are at present unknown. No element of odd atomic number has more than two isotopes and, above atomic number 9, the mass-numbers of the isotopes always differ by 2, and the lighter is the more abundant constituent. The number of nuclear electrons tends to be even. That is, in the great majority of cases even atomic number is associated with even mass-number, and odd with odd. Beryllium and nitrogen are the only elements consisting entirely of atoms whose nuclei contain an odd number of electrons.

If the mass numbers of the various species of atoms are plotted against their relative abundance in the earth's crust, a strong preponderance of those of type 8n may be seen. There is an extreme difference of range between the abundance of isotopes in an element and elements in nature. In the case of elements of an odd atomic number this cannot be ascribed merely to lack of delicacy in the means of detection of their isotopes. Thus while there are only about three Cl^{35} atoms to one Cl^{37} and about two Ga^{69} atoms to one Ga^{71}, yet there are a thousand million more atoms of chlorine than of gallium. This suggests that isotopes have some relation in common more fundamental than that of identity of nuclear charge, an idea which is supported by other independent lines of reasoning.

Spectra of Isotopes.—As regards their series spectra, in which, on Bohr's theory, the two bodies concerned are an electron and an enormously more massive atomic nucleus, the prediction that isotopes should be indistinguishable is satisfied to a high degree of precision. So far the only effect detected is a minute difference of wave-length between the lines of Carnotite lead (206) and ordinary lead (207·2). The most accurate measurements by Merton indicate that this has a maximum value of 0·011 Å for the line $\lambda = 4058$. Smaller shifts are detectable in a few other lines, the wave-length for the lighter atom being the greater in all cases. In band spectra, where two nuclei are concerned, the isotope effects are much larger and in excellent agreement with theory. In the case of HCl bands in the infrared region the duplicate peaks are as much as 14 Å apart, and in position and relative intensity, correspond exactly with the results expected from the presence of HCl^{35} and HCl^{37}.

More recently by investigation of band spectra produced in the visible region by boron oxide and silicon nitride, Millikan has shown that separate band heads appear corresponding to the two isotopes of boron, in the one case, and to three isotopes of silicon in the other. These results constitute valuable independent confirmation of the results of the mass-spectrograph.

Separation of Isotopes.—It is perhaps a fortunate thing for the simplicity of chemical arithmetic that the artificial separation of isotopes is excessively difficult, while at the same time no process tending to that end in nature appears to exist at all. Of the artificial methods the only one giving complete separation is the actual analysis of the mass-rays, during which the isotopic atoms strike the plate at different points and therefore, if collected, would yield pure specimens. The quantities so produced would, with the means at present available, be far too minute to be of any practical value.

A large number of methods for partial separation have been suggested and tried. The first successfully used, which is only applicable to gases, is that of free diffusion through pipe-clay or other suitable porous material. The diffusion rates are inversely proportional to the square roots of the masses concerned. It follows that if a large volume V of a mixture of isotopes is allowed to diffuse, leaving a small residue v, the latter will be richer in the heavier constituent than was the original gas. The actual numerical value of this enrichment, under ideal conditions, with isotopes, such as those of neon, which differ by 10% is only $20\,(V/v)^{\frac{1}{2}}$ so that only by the use of very large volumes, or laborious repetitions, can any measurable change be achieved. The original experiments with neon gave a shift of atomic weight of rather more than 0·1 of a unit. Harkins, at Chicago, by the use of 19,000 litres of HCl, was able to obtain considerable samples in which the atomic weight of chlorine differed by 0·055 unit.

Table of Elements and Isotopes

Element	Atomic number	Atomic weight	Minimum number of isotopes	Mass numbers of isotopes in order of intensity
H	1	1·008	1	1
He	2	4·00	1	4
Li	3	6·94	2	7, 6
Be	4	9·02	1	9
B	5	10·82	2	11, 10
C	6	12·00	1	12
N	7	14·01	1	14
O	8	16·00	1	16
F	9	19·00	1	19
Ne	10	20·20	2	20, 22
Na	11	23·00	1	23
Mg	12	24·32	3	24, 25, 26
Al	13	26·96	1	27
Si	14	28·06	3	28, 29, 30
P	15	31·02	1	31
S	16	32·06	1	32, 33, 34
Cl	17	35·46	2	35, 37
A	18	39·88	2	40, 36
K	19	39·10	2	39, 41
Ca	20	40·07	2	40, 44
Sc	21	45·1	1	45
Ti	22	48·1	1	48
V	23	51·0	1	51
Cr	24	52·0	1	52
Mn	25	54·93	1	55
Fe	26	55·84	2	56, 54
Co	27	58·97	1	59
Ni	28	58·68	2	58, 60
Cu	29	63·57	2	63, 65
Zn	30	65·38	4	64, 66, 68, 70
Ga	31	69·72	2	69, 71
Ge	32	72·38	3	74, 72, 70
As	33	74·96	1	75
Se	34	79·2	6	80, 78, 76, 82, 77, 74
Br	35	79·92	2	79, 81
Kr	36	82·92	6	84, 86, 82, 83, 80, 78
Rb	37	85·44	2	85, 87
Sr	38	87·63	2	88, 86
Y	39	88·9	1	89
Zr	40	(91)	3(4)	90, 94, 92, (96)
Ag	47	107·88	2	107, 109
Cd	48	112·41	6	114, 112, 110, 113, 111, 116
In	49	114·8	1	115
Sn	50	118·70	7(8)	120, 118, 116, 124, 119, 117, 122. (121)
Sb	51	121·77	2	121, 123
Te	52	127·5	3	128, 130, 126
I	53	126·92	1	127
X	54	130·2	7(9)	129,132,131, 134, 136, 128,130,(126),(124)
Cs	55	132·81	1	133
Ba	56	137·37	(1)	138
La	57	138·91	1	139
Ce	58	140·25	2	140, 142
Pr	59	140·92	1	141
Nd	60	144·27	3(4)	142, 144, 146, (145)
Hg	80	200·6	6	202, 200, 199, 198, 201, 204
Bi	83	209·00	1	209

Another method, following much the same numerical laws, is that of Bronsted and Hevesey, which consists of free evaporation from a liquid surface at very low pressure. They obtained two samples of about 0·2 cc. of mercury differing in density by 5 parts in 10,000, or 0·1 of a unit. The atomic weights showed a corresponding difference, but the electrical conductivity of the two samples was indistinguishable to one part in a million.

Other methods of separation such as chemical action, centrifuging, ionic migration and thermal diffusion have only yielded meagre or entirely negative results. A very large number of attempts have been made in recent years to discover any variation in the chemical atomic weight of elements known to be complex, which would indicate a change in the proportions of the isotopes present. Boron, silicon, chlorine, iron and nickel have all received attention, but in no case with any certain positive result. From their experiments on silicon from no less than 12 different terrestrial and meteoric sources, Jaeger and Dijkstra concluded that these gave products not differing in density by more than 0·00004%.

The accumulation of negative evidence of this kind is very impressive, and supports the idea that the evolution of the elements, apart from those produced by radioactive disintegration, must have been such as to lead to a proportionality of isotopes which was constant from the start, and, since we know of no natural process of separation, has remained constant ever since. See F. W. Aston, *Isotopes*, 2nd ed., 1924. (F. W. A.)

ISRAËLS, JOSEF (1824–1911), Dutch painter (*see* 14.885b), died at The Hague Aug. 12 1911.

ITAGAKI, TAISUKE, COUNT (1837–1919), Japanese statesman, died in 1919. True to his liberal principles, he forbade his son to apply for the succession to his title and it lapsed.

ITALIAN CAMPAIGNS.—Italy entered the World War as a combatant on May 23 1915, when she declared war on Austria. The following article constitutes an outline of the struggle between Italy and Austria from that date until the signing of the Austro-Italian Armistice on Nov. 3 1918. The article has been divided into five sections, namely: I. Italy's Strategical Position; II. The First Year's Campaign; III. Battles of the Isonzo and the Carso; IV. The Austro-German Effort; V. The Collapse of Austria. More detailed accounts of the outstanding battles in the campaign are given under separate headings, namely: ASIAGO, BATTLE OF; CAPORETTO, BATTLE OF; and VITTORIO VENETO, BATTLE OF.

I. ITALY'S STRATEGICAL POSITION

At the outbreak of the World War the Italian General staff had no worked-out plan for an offensive campaign against Austria-Hungary. The great military superiority of the Habsburg Empire and the unfavourable frontier drawn in 1866 seemed to deny the possibility of Italian offensive action. A glance at the map makes the position clear.

Original Italian Plan.—When Italy was preparing to enter the War, the fact that Austria-Hungary was already heavily engaged elsewhere offered the chance of an Italian attack, and Gen. Cadorna, who took command on the declaration of war, had worked out his scheme in expectation of simultaneous offensive action on the part of Russia and Serbia. The plan was based on the idea that Italy must hold on the north and push towards the east. The eastern front, though difficult enough, seemed less impervious to an offensive than the Alpine masses on the north. An attack in this direction was calculated to occupy a much larger number of enemy troops, which was obviously a part of Cadorna's duty, and was further a direct threat against a vital part of the monarchy. These advantages were rightly held to compensate for the fact that an advance eastward meant the lengthening of a front already very long, and increased, moreover, the menace of the Trentino salient.

This threat was mitigated by the expectation of Allied action on the northeast and southern fronts of Austria-Hungary, which would prevent the enemy taking advantage of the weakness indicated. But, on the eve of Italy's declaration of war, the situation had changed. The Russian armies north of the Carpathians had given way before the attacks of Mackensen and Böhm-Ermolli. There was no word of movement, even of demonstration, on the part of Serbia, in spite of requests from the Allies, and in May the Austro-Hungarian troops on the Serbian front were reduced by five divisions, which were sent to the Isonzo-Carso front, their place being taken by three newly-formed German divisions.

Disposition of the Forces.—On the eve of war Cadorna's dispositions were as follows: Gen. Roberto Brusati's I. Army, with five divisions and 10 Alpine battalions, was to conduct a limited offensive in the Trentino, with the object of shortening the line and securing strong defensive positions. Gen. Nava's IV. Army, five divisions and seven Alpine battalions, was to attack the enemy communications in the Pusterthal and co-operate in an advance towards Tarvis; this advance was to be carried out by the "Carnia Force," consisting of one infantry division and 16 Alpine battalions under Gen. Lequio. The II. and III. armies, under Gen. Frugoni and the Duke of Aosta respectively, were to attack with all speed on the Isonzo front. Frugoni had eight divisions and the Duke of Aosta six, with three cavalry divisions. But on May 24 only three corps (seven divisions) and three cavalry divisions were ready to attack.

On May 20 the Austrian armies, which had been placed under the command of the Archduke Eugene, with Gen. Krauss as his chief-of-staff, formed little more than a screen. Gen. Dankl, lately in command of the Austrian I. Army, had about two divisions in Tirol, with some Landsturm battalions; Gen. von Rohr had a similar force to oppose an advance on Tarvis; and the Isonzo front, from Monte Nero to the sea, was lightly held by three divisions under Gen. Ludwig von Goiginger. But reinforcements were close at hand. Within a few days Rohr had two more divisions at his disposal, and by May 27 Gen. Boroević von Bojna, to whom the Isonzo front had been entrusted, had 90 battalions between Monte Nero and the sea.

II. THE FIRST YEAR'S CAMPAIGN

The opening moves of the Italian offensive, all-important as they were in relation to the future operations, failed to obtain the results hoped for in Cadorna's design. The I. Army performed its limited task quickly and satisfactorily, but the IV. Army was very slow. Here, almost certainly, a good chance was missed. Lequio's Carnia force was quick to move and found that the enemy was equally quick. This sector was all-important to the Austrians, from the point of view both of offence and defence. It was essential to prevent a break-through to Tarvis and Villach, and if they could hold the frontier line it preserved for them the chance of the attack down the valleys leading to the Tagliamento. Here alone the way was blocked against any but an overwhelming force.

Italy Takes the Offensive.—Meanwhile, the II. and III. armies were on the move. Frugoni, with the five divisions of his army that were ready, attacked along the line of the Isonzo from the Saga to opposite Gorizia. The Duke of Aosta, with a single corps and two cavalry divisions, was to force the passage of the lower Isonzo and push on towards the Carso. The Austrians had withdrawn beyond the river, except at the two strong bridge-heads opposite Tolmino and Gorizia, which were held in force, and south of Gorizia the line of defence chosen was the Carso plateau. Speed and initiative were essential if the opening moves of the Italian offensive were to be successful, and at various points speed and initiative were lacking. The bridge-heads were invested, as were several other strong positions held by the enemy.

On the other hand, the country is extraordinarily difficult, and roads were few and mostly bad; and those which were suitable for the movement of troops and guns led only to the points which the enemy was holding in some force. Fortune, too, was against the attacking armies. Appalling weather made movement in the mountains almost impossible during the critical period, and when the chance of a surprise had gone the great barrier of the Julian Alps was an insuperable obstacle to such forces as the Italians could bring against it. Guns, machine-guns and transport were lacking. Farther south, in the plain west of the Carso, the Isonzo came down in sudden and violent flood and held up the Duke of Aosta's advance. The fords were impassable and bridges had been blown up by the retreating enemy.

By the end of the third week in June the Italians had gained several important positions, some of them after very hard fighting, but they had been brought to a stop before the Austrian

main lines, and it became clear that the hopes of a war of movement must be given up, that only the slow processes of trench warfare could lead to success. The Italian mobilisation was now completed, and Cadorna had ready some 35 divisions. Against these the Archduke Eugene had some 20 divisions, including the Bavarian *Alpenkorps*, which had been sent to Tirol, although Germany and Italy were not yet at war. Boroević and Dankl were much weaker in infantry strength than the armies opposed to them. But they were strong in artillery, were very much better equipped with machine-guns, and held positions that were naturally ideal for defence and had been well prepared.

First and Second Battles of the Isonzo.—On June 23 began what is known as the first battle of the Isonzo. The II. Army, with a strength of 10 divisions and two Alpine groups, attacked the enemy lines in the Tolmino sector, and from Plava to Podgora, while the III. Army, with six divisions, moved to the assault of the western rim of the Carso plateau. The Italians had not sufficient heavy artillery; Boroević had now nine divisions, with their march battalions, and further reserves were on the way. After very heavy fighting at Plava, where the earlier Italian advance had established a small bridge-head, at the Gorizia bridge-head (M. Sabotino and M. Podgora) and on the edge of the Carso the action was broken off on July 7. During the fortnight's fighting the Italians had gained a little ground at the cost of about 19,000 casualties. The Austrian casualties to date were 22,000.

After 10 days' breathing space Cadorna attacked again in the same sectors. Boroević had now 13 divisions under his command, but Cadorna had concentrated all his slender supply of heavy guns on the Isonzo front. No headway was made by the II. Army but a fierce struggle took place on the Carso. Monte San Michele was taken on July 20 but lost again, and six days later a fresh attack had the same result. The second battle of the Isonzo ended on Aug. 3 with the Italians close under the crest of Monte San Michele and the village San Martino del Carso, and in possession of most of Monte dei Sei Bus, farther south. The Italians lost some 34,000 men, but the Austrians also suffered severely and lost over 10,000 prisoners.

The Autumn Offensive, Oct.–Dec.—Various isolated actions were carried out on the long front during the summer, but the time was devoted chiefly to preparation for a big offensive in the autumn. By the middle of Oct. Cadorna could dispose of 312 battalions on the Julian front. The II. Army now consisted of 12 divisions and the III. of seven, while a reserve of five divisions lay ready in the Friuli plain. When the attack began Boroević had about half this number of troops, but within a fortnight he had the equivalent of 15 divisions at his disposal. It was on the II. Army front that the Italian numerical superiority was great; on the Carso the Duke of Aosta had no marked advantage in numbers over the Archduke Joseph, who had assumed the command in this sector in July. But the terrain on Boroević's right was such that he could expect to hold with greatly inferior forces, especially in view of the Italian weakness in artillery. The offensive went badly. By his main attack Cadorna had hoped to turn the Gorizia positions from both north and south, and as a secondary operation, after crossing the middle Isonzo, to threaten Tolmino from the south, as well as from west and north. After a first phase lasting a week, the attack was renewed four days later on a narrower front, but the third battle of the Isonzo closed on Nov. 4 with little tangible result.

Six days later the fourth battle of the Isonzo was begun, and the struggle went on for more than three weeks, the offensive being finally broken off on Dec. 5. As men and munitions became exhausted the scope of the action had been gradually reduced to an attack on the Gorizia bridge-head and still another struggle for Monte San Michele. Once more the artillery proved insufficient, and the main feature of the fighting was the heroic efforts of the infantry on both sides. During the two battles, which were fought in persistent bad weather, the Italians lost over 113,000 men and the Austrians about 90,000. The result of the first seven months' campaigning was disappointing to those who had hoped for far greater effects from Italy's intervention. It was not generally recognised how poorly the Italian Army was provided with the material necessary to modern war. Inevitably, moreover, the Austrians had a great advantage in their nine months' war experience. They were clearly superior in skill to their opponents, and their superior skill was backed by a spirit which the armies of the dual monarchy sometimes failed to show on the Eastern Front.

Preparations for 1916.—The winter months were busily em-

ployed, especially in the munition factories. It was beginning to be recognised in Rome that estimates regarding numbers of men and shells had to be revised. During the winter the small total of heavy and medium guns was increased sevenfold, and great if still inadequate efforts were made to increase the supply of shells. An important innovation of the winter was the *bombarda*, or big trench mortar, large numbers of which were constructed to make up for the deficiency in heavy artillery. The *bombarda* was in fact much more than what is usually understood by the term trench mortar. Its range was much longer, and the destructive power of its big projectile was very great.

The supply of men, no less than that of material, required to be replenished and augmented. In seven months the Italian losses in the field were close upon 280,000—66,090 killed, 190,400 wounded and 22,520 missing or prisoners. The Austrian losses were 28,000 killed, 97,000 wounded and 31,000 missing or prisoners, in all 156,000. The Italian figure was in addition to casualties from sickness, which were heavy, including as they did the losses from an outbreak of cholera in the II. Army. Men had to be found not only to fill up the gaps but to make new formations. During the winter the gaps were filled, and eight new divisions were ready in the spring, while others were in process of formation, and Cadorna had succeeded, after some difficulty, in having the classes required for drafts called up well ahead of his immediate needs.

III. BATTLES OF THE ISONZO AND THE CARSO

During the early months of 1916 the only fighting of any importance took place in March, when Cadorna opened a big demonstrative action on the Julian front, with the object of preventing the dispatch of Austrian forces to Verdun. The action continued from March 11 to March 29, and received the name of the Fifth Battle of the Isonzo. Although it was only a demonstration, some hard fighting took place, and both sides suffered considerable loss. Meanwhile, preparations for a real Italian offensive on the Julian front were well advanced, when news came that the Austrians were preparing a big attack in the Trentino.

Austrian Failure in the Trentino.—This attack, which is described elsewhere (*see* ASIAGO, BATTLE OF) had a big initial success, but it was already condemned to failure when Brusilov, answering the appeal for co-operation made by Cadorna on May 19, attacked the weakened Austrian lines in front of him on June 4, and won the great victory that, if Cramon may be believed, came within an ace of being decisive. The attack in the Trentino, based on a miscalculation, nearly ended in the collapse of Austria's eastern front, and brought only a slight territorial gain that was no compensation for the defeat elsewhere and for the losses suffered. Nor did the penalty end with these. Cadorna refrained from knocking his head against the lines upon which his retreating enemy turned and stood. The positions he reached were adequate to his aims in the Trentino, which were purely defensive, and instead of persisting in his counter-offensive he rapidly swung his reserves back to the Julian front, smashed through the Gorizia bridge-head and took Gorizia, and drove the Austrians from the western section of the Carso plateau.

The Taking of Gorizia.—During the winter of 1915–6, in preparation for an attack upon Gorizia and the Carso, the right wing of the II. Army had been transferred to the III., so that the front from north of Monte Sabotino down to the sea was under the Duke of Aosta. At the end of July, when the delayed attack was imminent, the Duke had 16 divisions and a dismounted cavalry division. He had 1,250 guns, of which 520 were heavy or medium, and these were supplemented by nearly 800 *bombarde*.

On the Carso and about Gorizia Boroević was badly prepared to meet the Italian attack. He had only five divisions in line between Monte Sabotino and the sea, and one in immediate reserve, when the Duke launched his attack, and the Austrians were taken by surprise. On Aug. 4 the Duke began with a feint against the low hills east of Monfalcone, and two days later the real attack developed, when the VI. Corps attacked the Gorizia bridge-head and the XI. the summits of Monte San Michele. The VI. Corps, commanded by Gen. Luigi Capello, had outgrown the dimensions of an army corps, for it consisted of no fewer than six divisions. Capello's attack was brilliantly successful. Monte Sabotino, which had resisted so many attempts at capture, was taken on the run in 40 min., while the greater part of the Podgora ridge was torn from the Austrians and some Italian detachments reached the river at sunset. The Austrians defended with the most obstinate valour, and gained precious time for their hard pressed commander.

Italian troops crossed the river on the night of Aug. 8, and the town of Gorizia was occupied next day without resistance, while a general attack on the Carso was breaking down the stubborn defence which had survived the loss of Monte San Michele early in the first days' fighting. On Aug. 10 the Austrians were driven back across the Vallone, the deep cut that separates the San Michele-Doberdo section of the Carso from the main plateau. Both to the east of Gorizia and on the far side of the Vallone the advancing Italians found themselves faced by new lines hidden among the woody slopes beyond the town and the stony undulations of the Carso. Attempts to continue the offensive were not successful. The sixth battle of the Isonzo was an important Italian success, but there was not sufficient weight of guns and ammunition to push the attack home.

Closing Operations of 1916.—In Sept., Oct. and again at the beginning of Nov. the Duke of Aosta attacked on the main Carso plateau, between the Vippacco and the Brestovizza valley, punching out a big salient on the northern half of the Carso, driving the Austrians back to their last line of trenches and occupying the important position of Dosso Fajti. But the seventh, eighth and ninth battles of the Isonzo were each broken off as soon as the attack slowed down. Cadorna was attempting to gain position for a bigger attack later on, when men, guns and shells should be more plentiful. Bad weather prevented another blow, and prevented also an attack in the Asiago uplands, which had been planned for the middle of November.

The year had seen much heavy fighting, and both sides had suffered severely. The Italian casualties were nearly 120,000 dead, 285,000 wounded and 78,000 prisoners, the bulk of the latter taken in the first days of the Austrian offensive in May. The Austrian losses were also heavy, well over 200,000 killed and wounded and some 60,000 prisoners. If the territorial gains at the end of the year's fighting were not great, Cadorna's continued attacks, following upon the costly failure of the Austrian offensive in the Trentino, had done their work in occupying an increasing number of the enemy's troops and wearing down his resistance. Cadorna's rôle was clearly marked out; so long as the plans of the Allies were based upon the policy of attrition, he had to hammer when he could, with what means he could collect from month to month as the output of guns and munitions increased and fresh troops were trained, keeping always in view as an essential aim that of attracting to his front, and wearing out, the maximum number of enemy forces. Judged from this standpoint, the Italian effort of 1916 was of the greatest value to the Allied cause.

Although Cadorna was strongly opposed to the dispersal of his forces in *petits paquets* and had resisted the suggestion of an expedition to Libya to quell the rising which had reduced the Italian occupation to a few points on the coast, the importance of the Balkan front had not been lost sight of by the Italian Government. Fresh troops were sent to strengthen the Italian position in Albania, and in Aug. a strong force arrived in Salonika under the command of Gen. Petitti di Roreto to take part in the Allied advance on Monastir. Early in Oct. an Italian column occupied Argyrokastron, and before Nov. the Italians were in touch with the left wing of the Allied forces based upon Salonika.

IV. THE AUSTRO-GERMAN EFFORT

At the Allied conference held in Rome in Jan. 1917 the formal proposal was made that an Allied force should join the armies of Italy in an attempt to smash the weaker of the two Central Powers. In spite of Mr. Lloyd George's advocacy the plan did not commend itself to the French and British military authori-

ties, who offered, however, to send 300 heavy guns to Italy on condition that they were returned to the French front by the month of April. Cadorna declined the offer, on the ground that the season was unsuitable for an offensive on his front, and that the guns would have to be returned at the moment when they would be most useful. The question of closer co-operation was dropped for the time being, but the conference organised a line of communications through Italy to Salonika, via the southern Italian ports, a route which greatly lessened the dangers from submarine attack, and at the same time made a much smaller demand on the diminishing tonnage of the Allies.

Cadorna's Plan.—Cadorna embodied his proposals in a memorandum written after the Rome conference; they were as follows: If the Allies would give him at least 300 heavy guns he would make two attacks on the Trentino and Julian fronts—his own artillery was insufficient for this double offensive—and so find the enemy's weak point. He had the advantage of interior lines, and would move his reserves of guns and men from the Venetian plain according to the development of the two actions. If, on the other hand, the Allies would send a minimum of eight divisions in addition to the heavy guns, he would concentrate upon the Julian front and attack from Tolmino to the sea, with the object of breaking through towards Ljubljana (Laibach). Such an attack, in Cadorna's view, would have had decisive results. He believed that Austria could not recover from so severe a blow.

The plan was tempting, but it did not commend itself to the Allied commands. French and British opinion was against any further diversion of effort from the Western front, for there was the chief enemy, upon whose defeat the result of the war depended. And there were obvious technical difficulties in the way of supplying large French and British forces on the Julian front. Nivelle and Robertson, who visited the Italian front in the spring, agreed to the principle of direct co-operation by the dispatch of troops and guns in the event of necessity, but both were inclined to prefer co-operation by simultaneous attack, and while a scheme for the quick transport of troops from France to Italy was prepared, no definite engagements were taken. It was agreed, on the other hand, between Cadorna and Nivelle, that the Italian and French spring offensives should be timed to coincide as nearly as possible.

The Italian Spring Offensive.—Cadorna's attack was slightly delayed owing to a threat of an Austrian offensive in the Trentino, and later, by bad weather. But the Italian guns, which had been reinforced by 11 batteries of British 6-in. howitzers and 35 French heavy guns, opened fire on May 12. Cadorna feinted with the III. Army on the Carso, making his real attack with the II. Army, now under Gen. Luigi Capello, against the hills north and east of Gorizia. North of the town the greater part of the long ridge (Kuk-Vodice) running southward from above Plava was gallantly stormed and held against the most determined counter-attacks, but little progress was made east of the town. As soon as the occupation of the Kuk-Vodice ridge seemed assured Cadorna moved the bulk of his heavy guns southward and attacked with the III. Army on the Carso. Useful progress was made here also, a number of positions being captured, and the VII. Corps on the right carrying one line after another till they were half-way up Monte Hermada (Querceto). But ammunition was running very low; the offensive was broken off at a moment when it seemed as though further success lay very near. On the evening of May 26, when the attack on the Hermada was stopped, the defenders of the battered hill were reduced to under 100 men, each of whom received the Maria Theresa medal.

There was only a short breathing space. On June 4 the Austrians on the Carso counter-attacked in the most determined manner. Finding a weak resistance on the part of the troops who has come into line as reliefs, they freed the lower slopes of Monte Hermada, and took a large number of prisoners. During the four weeks' fighting Cadorna used 31 divisions and lost 132,000 killed and wounded and 25,000 prisoners. Boroević had held his ground, or nearly, with 17 divisions, and his losses, including 25,900 prisoners, were close upon 120,000.

The rumour of battle had scarcely ceased on the Julian front when the Italians attacked in force north of Asiago, on a front of nine miles. The attack failed. Progress was made at one point only, on Monte Ortigara, and here too, after a long and bloody struggle, the attacking troops were thrown back. Between June 10 and June 29 the Italians lost 24,000 killed and wounded and 2,000 prisoners. The Austrian casualties were over 9,000.

Cadorna's Second Offensive, Aug.–Sept.—The general situation at the end of June gave cause for disappointment and some anxiety. Russia was going out of action. The prospect of an Entente victory with which the year had opened was clearly removed to a distance, and war weariness was making itself increasingly felt in Italy. The question of Allied co-operation on the Italian front was once more discussed but without result. It was decided that Cadorna should attack alone in August. The army was strung to the highest point of tension, awaiting the order to attack, when Pope Benedict XV. launched his appeal for peace. Parts of the army were shaken, for the Pope, in his impartiality, placed the two contending groups of Powers on the same level; he held out the hope that Germany and Austria were ready to consider certain territorial questions "in a conciliatory spirit," taking into account "the aspirations of the peoples"; and to the long and weary struggle he attached the label "useless slaughter." Some of the commands were anxious about their men when the attack began, on the night of Aug. 18.

As a matter of fact, the troops put aside their questionings, and the blow dealt to the Austrians was a very heavy one. The Isonzo was crossed in many places between Tolmino and Plava and the greater part of the Bainsizza plateau was occupied by troops of the II. Army, while the southern end of the Chiapovano valley was passed and a footing obtained on the western corner of the Ternova plateau. But a long sustained effort brought no further success. Cadorna intended to renew his offensive at the end of Sept. by an attack against the Ternova plateau, in the hope of definitely turning the Gorizia positions from the north and cutting the main line of communications between the Austrian right and left. But towards the middle of the month news came of increased enemy forces and a probable counter-offensive at an early date, and Cadorna, after taking stock, decided he must stand on the defensive. The four weeks' fighting in Aug. and Sept. had cost him over 166,000 men—40,000 killed, 108,000 wounded and over 18,000 prisoners. The toll taken by sickness had also been very heavy. The units were at low strength and the new drafts had not been satisfactorily absorbed. A breathing space was urgently needed.

British and French Reinforcements.—The Austro-German success against the II. Army, the retreat of the Italian forces to the Piave, and the resistance in the new positions are described in a separate article (*see* CAPORETTO, BATTLE OF). When the gravity of the situation became clear, England and France acted with all possible speed. The order was given for six French and five British divisions to entrain for Italy, and Foch and Robertson hastened to the spot. An Allied conference at Rapallo began on Nov. 4, and from its discussions were born the Supreme Allied Council, which was to meet, once a month if possible, at Versailles, and the Versailles Military Council, which was to sit permanently. It was agreed that the failure of the Italian armies to resist the enemy attack called for a change in the Italian command, and Cadorna was appointed Italian military representative at Versailles. He was succeeded by Gen. Armando Diaz, commander of the XXIII. Army Corps, and the functions of Gen. Porro, who was also relieved of his post, were divided between Gen. Giardino, who had been Minister of War during the summer, and Gen. Badoglio, commander of the XXVII. Corps.

V. THE COLLAPSE OF AUSTRIA

After the failure of Krauss and Conrad to break through to the Venetian plain, the Italian front saw no action of first class importance for nearly six months. The time was well occupied in reorganisation, but there were several minor combats. The German divisions left Italy at the beginning of 1918, in anticipation of the great offensive which was being prepared on the

Western front. Gen. Plumer, who commanded the British forces, also left Italy to take up his old command. He had acquired a great popularity, and his departure was much regretted. Fortunately he had a worthy successor in the Earl of Cavan. When the German offensive in March 1918 pierced the line of the British V. Army four French and two British divisions were immediately withdrawn from Italy. They were followed by the Italian II. Corps under Gen. Albricci. This left Diaz with 55 divisions (50 Italian and five Allied) as against 60 freshly organised Austrian divisions, who were preparing for an early offensive.

Austrian Attacks Fail.—The original proposal of the Austrian General staff, now under Gen. Arz von Straussenburg, was to make a drive on both sides of the Brenta. Conrad, now in command in the Trentino, pressed for an attack in the Asiago uplands. Krauss disapproved of both plans and urged an offensive on both sides of the Lake of Garda. Conrad's plan was chosen, but Boroević urged that this offensive should be accompanied by a straight drive by his armies across the Piave. This was agreed to, and both army groups attacked on June 15. Conrad attacked with Scheuchenstuel's XI. Army from south of Asiago to Monte Grappa, while the Archduke Joseph attacked the Montello and Werzel von Wurm crossed the lower Piave. Conrad had 27 divisions at his disposal, and Boroević 23.

Conrad's attack was a complete failure. It went well to begin with, but at the end of the day all hope of success had gone, and by the evening of June 16 he was finally beaten. Boroević, on the other hand, made good headway on the first two days, for the Archduke Joseph took half the Montello, and Werzel von Wurm established an extensive bridge-head opposite San Donà di Piave. But at the end of a week's fighting the Austrians were closely held, and the order was given to retire across the Piave. The failure was complete, and very costly. Conrad lost 36,000 men and Boroević over 60,000. The defeat broke forever the offensive power of the Austro-Hungarian Empire. The consciousness of impending disaster grew and spread through the monarchy, and the troops were greatly disheartened by failure.

Final Italian Offensive.—It was felt in many quarters that Diaz should have followed up the victory by a strong counter-attack, but he was unwilling to attack in force without careful preparation. He had had heavy casualties, over 40,000 killed and wounded and a very large number of prisoners, and he preferred caution. Plans were drawn up and preparations made for an offensive between the Vallarsa and the Brenta in September. Early in Sept. Diaz went to Paris to discuss the situation. He was still pre-occupied in regard to his reserves, and asked that a strong American force should be sent to Italy. This was refused, and in spite of criticism he delayed his offensive still further, while working out secretly a more ambitious scheme which was to be adopted if the chance should offer.

In the middle of Sept. the victorious advance from Salonika began, and the chance seemed to have come. "On Sept. 25 orders were issued for a rapid concentration of troops, artillery and technical services in the sector chosen for the attack, which was no longer the plateau, but the Middle Piave." (Gen. Diaz's Report). The attack (*see* VITTORIO VENETO, BATTLE OF) was launched exactly a year after the disaster of Caporetto, and it shattered the armies of Austria-Hungary. Seldom in history has so great a disaster been followed by so complete a triumph. Yet the final overwhelming success of Vittorio Veneto was not Italy's greatest victory. The way to it was paved by greater deeds, the wonderful recovery on the new line after the great retreat, and the successful resistance against the last Austrian offensive that was the first ray of light to break upon those gloomy months when the fortune of the Allies seemed at their lowest. Nor can the sum of Italian achievements be judged by the issue of those battles which were crowned with victory.

Conclusion.—Italy's contribution to the long effort that led to the triumph of the Allies can only be gauged by a review of the campaign as a whole, by a realisation of the extent to which she drained the resources of Austria-Hungary, and of the price which she paid. Her dead totalled 600,000; and 570,000 men were permanently disabled for military service by wounds or disease. For two and a half years the Italian armies were a constant threat to the Habsburg Empire and kept employed a number of divisions that increased from 20 to 40 (in the summer of 1917). During the last three months of 1917 the number of enemy divisions rose to 55, and in 1918 practically the whole effective strength of Austria-Hungary was arrayed against Italy, the number of divisions at one time approaching 70.

The figures speak plainly, and Ludendorff, in an interview published in the spring of 1919, placed among the chief causes of the German defeat "the lack of support from Austria, gripped ever more tightly at the throat by Italy." Cadorna rightly claimed that Italy's "grip on Austria's throat from 1915, compelling her to immobilise against us ever increasing forces, constituted the most notable result of our war, though it was little apparent to the eyes of civilians. It contributed largely to the victory of the Allied arms and to our final triumph."

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ITALIAN LITERATURE (*see* 14.897).—The development of Italian literature, including philosophy and history, during the period 1910–26 was remarkable. Carducci and Verga mark the end of the stage during which Italians were finding themselves intellectually and politically. Pascoli, Fogazzaro, and D'Annunzio really belong to the new period which crystallised in the years immediately preceding the World War, and came to fruition in the social, political and spiritual revolution which followed it. These writers, together with Benedetto Croce and Giovanni Gentile, in the field of aesthetics and philosophy were largely responsible for widening the scope of intellectual activity and culture, so that they ceased to be narrowly Italian and became European.

The works produced in the first 25 years of the present century, and more particularly during 1910–25, are characterised by a spirit of daring, restlessness and youth; by intellectual curiosity, love of novel experiments and experiences, and above all by self-analysis, which, in some cases, led to egocentricity and decadence. Such defects, however, were due to the ebullience of youth seeking vent for its new-found energy rather than to weariness and to the search after sensations for their own sake. Writers aimed at the discovery of new forms of expression to supersede the old; thus, the Futurists were of service to the new literature, if only by reason of their attempt to break down inherited and stereotyped traditions in prose and verse. Prose underwent a remarkable change. It became crisper and at the same time more flexible, while language attained the unity long advocated by Manzoni.

Fresh interest was awakened in the most varied forms of criticism, in history, culture and philosophy of all times and in all countries. In this eclectic tendency Renato Serra, a young and promising critic who was killed in the War, saw the beginnings of a new form of classicism. Interest in foreign literatures, including those of the East as well as of the West, produced a vast library of translations varying in quality, but on the whole showing a marked tendency towards treating translation as an art. With the exception of Adolfo de Bosis' remarkable version of *The Cenci* (1916) and *Epipsychidion*, Carlo Linati's *Tragedie Irlandesi di W.B. Yeats* (1914), Raffaello Piccoli's *Drammi Elisabettiani* (1914) and Mario Praz's magnificent tour de force represented by his anthology of verse renderings *Poeti Inglesi dell' Ottocento* (1925), English literature found less translators than German, French or Russian, and contemporary writers, apart from Kipling, Shaw, Galsworthy and Barrie, are only available in the original. This cosmopolitan spirit acted as a stimulus to the growth of the new national literature rather than to imitation of foreign models. A further significant evidence of this new energy are the changes which have taken place in the publishing world, where the output has increased and the technical production improved as a direct result of the increase of the reading public of all classes.

Fiction.—Although strictly belonging to the preceding generation, Alfredo Oriani (1852–1909) and Carlo Dossi (1847–1910) did not receive due recognition until after their deaths. The former was obsessed by ugliness and horrors and at the same time had an intense love of beauty. The impartiality and variety of outlook was in part the reason for his popularity among the younger generation. And Dossi, by his harsh and elliptical style and his original and vivid treatment of his subject matter, unfashionable in his own day, opened out new paths to his successors. G. Pietro Lucini (1867–1914) is also of interest on account of his reaction to the various decadent European schools and as a forerunner of the Futurists who claimed him as one of themselves. Of an entirely different character is the work of Alfredo Panzini (b.1863) one of Carducci's best pupils. Possessing a quiet sense of humour tinged with irony, his attitude towards life is detached but not aloof. In what are generally considered to be his masterpieces *Le Fiabe della Virtu* (1905), *La Lanterna di Diogene* (1909), *Santippe* (1914) and *Viaggio di un Povero Letterato* (1919), Panzini is acutely sensitive to all forms of beauty and to the conflict between them and the evils and uglinesses of the world. He has the temperament of a poet; his style is pure, simple, direct and moving, the prose counterpart of Carducci's best lyrics.

Adolfo Albertazzi (b. 1865) learned the art of the short story from the Italian masters of the past and the modern writers of foreign countries. Some of those collected in the *Diavolo nell'Ampolla* (1918) and in other volumes are among the best of the kind published in modern times. It is worthy of notice that most of the novelists, dramatists and critics of to-day—men and women—have tried their hand at the short story of the magazine type. Of these Luciano Zuccoli (b. 1870), Virgilio Brocchi (b. 1876), Antonio Beltramelli (b. 1880), Guido da Verona (b. 1881) and Ugo Ojetti (b. 1871) who is also a very highly esteemed art connoisseur, and among the women writers Clarice Tartufari (b. 1868), Sibilla Aleramo (b. 1879), Neera (1846–1916), Amalia Guglielminetti (b. 1885) and Carola Prosperi (b. 1883) are the most popular. Generally speaking, most of these works are of value mainly as documents of social history rather than as literature.

The New School.—The younger novelists and story writers, though very numerous, shared a tendency to be egotistic, self-analytical and autobiographical, and cultivated a lyrical prose style. The lack of any national literary centre comparable with Paris or London has created regional groups united by geographical convenience, the individual members of which continued to follow, in part at least, the literary and intellectual tradition of their several provinces which, however, amounted to little more than impressionistic landscape-painting in words, as in the case of Carlo Linati, who in the finely written *Sulle Orme di Renzo* (1919) has given a poetical interpretation of the Lombard spirit as revealed in the countryside. The War practically destroyed narrow provincialism and successfully fused its best characteristics into a wider nationalism.

The great national and international reputation acquired by Croce and Gentile, both Neapolitans, the influence exerted on criticism by their review *La Critica*, founded in 1903, the fact that a considerable proportion of the best-known novelists and dramatists of the past 50 years (Capuana, Verga, Serao, Bracco, Pirandello) have been Southerners and, lastly, historical, geographical and racial conditions, have all contributed to produce a strong clan-feeling different from that of other regional groups. Of these the most important was perhaps the Florentine called "Gruppo della Voce," from the periodical of that name founded by Giovanni Papini and Giuseppe Prezzolini about 1909, itself the off-spring of an earlier review—*La Leonardo* (1903–7), which gave a great impulse to philosophical studies. Both periodicals had for their programme the revaluation of old values and the diffusion of new ideas in literature, art and philosophy. Scarcely one of the younger writers of any note did not contribute to one or the other of these reviews, which, in many cases, were the first to discover them. Not all of the contributors were of equal merit or free from any defects, but they showed the presence of a new spirit and vitality much needed, and exerted an influence as far-reaching as it was important and often superior to their individual achievements. Papini (b. 1881), however, is the only one who is at all known outside Italy mainly on account of the much-advertised *Storia di Cristo* (1921), a work which has added little to a reputation really founded upon his autobiography, *Un Uomo Finito* (1912), *Cento Pagine di Poesia* (1915), and the brilliant, provocative, and at times superficial critical essays *Stroncature* (1916), Papini's encyclopaedic mind, ever in quest of new knowledge and intellectual experience, admirably typifies the vices and virtues of the historical movement which came to an end on the outbreak of the World War. Papini, as the imposing bibliography of his works shows, has passed through many phases, Pragmatism, Futurism and later Neo-Catholicism, always preserving a style, essentially Tuscan in character, at times colloquial to the point of vulgarity, yet rich, vivid, lucid with a slight tendency to rhetoric. Giuseppe Prezzolini also wrote some excellent critical essays, mostly on his contemporaries, but later abandoned literature and philosophy for politics. Of the other principal contributors to *La Voce*, Scipio Slataper (1888–1915), a Triestino killed in the War, is best known for his noteworthy lyrical autobiography in prose, *Il Mio Carso* (1912) and a suggestive study on Ibsen published posthumously (1916).

Ardengo Soffici (b. 1879) is one of the most remarkable of the group. His best writings are a fragment of a novel, *Lemmonio Boreo* (1912), two autobiographical journals, *Giornale di Bordo* (1915) and *Kobilek, Giornale di Guerra* (1918), and the art criticism in *Il Caso Medardo Rosso e l'Impressionismo* (1909) and *Scoperte e Massacri* (1919). Soffici as a writer is both thoughtful and forceful and uses language impressionistically, frequently introducing exact and unexpected similes. The latter two works did much to rouse the artistic youth of Italy to an intelligent appreciation of the significance of modern art movements by their insistence upon the necessity for the art-critic to be an artist (Soffici himself was a painter of some repute) and thoroughly conversant with the technique of painting while possessing the capacity for feeling the values of form, colour and composition. Renato Serra, killed at the Front in 1915, was one of the most promising of the younger writers, who is best known for his remarkable psychological document, the *Esame di Coscienza di un Letterato*, published in 1916, in which he examines the attitude of an artist and an intellectual towards the War with great acuteness. The fact that some of it is mainly now of historical interest does not detract from its high literary value, which makes it and D'Annunzio's *La Leda senza Cigno* (1916–8) two of the very few works of art inspired in Italy by the War. Several other writers, such as Federigo Tozzi (1883–1920), Ferdinando Paolieri (b. 1878), Bruno Cicognani (b. 1879) and Piero Jahier (b. 1884), also have points of contact, in spirit and in style, with the Florence group. Several journalistic and literary coteries were found in Rome, such as that of *La Ronda* (1919), a short-lived but lively periodical, edited by Emilio Cecchi (b. 1884). Among the contributors were Antonio Baldini (b. 1889) and Riccardo Bacchelli (b. 1891). Since the advent of the Fascist Govt., however, Rome is rapidly developing into the centre of Italian culture.

The Futurists.—It was very natural that the Futurist movement should have been started in Milan, since that city has always taken the lead in any new intellectual movement, and in the present case, as the most modern and "mechanical" city in Italy, was peculiarly adapted to be its headquarters. It is also significant that after the World War it moved to Rome with an entirely new body of supporters, though still under the leadership of its founder, F. T. Marinetti (b. 1878). In the first Futurist manifesto published in 1909 in the Paris paper *Figaro* Marinetti announced the new aesthetic of the machine, considered as symbol, source and teacher of a new artistic sensibility, and preached the beauty of speed. It was rapidly followed by the "Technical Manifesto of Futurist Literature" (1912), which decreed that syntax should be replaced by "wireless imagination and words at liberty," and by others dealing with the theatre, art, architecture and life. Apart from its sensationalism and self-advertisement and its principles of destructiveness, Futurism

none the less acted as an irritant and forced writers, and particularly poets, to react against stagnation and to define poetry anew, and the difference between it and prose. Of the many books published by the first generation of Futurists some, like Filippo Tommaso Marinetti's (b. 1878) extraordinary novel *Mafarka le Futuriste* (1910), *Le Roi Bombance* (1910), a play, written originally in French, and *Zang-Tumb-Tumb* or *The Siege of Adrianople* (1912)—an experiment in "free-words"—are among the curiosities of literature. On the other hand, Palazzeschi's (b. 1885) ironically grotesque tale, *Il Codice di Perela* (1911), and the volume of free verse *L'Incendiario* (1910), Luciano Folgore's (b. 1888) *Canto dei Motori Versi liberi* (1912) and a few of Marinetti's earlier poems practically sum up the best literary products of the movement.

The Poets.—Carducci, Pascoli and D'Annunzio have had a certain number of followers and imitators, but either through lack of inspiration and technical ability or because fiction offered a more profitable market none have produced anything of definite importance excepting Salvatore di Giacomo (b. 1860). He has written some of the finest dialect poetry in Italian literature inspired, like most of his other work, by the life of the Neapolitan populace. The poignant "Tarantella scura," the dramatic sonnet-sequence "A San Francisco," and the very beautiful song "Uocchie de suonno," republished in *Poesie* (1907), possess the universal quality of true poetry, which is sometimes found also in a few of Pascarella's and Trilussa's poems in Roman dialect. Of the others, Guido Gozzano (1883–1916), Marino Moretti (b. 1885), Enrico Pea (b. 1881), Amalia Guglielminetti (b. 1889) gave evidence at first of technical skill and lyrical vein which has since degenerated into affectation and mannerisms. As the very useful anthology, *Poeti d'Oggi: 1900–1920* (1920), edited by Papini and Pancrazi paradoxically yet conclusively proves, those who write poetry to-day choose to do so by using prose instead of verse for their medium. In this sense many of the writers dealt with above may justly be considered poets.

The Drama.—There have been since D'Annunzio some successful attempts at poetic drama such as Benelli's historical tragedies *Maschera di Bruto* (1909) and *Cena delle Beffe* (1909), written in effective blank verse, Ettore Moschino's *Tristano e Isolda* (1910), Enrico Butti's fanciful *Castello del Sogno* (1910), and E. L. Morselli's (1882–1921) *Orione* (1910) and *Glauco* (1919). The latter of these are written in lyrical prose and are by far the best productions of this type of drama. Some of the other playwrights like Dario Nicodemi have portrayed, with varying ability, society life, according to the formula derived from the French dramatists. Others, following the realistic tradition of Capuana, Verga and Giacinto Gallina, have written light comedies or dramas in dialect or local vernacular. Many of these are very charming and well constructed, especially the Florentine ones, *L'Acqua Cheta* (1908) by Augusto Novelli and *I Pateracchio* (1910) by F. Paolieri. Some notable plays of the grand-guignol type have been written in Neapolitan dialect by Salvatore di Giacomo, *Assunta Spina* and *O' Mese Mariano* (1910), Ernesto Murolo and Roberto Bracco, and, in Sicilian, by Pirandello (*Liolà*, 1917). The fame of Roberto Bracco as a dramatist rests, however, on *Piccola Fonte* (1905) and *Piccolo Santo* (1912), the latter being one of the masterpieces of modern Italian dramatic literature. Most of his plays present psychological and spiritual tragedies with hardly any external action, and are pronouncedly feminist in sympathies. Technically, they are remarkable for austere simplicity of construction and lack of any external appeal to the emotions.

The essential difference between Bracco and Pirandello is that one is intellectual, the other cerebral. In Pirandello (*q.v.*) the dramatic form is a natural step from the novel and the short stories, in which the characters are, *dramatis personae* always talking among themselves but unable to make each understood to the other, until they begin to doubt whether they really exist and are not shadowy forms conjured up by the imagination of those among whom they live and by which they are bound. The dramatic situations arise out of the contrast between what the individual is, what he conceives himself to be and what others think him. What is reality, if indeed there be such a thing, and what is unreality? Is there a dividing line between madness and sanity? Can life have a meaning outside the ever-changing, and arbitrary value attached to it by an individual? These are the problems which constantly reappear in his fiction and in his plays—the logical, if extreme, outcome of the introspective and psycho-analytical tendencies of his period. Pirandello has revealed his sense of theatrical technique but his situations are the result of logic rather than of ingenuity. He is responsible for introducing a new prose style, clear-cut, dry and nervous on the stage, a considerable achievement which may have far-reaching effects on his successors.

Next to Pirandello, Rosso di San Secondo (b. 1887), a Sicilian known also for his short stories, and Federico Valerio Ratti, author of a remarkable tragedy on Judas Iscariot, are the most promising dramatists. The work of the former has as its dominant motif the contrast of Life governed by discipline as opposed to impulse, symbolised respectively by the North and the South. The characters of *Marionette, che Passione!* (1918), *La Bella Addormentata* (1919), which he describes as a "painted adventure," and *Lazzerina fra i Coltelli*, his most recent and abstract work, are allegorical and poetical, and achieve a certain original and dramatic effectiveness. Luigi Chiarelli's play, *La Maschera e il Volto* (1917), presents in light comedy form many of Pirandello's ideas. Its success, perhaps, was due to the label of "grotesque" which he gave it and subsequently adopted loosely to denote plays of a similar genre such as Luigi Antonelli's *L'Uomo che incontro se stesso* (1919), Fausto Maria Martini's *Fiore sotto gli Occhi* (1922), and Cantoni-Gibertini's *Fantoccio*; other experiments were encouraged more by the desire to appear original than by dramatic ability.

Criticism.—Towards the beginning of the 20th century critical theories underwent a considerable change. This was due to the general reaction against positivism and materialism in favour of idealism, which found its most eminent supporter in Benedetto Croce (*q.v.*) Many have applied these principles, and even those who disagree with them have felt their influence. Croce has further made some notable contributions to the history of Naples, not counting those to philosophy. In this respect Gentile shares with Croce the right to be treated as one of the most important philosophical thinkers of the present day and as a critic. Among the older idealist—though not Crocean—critics, Arturo Farinelli, author of *Il Romanticismo in Germania* (1911), *Michelangelo e Dante* (1918), and several other valuable works; Cesare de Lollis, and Alfredo Galletti, who succeeded Pascoli in the chair of Italian literature at the University of Bologna and to whom he had devoted a very brilliant and profound critical study, are the most important.

To these three university professors all of whom combined wideness of literary sympathies and knowledge with uncommon critical abilities, should be added the name of a younger man—G. Toffanin—who at the time of writing has already given several proofs of originality, talent and scholarship of a very high order. The work of the militant critics is represented among other works by Thovez's essays *Il Pastore il Gregge e la Zampogna* (1910) and *Mimi dei Moderno* (1919); by Renato Serra's *Scritti Critici* (1910), and *Le Lettere* (1914), a brilliant survey of contemporary literature and its characteristics, as well as by the critical writings of Papini and G. A. Borgese (b. 1882) who, besides the *Storia della Critica Romantica in Italia* (1903) has also written *Rubè* (1921) an interesting autobiographical novel. In some ways their views are often paradoxical and exaggerated, but they possess, however, the frank enthusiasm and charm of youth added to knowledge and aesthetic appreciation.

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ITALO-TURKISH WAR.—Following the diplomatic discussions which took place between Rome and Constantinople during the summer of 1911, an ultimatum from Italy was delivered to the Porte on Sept. 28, demanding Turkey's consent to a military occupation of Tripolitania and Cyrenaica. A period of 24 hours was set by the ultimatum, and as the Turkish reply did not meet the Italian demands a state of war was declared as from 2:30 P.M. on Sept. 29.

Italian Naval Activity.—Military action was slow to succeed the formal declaration of war, and it was not till Oct. 11 that the first transports reached Tripoli. Meanwhile the Italian navy had been busy. On Sept. 28 a squadron appeared off Tripoli, and notice was given that if the town were not surrendered it would be bombarded. The obsolete fortifications were bombarded for two hours on Oct. 3, after the Turkish authorities had declined to surrender the town. By next day, the Turkish garrison, acting upon orders received from Constantinople, had retired into the sandy plains, and on Oct. 5 a force of 1,600 sailors was disembarked.

Meanwhile hostilities had been begun elsewhere. On Sept. 29 and 30 Italian destroyers under the command of the Duke of the Abruzzi sank the Turkish torpedo-boats off Prevesa in Epirus and on Oct. 1 Admiral Aubry left Augusta to go in search of the Turkish fleet, which the declaration of war had found at Beirut. But the orders given him were suddenly countermanded, and instead of steaming to the Aegean in order to intercept the Turks, he was sent to Tobruk, which was occupied by a detachment of sailors on Oct. 4.

The renunciation of the attempt to cut off the Turkish fleet was inspired by political reasons. The Italian Govt. believed that the Porte would soon realise that it was impossible to defend the Tripolitan provinces, and would be willing to enter into some arrangement that would satisfy Italian aspirations and save the face of Turkey. Another reason was the desirability of localising the conflict. Other European Powers were not willing that hostilities should be extended, and the other members of the Triple Alliance were particularly energetic in their disapproval.

Italian Expeditionary Force.—A week elapsed between the landing of the sailors at Tripoli and the arrival of the expeditionary force, and it was not till Oct. 20 that all the equipment had been put on shore. The force consisted of some 9,000 rifles with a few field and mountain batteries and two squadrons of cavalry. There was very little transport, for it had not been anticipated that the Turks would retreat towards the interior and receive support from the native tribesmen. That Neshat Bey, the Turkish commander in Tripoli, did receive this support was largely due to two men—Ferhat Bey, deputy for Tripoli and Suleiman el Baruni, a Berber from Fessato, who was deputy for the Jebel region.

Meanwhile Homs, Derna and Benghazi had been occupied. There was some resistance at each place, especially at Benghazi, but the first fighting of any importance was a sudden attack on Oct. 23 upon the Italian lines at Shara Shat in the Tripoli oasis, backed by a rising behind the lines. Two companies of Bersaglieri were cut to pieces, and the rest of the regiment were hard put to it to hold their own. Further attacks led to a withdrawal of the line, and to the clearing of the oasis behind the trenches.

Large reinforcements were sent from Italy, and by the fourth week in Nov. Gen. Caneva, who was in command of the expedition, had about 25,000 rifles and 16 batteries. He took the offensive, and in two actions cleared the oasis and sent the Turks and their tribesmen allies packing. Turkish headquarters were established at Aziziya, some 30 m. south of Tripoli.

Political Aspect.—At the beginning of Nov. the Italian Govt. had considered the possibility of extending the theatre of war, on the sea at least, in the hope of inducing Turkey to give up the struggle. Austro-Hungary intervened, backed by Germany, invoking Article VII. of the Triple Alliance. Italy's action being limited in this way, it was necessary to solve the problem directly, but the task was more difficult than it need have been owing to the limitations laid upon Gen. Caneva by the Italian Government. Gen. Caneva's orders appear to have been that he must not risk reverses or suffer heavy loss. In the circumstances, an expedition in pursuit of the Turks and their mobile allies seemed hardly practical.

In any event, months went by without any action of importance in Tripolitania. In Cyrenaica there was one fight near Benghazi, when a force of Arabs who had come near the town were attacked and severely punished. Derna was closely beset throughout the winter, and Enver Bey, who had succeeded in reaching Cyrenaica towards the end of the year, organised a formidable resistance, securing relative unity among the tribesmen, and a willingness to co-operate with the Turks, which had never before existed.

Italian Offensive Renewed.—In April, the long spell of inaction in the western province came to an end, and from that time onward the resistance of the Turks and Arabs was gradually broken by a series of operations at various points.

In April, also, Italian warships appeared off the entrance to the Dardanelles. They were fired on by the Turkish forts and their answer drew a fresh and very energetic protest from Vienna. The northern Aegean was left alone by the Italians henceforth, but in May the island of Rhodes and 12 small islands of the Sporades (subsequently famous as the Dodecanese) were occupied by Italy. During the summer there were a number of successful actions in Tripolitania, and peace negotiations were begun at Ouchy in August. Progress was very slow, and it was not until Oct. 15, when two important victories had been won by the Italians, at Derna and Sidi Bilal (near Zanzur) that the Treaty of Ouchy was signed.

Conclusions.—The conduct of the Tripoli campaign was prejudiced, first, by the failure of the Italian Govt. to judge the situation correctly, and secondly, by the limitations which were laid upon the military command. It was not possible at once to launch a desert expedition, and the difficulties of an advance to the Jebel, through country largely waterless, may be said to justify the adoption of a less ambitious plan. What is difficult to understand is the practical veto upon action of any kind, which immobilised large forces from Dec. till April and delayed the carrying out of the policy which eventually put an end to hostilities, the policy of extending the area of operations and striking a blow whenever the chance offered.

The operations of the summer changed the situation, but Italian prestige was not wholly restored by the later successes, or by the subsequent actions against the tribesmen who did not lay down their arms when the treaty was signed. The policy of the Government bore heavily upon the army, which came in for much unfair criticism and increased the difficulties of those who undertook the administration of the country after the peace. The troubles which were to come with the outbreak of the World War may be traced in part at least to the hesitations and uncertainties of the six months following the landing.

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ITALY (*see* 15.1).—A country of Southern Europe and a member of the League of Nations. The additions to the territory of Italy under the peace treaties are shown in the attached map (*see* also ST. GERMAIN, TREATY OF). The area was increased by 9,005 sq. m. to a total of 119,624 square miles. The census of 1921 gave a total population of 38,755,576. The population of the new territories at the date of the census was Trento Venezia Tridentina 641,747; Fiume, Pola, Trieste and Zara (together constituting Venezia Giulia) 728,544; making a total access of population of 1,370,291.

I. POLITICAL HISTORY

The Giolitti Government.—On the resignation of the Luzzatti Cabinet (March 18 1911), Sig. Giolitti formed a government. During the previous few years relations with Turkey had become strained owing to the restrictions placed by the Porte on Italian enterprise in Tripoli, the only part of North Africa where

Italian expansion was still possible. At the same time the policy of Germany aroused the suspicion that she was contemplating action in that province. The Nationalist movement, created at the Florence Congress of 1910, and directed towards awakening the country to the necessity of a more vigorous foreign policy, advocated the occupation of Tripoli. The success was such that Giolitti himself, anxious as he was to avoid foreign complications, could not afford to disregard it.

After a series of diplomatic incidents, an ultimatum was presented to Turkey on Sept. 28 1911, and no satisfactory answer being obtained, war was declared on the 29th. Except for the Socialists, public opinion strongly supported the government, regarding the war not merely as a colonial enterprise, but as a patriotic reaction against the old pusillanimous policy and the petty intrigues of Parliament. On Nov. 5 Italian sovereignty was extended to Tripolitania and Cyrenaica. Foreign Powers were not friendly to Italy's African policy, and while Austria placed a veto on the extension of the campaign to the Balkans, a serious diplomatic incident arose with France over the searching by Italian cruisers of the French steamers "Carthage" and "Manouba," suspected of carrying contraband. Although the affair was satisfactorily settled at The Hague, it did not improve Italo-French relations. On Oct. 15 1912 the peace preliminaries were signed at Ouchy, and the treaty on the 18th, the Sultan retaining only spiritual authority over the inhabitants of the annexed territories, Italy remaining in occupation of Rhodes and the Dodecanese until Turkey had withdrawn all her troops from Libya and fulfilled her other treaty undertakings. The total cost of the campaign had been 458 million lire. Fighting, however, did not end immediately, as the Arabs, secretly supported by Turkey, continued to resist in the interior.

Sig. Giolitti's proposals for the extension of the franchise (raising the electorate from three to eight million voters), payment of members and a government monopoly of life insurance were voted without much opposition, as Parliament did not wish to embarrass the Cabinet during the War. At the Socialist congress of Reggio Emilia (June 1912) a group of leaders, including Leonida Bissolati and Ivanoe Bonomi, who approved of the government's African policy, were expelled from the party and formed a new group called the Reformist Socialists, prepared to collaborate with the Constitutional parties. The majority styled itself thenceforth the "Official" Socialist party. In the field of labour there were strikes at the Fiat works in Turin, and among the agricultural workers of Ferrara and a general strike at Milan in the summer of 1913.

During the Balkan Wars of 1912–3 Italy and Austria had agreed to the creation of an independent Albanian state, thereby excluding the Serbs from Durazzo and the Greeks from Valona. In spite of this settlement and of the Marquis di San Giuliano's attempts to arrive at a friendly understanding with Austria, relations were strained to breaking-point by Austria's treatment of her Italian-speaking subjects and the menaces of the Austrian military party against Italy.

At the elections of Oct. 26–Nov. 2 1913, under the extended franchise, the Socialist group was increased to 79. For the first time a Catholic party presented itself to the polls, the Pope having withdrawn the *non expedit*, and 33 Catholics were returned, while a number of Liberals and Democrats owed their success to Catholic support. Sig. Giolitti's position was somewhat shaken, for, although the Socialists were ready to give him tacit support in exchange for concessions to their co-operative societies and certain measures of a demagogic character, disagreement among his own followers over the question of Catholic support, and the threatened railway strike were likely to cause trouble. On March 10 1914 he resigned and was succeeded by Antonio Salandra, a Right-wing Liberal of high standing. San Giuliano remained at the Foreign Office, but Gen. Spingardi was succeeded as War Minister by Gen. Grandi. The revolutionary *Sindacato ferrovieri* now demanded a general increase of wages, but, owing to financial difficulties, the government could offer an increase only to the lowest categories; the *Sindacato* threatened a strike, but eventually gave way.

On the national festival of the Statuto (June 7 1914) riots broke out at Ancona because the authorities had forbidden the holding of an anti-militarist meeting. A general strike ensued in the town and the trouble spread to other parts of the Marche, to Romagna, and most of the larger cities. The movement was of a mainly revolutionary character; its leader was the Anarchist Enrico Malatesta, and Benito Mussolini (*q.v.*), editor of the *Avanti*, played a prominent part in it. For a week many towns were under mob rule, until a popular reaction led by the Nationalists cleared the streets of the seditious elements and the troops and police restored order. Sig. Salandra was criticised for his lack of energy in dealing with the outbreak, while the Socialists attacked him for his "reactionary" methods; a group of Giolittian deputies, headed by Orlando and Schanzer, tried to bring about his fall, but he secured a vote of confidence.

The World War and the Peace

The Austrian ultimatum was presented to Serbia on July 23 1914. Italy co-operated with Great Britain in trying to avert a catastrophe, and public opinion, although realising that if a *casus foederis* under the terms of the Triple Alliance were to arise, Italy would be bound to stand by her Allies, was hostile to the idea of siding with Austria. General relief was caused by Italy's declaration of neutrality on Aug. 3 which was based on (1) Austria's failure to co-ordinate with Italy before taking action, (2) the fact that Italy had not been given time to act in favour of peace, or to make adequate military preparations and (3) the fact that Italy was not bound by the terms of the Alliance to take part in an aggressive policy. It was afterwards announced that no *casus foederis* could arise for Italy in a conflict in which Great Britain was involved.[1]

Neutrality declared, military preparations began. The reorganisation and re-arming of the whole army was largely the work of the new Chief of the General Staff, Gen. Luigi Cadorna (*q.v.*). The question now was whether Italy should remain neutral to the end of the War. The Triplicists, although fairly numerous in Conservative and diplomatic circles, and in a part of the army, hardly went so far as to advocate intervention on the side of the Central Powers, for the invasion of Belgium had created a very unfavourable impression, but they advocated neutrality. The Catholics were neutralists from dislike of "atheist" France and Orthodox Russia and from sympathy with Catholic Austria. The "Official" Socialists were neutralists because they opposed all war except class-war, but ended by openly espousing the Austro-German cause. The Nationalists, Irredentists and some Liberals, realising that this was the last chance for completing Italian unity and affirming Italy's position as a Great Power, favoured intervention, while the Democrats, Freemasons, Republicans and Reformist Socialists were interventionists from sympathy with France. Mussolini's little group of Syndicalists desired intervention, partly for the same reason as the Nationalists, but also in the hope that war would promote social changes. Mussolini resigned the editorship of the *Avanti!* and founded a new paper, *Il Popolo d'Italia*, which supported intervention.

On Oct. 9 1914 Gen. Grandi resigned on account of a disagreement with Gen. Cadorna, and was succeeded by Gen. Zupelli. A week later the Marquis di San Giuliano died, and the Prime Minister temporarily took over the Foreign Office. On Oct. 31 the Treasury Minister Rubini resigned on a question concerning the supply of funds for the army, and the Cabinet followed suit. But Sig. Salandra himself reconstructed it by Nov. 5, and selected Baron Sonnino as Foreign Minister. Owing to the troubles in Albania, the departure of Prince William of Wied and the Greek invasion of the southern districts, Italy occupied the islet of Saseno on Oct. 31, and on Dec. 26 the town and harbour of Valona. 1915 began with a serious earthquake in the Abruzzi (Jan. 13), which caused the death of 30,000 people.

The Treaty of London.—Meanwhile the interventionist tendency grew stronger. Both Salandra and Sonnino were determined not to let the War end without trying to acquire at least

[1] *See* Europe. The treaty of 1882 stated that "the treaty was not in any case directed against England."

a part of the Italian districts of Austria, and to secure a rectification of the frontiers of 1866 which left Italy open to invasion. In Dec. 1914 Italy had reminded Austria that the invasion of Serbia, by tending to destroy the balance of power in the Balkans, gave Italy a right to compensation under the terms of Article 7 of the Alliance as renewed in 1887. Austria began by rejecting the claim, then suggested compensation at the expense of France, and finally offered a part of the Trentino to be ceded after the War, but Sonnino insisted on immediate cession, and to this Austria at last agreed. Sonnino demanded all the Trentino, the Isonzo valley, some of the Dalmatian islands, a free hand in Albania and the formation of Trieste and Northwestern Istria into an independent state, Italy in return to remain neutral to the end of the War. As Austria continued to give evasive replies, Italy opened negotiations with the Entente. On April 26 1915 the Treaty of London was concluded between Italy, Britain, France and Russia, to be completed by naval and military conventions. Italy undertook to intervene, and was promised the Trentino and Upper Adige valley to the Brenner pass, Trieste, Gorizia-Gradisca, Istria and the Istrian islands, Cherso and Lussin, Dalmatia as far as Cape Planka, Valona, full possession of Rhodes and the Dodecanese and in Asia Minor a zone of influence and eventually a share in its partition. If an independent Albania were created, it would be under Italian control, while Italy would not oppose the cession of the northern and southern districts to Serbia and Greece if the other signator so desired.

The poet D'Annunzio by his fiery speeches, and Mussolini by his articles, largely influenced public opinion in favour of intervention. On May 3 1915 Italy denounced the alliance with Austria, but Prince von Bülow made a last effort to secure Italian neutrality through Giolitti. That statesman believed in the necessity for neutrality, as he had no confidence in Italy's powers of resistance, and, although informed by Salandra of Italy's engagements with the Entente, he continued his neutralist activities in collaboration with von Bülow. Salandra, knowing that if Giolitti declared his opposition, the Cabinet must fall, resigned on May 13. It seemed as though Giolitti's triumph were assured, but the voice of the country then made itself heard. Huge popular demonstrations in favour of Salandra and intervention were made all over Italy, and the King refused Salandra's resignation; Austria's final offer, no improvement on the last, communicated by Von Bülow to Giolitti before being communicated to the government, was rejected.

Italy Enters the War.—On May 20 1915 the Chamber and the Senate granted the Government full powers. Neutralism and Germanophilism had apparently disappeared, except among the Official Socialists. On the 23rd the general mobilisation was ordered, and on the 24th war against Austria was declared, while diplomatic relations with Germany were broken off. Owing to the persecution of Italian subjects in Turkey and Turkish assistance to the rebels in Libya, where Italian occupation was reduced to Tripoli and Homs and a port of Cyrenaica, War was declared against the Porte on Aug. 21, and against Bulgaria in September. On Dec. 1 Baron Sonnino adhered to the London Agreement, undertaking not to conclude a separate peace. An expeditionary force was sent to Albania, where it saved the remnants of the Serbian Army driven from its own country.

The initial successes of the Italian offensive were satisfactory, but did not lead to definite results. The subsequent defeats sustained in the Trentino and on the Asiago plateau (May 1916) shook the Cabinet's position, and on June 10 Sig. Salandra resigned. The Giolittians regarded this as a victory of theirs, but the new Cabinet was in no wise Giolittian. Sig. Paolo Boselli, the veteran statesman, respected by all parties, formed a Cabinet in which all shades of opinion, except the Socialists and Neutralists, were represented. Sonnino remained at the Foreign Office, while Orlando was transferred from the Ministry of Justice to that of the Interior.

The Austrian Trentino offensive had delayed Gen. Cadorna's attack on Gorizia, but this was now resumed, and on Aug. 4 1916 after 11 days' desperate fighting, the fortress fell and public confidence was thereby restored. That same month an expeditionary force was sent to Macedonia where it played a distinguished part in the Eastern operations. On Aug. 27 Italy declared war on Germany, owing to the assistance she had afforded to Austria and the seizure of Italian property by the Imperial Government. In April 1917 the British, Italian and French Premiers concluded a convention at St. Jean de Maurienne whereby it was agreed that in a future partition of Anatolia the Smyrna area was to be assigned to Italy.

During the operations of 1916 and 1917 the Italians achieved some important successes, and above all pinned down Austria's best troops, preventing her from sending reinforcements to the West. But the protracted struggle, the fearful losses, the collapse of Russia, and the grave privations at home had accentuated the feeling of depression in Italy, to which enemy and neutralist propaganda contributed. The Socialists fomented the discontent. Claudio Treves's phrase, "next Winter not a man in the trenches," the German peace offensive, the Pope's allusion to "the useless carnage" and the defeatist campaign of the Giolittians began to affect public opinion and the war-weary troops. There were revolutionary riots in Turin (Aug. 1917) and signs of a diminished military spirit among certain units at the front. Gen. Cadorna had repeatedly warned the government, and particularly the Minister of the Interior, Orlando, but no attention was paid to him. This state of affairs and certain military errors of Generals Cadorna, Capello, Badoglio and others resulted in the Caporetto disaster (Oct. 23 1917).

The Recovery.—After a defeat of these proportions it appeared impossible that the army and people could recover. But by Nov. 22 the army had reconstituted its front on the Asiago-Grappa-Piave line, and the enemy's advance was definitely held up. British and French forces hurried to assist Italy, but did not come into action till December. Cadorna was relieved of his command and succeeded by Gen. Diaz. At the Rapallo inter-Allied conference on Nov. 4 the Military Committee of Versailles was formed. In consequence of the Caporetto disaster the Boselli Cabinet resigned (Oct. 26), and on the 30th Sig. Orlando succeeded, he himself becoming Prime Minister, Sonnino remained at the Foreign Office and Nitti became Treasury Minister. The necessity for relieving the refugees from the invaded area was a serious problem, but it was efficiently handled, and the sight of the refugees helped to strengthen the spirit of resistance. The army was rapidly reorganised and the losses in material made good through the enterprise of the Italian manufacturers and the technical genius of Gen. Dalollio, Minister of Munitions.

On Jan. 8 1918 President Wilson published his famous Fourteen Points. Those referring to Italy—"the rectification of the Italian frontiers on clearly recognised national lines," and "autonomy" for the peoples of Austria-Hungary—were of a nature to raise anxiety as to his intentions. From April 8 to 10 the congress of nationalities oppressed by Austria met in Rome, and although organised by a private committee, its delegates were received by Orlando, to whom they presented the so-called "Pact of Rome," this should have been an earnest of mutual good-will between Italy and the Yugoslavs, but it had no binding force and compromised the solution of the territorial problems involved. Meanwhile the Yugoslavs were conducting a propaganda to induce Britain and France to rescind the objectionable clauses of the London Treaty, and even proposed that, should Italy remain obdurate, the Allies and America should cut off her supplies of food and fuel, a request which was rejected. The economic situation was becoming worse, but Italy submitted to privations greater than those of any other Allied country. The shipping losses were serious, the bread ration was reduced to 250 grammes per head per day, meat was sold only twice a week, and many goods were unobtainable.

In June 1918 the Austrians launched a powerful new offensive on the Asiago-Piave front, but after a few initial successes, were driven back with heavy losses. The Italian contingent in Macedonia, commanded by Gen. Mombelli, contributed materially to the victory in the Balkans (Sept. 15–29). On Oct. 24 Diaz launched his attack on the Austrians from Asiago to the sea, and by Nov. 3 "what had been one of the most powerful

armies in the world," as the victory communiqué stated, " was annihilated." Some 600,000 prisoners, 7,000 guns and immense quantities of material were captured. The same day at Villa Giusti near Padua the armistice between the Italian and Austro-Hungarian armies was signed, the enemy undertaking to evacuate all the territories assigned to Italy by the London Treaty. The Armistice came into force on Nov. 4, followed a week later by that with Germany; to the latter's collapse the Italian victory had contributed, as it had opened the door into the heart of Germany. The whole area within the Armistice line was rapidly occupied, as well as certain points beyond it for the maintenance of order. Italy's losses had amounted to well over 600,000 killed and a million seriously wounded, including 220,000 permanently disabled. The knowledge of these losses created a deep impression in Italy, but it was felt that they were not adequately appreciated in Allied countries.

The Peace Conference.—On Feb. 7 1919 the Italian Govt. presented a memorandum to the Peace Conference, embodying and justifying its territorial claims, which corresponded to those agreed upon in London, but Fiume was also mentioned, because on Oct. 31 1918 the National Council of that town had, in the name of the Italian majority, applied for annexation to Italy. There were no difficulties about the Trentino as its population was wholly Italian. The Alto Adige contained a German-speaking population, but it would have been difficult to devise a satisfactory frontier south of the Brenner. In the Venezia Giulia about half the population was Italian, but many of the Slavs had been recently imported by Austria to swell the non-Italian percentage; of the natives the majority were Italian, including all the more civilised inhabitants. In Dalmatia the great majority was Slav, but the civilisation and traditions of the province were Italian. Italian public opinion was unanimous in desiring a satisfactory frontier and the protection of the *Italianità* of the Italian communities east of the Adriatic, but was divided as to the details of the settlement. The Nationalists demanded the Treaty of London territories plus Fiume. The *rinunciatari* were ready to give up Dalmatia, part of Istria and the Trieste hinterland, because they wanted to conciliate the Yugoslavs and disregarded strategic necessities, but demanded Fiume. Sig. Bissolati, Minister without portfolio, wished even to renounce the Alto Adige. In the Italian Peace Delegation too, opinion was divided; while Sonnino stuck to the Treaty of London and did not insist on Fiume, Orlando demanded the latter, but was prepared to compromise on Dalmatia. The Yugoslav counter-claims extended to the old Italo-Austrian frontier and even beyond it, and this attitude aroused much indignation in Italy, the more so as, until the very eve of Austria's collapse, the Croats and Slovenes had behaved as faithful subjects of the Dual Monarchy and had fought in the war against Italy, whereas now they made their claims posing as Allies, and were treated as such by British, French and American statesmen.

The Government had many internal difficulties to contend with. The army could not yet be demobilised owing to the unsettled conditions on the frontiers and the necessity for keeping forces in Albania, Bulgaria, etc. In Italy itself the Socialists and Communists, now that the war régime and the censorship were relaxed, took advantage of the general weariness of the people to foment revolutionary agitation, hoping to emulate their comrades in Russia. The financial situation was serious and Sig. Nitti's budget statement for 1917–8, presented on Nov. 2 1918, showed a deficit of 6,271 millions. Sig. Bissolati, disagreeing with his colleagues over the Alto Adige and Dalmatia, resigned. On Jan. 1 1919 the state of war was declared at an end throughout Italy, except in the Veneto. On the 3rd, President Wilson arrived in Rome and was received with frenzied enthusiasm as the man who had contributed the most to end the War, but the Ministers who discussed politics with him suspected him of little sympathy with the more extreme Italian aspirations.

The Adriatic Question.—The ministerial crisis initiated by Bissolati's resignation came to a head on Jan. 18, and resulted in the resignation of Nitti, who wished to prepare the way for assuming the premiership himself, and of four other ministers. The Italian Peace Delegation to the Paris Conference, which first met on that same day, was composed of Sig. Orlando, Baron Sonnino, Sig. Salandra, Sig. Barzilai and the ambassador, Marquis Salvago-Raggi. On Feb. 17 the debate on the Adriatic question began, but led to no result. In the meanwhile frequent incidents between Italian and Yugoslav soldiers occurred on the frontier. The Adriatic debate in Paris was adjourned to give precedence to the treaty with Germany; to this the Italian delegation agreed, accepting all the proposals of the Allies, including the partition of the German colonies from which Italy was excluded. The delegation was severely blamed in Italy on this account. The Adriatic discussion was then resumed, and on April 23 Wilson published his famous appeal to the Italian people over the heads of their government, setting forth his reasons for opposing certain claims. The message caused wide-spread astonishment as a violation of the rules of secret diplomacy, while in Italy it aroused great indignation. Orlando started for Rome on the 24th to consult Parliament and the country, and was received with enthusiastic demonstrations. In the Chamber his policy was approved by 382 votes to 40 and found adherents even in the Socialist camp.

D'Annunzio took up the Fiume-Dalmatia question with fiery eloquence, and the Nationalists urged the government to annex both. Orlando failed to take advantage of the anxiety of Britain and France that Italy should sign the treaty with Germany, or of Wilson's desire that she should adhere to the League Covenant, to secure advantages for his country, and on May 5 he returned to Paris without having obtained any guarantees for Italy's claims. He found the German treaty ready and Italy's diplomatic position worse than when he had left. Discussions on the Adriatic question were resumed, and various proposals for its solution were advanced, including one suggested by M. Tardieu, on which agreement would have been possible, if President Wilson had not agreed to rejection by Yugo-Slavia. Orlando returned to Rome in June, and on the 19th he was beaten in the Chamber and resigned. Sig. Nitti now formed a new Cabinet, with Senator Tittoni at the Foreign Office, Senator Schanzer at the Treasury and Gen. Albricci as War Minister. On June 28 the new Peace delegation, presided over by Senator Tittoni, left for Paris, and the same day the treaty with Germany was signed by Baron Sonnino and the Marquis Imperiali.

Internal Troubles.—The internal situation now grew more serious. Prices had risen considerably. The government's measures for limiting them merely made the goods disappear for a time and then reappear at still higher prices. The bread subsidy involved a huge deficit in the budget, the doles to the unemployed encouraged idleness, and the regulations hampering trade rendered production ever more difficult. The workers received high wages, but were discontented because prices were rising, while both they and the war profiteers indulged in an orgy of extravagance. The people with fixed incomes felt the pinch most, but everyone grumbled. The Socialists, who now adopted the name of " Maximalists " to affirm their dependence on Moscow, encouraged the workmen in the belief that the War had been fought solely to enrich the capitalists, and that now it was the workers' right to secure all the wealth of the country. Ex-neutralists also helped to foment discontent. In Jan. 1919 the Partito popolare italiano (Catholic) was formed; it had a more definite programme and a more complete organisation than the old Catholic group, and it developed rapidly under the guidance of its political secretary, the Sicilian priest, Don Luigi Sturzo. It advocated reforms of a Christian-Socialist character, including the expropriation of the landed estates for the benefit of the peasants, but with compensation to the landlords. Its foreign policy professed to be patriotic, and favoured co-operation between capital and labour. It attracted some peasants and workers who would otherwise have gone Red.

A series of avowedly revolutionary strikes broke out in every trade, and even in the public services. A postal strike was threatened in Dec. 1918, fomented by the Socialist party, and only called off on the government's promise of higher wages. During a Bolshevik demonstration on April 13 1919 at Milan, a shot was fired at a patriotic *cortège*, which provoked a reaction in

the crowd and the offices of the Socialist paper *Avanti!* were wrecked. Strikes of tramwaymen, employees of the secondary railways and the merchant seamen followed in quick succession.

At the Peace Conference, during the absence of the Italian delegation, Mr. Lloyd George and M. Clemenceau ignored the St. Jean de Maurienne agreement, and in accord with President Wilson decided to send Greek troops to Smyrna. Immediately after the Greek landing Italian troops occupied various points in southwest Anatolia. Italian forces co-operated with the British and the French in occupying other parts of Turkey, but the Italian view was that real peace could only be secured by a more conciliatory attitude towards the Turks. At the same time, in order to try to conciliate Greece, Sig. Tittoni concluded an arrangement with M. Veniselos in July 1919 for the delimitation of their respective spheres of military occupation, leaving the Greeks a free hand in Southern Albania. This last clause had an unfortunate effect on Italo-Albanian relations, but the whole agreement was afterwards rescinded, as Greece proved unable to carry out her part of the bargain. Meanwhile Italian steamship companies, banks and business firms showed considerable enterprise in the Near East.

D'Annunzio and Fiume.—Fresh troubles broke out at Fiume (*q.v.*), where on July 2–5 1919 the alleged antipathy of the French troops (mostly colonials) to the Italians and alleged sympathy with the Croats, led to reprisals, in which some French and Annamite soldiers were killed or wounded. The Peace Conference thereupon appointed an inter-Allied commission of inquiry, which proposed the dissolution of the Fiume National Council, elections to be held under inter-Allied control, the disbanding of the Fiume volunteers, the reduction of the Italian garrison, and the importation of British or American police. These proposals were about to be carried out when on Sept. 12 D'Annunzio arrived at Fiume from Ronchi, at the head of some Italian troops, whom he had induced to follow him to save the town for Italy, and a number of volunteers. Most of the Italian troops and seamen in the town and port joined him, and he set up a government of his own. The Allied troops departed, and Nitti stigmatised the poet's conduct in the most violent terms, calling on the workmen and peasants of Italy to back him up against the *Patriotards*. But a large part of Italian opinion supported D'Annunzio, and volunteers, including men of the highest character and also many adventurers, flocked to his standard.

Riots against high prices broke out in the summer of 1919 in various parts of Italy, and agents of the Chambers of Labour illegally requisitioned foodstuffs and other goods for which they paid prices far below the market rates. The Government did nothing. The Socialists and Communists then organised a general protest strike for July 20–1 against the policy of the bourgeois governments towards Soviet Russia and Hungary. But there was no revolutionary outbreak, and the strike was only partial, largely owing to the beginnings of reaction on the part of public opinion voiced by the various citizen committees, rather than to government action. The Fascist movement, under Benito Mussolini now began to arise as a patriotic reaction (*see* FASCISM). Strikes and disorders continued in various parts of Italy, but Sig. Nitti expressed the belief that the only remedy was to let the spirit of unrest wear itself out, regardless of the immediate danger to the country. He had created a new police force, the Guardia Regia, which, however, proved costly and unequal to its duties. The Premier's treatment of the army caused much dissatisfaction. In his desire to restore the "Peace spirit," he failed to protect the soldiers from outrage and insult, and advised them to go about in mufti and disarmed when off duty. A decree of the Minister of War, issued at the instance of Sig. Nitti, granted an amnesty to deserters, thereby placing them on an equal footing with those who had done their duty in the War. In consequence of the findings of the Committee of Inquiry on Caporetto, Cadorna and other generals were put on the retired list.

On Sept. 10 1919 the Peace Treaty with Austria was signed at St. Germain-en-Laye (*see* ST. GERMAIN, TREATY OF), whereby Italy definitely acquired the frontiers assigned to her by the Treaty of London on the north and northeast, plus the Sexton valley and Tarvis. The German inhabitants of the Alto Adige were dissatisfied with this decision, but their treatment at that time gave no reason for discontent. On Nov. 12 Senator Tittoni resigned from the Foreign Office and the peace delegation, and was succeeded by the eminent jurist, Senator Vittorio Scialoja.

INDUSTRIAL AND POLITICAL UNREST

In spite of, or because of, the government's restrictive measures, prices had more than doubled. The government had made the wheat trade a state monopoly. While it requisitioned domestic wheat at a price below the cost of production, it had to buy foreign wheat at the market price. Thus wheat-growing was discouraged at home, and bread was sold below cost thereby increasing the deficit by six milliards. Transport was disorganised. While the traffic had decreased, the staff, for demagogic reasons, had been increased from 154,000 to 180,000, and afterwards to 240,000; the railwaymen had become more and more idle and insubordinate and were wholly under the influence of the revolutionary syndicate, and thefts of goods on the railways had reached unheard-of proportions.

The Extremists.—By the electoral law of Sept. 1919 the proportional system, whereby the voter voted not for a candidate but for a list, was adopted to please the Socialists and the Popolari, who, as the only two mass parties hoped to derive benefit from it. The Socialists at the Bologna Congress decided to present a Maximalist programme demanding the abolition of capital and the institution of a Soviet Republic, but the extremist group proposed abstention from the polls and an armed rising. The Popolari decided to present their own candidates instead of co-operating with other parties; an extreme wing, led by Sig. Miglioli, promoted strikes and disorders and differed little from the Socialists. The Constitutional groups were split up and were without a programme or organisation. The government was discredited and unpopular. The elections were held on Nov. 16 1919: 156 Socialists, 101 Popolari and 30 Combatants were returned, but none of the Fascist candidates. On the opening of Parliament by the King on Dec. 1 the Socialist deputies withdrew from the Chamber, and as a protest against this insult a patriotic demonstration was held outside, in which some Socialist deputies were injured. A general strike was proclaimed in consequence, and at Mantua there were serious riots, the anarchists committing several murders, breaking open the prisons and pillaging the shops.

Fresh incidents occurred on the Adriatic coast, and at Spalato (Split) the Yugoslav mob attacked the Italian inhabitants under the eyes of the American admiral. Early in Oct. Senator Tittoni had proposed a *modus vivendi* to D'Annunzio, whereby Italian troops would occupy Fiume pending a settlement in Paris, Italy undertaking not to permit the annexation of Fiume to Yugoslavia; but D'Annunzio refused to agree. At the Peace Conference various proposals were suggested, but the Allies and the United States reached no settlement.

The Socialist successes at the election resulted in further disorders. On Jan. 13 1920 the postal employees went on strike because their demands for higher wages were not instantly complied with; volunteers replaced the strikers, in spite of official discouragement, and this broke the back of the agitation. But on the 22nd the railwaymen struck, and although here too volunteers enabled the management to maintain a reduced service, on the 29th Sig. Nitti came forward with concessions and undertook not to punish a single striker, in spite of the explicit provisions of the regulations. The strike ended in a triumph for the revolutionists. In the spring there was a two months' strike of the secondary railways of Lombardy, and one at the Mazzonis cotton mills in Piedmont, where the government legitimised the arbitrary seizure of the factories by the workmen. The railwaymen in general refused to run trains conveying soldiers or police to places where there were disorders; there was a railway strike at Cremona and elsewhere because the station-master, who had dared to dispatch a train supposed to be conveying war material to Poland, then at war with Soviet Russia, was not dismissed.

Sig. Nitti, finding himself unable to conduct the Government

in the face of the growing opposition, had resigned a first time on March 12 1920, but as no one else was prepared to assume office in these difficult conditions, he reconstructed his Cabinet with a few changes. On April 17 the Supreme Council met at San Remo to prepare the peace with Turkey, the Adriatic problem was also to be discussed, but at the request of M. Trumbich, the Yugoslav Foreign Minister, direct negotiations were instituted at Pallanza a few days later. On May 12 the Cabinet, having been defeated in the Chamber, resigned, and the crisis broke up the Pallanza conference. No other combination having proved possible, Sig. Nitti was again asked to reconstruct his Cabinet, which he accomplished by May 21, but even in its third reincarnation it proved stillborn. The Prime Minister's failure to solve the Adriatic problem and the indignation aroused by the arrest of the Dalmatians and Fiumani in Rome on account of an alleged plot, made his position untenable. On June 4 he enacted a decree reducing the bread subsidy, but yielding to the threats of the Socialists, he withdrew it five days later and resigned without waiting for a vote.

Giolitti's Difficulties.—Sig. Giolitti now appeared the only man capable of forming a government, and this he achieved by June 16. Count Sforza was chosen Minister for Foreign Affairs. The budget statement for 1920–1, presented on June 27 1920, showed a deficit of 14 milliards.

Troubles now broke out in Albania. In 1917 Gen. Ferrero had proclaimed an Italian protectorate over Albania, but the subsequent agreements whereby Italy undertook to allow Yugoslavia and Greece to occupy parts of the country aroused much dissatisfaction among Albanians. An Albanian Govt. had been formed at Tirana and the Italian garrisons were greatly reduced; in the spring of 1920 Albanian bands began to disturb the Italian troops, and on June 5 they attacked and captured some of the outposts. An attack on Valona was repulsed with loss to the enemy, but on June 24 Sig. Giolitti, alarmed at a mutiny which had broken out as a result of anarchist propaganda at Ancona, and yielding to the Socialist demands, announced that Italy would withdraw her troops from Albania and negotiate with the Tirana Govt. An agreement was arrived at on Aug. 3, and on Sept. 2 the last Italian troops departed, only the islet of Saseno being retained.

At the Spa Conference (July 5–16 1920) Italy succeeded in getting her share of the German indemnity raised to 10%, and that of the Austrian, Hungarian and Bulgarian indemnities to 25%. On Aug. 6 the Tittoni-Veniselos agreement was rescinded, and on the 10th the treaty with Turkey was signed at Sèvres; by the terms of the tripartite agreement Italy obtained "economic priority" over a wide zone of Anatolia south and east of the Greek zone (Smyrna) and a concession for exploiting the Heraclea coal-fields. By a separate agreement with Greece,[1] Italy undertook to cede to the latter the Dodecanese minus Charki and Castellorizo, which together with Rhodes were to remain Italian for 15 years, and then, if Britain ceded Cyprus to Greece, a plebiscite was to decide the fate of Rhodes.

The Rapallo Conference.—Serious anti-Italian disorders occurred on July 11 at Spalato, where the Croat mob murdered the commander of the cruiser "Puglie" and wounded several officers and men; protest demonstrations were held at Trieste, and shots having been fired from one of the Yugoslav institutions, several of them were set on fire. At Fiume the National Council resigned and D'Annunzio proclaimed the Reggenza del Carnaro, for which he drafted a curious, mystical, semi-medieval statute. As President Wilson's term of office was nearly up, the Yugoslavs felt that a direct understanding with Italy would be the best solution. The Italian Govt. communicated its proposals to those of Britain and France, which advised Yugoslavia to accept them. A conference was held at Rapallo on Nov. 8, Italy being represented by Sig. Giolitti, Count Sforza, Sig. Bonomi, Gen. Badoglio and Admiral Acton; Yugoslavia by MM. Vesnich, Trumbich, Kosta, Stoyanovich and Col. Kalafatovich. On the 12th the treaty was signed. Italy waived her rights over Dalmatia, except for the town of Zara, and the following frontier was agreed upon: Mount Pec, Mount Yalovets, the watershed between the Isonzo and the Wurzen See and the Wocheiner Save, northeast slope of Mount Mezik, east slope of Mount Porzen, west slope of Mount Blegos, Zelse, Cabranska, east of Mount Trstenik, east of Griza, east of Mattuglie, frontier of the Fiume State on the Fiume-Castua road; the islands of Cherso, Lussin, Lagosta and Pelagosa were assigned to Italy, while both Powers recognised the independence of Fiume; the Italian-speaking inhabitants of the territories assigned to Yugoslavia were entitled to opt for Italian citizenship without having to leave the country, and full freedom of language, culture and religion were granted to Yugoslavs in Italian territory.

By a secret clause, which soon became public property, although Count Sforza denied its existence, Porto Baros, an integral part of the port of Fiume, was promised to Yugoslavia. D'Annunzio, however, refused to recognise the treaty, and his *legionari* occupied Castua and the islands of Vegli and Arbe (assigned to Yugoslavia) and tried to invade Dalmatia. But the Government, determined to enforce the treaty, established a blockade round Fiume; on Dec. 23, as D'Annunzio refused to obey Gen. Caviglia's summons to submit, military operations were commenced. There was some fighting, but on the 30th D'Annunzio authorised his plenipotentiaries to accept the conditions imposed. Fiume was to be placed under its own town council, with a local volunteer force to maintain order, assisted by Italian carabinieri, until after the elections for the Constituent Assembly. D'Annunzio left Fiume on Jan. 18 1921. But the elections in the spring of that year led to disorders necessitating the maintenance of Italian troops. The evacuation of Dalmatia, divided for the purpose into three zones, began in the spring of 1921.

Industrial Disturbances.—The internal troubles reached their zenith in the autumn of 1920. There were industrial, agricultural and railway strikes in various parts of the country, and in Sept. a very serious agitation broke out in the metal trades. These industries had earned large profits during the War and were paying high wages. But the cost of production was increasing, and there were signs of a coming slump, so that it was impossible to grant the still higher wages which the workmen now demanded. The workmen of the Romeo works in Milan now adopted obstructive tactics and sabotage, and the management retorted by a lock-out on Aug. 20. Thereupon the F.I.O.M. (*Federazione italiana operai metallurgici*) ordered all the metal workers in Milan to remain in permanence at the mills without working. The Federation of Mechanical Industries then extended the lock-out to the whole of Italy on the 31st, and the workmen, many of them armed, seized a number of factories in Lombardy, Piedmont and elsewhere.

Encouraged by the passive attitude of the authorities, they kidnapped owners and managers and tried to force them to run the works exclusively for the workers; armed "Red Guards" were organised, revolutionary tribunals set up and persons approaching the factories were shot at. At Turin the factory councils attempted to sell the goods manufactured during the occupation, although the owners warned the public of the nullity of such sales. But the workmen found themselves incapable of running the factories unaided, and the occupation ended by becoming merely an occasion for orgies. On Sept. 6 the General Confederation of Labour expressed its approval of the occupation, but declared that the movement must be placed under its own guidance in order to secure "collective management," and forbade any further extension of the seizures for the present. Nevertheless the extremists became more truculent, and at Turin a Nationalist student and a prison warder who happened to be passing near an "occupied" factory were brutally murdered by "Red Guards," and in many works the safes were broken open and the contents pocketed by the leaders.

Sig. Giolitti at last felt that he must do something. He summoned the representatives of the owners and the workers to meet him on Sept. 19 in Rome. At this meeting an agreement was arrived at; wages were to be raised and a form of workmen's control over industry, which the Government undertook to embody in a bill, was agreed to. The owners also agreed to pay for the

[1] Denounced by Italy, Oct 8. 1922.

work performed during the occupation, with deductions for damage done to the plant, but they refused to readmit all the workmen as the Government demanded, and only did so at last under protest against this imposition. The factories were evacuated on the 27th and work was resumed on Oct. 4. As a practical attempt to establish Communism, as the group by Bombacci hoped, the agitation had failed, and Giolitti claimed that by proving to the workmen that they could not run industry without the capitalist and the expert, they had been taught a useful lesson. But the Premier's real motive was probably the fear of provoking revolution and distrust of the nation's patriotism and courage. Incidentally the "occupation" wrought serious injury to Italian credit at home and abroad.

The Fascists.—About this time agrarian troubles had also broken out in various parts of Italy, notably in the Veneto, the provinces of Bergamo and Cremona, the Lazio, Tuscany and Sicily. The peasants demanded contracts which, if accepted, would have left the landlords without enough income to pay the taxes. In this agitation Socialist and Left-wing Popolari vied with each other in revolutionary methods. The public meanwhile was beginning to weary of these constant disorders and of the tyranny of a factious minority, and the middle classes set to work to organise resistance. The Agrarian Association of Bologna was particularly active, but it was the Fasci, now arising all over Italy, under Mussolini's leadership, which organised the national reaction. The first attempt at resistance at Bologna, the hotbed of revolution, was on Sept. 20, when, as the result of a Communist attack on a patriotic procession, a kiosk where seditious papers were sold was destroyed. At a strike demonstration in the same city in Oct. 14 1920 against the "white terror" in Hungary, the Anarchist, Malatesta, incited the mob to violence, and a police inspector and a Guardia Regia were murdered. Small groups of Nationalists and Fascists thereupon paraded the streets; in an instant the tricolour flag appeared everywhere and the strike ceased. The municipal elections in Oct. and Nov. registered a decline in Socialist influence in Rome, Naples, Turin, Genoa, Venice and Florence, but at Milan and Bologna revolutionary majorities were again returned.

The assumption to office of the Red administrations was to offer occasion for fresh outbreaks of violence. In Bologna the Communist deputy, Bucco, secretary of the local Chamber of Labour who had been the Red tyrant of the province, now began to fear for his own safety and applied for police protection against the Fascists; he was spirited out of the city and after his departure a deficit of a quarter of a million was found in the accounts of the Chamber of Labour. On Nov. 21 1920 the first meeting of the new Bologna town council was intended to be the occasion for an armed rising organised by the Communists, with the help of the municipal guards and the fire brigade. There were anti-Socialist demonstrations in the streets organised by the Nationalists and Fascists, supported by other citizens, but in the town hall two councillors of the constitutional minority, Giordani, a disabled ex-officer, and Colliva were murdered by Communists. The upheaval of public opinion was now irresistible; the Red leaders had to fly for their lives and the whole fabric of Bolshevik organisation in Bologna crashed. The town council never met again and was eventually dissolved, while the Fascists wrecked or burned down various Socialist institutions. At Modena a Fascist was murdered and several others shared a like fate while attending their comrades' funeral; this led to a general anti-Socialist uprising there also, and similar episodes occurred at Ferrara. Throughout the Po valley the Fascists proceeded to break the tyranny of the "Red baronies"; the revolutionary *leghe* which had dominated labour in that area, were dissolved, and one Red town council after another resigned or was dissolved by the prefects, while ever increasing masses of workers, industrial and agricultural, went over to Fascism and thus formed the basis of the Fascist labour movement.

Socialist Dissensions.—During the last months the Maximalist Socialist party had begun to show signs of dissension. The extremist group led by Bombacci and Gennari advocated an immediate revolution, while the Turati-Treves group opposed the idea; at the Reggio Emilia congress Nofri and Ponzani, who had returned from Russia, proceeded to condemn the Soviet system. The Russian leaders demanded the absolute submission of the Italian party to the orders of Moscow and the expulsion of all Socialists tainted with the Reformist heresy. At the general congress of the party in Leghorn (Jan. 13–22) a resolution in favour of a middle tendency, supported by Turati, Treves, Buozzi, Baldesi, D'Aragona and the G.C.L., who called themselves *Unitari* and were prepared to collaborate with bourgeois Governments, was adopted. The Communists (represented by 18 deputies) thereupon broke away and formed a party of their own. The new party now tried to affirm itself by a series of terrorist outrages in the hope of promoting revolution. Bombs were thrown in Florence on Feb. 27, killing and wounding several persons, whereupon the Fascists retaliated by murdering Lavagnini, a notorious Communist railway organiser; the railwaymen and electricians went on strike and various affrays between Communists and Fascists occurred, until the troops intervened and restored order. At Empoli a number of unarmed sailors were murdered by Communists, and the Fascists, summoned from various parts of the country, inflicted severe reprisals. Similar occurrences took place at Foiano della Chiana and other places. But everywhere the popular reaction, guided by Fascists and Nationalists, was vigorous and unmistakable. The Government unable to tackle the situation, itself, left the Fascists a free hand to fight the Reds.

Sig. Giolitti now had the courage to propose the abolition of the bread subsidy, and presented a bill to that effect, which was voted by a large majority on March 1, in spite of Socialist obstruction. The bill in favour of syndicalist control over industry, presented by the Premier in accordance with the agreement of the preceding Sept., encountered much opposition in Parliament and was finally dropped.

Giolitti Resigns.—The Parliamentary position was becoming insecure, and a hostile motion on foreign policy proposed by Sig. Amendola was rejected only by a small majority. On April 7 1920 Sig. Giolitti dissolved the Chamber, and on May 15 the elections were held. Out of 535 seats (27 had been added for the new provinces) the Liberals and Democrats of various shades secured 275, the Popolari rose from 101 to 107, the Socialists fell from 156 to 122 Unitari and 16 Communists; there were in addition four Germans for the Alto Adige and five Slavs for the Venezia Giulia. The Fascists were 38 and the Nationalists 10. Although the composition of the new Chamber was not very different from that of the old, the Socialists and Communists were now faced by a vigorous Fascist-Nationalist group supported by sympathisers belonging to other parties. On June 11 Parliament opened, and in the debate on the speech from the Throne, the Nationalist Federzoni (*q.v.*) delivered a strong attack on Count Sforza's foreign policy. On June 26 the Cabinet secured only a small majority on a vote of confidence on foreign policy, and Sig. Giolitti resigned.

Sig. Bonomi formed an administration composed as follows: Bonomi (Presidency and Interior), Marquis Tomasi della Torretta (Foreign Affairs), Giradini (Colonies), Rodinò (Justice), Soleri (Finance), De Nava (Treasury), Micheli (Public Works), Belotti (Industry and Trade), Bergamasco (Marine), Corbino (Education), Mauri (Agriculture), Beneduce (Labour), Giuffrida (Post Office), Ranieri (Liberated Territories). The Cabinet comprised members of many parties, but the Popolari were predominant and Don Sturzo ruled Sig. Bonomi with a rod of iron. Under Popolare influence, strengthened by that of the semi-Socialists Giuffrida and Beneduce, further advanced legislation was enacted. A bill enabling any public body to expropriate land which in its opinion was inadequately cultivated, the owners to be indemnified with land bonds of uncertain value paid for by the whole community was introduced but aroused violent opposition and never became law.

Sig. Bonomi had the merit of deciding that the celebration of the ceremony for the Unknown Soldier should at last be held; it took place on Nov. 4 1921. Two days later the Fascist congress was opened in Rome, and Fascism was definitely constituted into

a political party. On the 10th the Communists and Socialists proclaimed a general strike as a protest against the presence of the Fascists in Rome; disorders ensued, in which five persons were killed and several wounded. The troubles had ceased by the 14th, after which the Fascist congress broke up. The debate in the Chamber on the eligibility of the deserter Misiano, who had been returned for Turin and Naples, led to violent scenes, until on Dec. 20 his election was annulled. During this same month the Banco di Sconto failed, and the Government was severely blamed for not having prevented the collapse of so important an institution, whose actual condition was by no means hopeless; as was proved at the subsequent legal proceedings before the Senate,[1] the failure caused serious prejudice to the general financial and economic situation of the country.

The publication by a French journalist of an account of an imaginary insult attributed to M. Briand against the Italian Army at the Washington disarmament conference led to anti-French demonstrations at Turin and elsewhere, until the misunderstanding was cleared up. The attempt to conclude a commercial treaty with Russia failed, as the Soviet Govt. refused to ratify the agreement. In Jan. 1922 Sig. Bonomi attended the Cannes meeting of the Supreme Council, where it was decided to hold an economic conference in Genoa in the spring.

The Facta Govt.—The Bonomi Cabinet was now attacked on all sides, and when on Feb. 2 1922 the Democrats, 16 of whom were in the Government, went over to the Opposition, Sig. Bonomi resigned. The King, however, asked him to go before Parliament, in order that by its vote it might give some indication for a solution. This Bonomi did, and the Cabinet having been beaten on the 17th resigned definitely. It was not until the 25th that a new Cabinet was formed by Sig. Luigi Facta. He was a thoroughly honest man, and his acceptance of office in these circumstances was proof of his patriotism, but he was not a first-class statesman. He selected Senator Schanzer for the Foreign Office, while the other Ministers were of respectable mediocrity. On March 15 the Premier communicated to the Chamber the Government's programme, based on the restoration of order, and secured a vote of confidence.

In 1922 the reconquest of Tripolitania was commenced with the reoccupation of the port of Misurata at the end of January. After a series of operations lasting through 1922 and 1923 the whole colony was reoccupied. The Governor in this period was Count Giuseppi Volpi, afterwards Finance Minister.

Trouble now broke out in the port of Naples between the Red dockers' union, which wished to retain its labour monopoly, and the new Fascist dockers' union, created to combat the prevailing conditions of anarchy and graft brought about by the Reds. The Red union proclaimed a strike in all the Italian ports on March 18 as a protest against the existence of the Fascist union, and the Government referred the solution of the conflict to the *enti-autonomi* of the ports, a decision which caused much dissatisfaction in non-Socialist circles, as those bodies were notoriously under Socialist influence. But the Fascists eventually succeeded in breaking the Red monopoly and restoring order and freedom of labour in the ports, to the great advantage of the maritime trade of Italy.

The Genoa conference was inaugurated on April 10. Sig. Facta presided with dignity, but the hardest work was accomplished by Sig. Schanzer, who often succeeded in composing differences between the British and the French and between the French and the Germans and Russians. The Russian delegation was at first alarmed at the possibility of an unfriendly reception by the Fascists, but the Fascist party directorate assured the Bolsheviks that if they abstained from interference in Italian internal affairs they would not be molested; this they undertook to do, and they carried out their undertaking.

The railway syndicate at Bologna issued an order that all traffic was to be held up on May 1, and although the management was able to secure an almost complete service, many railwaymen did cease work, thereby causing inconvenience and delay. This time the Government did indict the members of the executive committee of the syndicate, and some of the leaders were punished. On May 24 the funeral procession escorting the body of the war hero Enrico Toti to the cemetery in Rome was fired on by Communists in the San Lorenzo quarter, with the result that two persons were killed and several wounded. The next day the Committee of Proletarian Defence and the Alleanza del Lavoro, a newly formed coalition of the Communist, Socialist and Republican parties and the G.O.L., ordered a general strike in Rome; the Fascists tried to organise a counter-demonstration, but were dispersed by the police. This strike, which ended on May 26, intensified the exasperation of all law-abiding citizens against agitators.

The Bologna Reds.—In the province of Bologna the Red unions had lost much of their influence, but the leaders managed to maintain authority with the acquiescence of the Government. While locally there was a scarcity of labour and very high wages, in the neighbouring provinces there was unemployment, but the Bologna union leaders were determined to prevent the migration of these "foreign" workers, lest their own monopoly should be menaced, and they induced the prefect to forbid it. The prefect's action was *ultra vires* as it violated the rights of individuals in the interest of a privileged class, and the Fascists, voicing the general indignation which it aroused, concentrated on Bologna in military formation and demanded the revocation of the decree and the removal of the prefect. Sig. Mussolini, having obtained satisfactory assurances from the Government, ordered the Black Shirts to demobilise and evacuate the city, which they did on June 2; the decree was then revoked, and the prefect transferred.

There were now rumours of a new cabinet crisis, and the Socialists were divided on the question of collaborating with a bourgeois government. The Fascists, Nationalists and the Right were opposed to any sort of Socialist infiltration, which would involve unlimited extravagance and more advanced legislation. On July 12 1922 Sig. Peano, the Treasury Minister, issued his financial statement for 1921–2, which showed a deficit of 4,500 million lire, while experts estimated it at 6,500 million; public opinion was seriously alarmed, but in Parliament the deputies were too busy over lobby intrigue in view of the expected crisis to worry about finance. There were disorders at Cremona, provoked by the left wing Popolari led by Miglioli and the Socialists; the Fascists mobilised and wrecked several Socialist institutions and Miglioli's own law offices. The Democrats in the Chamber seized the occasion to contract an alliance with the Popolari, and on July 19 Sig. Facta was outvoted and resigned. But it proved impossible to form a new Cabinet, and after various unsuccessful attempts by Bonomi, Orlando and Meda, during which even the Socialist Turati was summoned to the Quirinal for consultation, the King sent for Facta once more, and the old Cabinet was reconstructed, with Senator Taddei, prefect of Turin, as Minister of the Interior.

The General Strike.—On Aug. 1 a general strike throughout Italy was suddenly proclaimed by the Alleanza del Lavoro, as the result of a Communist initiative, supported by the Socialists, who were disappointed at having failed to secure a Democratic-Socialist Cabinet, and Turati proclaimed it a "legalist" strike, because its professed object was to affirm the authority of the State against the Fascists. Work was suspended in many factories and a part of the railwaymen struck; but the Fascists and Nationalists ordered a general mobilisation, and the Fascist directorate issued a manifesto calling on the public servants and the workers "to shake off the yoke of the politicians by whom they were led," and giving the Government 48 hours within which to prove that it possessed authority over its own employees and those who were attempting to destroy the nation. "On the expiry of this delay Fascism will assume full freedom to supplant the State." Serious conflicts between Fascists and Communists occurred at Milan, Ancona and other places, but the strike rapidly collapsed, and on the 2nd the Alleanza del Lavoro ordered it to cease; by the 4th all disturbances were over. During the strike agitation the Fascists delivered an attack on the Communist-

[1] The case was tried by the Senate because there were senators among the accused.

Socialist municipality of Milan, which had for years ruled the city, bringing it to the verge of ruin and indulging in the most scandalous graft; the deficit was 375,000,000, there were bills for 101,000,000 lire overdue, and the richest city in Italy could obtain no credit anywhere.

The Liberal *Corrière della Sera*, as well as the Fascist press, had been conducting a very vigorous campaign against the administration, but the Government did not interfere. On Aug. 1 the tramwaymen, electricians, sweepers, employees of the waterworks and firemen of the city, all struck, but the Fascists and other citizens took their places; on the 3rd the Fascists succeeded in getting into the town hall and expelling the few assessors present, and for the first time since 1914 the tricolour was raised on Palazzo Marino amid scenes of great popular enthusiasm. The Fascists withdrew on the 4th and handed over the building to the prefect's commissioner. On the 27th, after the disastrous results of the inquiry into its financial administration, the council was dissolved and a royal commissioner placed in charge.

At Genoa the Fascists led a similar operation against the port consortium, which was largely under the influence of the Red dockers' union. Under Fascist pressure the consortium was dissolved and a royal commissioner appointed. The Fascists extended their action against a number of Socialist, Communist and Popolare town councils and institutions, forcing the administrators to resign; sometimes violence was resorted to, but in most cases the administrations resigned from sheer fright; very frequently evidence of embezzlement was discovered. Another operation was carried out against the provincial administration of Trento, and the Governor, Sig. Credaro, accused of being under the influence of the anti-Italian Pan-German elements of Bolzano, was recalled by the Government on the initiative of the Fascists. All these actions were of course illegal, but public opinion approved of them because it considered that the Fascists were doing what the Government should have done before.

The Fascist Programme.—Facta's position was daily weakening, and indeed the whole machinery of government was obviously breaking down. At the Socialist congress held on Oct. 3 the party split into two groups, the *Unitari* or collaborationists and the uncompromising *Massimalisti;* as a result of this split the G.C.L. broke off its alliance with the Socialist party and declared itself a non-political body, but many of its adherents had already gone over to Fascism. The Partito Popolare was also divided by conflicting tendencies, and the Pope enjoined on the bishops and clergy to abstain from partisan political activity. The moment was now ripe for a bold Fascist move. Sig. Mussolini considered that it was not enough to crush Bolshevism, and that if Italy was to become a really great nation the whole body politic must be reformed on Fascist lines, and the national finances re-established by eliminating extremist legislation and extravagance.

Although many Liberals approved of the Fascist programme, the Fascists themselves were convinced that it could not be carried out under normal Parliamentary conditions. They now demanded of the Government either a dissolution or the resignation of Facta and the formation of a new Cabinet comprising five Fascist Ministers; but the Premier rejected both alternatives. At a Fascist gathering at Udine on Sept. 29 Mussolini made an important declaration in favour of the monarchy, thereby securing the support of many non-Fascists. His hints at a revolution, however, were still regarded as figures of speech, but he was now entrusted by the party directorate with a mandate to conduct a political and even military action to bring Fascism into power. On Oct. 24 another Fascist congress was held at Naples, where 40,000 Fascists in military formation paraded the streets. In his speech at the San Carlo theatre Mussolini said that "what we have in view is the introduction into the Liberal State, which has fulfilled its functions . . . of all the forces of the new generation which has emerged from the War and the victory." In another speech he declared that "either the Government will be given to us or we shall seize it by marching on Rome."

March on Rome.—That same evening the Fascist Quadrumvirate was formed, composed of Michele Bianchi, general secretary of the party, Italo Balbo, commander of the armed *squadre*, Gen. De Bono (ex-commander of the IX. Corps), who had organised them, and the deputy C. M. De Vecchi, while Dino Grandi, an authority on labour problems, was entrusted with the political functions of the enterprise. The congress broke up and Salandra and Orlando, acting on behalf of the Quadrumvirate, called on Facta to resign, which, after some hesitation, he did on the 27th. In the meanwhile the general mobilisation of the Fascists had been ordered, and they proceeded to concentrate on Rome in four columns. Both the Fascist leaders and the Army officers were anxious to avoid any conflict between the *squadre* and the troops, and the news that martial law had been proclaimed caused deep consternation. Facta had indeed drafted and issued the decree, but the King refused to sign it as it would have meant civil war, and it was immediately withdrawn. Sig. Salandra was now entrusted with the formation of a Cabinet, and he offered portfolios to De Vecchi and Grandi; but Mussolini on being consulted rejected the proposal, for the formation of a Cabinet of the old parliamentary type was now impossible. On Salandra's advice the King sent for Mussolini. The Fascist columns began to enter Rome on the morning of Oct. 30 1922 and the city was peacefully occupied; the only regrettable incidents were the murder of a Fascist at Valmontone by Communists and the murder of some Communists by Fascists in the San Lorenzo quarter of Rome. Mussolini reached Rome from Milan the same day, and at once presented himself to the King, with his Cabinet list already prepared, which the King at once accepted. As the presence of the *squadre* in Rome was no longer necessary, and might lead to trouble, Mussolini ordered them to depart; this they began to do on Oct. 31, after paying a tribute of honour to the tomb of the Unknown Soldier and homage to the King; by Nov. 2 all had left the capital.

The new Cabinet was composed as follows: Mussolini, Premier and Minister of Foreign Affairs and the Interior; Gen. Diaz (War), Adm. Thaon di Revel (Marine), Prof. Alberto De Stefani (Finance), Prof. Tangorra (Treasury), Duke di Cesarò (Post Office), Federzoni (Colonies), Prof. Gentile (Education), De Capitani (Agriculture), Carnazza (Public Works), Count Teofilo Rossi (Industry), Cavazzoni (Labour), De Vecchi (Under-Secretary for Pensions). Although predominantly Fascist, the Cabinet comprised members of all the chief groups except the anti-national parties; Rossi was a Giolittian, Cesarò a Social Democrat, Gentile[1] and De Capitani Liberals, Tangorra and Cavazzoni Popolari. Sig. Mussolini did not have a Parliamentary majority, but he was supported by the mass of public opinion even outside Fascist circles. He gave stringent orders for the cessation of all acts of violence, and for the reinstatement of the town councils which had been forced by the Fascists to resign after Nov. 1. Occasional conflicts still occurred, but on the whole order was restored with surprising rapidity.

On Nov. 16 the Premier informed the Chamber that for the second time the Italian people had given themselves a Government independent of any Parliamentary designation,[2] that he might have closed Parliament and formed a purely Fascist Cabinet, but that he preferred, at all events in the first phase, to form a coalition with all the national parties. He undertook to balance the budget, provide for the working classes, but not in accordance with any extravagant theories, and conduct the foreign policy of Italy with firmness and dignity. He finally asked for full powers for a year to carry out the necessary reforms, and these were granted by 275 votes to 90. The Nationalists were now absorbed into the Fascist party.

The Deficit.—The most urgent problem before the new Government was finance. The estimated deficit for 1922–3 was 6,500 million lire and Sig. De Stefani at once proceeded to adopt drastic economies, reorganise taxation and encourage economic activity without hindrances to production. Prof. Tangorra having died on Dec. 21 De Stefani took charge of the Treasury as well. The Ministry of the Liberated Territories and several under-secretaryships were abolished, and by the decree of Jan. 23 1923 the Gov-

[1] Gentile afterwards became a Fascist.
[2] The first was in May 1915.

ernment was enabled during one year to place on the retired list all officials who were too old or otherwise incapable of fulfilling their duties, and to revise all appointments made under special war legislation since May 1915. The Guardia Regia, which had not answered its purpose on account of defective discipline and organisation, was disbanded. The Fascist and other armed *squadre* were also disbanded, and the *Milizia Volontaria per la Sicurezza nazionale* (*see* FASCISM), composed of *ex-squadristi* and officered by ex-army officers, was created in Jan. 1923 to assist in the maintenance of order. In the administration of justice the four courts of cassation were reduced to one, and many minor courts suppressed. The railway staff, which amounted to 225,000 when the Fascists came into power, was reduced to 170,000.

A large number of abuses were eliminated; the eight hours' day, which had been reduced to five or six hours of real work, was restored; railway thefts and damage to property were brought down to trifling proportions, the system of equalising wages, so that a linesman or engine-driver was paid as highly as, or more than, an important official, was done away with; the free passes issued to the leaders of the revolutionary *sindacato ferrovieri* and many other persons were withdrawn, discipline was re-established and bonuses for economy reintroduced. These reforms, which were largely the work of the special high commissioner for the railways, Sig. Edoardo Torre, resulted in improving the service out of all recognition, and converting the railway deficit, which in 1921–2 amounted to 1,400 million lire, into a surplus of 176,000,000 for 1924–5. A similar transformation was effected in the postal and telegraph services, where insubordination and disorganisation had reached incredible proportions under the previous governments; here too a deficit of some 500,000,000 was converted into a surplus of 43,000,000. Originally the Government intended to restore the railways and some of the postal services to private enterprise; this has been done for the telephones from July 1 1925, but not for the railways. Reforms of a similar nature were introduced into many other departments, and everywhere the number of officials was reduced.

The Yannina Murders.—Soon after coming into power Sig. Mussolini attended the opening of the Lausanne conference on the peace with Turkey, and there he first came into contact with his British and French colleagues. On Aug. 27 1923 the Italian General Tellini, president of the inter-Allied commission for the delimitation of the Graeco-Albanian frontier, and four of his staff were murdered by Epirote bands near Yannina on Greek territory, as a result of a violent campaign in the Greek press against Tellini, who was accused of unduly favouring the Albanian claims. On the 29th the Italian Govt. presented an ultimatum to Greece demanding immediate satisfaction and an indemnity of 50,000,000 lire. As the Greek Govt. rejected some of the conditions, and denied responsibility for the crime, an Italian fleet was sent to Corfu to occupy the island. The Greek commander having refused to lower the flag a few shots were fired on the fort, one of which killed or wounded a number of refugees,[1] who, unknown to the Italian admiral, were lodged in it. The island was then occupied. On Sept. 1 Greece appealed to the League of Nations Council, but as the Conference of Ambassadors had also been invested with the conflict, the Italian delegate to the League Council, Sig. Salandra, maintained that the Conference alone was competent to deal with the matter, whereas the British delegate, Lord Robert (now Viscount) Cecil; the Greek delegate, M. Politis; and the delegates of the small Powers insisted on the League's right to intervene. After arranging that an inquiry should be conducted by the four Great Powers[2] the Conference of Ambassadors finally decided that Greece should make full satisfaction in the most solemn form to Italy and pay the indemnity of 50,000,000 lire. Italy declared that the occupation of Corfu had no other object than that of obtaining satisfaction for its demands. On the 13th the Conference announced Greece's acceptance of its decision and Italy's undertaking to evacuate Corfu by the 27th, which was done. As a result of the conflict Italo-Greek relations were much improved, but there were controversies in the League Council between Sig. Salandra and Lord Robert Cecil and the delegates of Sweden and Norway.

The next important action of the Fascist Govt. in the field of foreign affairs was the settlement with Yugoslavia. As Sig. Mussolini had long recognised the difficulty of fully carrying out the Rapallo and Santa Margherita agreements, he had suggested, as early as Nov. 1922, to M. Ninchich the advisability of a more complete agreement. The Santa Margherita convention was ratified on Feb. 21 1923, and Italy proceeded to evacuate the third Dalmatian zone,[3] but the existence of the Fiume Free State was the chief obstacle to a real understanding. Sig. Depoli, head of the government, had resigned, as he could not continue to rule the town, which was threatened with starvation, and Sig. Mussolini sent Gen. Giardino to Fiume in Sept. 1923 to take charge of the administration, and provided him with adequate funds. Negotiations with Yugoslavia were then resumed, and on Jan. 27 1924 the various agreements were signed in Rome. By the first of these the two Powers undertook to collaborate in maintaining the conditions established by the peace treaties and to assist each other politically and diplomatically in case of a conflict. By a second convention Italy recognised Yugoslavia's full sovereignty over Porto Baros and the Delta, while Yugoslavia recognised that of Italy over Fiume; a free customs zone was also established comprising Fiume and Castua (the latter ceded to Yugoslavia). Ratifications were exchanged on Feb. 22, and subsequently a series of commercial agreements was concluded.

Mussolini and Parliament.—One of the main considerations of the Fascist party was the relation of the executive to the legislature. Parliament in Italy had long been degenerating, and after the War conditions had become worse than ever. Sig. Mussolini was determined not only to eliminate certain evils, but to prevent their recurrence, and above all to give stability to the government. In the summer of 1923 he drafted a bill whereby the country was divided into 15 constituencies, each voter to vote for the party list which he preferred, the party securing relatively the largest number of votes to be entitled to two-thirds of the seats in the Chamber, while the remaining third was divided among the other parties on a proportional basis. The bill encountered much opposition among the Socialists and the Popolari, and also among some sections of the Liberals, but it was admittedly only a temporary and tentative measure, and it was voted by a large majority in the Chamber in July and by the Senate in Nov. 1923. At a Cabinet Council on Dec. 31 the government renounced the full powers granted to it by Parliament a year previously, and on Jan. 25 1924 Parliament was dissolved.

Sig. Mussolini stated that he now wished to appeal to the country for a verdict on the work accomplished, but that, while recognising the value of the elective Chamber, it must not be accorded absolute predominance over the other organs of the State—the Crown, the Senate, the Executive—all of which have their allotted functions. He rejected the idea of electoral and political alliances with other parties, but decided to include in the government electoral list men of all parties or no party who might be counted on to render services to the country. He approached certain leading Liberal and Democratic statesmen of Southern Italy, where Fascism had less hold than in the North, in order to include them in the Government list. Salandra, Orlando, De Nicola and De Nava accepted. The Duke of Cesarò, Minister of Posts and Telegraphs, having quarrelled with the Premier over the latter's refusal to contract an alliance with the Social Democratic party, and also because he disapproved of certain influential Fascists, resigned and presented an opposition list of his own, chiefly in Sicily.

The Government list was prepared by the Fascist representa-

[1] Colonel Lowe, of the Near East Relief Organisation, deposed that the casualties amounted to 100, including 20 dead, of whom 16 were children.

[2] For full details of the incident see the article by "Verax" in *La Vita italiana* for Dec. 15 1923; and for text of report see *The Janina Murders* and *The Occupation of Corfu*, George Glasgow (London, 1923).

[3] The port of Dalmatia assigned to Italy by the Treaty of London and ceded by her to Yugoslavia at Rapallo had been divided for the purpose of evacuation into three zones.

tives in each constituency, passed by the " Pentarchy " (Finzi Michele Bianchi, Giunta, Acerbo and Cesare Rossi) and finally submitted to Mussolini for approval. In four constituencies there were extra lists for government supporters for whom there was no room in the government list proper. The government candidates comprised 200 ex-combatants, and a number of men eminent in science, literature, business, agriculture and industry. The opposition groups competed for the 179 seats reserved for the minorities. The elections were held on April 6, and, except in a very few cases, went off without disturbances. In all 7,628,859 votes were recorded (73% of the registered voters, a larger percentage than at any previous election). Of these 4,693,690 were for the government, *i.e.*, 65·25% of the recorded votes, not including those in favour of minority candidates who had declared themselves supporters of the Government; the Government thus would have been entitled to two-thirds of the seats independently of the new law. The supporters of the Government were 355 (Sig. De Nava having died), of whom 260 were Fascists and 114 members of other groups. The opposition groups were distributed as follows: Constitutional Opposition 12, Liberal Democrats 17, Social Democrats 11, Popolari 40, Massimalists 22, Unitari Socialists 27, Communists 17, Republicans seven. Of the ex-Premiers, Bonomi was not returned; Nitti and Facta did not stand, but Facta was raised to the Senate soon afterwards.

The Matteotti Murder.—Parliament was opened by the King on May 24 1924. After his overwhelming victory at the polls Sig. Mussolini held out the olive branch to the Opposition parties, and everything seemed to point to a return to normal political conditions; on June 7 the Chamber gave the Cabinet a vote of confidence by 361 to 107. But on June 10 the Socialist deputy Giacomo Matteotti, Secretary of the Unitario group, mysteriously disappeared, and a day or two later it was discovered that he had been kidnapped in a motor-car by Dumini, Volpi and other Fascists of shady antecedents and carried off to an unknown destination. The kidnappers, suspected of complicity in attacks on other anti-Fascist leaders, were caught at once, and four prominent Fascists—Marinelli, the administrative secretary of the party; Filippelli, editor of the *Corriere italiano;* Cesare Rossi, head of the official press bureau; and Naldi, the editor of the *Nuovo Paese*—were also arrested as accomplices. The body of Matteotti was discovered on June 13 buried in a lonely spot 20 km. from Rome.

The affair created a sensation, and the Opposition deputies and press seized on it to indulge in the gravest accusations against all the leading Fascists. On June 15 the Opposition deputies withdrew from the Chamber, stating that they would not return until the Matteotti mystery and the so-called " moral question "—that is, the supposed complicity of the Government in the affair—had been cleared up. The Opposition by this so-called " withdrawal on to the Aventine "[1] thus hoped to render Parliamentary business impossible and to exploit the consternation aroused by the crime to upset the Fascist Government. Among the persons more directly accused was Aldo Finzi, Under-Secretary for the Interior; he immediately resigned, and his resignation was accepted by the Premier as he had not proved equal to his duties, but when he brought libel actions against his accusers they were unable to prove their case by evidence.

The Chamber was now adjourned, and on the 16th Gen. De Bono, whose activities as chief of police had appeared faulty, was replaced by Sig. Crispo Moncada, prefect of Trieste. The same day Sig. Federzoni was transferred from the Colonial Ministry to that of the Interior: he immediately cleared the department of the doubtful elements who had taken advantage of their connection with it for purposes of their own. On the 30th all the Ministers placed their portfolios in the Premier's hands, and he effected the following changes: Federzoni, who had become Minister of the Interior, was replaced at the Colonial Ministry by Prince di Scalea, Gentile (Education) by Count Alessandro Casati, Carnazza (Public Works) by Gino Sarrocchi, Corbino (National Economy) by Cesare Nava. Most of the under-secretaries were also changed, and many undesirables expelled from the Fascist party.

Opposition Tactics.—The Opposition saw in the Matteotti affair a chance of mobilising a part of the nation against the Government, and secured the support of many who had adhered to Fascism only as long as they had believed it to be invincible, and were ready to abandon it the moment they thought that its days were numbered. Orlando, who had been elected on the Government list, and Giolitti, who had declared himself benevolently independent, joined the Opposition, professedly on constitutional grounds, but did not withdraw from the Chamber. The " Aventine " groups on June 27 confirmed their abstention from Parliamentary activity, demanded the disbanding of the Milizia nazionale, the repression of all acts of violence by Fascists (without mentioning those committed by non-Fascists) and formed a committee for joint action; their unofficial leader was Giovanni Amendola. The conduct of the constitutional Opposition, in allying itself with the revolutionary Socialists and the Popolari extremists, was much criticised even in non-Fascist circles. Various new Opposition associations were now formed, such as the Lega italica, the Italia libera (with which Gen. Peppino Garibaldi was connected), the Unione nazionale, etc. The directorate of the ex-combatants' association also assumed an attitude of veiled hostility to the Government, and as this created a sharp division within its ranks the Government dissolved the directorate and placed a temporary board in charge.

The press campaign now reached an unparalleled degree of violence, Don Sturzo's *Popolo* vying with the Socialist *Avanti!* and Amendola's *Mondo*, and was a direct incitement to many acts of violence committed against Fascists.[2] Sig. Mussolini therefore decided on July 8 to call into force the decree of July 12 1923 drafted by the Duke of Cesarò, and the prefects were ordered to apply Art. 3 of the Communal and Provincial law, whereby in the interests of public order they were empowered to confiscate issues of papers containing seditious matter or incitements to violence, and in the case of repeated offences temporarily to suspend their publication. This measure was afterwards completed by the royal decree of March 4 1926. Several Liberal and Democratic organs which systematically attacked the Government were acquired by pro-Fascists.

The Crespi family, who were the chief shareholders of the Milan *Corrière della Sera*, bought out Senator Albertini and his brothers, who had for many years edited the paper; it then became more favourable to the Government in its outlook. The Milan *Secolo*, the Rome *Giornale d'Italia* and the Naples *Mattino*, as well as some other papers, have undergone a similar transformation; many of the members of the staff remained with their respective papers under the new conditions, while those who refused to do so received large indemnities under the very liberal provisions of the Italian law on journalistic contracts. Several opposition papers continued to exist, including the Democratic *Mondo*, the *Voce Republicana*, the *Avanti!*, etc., but can exercise little influence. These measures were admittedly of a temporary character, enacted in view of the transition from the old to the new régime. An important reform was carried out in the Milizia nazionale; the decree of Aug. 4 provided that its members should swear allegiance to the King. On Oct. 28 the Milizia took the oath.

In the field of foreign affairs a treaty was concluded with Britain whereby the Transjuba territory was ceded to Italy. There had been a previous agreement to that effect, but the British Foreign Office had raised difficulties, claiming that the question should be settled together with that of the Dodecanese; the Italian Govt. persuaded Mr. Ramsay MacDonald that the two questions were wholly unconnected, and the treaty was signed on July 15 1924, whereby Italy secured a larger area than had been at first contemplated. Ratifications were exchanged on May 1 1925.

[1] After the withdrawal of the Roman *plebs* on to the Aventine Hill as a protest against the aristocracy. Opposition deputies did not, as has often been reported in the foreign press, actually meet on the Aventine.

[2] Since the Matteotti murder 65 Fascists have been murdered by their opponents; among the victims was the deputy Casalini.

Mussolini's Skill.—The Government's position had been undoubtedly shaken by the Matteotti affair, but no evidence was produced implicating any of its members in it, and Sig. Mussolini parried the attack with consummate skill. The Fascist party, except for an insignificant number of defections, rallied round him solidly, and after the first bewilderment non-party opinion continued its support of him. The country tended to calm down, in spite of occasional regrettable incidents provoked by both sides, of which the most serious was the murder of the Fascist deputy Casalini by a Communist on Sept. 12 1924. The Chamber opened on Nov. 12, Orlando and the Communists being present, while later Giolitti's attack on the Government for its unconstitutional methods caused some surprise as coming from a statesman who while in office had proved a past-master in the art of violating the Constitution. The Premier had come to the conclusion that the electoral law enacted in 1923 had not proved satisfactory, and on Dec. 20 he presented a bill to Parliament providing for the re-establishment of the old one-member constituency system, eventually passed by 307 votes to 33, and approved by the Senate on Feb. 10 1925. This measure divided the "Aventine," as the Democrats and Liberals were in favour of it while the Socialists and Popolari were proportionalists. In his speech in the Chamber on Jan. 3 1925, Mussolini reaffirmed the uncompromising policy of Fascism, rejecting all alliances, and stated that the Government was determined to *Fascisitizzare* the state, and that if the Opposition did not abstain from factious violence severe repressive measures would be resorted to. These declarations induced Salandra to withdraw his support, although, like Orlando and Giolitti, he did not retire on to the "Aventine;" a part of his group (the Liberal Right) broke away and formed the pro-Fascist National Liberals. In March Sig. Roberto Farinacci was appointed general secretary of the Fascist party, which he proceeded to reorganise, giving it a rigidly intransigent character. His speeches and articles represent the extremist attitude of Fascism.

National Defence.—The bill presented by the Minister of War, Gen. Di Giorgio, for reorganising the army on the basis of a reduction of the peace-time effectives, the sums thus economised to be devoted to material, encountered much opposition in military circles and in the Senate. On April 1 the Premier proposed the adjournment of the debate and appealed to the generals in the Senate to collaborate in improving the nation's defences. Gen. Di Giorgio felt called upon to resign, and Sig. Mussolini himself took charge of the War Ministry *ad interim*, with Gen. Cavallero as Under-Secretary; Gen. Badoglio was appointed chief of the staff and entrusted with the co-ordination of the army, navy and air force. On May 5 Adml. Thaon di Revel resigned, and Sig. Mussolini took over the Ministry of Marine and the newly created Air Ministry as well, with Adml. Sirianni and Gen. Bonzani as Under-Secretaries. This arrangement is regarded as leading the way to a future Ministry of National Defence. A great manifestation in honour of the King's jubilee was held on June 7. It was generally recognised that the prestige of the monarchy had been greatly strengthened by the Fascist régime.

The Government was rapidly regaining the ground it had lost in consequence of the Matteotti affair. The decision of the Senate judicial committee, rendered on June 12 1925, on Sig. Donati's charges against Gen. De Bono, acquitted the latter of guilt in connection with the Matteotti affair and of the other more serious accusations, only certain minor counts being declared not proven. At the municipal elections of Palermo on Aug. 2 1925 the anti-Fascist list was supported by Orlando, who had mobilised his adherents in its favour, but the Fascist list secured a large majority. In consequence Orlando resigned his seat, declaring that there was no longer a place for him in Italian political life. His withdrawal from politics made very little impression, as he had already to a very large extent lost his political influence. The findings of the prosecuting section of the Court of Appeal on the Matteotti case in Dec. 1925, while committing Dumini and four accomplices to trial for murder, excluded premeditation and exonerated members of the Government and officials from complicity. Cesare Rossi, Marinelli and Filippelli were consequently set free.

The trial of the five men accused of having caused the death of Sig. Matteotti was ended on March 24 1926, at Chieti. Dumini, Volpi and Poveromo were found guilty of non-premeditated unintentional homicide extenuated by the subnormal physical resistance of Sig. Matteotti and by other circumstances; Viola and Malacria were found not guilty. The sentence on Dumini, Volpi and Poveromo was 5 years 11 months and 20 days penal servitude of which 4 years are remitted under the recent amnesty and one year and 9 months were already served in awaiting trial. They had therefore to serve only 2 months and 20 days imprisonment.

Financial Reform.—In the spring of 1925 financial difficulties had arisen resulting in the serious depreciation of the lira, which fell from a little over 100 to the £ to close on 150; this was partly due to the heavy excess of imports over exports in consequence of the bad harvest of 1924, but also to speculation initially promoted by certain members of the Opposition who hoped to break Fascism through a financial disaster and the consequent panic in a part of the public, which believed that the Government intended to reduce the currency to zero after the example of Germany. The measures enacted to restrain speculation aroused much opposition in stock exchange circles and caused a temporary suspension of operations. Prof. De Stefani subsequently modified the regulations, but the Premier felt that a bold treasury policy was now necessary, requiring the services of a practical financier. De Stefani's great task in reorganising the fiscal system and balancing the budget was accomplished; for 1924–5 a surplus of 209 millions was announced, which eventually rose to 417 millions. In July he resigned and was replaced by Count Giuseppe Volpi, Governor of Tripoli, and formerly a business man of wide experience.

The American Debt.—After enacting new regulations, which effectively restrained illicit speculation and improved the currency (the lira rose to 120 to the £) he undertook the settlement of the War debt to the U.S., which was weighing heavily on Italian finance. On Oct. 22 he sailed for Washington, accompanied by Dino Grandi, Under-Secretary for Foreign Affairs, the manufacturer Pirelli, the banker Alberti and the diplomat Count Bonin Longare; on Nov. 14 an agreement was concluded whereby Italy's debt, originally $2,148,000,000, was reduced to $2,042,000,000 to be spread over 62 years, which, calculating the interest at 5%, reduces the actual value of the debt to $360,000,000 (a reduction of 82%); as the interest to be paid amounts to $73,000,000 the total to-day (1926) is $433,000,000. Five millions were to be repaid in each of the first five years, thereafter $20,000,000 till the 30th year, and $50,000,000 for the remainder. The agreement was ratified by the U.S. senate on April 21. A loan floated by the American banks for $100,000,000 to enable the Government to stabilise the exchange was subscribed several times over, while other loans for public works and the railways were also successfully floated in New York. On Jan. 27 1926 Count Volpi signed with Mr. Churchill an agreement in settlement of the Italian War debt of £610,000,000, whereby Italy contracted to pay an annual sum of £4,500,000, slightly reduced at first, over a period of 62 years. The first payment of £2,000,000 was made in March 1926.

The Government undertook several important reforms in the field of internal legislation with the object of giving a more essentially Fascist character to the state. In order to bring Southern Italy up to the standard of the more progressive North a series of measures were enacted for co-ordinating agricultural land reclamation, drainage, the building of roads and railways, etc., for which adequate funds were provided and a suitable civil service organisation created. The wheat crop of 1925 had beaten all records, amounting to 64,000,000 quintals (the pre-War average was 49,000,000), but Mussolini was determined to spare no efforts to increase the output until the 75,000,000 annually required by the population could be grown at home, thereby avoiding heavy payments abroad; all forms of encouragement to producers were adopted and various agricultural

measures enacted, constituting what was known as "the battle for wheat."

Fascist Legislation.—Of the political Fascist measures the following are the most important:—

In order to eliminate the influence of Freemasonry in the administrative and political life of the country often inspired by foreign interests, a law was enacted in Dec. 1925 whereby all associations are obliged to communicate their statutes and their membership lists to the authorities, and, should secret societies continue nevertheless to exist, civil servants are forbidden to belong to them on pain of dismissal.

The law of Jan. 31 1926 provides that Italians living abroad who commit acts calculated to promote sedition in Italy or injure Italian interests shall be deprived of Italian citizenship, and in the graver cases even of their property.

The Government is empowered up to Dec. 31 1926 by the law of Nov. 1925 to dismiss from the public service officials who commit overt acts against the state and existing institutions or attempt to prevent the enforcement of the laws or to frustrate its policy.

The conditions of certain municipalities also called for reform. That of Rome, owing to the heavy charges entailed by the fact that it is the capital, could not defray expenditure out of the local revenues alone and constantly had to call upon the Government to make up the deficit; moreover it appeared desirable that the city should not be the scene of political wrangles and party conflicts. Consequently by the law of Oct. 28 1925, instead of an elective mayor and town council, a governor of Rome was created, to be appointed by Royal decree, assisted by two vice-governors, 10 *rettori* and an advisory council of 80 *consultori* to be selected from lists presented by the various economic, professional and educational bodies and certain other associations.

The law of Feb. 4 1926 provides that communes of less than 5,000 inhabitants, where municipal affairs were often run for the benefit of the mayor and assessors and their families, shall be administered by a *Podestà* appointed by royal decree, assisted by an advisory council of *consultori;* a *podestà* can also be appointed for five years in larger communes where the elective council has been dissolved twice in two years.

The authority of the prefects is strengthened with a view to co-ordinating the various provincial services (law of March 1926), while the advisory provincial economic councils are created (law of March 1926) to assist the prefects and the Government in all matters of an economic character composed partly of ex-officio and partly of elective members. The law of Dec. 24 1925 conferred greater power of Parliamentary initiative on the Prime Minister and otherwise extended his authority; it also provides for the infliction of penalties for committing offences against him.

Labour Tribunals.—The most important measure of all is the law of April 3 1926, whereby the labour corporations are recognised and invested with the right of legally representing the various categories (employers, workers, employees, professional men, landlords, peasants, experts, etc.), and all labour conflicts are referred to the labour tribunals attached to courts of appeal; strikes and lock-outs are declared illegal and persons promoting them or participating in them are liable to penalties; the original draft of the bill provided that recourse to these tribunals should be voluntary in industrial conflicts, and obligatory only in those concerning agriculture, and Sig. Benni, president of the Industrial confederation, supported this distinction, whereas Sig. Rossoni, president of the labour syndicates, insisted that such recourse should be obligatory in both cases. Sig. Mussolini intervened in the debate with a powerful speech. After he had taken a day for reflection, he decided in favour of Rossoni's view, which was then accepted even by Benni himself, who withdrew his objections.

Although most of the "Aventinians" continued to remain absent from the Chamber, the groups led by Salandra and Giolitti were present, together with Orlando's followers and the Communists and a few stray Aventinians who had begun to drift back and the Communists; the latter took part in the debates and an amendment proposed by one of them was adopted. The unity of the Aventiniani was gradually breaking up through internal dissensions and personal jealousy. The general internal situation continued to improve, although affrays between Fascists and anti-Fascists occurred from time to time. The most serious of these was the attack on Sig. Amendoli, (*q.v.*) near Montecatini, in the summer of 1925, and the outbreak in Florence on Oct. 3, when as the result of the murder of the Fascist provincial secretary Luporini by a leading Freemason, the latter and two Communists were murdered by Fascists, and the shops and offices of several persons supposed to be Freemasons were wrecked. The affair was most regrettable, but it had been provoked by the anti-Fascists, and the persons responsible, whether Fascists, or opponents, were all apprehended, and while those charged with murder were awaiting trial before the assizes, the lesser offenders had already been tried and condemned. The prosperity of the country and the absence of unemployment have greatly weakened the Oppositions, many of whose members as well as many dissident Fascists have shown a tendency to abandon their uncompromising attitude, and not a few are applying for the Fascist *tessera*, but the party directorate are rigid in their refusal to readmit them. In March 1926 Farinacci, who had been counsel for the defence of Dumini in the Matteotti trial, resigned from the secretaryship of the Fascist party, and was succeeded by Augusto Turati; the party directorate was also changed at the same time, and on April 23 it decided to admit no new recruits to the party until 1927.

The object of these various measures and of the general policy of the Government is to give an essentially Fascist character to the state and its institutions, so that the main principles of Fascism, notably the idea of the duty of all citizens toward the state and the necessity that all should co-operate under the guidance of the government and of the men best suited for the task in every field of activity, for the common good and the dignity, prosperity and greatness of Italy, should come to be taken for granted by the nation. It is a policy similar to that of the men of the Risorgimento who succeeded in getting the then novel ideas of the unity and independence of Italy accepted by the mass of the people, who had until that time been indifferent or opposed to them. The gradual elimination of the opposition was based on the view that an opposition in the sense of a reasoned criticism of the Government's policy, which the Government itself would have welcomed, did not exist; there were only the survivors of groups belonging to a dead past, who hoped by a policy of factious scandalmongering, in alliance with the avowedly anti-national groups, to reconquer their old predominance. Hence the lack of interest on the part of the mass of the public at their disappearance.

The Ploi against Mussolini.—A sensation was caused on Nov. 5 1925 when it was announced that a plot had been discovered to murder Sig. Mussolini. The Socialist ex-deputy Zaniboni, was arrested in a room in a hotel commanding the Palazzo Chigi, armed with a rifle with which he intended to shoot the Premier while he was taking the salute during the march past of the patriotic societies on Armistice Day (Nov. 4). Gen. Capello (*q.v.*) ex-commander of the II. Army, an active Freemason and a bitter opponent of the Government, was arrested for complicity in the attempt. Mussolini was greeted with enthusiastic demonstrations in consequence of his escape. Another attempt on his life was made by the Hon. Violet Gibson, an apparently demented Irishwoman, on April 7 1926, on the eve of his departure for Tripoli. The Premier was slightly wounded in the nose, but proceeded nevertheless on his journey to visit Italy's North African colony.

In the field of foreign affairs a treaty with Egypt was concluded, whereby the Jaghbub oasis was ceded to Italy, who in exchange ceded to Egypt es Sollum. The oasis is important both as the headquarters of the Senussi sect and because it dominates the caravan routes between Egypt and Cyrenaica; by possessing it Italy will be able to prevent the contraband of arms from Egypt to the rebel tribes. The question had been long debated between Britain and Italy, and although Jaghbub had been promised to Italy, Lord Milner had informed Senator Scialoja in April 1920 that, as in the case of Transjuba, the agreement would only become effective after a general settlement of all the problems before the Peace Conference, thus coupling the Jaghbub question with that of the Dodecanese. As we have seen, this connection was rejected by Italy, and Britain had ended by accepting the Italian view, but with the concession of independence to Egypt in 1922 negotiations had had to be renewed with that country, and were concluded on Dec. 6 1925.

The policy of the Fascist Govt. to enforce the teaching of Italian in the schools of the Alto Adige, and otherwise to give an Italian character to this district inhabited by 180,000 to 200,000 Germans, aroused irritation in Germany, and the pan-German elements voiced by Herr Held, the Bavarian Premier, promoted an agitation against Italy, advocating a boycott of Italian goods, and accusing the Italian authorities of terrorising the population. Sig. Mussolini on Feb. 6 1926 delivered a vigorous speech in the Chamber denouncing this campaign and warning the German Govt. that unless it ceased Italy would not hesitate to adopt strong measures. This outburst caused widespread excitement abroad, but it achieved its object. Herr Stresemann replied in a very minor tone, admitting that the charges of persecution and terrorism were untrue, and this was confirmed by a part of the German Press, although the Italianisation of the district was deplored. In Italy Sig. Mussolini's conduct received general approval, as it was believed that he had spoken to the Germans in the only language which they understood. The anti-Italian agitation in Germany in fact died down, and relations between the two countries had become better than they had been for a long time.

The Italian Govt. attached particular importance to a good understanding with the Balkan States, and on the occasion of the visit to Rome of M. Ninchich in Feb. 1926 the question of Italo-Yugoslav relations was gone into once more, the conclusion arrived at being that in view of the general state of Europe, a yet closer collaboration between the two countries than had heretofore been realised was desirable. The visit to Rome of the Greek Minister M. Roufos, while not leading to any definite result, was an indication of the cordial sentiments of Greece towards Italy.

The year 1925 was proclaimed by Pope Pius XI., an *Anno Santo*, and over 1,000,000 pilgrims flocked to Rome from all parts of the world. The Italian Govt. and the Rome municipality collaborated with the Vatican in organising the transport of the pilgrims and in making arrangements for their stay. Imposing ceremonies were held in St. Peter's and the other churches, undisturbed by any untoward incident, in spite of the attempts of the anti-Clericals and the Freemasons to discourage the pilgrimages. Relations between the Church and the State continued to improve in spite of occasional misunderstandings, the Facsist Govt. attaching particular importance to conciliating the Vatican.[1]

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(L. V.*)

II. THE PROBLEM OF DEFENCE

No country, with the exception of India, is protected by nature in the way that Italy is protected by the formidable barrier of the Alps, which not only affords a defence against invasion by land, but also protects her, to a great extent, from attack from the air. By the treaty of peace signed at Vienna in 1866 Italy was denied the full advantage of her natural strategic frontier and Austria was allowed to retain a foothold south of the Alps in the north and east of the province of Venice; throughout the Great War Italy was never able to overcome the advantage which this adjustment conferred on Austria.

As the result of the Treaty of St. Germain Italy, for the first time in modern history, has secured as her political frontier the line that must always be her strategic frontier. The Italian frontier now follows the high Alps from end to end. This frontier, fixed by nature, has been strengthened by diplomacy, for one-third of it is bounded by the neutral and buffer State of Switzerland.

The ethnographical frontier, however, is not identical with the strategic frontier, and Italy now suffers the disadvantage of including within her boundaries about 250,000 Austrians in the Trentino and 250,000 Slovenes in Istria. As an offset to her strong land frontier Italy suffers strategically from a very extended coastline, though with the former great Austrian naval base of Pola now in her hands the Adriatic may almost be considered as a purely Italian sea.

The Military Forces.—The importance which Italy attaches to her military forces is best indicated by her military budget, which for 1924–5 and 1925–6 in millions of lire were as follows:—

	1924–5	1925–6
Army	1,990	2,130
Navy	925	980
Air Force	399	449
Colonial troops	195	252

The above forces are under a Minister of War, a Minister of Marine and a Minister of Air. After the World War, Italy followed the British example in establishing an air force distinct from the army and navy; at first this was under an under secretary responsible to the Minister of the Interior, but in 1925 a Minister for Air was created on an equality with the Minister for War and the Minister of Marine. The three offices were, however, temporarily in the hands of Sig. Mussolini, the Prime Minister.

In 1925 also the appointment of a chief of the general staff was created; this officer, who will be a marshal or general of army, will be responsible to the Minister for War for the army and to the President of the Supreme Commission of Defence (Prime Minister) for everything relating to the execution of the Supreme Commission of Defence and for the eventual operations of war of the three services.

The Regular Army.—The army is now organised in 10 army corps stationed as follows: I. Turin, II. Milan, III. Verona, IV. Bologna, V. Trieste, VI. Florence, VII. Rome, VIII. Naples, IX. Bari, X. Sicily. It will be seen that five of these army corps are stationed in or about the valley of the Po. These 10 army corps consist of 30 divisions, three of three brigades each, 16 of two brigades each, and 11 of one brigade each, making a total of 52 brigades. In addition to the 30 divisions there are three cavalry brigades, three groups of Alpini, each of nine battalions, 12 regiments of Bersaglieri, a tank corps. The length of service in the army is for 18 months. The numbers called up each year are about 180,000. The recruits are called up in May; so between May and Sept. there are therefore

[1] In the autumn of 1925 Mussolini made speeches of an unmistakably imperial nature. After the Locarno conference he said in the Chamber at Rome that "while the words of peace glisten on the horizon I must recognise that the skies have become populated with prodigious airplanes and that new and deadly weapons are appearing within the sea." Early in 1926 he went to Tripoli, where he addressed the Colonial Agricultural Congress, saying "We are hungry for land because we are prolific and intend to remain so. There is no doubt that my journey is destined to have profound repercussions on the spirit of the Italian people, repercussions which will be beneficial since that is our indestructible will." On July 23 he delivered another speech, breathing the same spirit. Although Mussolini has thus been very outspoken in his addresses to his own people, he has been conciliatory in his relations with other European powers, and is very ready to deny any thought of aggression by force, trusting rather to friendly agreement to secure his ends. (ED. *E. B.*)

two classes with the colours, less the number dismissed after 12 months' service (about 60,000); the maximum strength in these months is therefore about 300,000.

The Colonial Army.—The colonial army consists of both Italian and native units, the latter with Italian officers and a proportion of native N. C. O.s. In 1925 the colonial garrisons consisted of 12,350 Italians and 23,000 native troops, of which all except 8,500 were in Tripolitania and Cyrenaica.

The National Militia.—The national militia is the development of the Fascisti militia. In Oct. 1924 this force by decree was declared to be part of the armed forces of the state, took the oath of allegiance to the King, and became subject to the same disciplinary and penal regulations as the regular army. In peace the national militia is directly under the orders of the Prime Minister; on mobilisation such members as are liable to join as reservists are drafted into the army, navy or air force; other militiamen come under the control of the Minister of War. The members of the national militia are all volunteers. The functions of this force embrace co-operation with the army and public security services in the maintenance of internal order and the defence of Italian interests throughout the world.

The militia is divided into two battalions. In 1925 the strength of the 1st battalion was 175,000 and of the 2nd battalion 120,000; the 1st battalion is composed of men who by reason of their occupation or domicile are liable to be called up at any moment. A general calling up of the national militia can only be ordered by the Prime Minister himself.

The Air Force.—This force, which is under a Minister for Air, is subdivided into four portions: An independent air force, which will consist of 78 squadrons; the army air force, which will consist of 57 squadrons; the naval air force, which will consist of 35 squadrons and six airships; the colonial air force, which will consist of 12 squadrons. These auxiliary air forces, although working under the orders of the other services, will depend on the air force in regard to technical matters, administration and promotion.

Munition Factories.—During the World War Italy was handicapped to an extent unknown by other Powers by her lack of raw materials and by the limited capacity of her munition factories, and was largely dependent on the Allies. Her home resources in coal and oil are extremely limited (*see* ECONOMIC HISTORY, below), and she has only very limited quantities of iron ore. During the War she developed her metallurgical industry with great energy and determination; the great works of Ansaldo and Fiat are a remarkable testimony of this development. In the manufacture of aeroplanes, airships and mechanical transport Italy is now in the forefront of manufacturing nations, whilst in regard to armament she is now self-supporting. Although her lack of raw materials must always present an almost insuperable difficulty to Italy, she has remedied this deficiency as far as is possible by exploiting her limited resources and by the development of electrical power. In regard to man power, Italy has no difficulties; her population of 40,000,000, which increases at a rate of 500,000 a year, is ample for her purposes. (J. Du.)

III. ECONOMIC AND FINANCIAL HISTORY[1]

Population.—A remarkable increase of the Italian population took place between 1910 and 1925. The losses due to the War, to epidemics and disasters and to the decrease of births in the years 1916–9, failed to check the increase, since they were balanced by the return of a number of emigrants (estimated at about 1,000,000) while comparatively few, about 363,000 have since left the country. Thus, it is estimated that the 34,600,000 enumerated in the 1911 census, giving a density of 121 to the sq. km. had increased at the end of 1925 to 40,500,000 or 131 to the sq. km. (including the restored territories, which are more sparsely populated than the peninsula), and this in a country two-thirds mountainous or very hilly, poor in minerals and with a soil exploited by some 3,000 years of cultivation.

The birth-rate, like that of most countries, shows a continuous decline since the 'seventies, but infantile mortality has also diminished. The increase in the number of marriages has compensated for the decrease during the War, but the birth-rate per marriage is only at the pre-War level.

This rapid increase has resulted in the flooding of the labour market. The number of workers between the ages of 16 and 25 is probably about 24,000,000 as against about 20,500,000 in 1911. The difficulty of absorbing this mass of labour would have been even greater than it has been were it not for improvements in industrial equipment, factory organisation, agricultural technique and also the extension of Italian territory. The pressure, however, is increased by the great number of war victims, who are unable to contribute their full share of work.

Period	Marriages Per 1000 of pop.	Births Per 1000 of pop.	Deaths Per 1000 of pop.	Natural Increase[4] Per 1000 of pop.
1908–10	8·01	33·30	20·07	11·40
Normal pre-War[1] period	7·53	31·86	19·61	12·14
War period[2]	3·43	20·53	22·99	1·83
Post-War period[3]	10·31	30·00	17·60	12·60
Average of years 1911–24	7·40	27·80	19·60	8·25

[1] 1909–15 for births, 1909–14 for all other columns.
[2] 1916–19 for births, 1915–8 for all other columns.
[3] 1919–24 for births, 1920–4 for all other columns.
[4] Excess of live births over deaths.

Emigration.—In 1911 the Italians abroad numbered 5,500,000, including those who had emigrated long before that date but had retained their nationality, and whose children had declared themselves Italians. As the result of a special investigation, Savorgnan found that in the 40 years 1872–1913 emigration had effected a reduction of at least 3,800,000 persons in the natural increase of the population of Italy. During the War the movement naturally slackened. Conscription, and the intense demand for manpower at home removed alike the possibility of and the incentive to migration. The total number of emigrants in the four years was, in fact, barely three-fifths of the pre-War annual average. With the return of peace began a feverish race abroad, which was at its height in 1920 when those who had returned from the United States during the War realised that if they delayed they might not be able to get back at all. The numbers of those repatriated since 1921 have amounted annually to about half the total number of emigrants. In all probability the proportion was formerly greater, since nearly all of those in Europe and about 55% of those overseas returned for the winter. Nevertheless, when a census of Italians abroad was taken in 1921, it was found that there were 7,500,000 of them scattered about the world. For statistics of the movement of population and the restriction of migration to the United States *see* MIGRATION.

The present stream of emigrants differs considerably from that of 1909–13 in respect of quantity and quality, countries of destination and districts of origin. The restrictions introduced by the United States and other countries have not only reduced the total number of emigrants, but have tended especially to exclude the Southern Italians, whose need for an outlet is greatest. The average of Italian emigrants to North America was about 200,000 for the years 1919 and 1920, and for the years 1921–5 about 50,000; whereas the yearly quota allowed in 1926 was under 4,000.

Percentage Distribution of Italian Emigration

Destination	From N. Italy		From Central Italy		From South Italy	
	1909–13	1922–4	1909–13	1922–4	1909–13	1922–4
Europe and the Mediterranean basin	30	46	7	6	4	6
Countries overseas	10	13	7	5	42	24

[1] Note should be taken of the varying value of the lire. Expressed in lire the annual average value of sterling was:

1914	25.35	1920	99.79
1915	27.90	1921	93.91
1916	31.27	1922	91.86
1917	33.03	1923	99.75
1918	30.31	1924	102.14
1919	50.08	1925	121.54

The parity value of the lire is 25.22.

In 1924 France took 201,715 Italians, mainly from North Italy, and since the Armistice the annual average has been 126,000, or nearly double the number employed there in 1914. This state of things is, however, unlikely to continue; the reconstruction of the invaded districts is practically complete, and the demand for agricultural workers in the Gironde and the Garonne has now been almost satisfied. In the near future Italians will only be wanted in the industrial regions of Northern France. After France, the largest market for their labour is the Argentine Republic; Switzerland, Germany and Austria will assuredly not need them as they did in the past. This slackening in the flow of emigration has not, however, checked the tendency to an increase in the proportion of skilled workers among the emigrants, and a lessening of the former preponderance of agricultural labourers.

Percentage of Emigrants

Period	Agriculturists	Labourers	Bricklayers	Industrial Workers	Domestic Servants	Other occupations
1909–13	32	30	12	12	3	11
1919	16	13	9	17	17	21
1920	26	20	10	22	12	9

Production and Industry

Agriculture.—Despite considerable fluctuations from 1911 onwards agriculture has afforded a profitable occupation to 52 per cent of the population, *i.e.*, to 11 millions over 10 years of age. Besides food for direct consumption, the products included the raw materials of more than half the total of the country's manufactures, indirectly providing occupation for 27·8% of those employed in industry. In the years immediately preceding the War the average annual production was valued at about 7,800 million lire. Soil and conditions vary greatly, ranging from the rich fertility of some parts of Campania and Sicily, which will grow all kinds of luxury produce, to the moorlands of the north or the chalk-hills of Tuscany and the Lucan clays; from the plains of Lombardy and Venetia, where the "special" crops (tomatoes, sugar-beet, hemp, rice, vegetables, fruit) give a good return to energetic and prudent cultivators, to bare pastures scorched by the sun all through the rainless summers, and marshy lands where the farmer is handicapped by malaria and the poverty of the soil. Regions of the most intensive and extensive cultivation border on one another; the large estates situated on the gentle slopes which rise from the sea shore to the hills adjoin land divided into thousands of tiny holdings. Next to miserable marshlands with neither houses, trees, shade nor water, may be seen fertile oases with olives, oranges and lemons.

These various agricultural regions do not all permit of the utilisation of large capital in the form of machinery, selected seeds, pedigree stocks, proper buildings and skilled workers. Where climate and soil are favourable the owner can create a garden; elsewhere the struggle is long and hard and the return extremely small. In such areas capital is not the chief need, but the Government can do valuable work in preventing the damage done by erosion in the mountainous regions and by making roads and aqueducts.

Progress in these directions is slowly being made, though it suffered a set-back during the four years of war, when, owing to the requirements of the army, labour, fertilisers, machinery and means of transport, were all difficult to obtain, and produce was requisitioned at fixed prices which were far too low to compensate for the many months of laborious toil. Faced by all these difficulties and by the necessity of slaughtering large numbers of cattle and cutting down the forests for military requirements, Italian agriculturists have achieved a great feat in surmounting this troubled period without experiencing an excessive diminution of crops, cattle and forests. The greatest difficulties, however, came in the next years, 1919–22, when the effects of the great deterioration of the soil during the War period were felt; the supply of fertilisers was still very scarce, and cultivators suffered from the uncertainty of prices, the constant disputes with the wage-earners, and the high costs of transport. But these troubles ended at last, and the abundant harvests of 1923 and 1925 made ample amends for the former privations.

The increase in production has been obtained with scarcely any increase in the area under cultivation. Much is due to the intensification of effort, to a more generous use of fertilisers. The efforts and sacrifices of the small proprietors, above all the new settlers, were specially meritorious, for the acquisition of the land had often deprived them of most of their savings, with the result that they had to reduce their standard of living to a very low level in order to scrape together their working capital. Superphosphates, nitrates, basic slag, potash and other fertilisers, supplies of which were heavily reduced during the War, are all now being used in greater quantities than in 1913. The import figures of agricultural machinery do not, owing to the changes in the tariff, give a correct index of the increase or decrease in the purchase of farm machinery; it is certain that the home manufacture increased after the War. Irrigation is also making progress, and year by year new schemes are being started; at the same time water-logged areas are being drained by means of electrical power with the result of abolishing malaria as well as improving the fertility of the land.

In 1911 Italy was nearly self-supporting as regards agricultural produce, except in wheat and timber, and the amounts of these imported were almost entirely paid for by the exports of other agricultural products, so that the agricultural balance is really about even. Moreover, the industry is highly profitable; at the average prices current, the gross value of the total produce of the soil is estimated at 41,700 million lire. The total value would probably have to be increased by several hundred million lire if the whole of the peasant production could be brought into the account, for it must be remembered that no less than 87% of the rural proprietors cultivate very small holdings, most of which are less than half a hectare, though 6/7ths of the total agricultural land is being held by 214,000 "large" and "medium sized" and 500,000 "small" owners. But even excluding this supplementary amount, the figure of 41,700 million lire represents an average of 3,180 lire contributed by each agricultural worker over ten years of age; and an average value of 1,467 lire

Principal Agricultural Products (in thousands of Quintals)

	Annual Average 1909–14	Index No.	Annual Average 1915–8	Index No.	Annual Average 1919–22	Index No.	1923	Index No.	1924	Index No.	1925	Index No.
Wheat	49,270	100	45,510	92	45,400	92	61,190	124	46,310	94	65,600	133
Maize	25,680	100	23,000	90	21,800	85	22,660	88	20,830	104	26,140	102
Rice	4,870	100	5,320	109	4,700	97	5,210	107	5,910	121	6,200	127
Potatoes	16,560	100	14,310	87	13,650	83	17,960	108	19,580	118	22,000	132
Sugar-beet	17,240	100	12,580	73	16,800	97	26,990	156	37,240	215	13,000	76
Grapes	70,420	100	55,400	78	56,600	79	83,340	119	71,070	101	69,900	99
Wine	45,520	100	35,800	78	36,200	79	53,950	118	45,020	99	43,000	95
Olives	10,770	100	12,980	120	11,300	105	11,420	106	14,460	134	9,100	86
Olive Oil	1,810	100	2,180	120	1,900	105	1,880	104	2,400	132	1,500	83
Oranges and Lemons or Citrons and other fruits	7,890	100	7,330	93	6,430	80	6,180	78	6,500	82		
Hemp	850	100	880	103	815	96	603	71	740	87	1,170	138

of heavy produce for each hectare of agricultural or forest land, the lowest regional average being Sardinia with 460 lire and the highest, Lombardy with 2,580 lire.

Industry.—Of the 5,000,000 adults shown by the census of 1911 as occupied in industry, probably not less than a third were not employed in factories; and it must not be forgotten that a number of women and children entered as domestic workers actually help in the manufacture of articles of daily use or in making the numerous local products which reflect Italian artistic traditions, good taste and native skill, and which enter largely into the export trade. Such wares are embroidery, lace, carved furniture and terra cottas, wrought iron and chased metal work, decorative glass, spun glass and mosaics, stamped leather and illuminated vellum, all of which give ample opportunity to skilled workers and are mainly fashioned in small workshops. The multiplicity of such workshops and the extent of the sales to the public show the importance of these crafts.

Evidence of industrial development is generally sought for in the progress of large undertakings where thousands of workers are massed together, and certain branches of heavy industry are usually looked on as providing the best indices of the aggregate national activity. In Italy, however, the scarcity of fuel and of minerals, the difficulties of land transport due to the mountainous nature of the country, and also the special qualities of the working classes, who are not excessively robust, though quick, industrious and intelligent, have led to a preference for the working up of food products, textiles of various kinds, delicate machinery and housing accessories.

The census of industries which was taken on Jan. 10 1911 showed a very large number of undertakings (243,926), distributed throughout the country, the larger units being concentrated in North Italy, the smaller spread over the other parts of the peninsula. The larger units were comparatively few (only one-tenth of the total number—22,413 to be exact—employed more than 10 persons each), but this tenth possessed three-quarters of the aggregate mechanical and labour power. The distribution of the women, who constituted a third of the total number of persons employed, indicates the importance of the textile industries. These have been traditional for centuries in Italy, and were to be found in every valley, while domestic production had not yet disappeared. Next in importance, in respect of numbers of undertakings and employees, came food manufactures, while the steel and engineering industries were making but slow progress.

The War stimulated nearly every branch of industry, and the introduction of the shift system led to the expansion of plant and to new kinds of manufacture in which by-products, formerly neglected, could be utilised. The extraction of iron ore, pig-iron production and steel showed great increases. In addition to arms and munitions the requirements of the army included a vast number of commodities ranging from cloth to canvas, from shoes to motor-cars, from rubber to paper and from chemicals to naval dockyards. All these shared in the boom which followed the cessation of hostilities.

Employment.—After the Armistice a crisis was brought about by the necessity of substituting other industries for those of the War period, and the difficulties of forecasting demands were intensified by the shortage of raw materials, and by a fierce struggle for the control of associated or subsidiary products. With the assistance of industrial exhibitions organised at Milan, Padua and Naples, and of vertical combines which were formed on an extensive scale, the very difficult period of 1919–20 was at length surmounted. The workers' desire for a "new order" which should give them control of the factories, provoked a number of vast conflicts and strikes. In the first year after the Armistice 1,600,000 workers "downed tools," and 2,300,000 in the following year. In the two succeeding years the world crisis made itself felt, and the effects were intensified because, owing to the bad harvests, the spending power of the poorer classes was greatly reduced and the demand for manufactured goods thereby lessened. But in 1922 conditions began to improve; in that year there were less than 448,000 strikers, and the number of unemployed, which in Jan. 1922 had reached the maximum of 607,000, fell in the summer to half that figure and did not rise to any very great extent in the following winter. At the end of 1925, the number of unemployed was still reduced to the very small figure of 122,000. Certain undertakings which had been over-capitalised failed, and this directed attention to the necessity of reducing costs of production, which became of vital importance when active competition was renewed.

Price Level.—The recovery was brought about by the closing of the gap between internal and foreign price levels during 1924 and by the diminution in the violence of fluctuations. Prospective costs and profits could then be estimated with less uncertainty. Another contributory cause was the halt in the upward course of wages; in 1921 these were five and a half times higher than the pre-War level, but they fell in 1922, and throughout 1923 and in 1924 remained at barely five times the pre-War figure, *i.e.*, the rise was a little less than that in the cost of living, which was nearly six times the pre-War level. But in 1925 statistics show a very marked upward trend of the level of wages, caused by the ever-increasing cost of living. Imports of raw materials increased, and the mining industry almost entirely recovered.

Heavy Industry.—The production of pig-iron rose to only about a tenth below the 1910–4 average, and less was imported, since scrap was being more and more utilised for the manufacture of steel, both by the Martin and electric processes.

	Imports of Principal Raw Materials (thousands of metric tons)			National Production (thousands of metric tons)		
Annual average	Iron and Steel Scrap	Pig-iron	Copper	Iron Ore	Pig-iron	Iron and Steel
1910–4	340	230	36	563	369	973
1915–8	212	243	74	829	407	1,150
1919–21	102	146	42	427	130	740
1922	306	136	46	311	158	1,046
1923	434	132	50	341	236	1,219
1924	538	201	58	219	304	1,359
1925	958	265	66	..	..	1,600

A still greater expansion of the steel industries was hindered by the scarcity of minerals and of coal, the inferior physique of the workers and the difficulties both of organising vertical combinations and of maintaining their efficiency. Hence the preference of the Italians for industries where these drawbacks are not felt in the same degree; such are the building industry, the making of cement blocks and the preparation of foodstuffs for which there is abundant demand. Tanneries and stocking factories have greatly increased in number and capacity, and their products, like those of automobile works, are very largely exported. The film and armament industries have fallen to a very low level, the results of which are especially felt in the redeemed provinces where they were formerly of great importance. On the other hand, beet sugar is being produced in 53 factories as against a little over 30 in 1911, and the production, which averaged 1,700,000 quintals in the five years preceding the War, has lately reached 2,750,000 quintals; it is true that in 1925 the amount fell to the 1910 level, but the set-back is merely temporary. As soon as the stocks accumulated during the boom period have been sold off, the beet area will certainly be extended both in Emilia and the Veneto, where four-fifths both of the cultivation and of the manufacture are carried on. In Campania about half of the preserved vegetable foodstuffs are made, of which the annual value is about 368,000,000 lire, and three-fifths are exported.

Textiles.—As regards textiles, the woollen branches of the industry seem on the whole to have made most progress; larger quantities of raw material are being consumed, and certain processes are being undertaken which were formerly not attempted in Italy. Washing and combing are no longer done almost entirely abroad, thanks to the improvements in machinery and equipment which have been made since 1915, especially in

Annual average	Raw silk production	Exports of raw silk[2]	Exports of cotton, spun and woven	Production of electric power	Production of lignite	Imports of coal	Imports of petroleum, benzene and residual products
	(kilogrammes)	(kilogrammes)	(quintals)	(in million kilowatts)	(tons)	(tons)	(quintals)
1910–4	4,780,000	7,193,400	538,800	2,300	654,000	9,940,000	1,387,000
1915–8	2,492,000	4,720,000	586,000	3,200	1,540,000	682,000	2,260,000
1919–21	3,600,000	4,740,000	575,000	4,100	1,335,000	645,000	2,310,000
1922	3,990,000	4,410,000	390,600	4,300	946,000	8,838,000	2,911,000
1923	5,233,000	5,180,000	587,900	5,400	1,133,000	9,134,000	3,489,000
1924	5,563,000	5,440,000	775,500	6,000	1,048,000	11,221,000	3,767,000
1925[1]	..	6,370,000	800,000	7,600	..	10,500,000	4,250,000

[1] The whole year.
[2] Considerable quantities of cocoons are imported—hence the excess of export over home production.

Piedmont and the Vicentino. The silk and cotton manufactures are also expanding; better qualities of raw materials are being used (*e.g.*, Egyptian cotton) and equipment and processes have been modernised and improved. In fine, owing to the cheapness of female labour the textile industries have passed beyond the stage of catering for the home demand and for the poorest of the foreign markets, and the exports are no longer confined to the coarser kinds of fabrics, but include grades of medium fineness. The manufacture of mixed fabrics has been greatly facilitated by the increasing development of artificial silk, for which until a few years ago Italy depended largely upon foreign countries.

Motive Power.—An index of the manufacturing capacity of Italy is afforded by the figures of consumption of fuel and motive power; although the Italian mines yield only one-twentieth of the country's industrial requirements, the amount of hydro-electric energy (leaving out of account the periods of interruption due to the exceptional drought) is almost three times as great as in 1913 and takes the place of at least 7,000,000 tons of coal. In addition, the imports of coal are about the same as in 1913, while those of petroleum and benzene have nearly trebled in quantity.

Savings.—During the 15 years 1911–25 savings have experienced various set-backs, especially in the form of deposits in savings institutions and investments at fixed rates of interest. The effects of monetary depreciation have been felt by those who did not wish or did not know how to transfer their holdings of fixed interest bearing securities into industrial shares or real estate. The rate of interest on bonds has risen from 4% to 6% and over. It is questionable whether the 35·7 milliard lire deposited in various credit and savings institutions in the middle of 1924 represented an equivalent purchasing power to the 7·6 milliard lire similarly deposited in June 1914. In view of the rise of prices and diminution in the purchasing power of the lira, the deposits in the middle of 1924 were probably equivalent to about 5·5 milliard lire (pre-War values), but it should be observed that current savings are more often invested directly instead of through the medium of credit institutions. The issue of both long and short dated treasury bonds, the total of which rose from a few hundred millions in 1914 to 30 milliard lire over a period when the consolidated public debt also trebled in amount, indicates one of the many new avenues for savings which formerly found their way into banks and savings institutions. (A still larger field is now offered by industry, for example, the resumption of building after the War has absorbed a considerable amount of savings.) It has been estimated that new savings in 1925 amounted to 15 milliard lire, equivalent to about 2½ milliard lire (pre-War values). The accompanying tables show the amount deposited in savings and credit institutions, the official discount rate, and the number and capitalisation of joint stock companies:—

Number and Amount of Capital of the Principal Joint Stock Companies at the Beginning of Each Year

Year	Number	Total capital (million lire)	Amount per society (million lire)	Aggregate capital, calculated on the basis of 1913 purchasing power of the lira (million lire)
1913	2,951	5,506	1,870	5,506
1918	3,463	7,257	2,090	6,770
1922	6,075	20,249	3,340	8,975
1923	6,734	21,293	3,160	9,345
1924	7,782	23,421	3,020	10,170
1925	8,946	28,261	3,160	10,402
1926	10,515	36,278	3,450	11,444

Stock-exchange quotations of securities reflect the judgment of the market as to the resources, prospective profits, etc., of each undertaking. When grouped together for each industry the figures provide an index of the general financial forces influencing the different branches of economic activity.

	Index Numbers of Stock-Exchange Quotations for the Principal Joint Stock Companies and State Securities Calculated by Riccardo Bachi. Basis 100 for 1913					
	1914 Dec.	1918 Dec.	1922 Dec.	1923 Dec.	1924 Dec.	1925 Dec.
Credit Institutions	91	93	94	109	132	128
Inland Transport	93	151	150	167	215	228
Maritime Transport	94	184	114	124	181	154
Cotton	100	284	468	700	1290	1392
Mining	102	199	132	181	281	273
Iron and Steel	89	175	36	39	52	46
Engineering	84	121	25	25	36	32
Automobile	96	489	339	485	834	899
Electricity	95	144	113	139	203	196
Chemical	86	125	92	110	170	179
Sugar	90	156	193	229	375	282
Food	96	183	276	311	582	..
Real Estate	97	125	145	192	351	259
General Average	92	125	90	107	163	154
State Securities	96	69	64	66	71	66

Bankruptcies.—The number of bankruptcies, after falling to one-third during the War period and to less than one-seventh in the following three years, rose in 1924 to the level of 10 years previously. As the population has become denser and those engaged in industry and commerce more numerous, this figure may be regarded as normal.

	1914	1918	1920	1922	1923	1924	1925
Amounts deposited in the Postal and other Savings Institutions, banks, credit banks and peoples' banks, Monti di pietà, etc. (in millions of lire)	7,595	12,231	20,659	28,316	32,334	35,698	36,000
Official rate of discount	5–5·50	5–5·50	5–6	6–5·50	5·50	5·50	5·50–7
Rate of interest on the public debt (from annual averages)	3·62	5·66	6·62	6·55	5·97	5·28	5·44
Index numbers of wholesale prices of commodities (R. Bachi) (from annual average)	100	409	624	562	575	585	690

Sales of Property.—The sales of fixed property, which increased in the period of social upheaval and threats of expropriation, continue to be somewhat numerous, owing to the profitability of small holdings and to the break up of the large estates. The very small values of the average transfer indicate a new reduction in size of properties transferred. Allowing for a certain amount of evasion it is possible that this reflects an increase in the number of transfers of small properties for building purposes.

Annual Average	Number of Bankruptcies	Transfers of Fixed Property		
		Financial Year	Number	Millions of Lire
1912–4	7,170	1914–5	343,332	1,006
1915–8	2,520	1920–1	508,433	4,158
1919–21	1,007	1921–2	498,700	4,781
1922	3,562	1922–3	465,367	5,490
1923	5,691	1923–4	462,700	5,664
1924	7,276	..	..	..
1925	7,218	..	..	..

Trade and Transport

The development of Italy's foreign trade has been affected both by the depreciation of the currency and by the increase of her population; allowing for the reduced purchasing power of money, the average value per head of the population was less in 1925 than in the period immediately preceding the War, but was tending to increase.

Directions of Trade.—The directions of both imports and exports show considerable changes, compared with pre-War. Imports from the United States and the Argentine increased by 10 times, only surpassed by Switzerland with a 12-fold increase, while imports from France, England and Germany increased only from three to five times. The extension of Italian exports has been greatest to England, France and Switzerland, followed by Germany, the Argentine and the United States.

Balance.—The adverse annual balance of trade, which was 1·1 milliard lire in 1909–13, rose in 1925 to about 8 milliard lire; against this must be set the expenditure of foreign visitors and the remittances of Italian emigrants, the former being probably of the larger importance. Movements in the values of total imports and exports are given in the following table:—

Foreign Trade 1910–25 (Special Trade)

Year	Imports			Exports		
	Total millions of lire	Amount per head of pop. in lire		Total millions of lire	Amount per head of pop. in lire	
		a	*b*		*a*	*b*
1910–14	3,381	97	97	2,281	65	65
1919–21	20,123	546	105	8,700	236	45
1922	15,765	404	72	9,302	238	42
1923	17,189	436	76	11,086	281	49
1924	19,388	486	83	14,318	359	61
1925[1]	26,254	648	73	18,277	451	48

[1] The whole year.
(*a*) In lire. (*b*) In lire on the basis of purchasing power.

Transport.—The demands made by the War on both railway lines and rolling stock were very heavy; the length of railways was increased by 1,000 km., while another 1,000 km. were taken over in the restored provinces. On the state-operated lines the number of passengers increased during the last decade by 7%, and since 1922 the volume of goods carried has shown a considerable increase, following on the improvement in railway material and greater security of delivery. The charges both for passengers and for goods have been increased, while the *personnel* has been reduced and the price of coal has fallen from the excessive level of 1921, hence the deficit which arose during the years immediately succeeding the War has disappeared.

The net tonnage of the mercantile marine registered in Italian ports doubled between 1912 and 1924. The losses from submarines and mines were more than replaced by the shipping taken over in Trieste and Istria, and the ships as a whole are faster and more modern than before the War. Though the total weight of goods carried to and from Italy shows no appreciable increase compared to pre-War, a larger proportion is carried in Italian vessels, in spite of the obvious preference of importers from overseas to employ their own vessels.

All this economic development and also the emergence of Milan as a centre of importance in international trade could not fail to be reflected in the figures of the credit clearing-houses. The clearings, which in 1913 amounted to 63 milliard lire, rose in 1925 to 1,030 milliards or by 16 times.

Year	Length of the Rlys. Km.	Railways		Tonnage of Mercantile Marine	Shipping		Credit Clearing House Figures
		Railway Traffic			Goods loaded and unloaded at Italian Ports		
		Passengers	Goods		Italian Flag	Foreign Flags	
		(millions)	(mln. tons)	(mln. tons)	(mln. tons)	(mln. tons)	(mlds. of lire)
1913	17,649	94	37	0·87	16·4	15·4	61
1918	19,066	65	29	0·70	7·4	9·4	188
1922	20,904	95	36	1·50	13·8	9·7	588
1923	20,907	100	45	1·63	15·4	10·2	830
1924	20,907	100	57	1·63	18·2	13·4	914
1925	20,907	110	64	..	21·0	13·2	1030

National Finance.—The revenues of the state were about 2,400 million lire in 1910–1. This was the last of a series of years, beginning 1898–9, in which there was a continual surplus of revenue over expenditure; from then onwards, first the Libyan War and then the World War occasioned a long succession of financial deficits. The period 1911–25 falls naturally into four divisions.

1. *1911–2 to 1913–4.*—Owing to the Libyan War expenditure rose by 152 million in 1911–2, by 250 million in 1912–3, and by 181 million in 1913–4, resulting in deficits for the three years of 111·8, 257·5 and 163·9 million lire respectively. These deficits do not include sums borrowed by the Treasury, as a result of which the National Debt increased from 15,746·5 milliard lire to 17,080·2 milliard lire.

2. *1914–5 to 1918–9.*—The War years thus began with a budget which could have been balanced with a very slight effort, and with a public debt of about 17·5 milliard lire. The following table shows the increase in public expenditure due to the War:—

Year	Military Expenditure	Civil Expenditure	War Pensions	Total	Revenue	Deficit
	mill. lire	mill. lire	mill. lire	mill. lire	mill. lire	mill. lire
1914–5	3,296	2,099	..	5,395	2,560	2,835
1915–6	8,317	2,307	1	10,625	3,734	6,892
1916–7	14,069	3,497	30	17,595	5,345	12,250
1917–8	19,142	6,002	154	25,299	7,533	17,766
1918–9	23,280	8,942	229	32,452	9,676	22,776
Total for 5 years	68,104	22,847	414	91,366	28,847	62,519

The expenditure during the War years would have appeared much greater had it not been that many items remained in suspense and burdened the budgets of subsequent years. The increase of civil expenditure was due partly to the rapid rise in the cost of living, which necessitated increased salaries and bonuses, partly to allowances to the families of soldiers and to the refugees from invaded districts, partly to the taking over by the state of the administration of the mercantile marine, and partly to the interest on the National Debt, which rose from 530 millions in 1913–4 to 2,624 millions in 1918–9. It was impossible to raise revenue to within measurable distance of such expenditure.

A part of the increase in revenue was automatic, arising as it did from the depreciation of money, and the consequent increase in the receipts from indirect taxation. The resources of the financial administration were greatly strained by the withdrawal of men for the army, by the dislocation caused through inflation, and by the task of collecting the new taxation imposed during the War, such as new monopolies (matches, playing cards, coffee); a 5% tax on the letting of houses; the War *centesimo* on incomes above 10,000 lire; the tax on War profits, etc. None of these new taxes brought in any considerable sums to the exchequer, with the exception of the tax on War profits. Framed on lines somewhat similar to those of the excess profits duties of the United Kingdom and the United States, this tax was at first levied by the Royal Decree of Nov. 21 1915 on all profits of the War years in excess of 8%, the rates varying from 10 to 30%, this latter rate being applicable to all profits in excess of 20% on the capital invested in the undertaking. The growing feeling against War profiteers caused the rates to be raised to from 12 to 35% (decree of Aug. 31 1916), and shortly afterwards to 20 to 60% (decree of Nov. 9 1916). The yield of the tax increased from 108·2 million in 1916–7 to 451·6 million in 1917–8, and 805·8 million in 1918–9.

3. *1919–20 to 1921–2.*—The following table shows that the highest expenditure was reached, not during the War, but during the period of liquidation immediately after the War.

	Military Expenditure	Civil Expenditure	War Pensions	Total Expenditure	Revenue	Deficit
	mill. lire	mill. lire	mill. lire	mill. lire	mill. lire	mill. lire
1919–20	8,085	13,851	1,158	23,093	15,207	7,886
1920–1	9,212	25,780	1,236	36,229	18,820	17,409
1921–2	6,798	27,114	1,549	35,461	19,701	15,760
Total for 3 years	24,095	66,745	3,943	94,783	53,728	41,055

Of the civil expenditure 13 milliards were required for the service of the debt, 5·1 milliards for exchange transactions, etc., 3·5 milliards for the cost of the merchant shipping services, 5·3 milliards for food supplies, 3·1 milliards for deficits on the state railways, 3·9 milliards for War pensions, and 6·8 milliards for the reconstruction of invaded or restored territories. The costs of all these services were greatly enhanced by the depreciation of the currency.

Fortunately, the fall in the value of the lira also increased the public revenue, which during the War had varied from 2·6 to 9·7 milliards, and which rose in 1921–2 to 19·7 milliards. Part of this increase was due to confiscatory legislation passed under the influence of the socialistic and demagogic tendencies which prevailed after the War. A levy was imposed on increments in the values of property, which ranged from 10 to 80% of the War gain remaining to the taxpaper after the payment of the War profits tax. Before this had come into force it was increased by the law of Sept. 24 1920, which involved a tax of 100% on all the War profits of industrialists and traders. In no country was so high a rate imposed, and during the three years of liquidation the yield of the tax reached over 4,796 million lire. Further, an extraordinary levy on property was imposed, which was designed to be a progressive tax on capital, levied at rates varying from 5 to 50%, but owing to the impossibility of collecting the whole tax in a single year, it was necessary to spread it over a period of years, fixed, first at 30 and then at 10 to 20 years.

Among taxes already in existence the succession duty especially appealed to the new social theorists, and by means of various technical modifications and by changes in the method of assessment, this was raised to 30, 50, 80, and, incredible as it may seem, to 103% of the amount inherited. At the same time it must not be forgotten that credit is due for the abolition, on the initiative of Signor Giolitti, of the disastrous policy of regulating the price of bread, which for political reasons was sold below cost and threatened to send the Italian lira into the abyss after the German mark.

4. *1922–3 to 1924–5.*—Expenditure and receipts and the eventual balancing of the budget are shown in the following table:—

Year	Military Expenditure	Civil Expenditure	War Pensions	Total Expenditure	Receipts	Difference between Receipts and Expenditure (+ or —)
	mill. lire	mill. lire	mill. lire	mill. lire	mill. lire	mill. lire
1922–3	3,248	16,976	1,608	21,832	18,803	−3,029
1923–4	3,704	15,820	1,475	21,000	20,581	− 418
1924–5	3,286	15,284	1,453	20,023	20,440	+ 417

Except for the first four months, the period of transition from large deficits to the budget equilibrium of 1924–5 took place under the control of Signor de Stefani, head of the combined Ministry of Finance and the Treasury. He contrived to restrict expenditure within the limits of revenue by gradually eliminating abnormal expenditure and by a return to the sound conditions of Treasury control and supervision of accounts which had been largely abrogated during the troubled War years. The Italian Treasury has always been accustomed to publish monthly statements of its position, but this has been developed by Signor de Stefani with the result that figures are now published relating to all the various aspects of the economic life of the country. It has not merely been necessary to cut down expenditure, but also to make provision against the disappearance of abnormal War revenues, in particular the tax on War profits and on property. Many relatively unproductive War-taxes were abolished in 1923 and 1924, and the remainder were simplified and given a permanent place in the tax system. Being convinced that certain taxes had been raised to an excessive height, he carried through important modifications and reductions; thus he abolished the inheritance tax on property passing within the family, and reduced it largely in other cases. Again, he reduced to half or less the taxes on land and on factories, and decreed a gradual modification of the rates of tax on incomes from other sources. But at the same time he instituted investigations into taxable incomes in such a way as to bring the taxpayers' returns nearer to the real incomes and to reduce evasion to a minimum. It may be noted that in 1918 the manufacturers, traders and professional persons subject to tax numbered 543,184, and that the aggregate revenue from this source was over 704 million lire, while in 1924 the number rose to 762,137, and the tax yield to about 2,793 million lire. There were also added to the number of direct taxpayers 1,260,090 agriculturists, proprietors, cultivators, and metayers, who in 1923, for the first time in the history of Italy, were subjected to an income tax, the resulting yield being 2,081 million lire.

Public Debt.—The series of heavy deficits during the 10 years 1914–23 inevitably affected the public debt of the state; moreover, the method of partly meeting the deficit by the issue of paper money was, in its turn, a powerful cause of the increase of expenditure and of indebtedness, much of which would not have existed but for the disturbing influence of the issue of paper money. Below is a summary statement of the movements of the Italian State debt since 1911, in millions of lire:—

Italian State Debt (in millions of lire)

	June 30 1911	June 30 1914	June 30 1919	June 30 1922	June 30 1923	June 30 1925	Dec. 31 1925
Perpetual and long term debt	13,833	14,840	28,581	49,368	49,317	50,847	50,901
Treasury bonds 3, 5, 7 and 9 years	..	..	5,835	7,232	10,718	12,411	12,223
Treasury bills 3, 6, 9 and 12 months	82	380	15,054	25,417	24,835	17,583	18,307
Current accounts bearing interest	57	61	450	415	351	832	942
Total interest bearing debt	13,972	15,281	49,920	82,432	85,221	81,673	82,373
Notes issued by the Government or on Government account	436	490	10,293	10,316	10,192	9,168	9,163
Foreign debt at par	..	..	19,206	21,615	22,187	23,404	..

The foreign debt is not comparable with the internal debt, as it was contracted in dollars and sterling, and is here converted into lire at par, *i.e.*, gold lire, which are very different from the paper lire of the rest of the debt.

The internal debt reached its maximum on June 30 1923, which marked the end of extraordinary War expenditure. From then onward the amount decreased, and by Dec. 31 1925 the internal debt had contracted by 2·85 milliard lire. This affords the most significant proof of the improvement in economic conditions, of the growing yield of the ordinary taxes, and of the restriction of expenditure which characterised the long period of Signor de Stefani's control of finance. His successor, Signor Volpi, continued the process of financial reconstruction, and in particular settled the War debts with United States and Great Britain. The agreement concluded with the United States in Nov. 1925 reduced the debt from a nominal value of $2,042,000,000 to a present value at 5% of $430,000,000, distributed over 62 annuities rising from an initial minimum of $5,000,000 to a final maximum of $82,000,000. The agreement concluded with Great Britain in Jan. 27 1926 was set on payments distributed in 62 years, with yearly payments from £4,000,000 and £4,250,000 in the first six years, to £4,500,000 a year from 1931 to 1987. Considering that the national wealth of Italy was estimated at the beginning of the War at 100 milliards lire, and the national income at 20 milliards, it has involved a tremendous burden to maintain War expenditure which in the heaviest years reached 35 milliards, though reckoned in a currency which was continually decreasing in purchasing power.

Currency.—It is not surprising that the Italian economy should still bear the marks of this economic effort, of which the deepest is the decline in the value of money. The table on p. 578 shows the note circulation, the average circulation per head, and the average value of the lira in terms of gold.

During the period of actual fighting, when there was a deficit of 62·5 million lire, which could not be covered by internal loans amounting to 34·6 milliards, and foreign loans of 19·2 milliards, the state was forced to obtain advances from the banks, to the sum of 10·3 milliards, and the lira in consequence depreciated. In 1920 the value of the lira had fallen to 22 gold *centesimi*, and the total circulation had attained its maximum of 22 milliards. In terms of gold the circulation per head of the population increased only from 76·18 to

	Circulation (in millions of lire)			Paper lire per head of pop.	Rate of exchange of the paper lire in gold centesimi (average of the six months preceding and six months following Dec. 31)	Gold lire per head of pop.
	Bank	State	Total			
Dec. 31 1911	2,193·4	485·3	2,678·7	76·94	99	76·18
Dec. 31 1912	2,212·4	499·0	2,711·4	76·94	99	76·18
Dec. 31 1913	2,283·5	499·1	2,782·6	78·17	99	77·39
Dec. 31 1914	2,936·0	657·2	3,593·2	99·48	92·5	92·02
Dec. 31 1915	3,968·1	1,082·1	5,050·2	138·19	80	110·55
Dec. 31 1916	5,012·3	1,317·3	6,329·6	173·19	74·5	128·89
Dec. 31 1917	8,425·0	1,747·8	10,172·8	276·89	59·5	160·75
Dec. 31 1918	11,750·3	2,124·0	13,874·3	377·63	73	272·67
Dec. 31 1919	16,281·3	2,270·3	18,551·6	515·05	34	175·11
Dec. 31 1920	19,731·6	2,268·4	22,000·0	606·02	22	133·32
Dec. 31 1921	19,208·9	2,267·0	21,475·9	582·02	24	139·68
Dec. 31 1922	18,012·0	2,267·0	20,279·0	544·01	24	130·56
Dec. 31 1923	17,246·6	2,427·8	19,674·4	495·20	23	114·01
Dec. 31 1924	18,114·2	2,400·0	20,514·2	510·76	22	112·37
Dec. 31 1925	19,468·2	2,100·0	21,568·8	532·23	..	..

112·37 lire or not more than 50% of the increase in countries remaining on a gold standard; but the increase in the *per capita* circulation of paper money was the cause of a profound alteration in incomes and in the burden of taxation. It is estimated that the pre-War national income of 20 milliard gold lire had increased to 100 milliard paper lire in 1924–5. On the former income, the burden of taxation, both central and local, amounted to 2·5 milliards, or 12·5% of the national income, while in 1925, on the same basis, the tax burden rose to 20 milliards, or 20% of the national income of 100 milliards. These two proportions, 12·5% and 20%, reflect the changes in the burden of taxation resulting from the War. When it is considered that this increase in taxation was borne by a population whose average income per head before the War was about 500 to 550 gold lire a year (£20 to £22 sterling), and in 1925 was about 2,500 paper lire (£21 sterling), it is clear that if it was hard to pay 12·5% in taxation of an income of 500 to 550 gold lire, it is exceedingly hard to pay in taxes 20% of incomes of 2,500 paper lire. We may well speak of the heroic efforts of the Italian taxpaper, which have been the product of the War.

(L. E.)

IVORY COAST (*see* 15.98).—A French colony on the Gulf of Guinea. The area is 122,000 sq. m.; the population in 1925 was estimated at 1,400,000, of whom 1,100 were Europeans. From the lagoon port of Abijan a railway, 193 m. long, was opened to Bwake in 1913. Thence a motor road connects with the Upper Volta colony. Besides palm-oil and -kernels, fine woods, including mahogany and ebony, are exported. Forests cover two-thirds of the colony. *See* WEST AFRICA, FRENCH.

IWASAKI, KOYATA, 2ND BARON (1879–), Japanese philanthropist, was born in 1879, and succeeded to the barony in 1909. Educated at the Imperial University of Tōkyō and at Cambridge, England, he became president of the banking department of the Mitsubishi Company. His vast wealth was largely expended in experiments and benefactions. He instituted a research farm in the north of Japan for stock raising. His visit to England convinced him of the educational value of public libraries, and when the library of Dr. G. E. Morrison, for many years *The Times* (London) Correspondent in Peking, came into the market, Baron Iwasaki bought it for the students of Japan. He added to it the bulk of his own collection and in addition to buying a site and erecting a building to contain it, he allotted a sum of money annually to the institution for the purpose of keeping it up to date by the purchase of new books. The library is called the *Tōyō Bunko* (Oriental Library) and is situated in Kamifujimae Chō in Hongō, Tōkyō.

IZVOLSKY, ALEXANDER PETROVICH (1856–1919), Russian statesman, was born at Moscow March 17 1856, of an ancient Polish family which had been settled in Russia for generations. He graduated at the Imperial Lyceum of St. Petersburg (Leningrad) with the highest honours attainable, whereupon he became attaché to the chancellery of Prince Gorchakov. In 1879 he was appointed first secretary of the Russian Legation at Bucharest. After a spell of service in Washington he was charged with the resumption of relations between the Tsar's Govt. and the Holy See, a task which he fulfilled with great tact to the entire satisfaction of his chief, and incidentally won golden opinions of Cardinal Rampolla and Leo XIII. and received the post of Minister-Resident at the Vatican.

About this time he married Countess Toll, a friend of the dowager Empress Maria Feodorovna, to whose influence Izvolsky owed much of his professional success. His next posts, as minister plenipotentiary, were in Belgrade, Munich and Tokio. From the Japanese capital he warned Lamsdorff who was his chief of what was brewing for Russia in the Far East, but his reports on the warlike preparations were shelved as impertinent and ridiculed as absurd. He was next instrumental in having the Marquis Ito sent to Europe (1902) to settle differences with Russia, but the court camarilla in St. Petersburg thwarted all efforts towards an understanding. Two years later Izvolsky obtained from Japan moderate proposals for a friendly accord, which however were also rejected by the Tsar. Before hostilities broke out Izvolsky returned to Europe and through the Dowager Empress' influence became Minister Plenipotentiary at Copenhagen (1903). In the year 1906 he succeeded Count Lamsdorff as Minister of Foreign Affairs, moulding Russia's external relations and influencing the course of her domestic policy, as a Liberal, until the year 1910. From 1910 to 1917 Izvolsky was Russian Ambassador in France and after the revolution he fell ill and died in Paris Aug. 16 1919.

Izvolsky was endowed with more than average talents, considerable powers of observation, refined artistic tastes and a high sense of honour and duty. An omnivorous reader, he could talk interestingly about literature, art and history. But these and other accomplishments were neutralised by his consequential airs, his oracular pronouncements and his disdainful attitude. He carried self-respect to the point of self-worship and preferred stateliness to the close intercourse of friendship, and as he lacked the magnetic personal current which might have covered these defects, hosts of enemies confronted him at every stage of his career, countering his exertions and embittering his life. Few men have been more bitterly attacked than Izvolsky, whose main crime consists in his having practised the code of public morality that obtained in the school of diplomacy in which he graduated.

As the trustee of the Russian Empire in its external relations Izvolsky has no claim to high statesmanship nor indeed to genial gifts of any kind. He was a clever diplomatist—according to King Edward VII., the cleverest in Russia—with a very definite and circumscribed aim which he pursued with unflagging energy, an endless variety of means and untiring perseverance. When he became Foreign Secretary, France and Russia were but nominally allies, each one speculating on the intentions of the other; and the cardinal principle of his policy was to convert that alliance into an efficacious reality. This he did with occidental thoroughness. Hence he strove to draw Britain, Italy, Turkey, Bulgaria and Rumania into the Entente. Accepting as an axiom the inevitability of a great European war, the principal belligerents being France and Germany in the west, and Russia and Austria in the east, he came to the conclusion that between those future enemies there might be episodic arrangements and temporary makeshifts, but that there could be no complete settlement of differences except by the fortune of war.

Izvolsky's first success was the liquidation of the war with Japan, which he accomplished with remarkable foresight, breadth of view, thoroughness and moral courage. His next task was more arduous; the displacement once and for all of the causes of the rivalry between Russia and Britain. And it was largely to Izvolsky's personal efforts that the realisation of this plan was due. He began by coming to an arrangement with Britain about Persia, Afghanistan and Tibet (1907). This reconciliation definitely baffled Aehrenthal's scheme which the Tsaritza of Russia favoured—of a renewal of the Three-Kaiser Alliance.

Soon after this Izvolsky sounded Vienna unofficially as to how Austria would view an attempt by Russia to obtain the freedom of the Straits. Aehrenthal, then Minister of Foreign Affairs, who was still on relatively friendly terms with Izvolsky, since his residence as Ambassador in St. Petersburg, replied unofficially that no objection would be raised if Russia on her side agreed to the annexation of Bosnia and Hercegovina. This question and answer were, however, followed by a marked coolness in the mutual relations of the two Empires, and the matter dropped. The two states came together again when charged by Europe to draft and execute a scheme for the reform of justice in Macedonia. But Austria secretly obtained from Turkey, whose conduct she was supposed to be vigilantly supervising, a railway concession in the Sandjak of Novi Bazar. In St. Petersburg, London and Belgrade the news aroused intense indignation. But after King Edward's visit to Reval (June 1908), Izvolsky wrote a letter to Aehrenthal announcing that Russia had no objection to the Sandjak Railway if Austria would assent to an Adria Railway for Serbia. At the same time he proposed that the Tsardom should obtain the freedom of the Straits and Austria promulgate the annexation of Bosnia and Hercegovina. Izvolsky and Aehrenthal then met at Buchlau, the Moravian residence of Count Berchtold (Sept. 15 1908), and agreed to this arrangement. Izvolsky held that he made the proviso that the two points be referred to a European Conference, while Aehrenthal asserted that he announced the annexation as impending. Both were probably right. A few days later Aehrenthal acting in good faith annexed the two provinces without more ado, whereas Russia was kept out of her *quid pro quo* owing to the refusal of England and France to open the Straits question at that inopportune moment.

After this the relations of the two Ministers became personally estranged and the intercourse between their respective countries grew almost hostile. Indeed war was in sight for a while and was seriously discussed in St. Petersburg, but Russia being unprepared, it was staved off. Izvolsky sought compensation for his diplomatic defeat in bringing about a meeting between the Tsar and the King of Italy at Racconigi (Oct. 23–5 1909) and making the first serious effort to draw Italy into the orbit of the Allies. In spite of this Russia and Germany seemed for a brief while to become friends again and during the Tsar's two months sojourn in Germany Izvolsky was relieved of his office and sent to Paris as ambassador. In this capacity he continued to sway the policy of his country over the head of his nominal chief in virtue of his knowledge, tact and energy.

Izvolsky's strength lay in his resourcefulness in adjusting means to ends and above all in his rare tenacity of purpose. His weakness lurked in a morbid sensitiveness which at time incapacitated him for distinguishing between the satisfaction of personal rancour and the furtherance of national interests. But neither his qualities nor his defects justify the hyperbole that he was responsible for the World War. His policy like that of his Austrian rival is a sequence of cruel illusions for which their respective peoples have had to pay. (E. J. Dr.)

JACKS, LAWRENCE PEARSALL (1860–), British Unitarian divine, was born in Nottingham, where he received his early education. Afterwards he studied at London University, and at Göttingen and Harvard. In 1887 he became assistant to Rev. Stopford A. Brooke, at Bedford Chapel, London, and in 1889 he married Brooke's daughter, Olive Cecilia. He was subsequently minister of Unitarian churches in Liverpool and Birmingham. In 1902, on the foundation of *The Hibbert Journal*, Jacks was appointed first editor. In the following year he became instructor in philosophy at Manchester College, Oxford, and in 1915 was chosen principal of that college. Jacks wrote a number of books, of which the best known is his *Life and Letters of Stopford Brooke* (1917); others include *All Men are Ghosts* (1913); *From the Human End* (1916); *From Authority to Freedom* (1920); *The Challenge of Life* (1924); and *The Faith of a Worker* (1925).

JACKSON, HENRY (1839–1921), British classical scholar, was born at Sheffield March 12 1839. He was educated at the Sheffield Collegiate School, at Cheltenham College and at Trinity College, Cambridge, where he was elected fellow in 1864 and vice-master in 1914. From 1875 to 1906 he was praelector in ancient philosophy, and in 1906 was appointed regius professor of Greek, being given the O.M. in the same year. He resigned the vice-mastership of his college in 1919, and died at Bournemouth Sept. 25 1921. His important work in translating and commenting upon Aristotle's *Ethics* is alluded to in 2.513. He published *Texts to Illustrate a course of elementary lectures on Greek Philosophy from Thales to Aristotle* (1901) and a series of articles on "Plato's Later Theory of Ideas" (*Journal of Philology*); also *About Edwin Drood* (1911).

JÄGER, GUSTAV (1832–1917), German naturalist and hygienist (*see* 15.124), died at Stuttgart May 14 1917.

JAMAICA (*see* 15.132), a possession of Great Britain with dependencies in the West Indies. The area is 4,450 sq. m. and the estimated population (1924) 905,363.

Political History.—Immediately after the outbreak of the War (Aug. 4 1914) the legislature raised a Jamaica Volunteer Defence Force. Later it was decided to send a contingent overseas. War contingent funds were raised, and on Nov. 8 1915 the first contingent sailed for England. In all, Jamaica sent 243 officers and 10,168 men, who were enrolled in the British West Indies Regiment, which was formed on Oct. 26 1915 and saw much distinguished service in France, Egypt, Palestine and elsewhere. On March 22 1917 an Act for compulsory military service was passed, but conscription was never actually enforced. The Legislature agreed to pay the whole expenses of her contingents in the form of a contribution to the Imperial Treasury of £60,000 annually, beginning a year after the War. In 1921 the Hon. Edward Wood (now Lord Irwin) visited the Colony with a Colonial Office Mission, and made recommendations for the amendment of its constitution, which are still under discussion.

Fruit.—The chief staples are still fruit, sugar and the raising of stock. Owing to the prohibitive tariff in the United States of America, and the absence of steamers to carry oranges, etc., to the United Kingdom, the citrus fruit industry still languishes. In 1911 the export of bananas reached the record figure of 16,497,385 bunches. Exports, which fell after disastrous droughts and hurricanes in 1915–6–7 to 2,394,514 bunches, recovered, and in 1925 reached 14,896,581. Jamaica, which was not a party to the Canada-West Indies trade agreement of 1912, was a signatory of the agreements of June 18 1920 and July 6 1925. Under the latter, Canada will impose a customs duty of 50 c. per bunch on foreign bananas and admit Jamaica bananas free and will also provide a fortnightly mail passenger and freight service with refrigeration for 70,000 bunches of bananas, alternating with a fortnightly freight service with refrigeration for 50,000 bunches between Canadian ports and Kingston. At present the fruit industry is handled by five concerns, of which all but one carry the fruit to America. In 1925 the planters formed an association, one of whose objects is to secure the establishment of an alternative and independent direct line of steamers to carry fruit of all kinds to England.

Sugar.—Under the Canada-West Indies agreement Jamaica sugar will enjoy the increased preference of $1.00 per 100 lb. on 96° sugar entering the Dominion. In the United Kingdom the preference of British sugar, which was reduced in 1924 to 1s. 8·3d. per cwt. consequent upon the lowering of the duty, was restored in 1925 to 3s. 8¾d. per cwt., and the undertaking was given by Parliament that it would remain at that figure for 10 years. This has helped to establish confidence in the industry. In 1925 the Jamaica Sugar Estates Ltd. was floated with capital of £400,000 and a loan guaranteed under the Trades Facilities Acts to develop sugar production in St. Thomas-in-the-East.

Trade.—The percentage of total exports in 1923 were: Fruit 54·4; sugar 15·8; coffee 5·6; rum 1·2. The area under canes rose to 48,184 ac. in 1924, while that under bananas fell slightly to 74,548 acres. The total volume of trade shows expansion, imports having risen from £2,614,943 in 1910 to £4,827,074 in 1924, and exports from £2,568,222 to £3,122,961. In 1920 imports and exports reached the record figures of £10,313,300 and £7,146,000 respectively. In 1910–1 the colony's revenue was £990,399 and its expenditure £987,304. In 1924 the figures were £1,922,963 and £2,022,746. (*See* WEST INDIES.)

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JAMES, HENRY (1843–1916), Anglo-American novelist (*see* 15.143), renounced the nationality of his birth and became a naturalised British subject in July 1915. The act was symbolic of his lifelong love for the country of his adoption, and hardly less of his strong support of British conduct during the World War. It enabled him to be the recipient, in 1916, of the Order of Merit, the crowning official recognition of his distinguished career as a man of letters. James's work after 1911 included a series of informally autobiographical volumes: *A Small Boy and Others* (1913); *Notes of a Son and Brother* (1914); and *The Middle Years* (1917), which give interesting glimpses of his youth and that of William James. Some volumes of essays and prose studies also appeared: *The Ivory Tower* (1917); *Within the Rim* (1919); and *In the Cage* (1919). James died in Chelsea, London, on Feb. 28 1916. A selection from his letters, edited by Percy Lubbock, was published in 1920.

JAMES OF HEREFORD, HENRY JAMES, 1ST BARON (1828–1911), British lawyer and politician (*see* 15.144), died at Epsom, Surrey, Aug. 18 1911.

JAMESON, SIR LEANDER STARR (1853–1917), British politician (*see* 15.147). The union of the South African colonies in 1909 accomplished the principal object which Jameson had set before himself as a political leader. He wished to carry the spirit of union further by forming a combination of political parties to support a non-racial government for the new Union, regarded Gen. Botha as the natural leader of such a combination, and was completely ready to serve under him. This project of a "best man" government, however, was not accepted by Botha, who thought that the Dutch-speaking people of South Africa were not ready for it. The alternative, to which Jameson then set himself, was the formation of a new party representing the majority of the English-speaking people in the Cape, the Transvaal, the Orange Free State and Natal. The programme of the new Unionist party of South Africa showed his influence in every clause.

At the first South African general election in Sept. 1910 the Unionists won a considerable measure of success especially in the Cape and Transvaal provinces. Natal, where the English-speaking people were in a great majority, withheld from Jameson the general support which it might have been expected to give.

For two years Jameson led the Unionists in the South African House of Assembly with great moderation and self-restraint, but was compelled by ill-health to retire from the leadership of the party in 1912. He returned to England and settled in London, devoting himself, when his health took a turn for the better, to business interests, but on Nov. 26 1917 he succumbed after a short illness. Jameson's name will stand very high among those of the men who did service to South Africa and Rhodesia. Diffident and utterly free from self-seeking, his labours for racial reconciliation and material progress in South Africa were conspicuous, and the close friendship of Botha was a final proof of the quality of his patriotism. Jameson was created a K.C.M.G. on the inauguration of the Union in 1909 and a baronet in 1911.

JAMMES, FRANCIS (1868–), French poet and novelist, was born at Tournay Dec. 2 1868, and when still a child went to live at Orthez. He studied at the Collège de Pau and the Collège de Bordeaux, and afterwards became for a short time a notary's clerk at Orthez. It was during this uncongenial employment that he published his first verses, in 1893. After that date, his poems and novels succeeded each other rapidly. The chief characteristics of his style are a great simplicity and a preoccupation with the quotidian and humble manifestations of life. He takes great liberties with the alexandrine, which gives his poetry a novel and refreshing charm. His works reflect a sympathy for the poor and for animals, and a profound sincerity in the painting of French provincial life.

His works are: *Vers* (1893); *De l'Angelus de l'aube à l'Angelus du soir* (1898); *Clara d'Ellébeuse* (1899); *Le roman du lièvre* (1903); *pomme d'Anis* (1904); *Clairières dans le ciel* (1906); *Les georgiques chrétiennes* (1912); *Feuilles dans le vent* (1914); *Le Rosaire au Soleil* (1916); *Le curé d'Ozeron* (1918); *Le poète rustique* (1920); *Les livres des quatrains* (1923–5); *Ma France poétique* (1926). See also T. Braun, *Des poètes simples: Francis Jammes* (1900); A. de Bersancourt, *Francis Jammes, poète chrétien* (1910); A. Lowell, *Six French Poets* (1915); P. Lasserre, *Les chapelles littéraires* (1920).

JANÁČEK, LEOŠ (1854–), Czech composer, was born in Hukvaly, Moravia, and educated in the monastery of the Austrian Friars in Brno under Paul Křížkovsky. After studies in Prague, Leipzig and Vienna he returned to Brno, where in 1881 he became director of the organ school, and later professor of composition in the master school of the state conservatoire into which the organ school developed. Janáček followed in Křížkovsky's footsteps as a collector of folk songs, especially of Moravia, but went deeper than his master into their psychology. The chief characteristics of his works are spontaneity and richness of colour, together with vigour of idea and expression. Technically, his melodies proceed strictly from the verbal rhythm, and the orchestra is also assigned the function of a more creative atmosphere than is usual in modern symphonic accompaniments. Among his operatic compositions are *Jönufa: Její pastorkyňa*, a psychological drama of Moravian village life, first produced in Prague 1916; and *Katya Kabanova* (1922), based on *The Storm*, a Russian drama by Ostrovsky. In lighter mood are *The Excursions of Mr. Brouček* (1920), an operatic satire, and *Liška bystrouška* (1925), an animal opera. Janáček's remaining works include a dramatic song cycle, *The Notebook of One who Vanished;* a symphonic poem *The Fiddler's Child;* an orchestral rhapsody *Taras Bulba;* a string quartette; a concertino for small orchestra; the *Kreutzer sonata* and a sextette *Youth.* See F. Bartoš and L. Janáček, *Kytice z národních písní moravských kterouž uvili F. Bartoš a L. Janáček* (1890).

JANEWAY, THEODORE CALDWELL (1872–1917), American physician, was born in New York City Nov. 2 1872. He was educated at the Sheffield Scientific School, Yale University, and the college of physicians and surgeons, Columbia University. From 1898 to 1906 he taught medical diagnosis in New York University. In 1907 he became associate in medicine in Columbia University, and two years later professor of medicine. In 1914 he was called to Johns Hopkins University as professor of medicine, and became physician-in-chief to John Hopkins Hospital. His investigations in the phenomena of blood pressure opened up a hitherto unexplored field of medical research. After America's entrance into the World War, he became major in the Medical Officers' Reserve Corps and was engaged in research in Washington, D.C. He died at Baltimore, Md., Dec. 27 1917. He was a member of the board of scientific directors of the Rockefeller Institute for Medical Research. He was the author of *The Clinical Study of Blood Pressure* (1904).

JAPAN (*see* 15.156).—An empire of eastern Asia, one of the Great Powers, and a member of the League of Nations. The area, including Formosa, Karafuto (Japanese Sakhalin) and Chosen (Korea) is 262,826 sq. m. and the population (1920) 77,005,510.

I. POLITICAL AND SOCIAL HISTORY

The German Model.—Owing to the necessity of establishing a strong central authority—imposed upon Japan for self-defence as a result of the apparently aggressive policies in the Far East of Western Powers towards the end of the 19th century—and probably from an excess of conservative caution, as the country had just cast off its feudal traditions, the makers of modern Japan often turned to German legislation in seeking for models for the constitution and other laws. But an important factor that should not be lost sight of by students of Japanese politics is that English has long been by far the most extensively studied foreign language among the people. Whilst the static institutions remain more or less Teutonic in form, dynamic inspiration has continuously been drawn from English-speaking sources. That explains why the Japanese understand democracy along the lines of its common acceptation in the English-speaking nations; why the Press and students of politics often advocate the development of a polity somewhat like the British parliamentary system. The political history of Japan in the decade beginning 1910 was the last phase of the struggle between the cause of national security with which *the genros*, the Elder Statesmen, are popularly identified, and the progressive outcry for the emancipation of the people's will. As external dangers diminish, the *vox populi* speaks more effectively.

After the longest tenure of office in the constitutional history of Japan, four and a half years, the Marquis Katsura resigned the premiership in Aug. 1911, "with a view to renovating the spirit of the people." With the collaboration of Marquis Komura, Foreign Minister, Marquis Katsura had accomplished various financial reforms, the annexation of Korea, and the revision of commercial treaties with Western Powers. Katsura was succeeded by Marquis Saionzi, who had led the Seiyukai party since the retirement of Prince Ito (*see* 15.272). During the premiership of Marquis Saionzi a severe shock was experienced by the whole nation on account of the death on July 30 1912 of the revered and beloved Emperor Mutsuhito. Meiju Tenno, as he was posthumously styled, after the name of the era of his 45 years' reign, was succeeded by his son, Yoshihito Shinno, who ascended the throne at the age of thirty-three.

Fall of the Saionzi Cabinet.—The downfall of the Saionzi Cabinet arose out of the paramount instinct of national self-defence. Before the end of 1912, the establishment of two army divisions in Korea (Chosen) had been tenaciously persisted in by Lt.-Gen. Uyehara, Minister of War. But his colleagues in the Cabinet, as well as the Press, counselled retrenchment and economy. Uyehara resigned, and the Premier sought for his successor. But no soldier would accept the post without a promise by Saionzi as to the two-division increase; and by law a Minister of War must hold the rank of a general or lieutenant-general in the active service. The Premier was constrained to request the Emperor to relieve him of his office. There followed a ministerial deadlock, until Katsura, actuated by chivalrous motives, descended upon the confused arena. He had been created a prince, and had made up his mind to offer the young Emperor loyal but non-political services for the rest of his life in the capacity of grand chamberlain and lord keeper of the great seal.

But the young and care-free generation of Japan had come to assert themselves, and the unconstitutional tendency of the *Genro's* activities had been made the object of popular criticism. The widespread suspicion that he hoped to direct the affairs of state unconstitutionally "from behind the sleeves of the Sacred

Dragon," coupled with his personal failing health, made the path of Prince Katsura's renewed political life immeasurably thorny and arduous. He found the Lower House unexpectedly intractable. Mr. Ozaki's resolution of no confidence caused a tremendous sensation; riotous mobs demolished the offices of *The Kokumin*, a newspaper which had been loyally supporting the ministerial programme. No choice was left to Katsura but to tender his resignation.

Prince Katsura then sought to prove his sincere desire for the constitutional development of the Empire by starting a political party, the *Rikken Doshikai* (the Constitutional Comrades Association). Under this banner there rallied all the members of the Chuo Club, and a majority of the members of the *Kokuminto* (the National party). But Katsura died in the following December. The Yamamoto Cabinet which followed (Feb. 20 1913) was short-lived, owing to the unfortunate "naval scandal," involving the arrest and trial of high officials in the navy, a foreign company having dispensed bribes in connection with the building of a Japanese warship.

Politics During the World War.—After the refusal of Prince I. Tokugawa, and the abortive attempt by Viscount Kiyoura, to form a Cabinet, Count Okuma, the "grand old man" of Waseda undertook, on April 16 1914, to stand at the helm of the Empire, backed by the legacy of Katsura, the *Doshikai;* and Baron Kato, the leader of that party, was entrusted with the portfolio of Foreign Affairs. It fell to the lot of this Cabinet to deal with the invitation of Great Britain to join in the World War under the Anglo-Japanese Alliance. In Nov. 1915 the enthronement of the Emperor was conducted with the time-honoured imposing ceremonies at Kyoto, and the whole nation was *en fête* for seven days in honor of the event.

Count Okuma, in tendering his resignation on account of ill-health in the summer of 1916, recommended Viscount Kato, who had yielded the charge of foreign affairs to Viscount Ishii and was outside the Cabinet, to be his successor. At that moment however, the *Genros* were reported to have intervened, and, in spite of the fact that Kato's new party—the *Kenseikai* (the Constitutionalists), which was an amalgamation of the *Doshikai*, the *Chuseikai* and the Koyu Club—commanded a majority in the Diet, Marshal Terauchi was appointed Premier on Oct. 9. This alleged irregular development excited the hostility, not only of the Kenseikai, but of the general public, and ended in an antagonistic attitude on the part of the Diet towards the new government. Parliament was dissolved, and a general election took place on April 20 1917. The result was a signal victory for the government party, the Seiyukai winning 157 seats, whilst the number of the Kenseikai dwindled from 204 to 117.

Actuated by the desire, in view of the War, to effect unity of all shades of opinions, Marshal Terauchi created the Temporary Diplomatic Investigation Council (*Rinji Gaiko Chosa Kai*), where leaders of all political parties were represented. Kato was invited to join, but refused on the ground that he could not associate himself with the idea of establishing a responsible body for external affairs outside the Cabinet itself. The "rice riot" and the ensuing serious disturbances and strikes, which raged like wildfire in various parts of Japan in the summer of 1918, sealed the fate of the Terauchi Cabinet, which tendered its resignation in the middle of September.

Growth of Democracy.—By that time democratic ideas had been gaining strength on account of the War and internal social unrest. Moreover, the manner in which the Terauchi Cabinet was installed had its inevitable reaction. The people demanded that the next administration should be more in keeping with the spirit of the parliamentary system. Mr. Takashi Hara, the leader of the Seiyukai in succession to the Marquis Saionzi, was entrusted with the task of forming a new Cabinet; he was the first commoner to hold the office of Premier in Japan. The ministers, except those holding the portfolios of war and the navy, were for the first time, a body of party politicians more or less free from the bureaucratic savour which had always clung to the former administrations. Incidentally, a new minister—the Minister for Railways—was included in the Cabinet.

In March 1918, in response to the popular demand, a political reform bill was passed, lowering the property qualification of voters to the payment of a direct national tax of three yen instead of 10 yen. The number of electors was thus more than doubled, increasing from 1,450,000 to 3,000,000. The people were, however, not satisfied, and popular clamour for universal suffrage followed. In Feb. 1920 a universal suffrage bill was at last introduced by the Opposition in the House of Representatives. But on the ground that no election on the basis of extended franchise had as yet taken place, and that consequently it was premature to make any further attempt at suffrage reform, the Diet was immediately dissolved. The nation was called upon to express its opinion on the matter by the general election of May 10. The result was a decided victory for the Seiyukai, the government party, which secured 280 seats, whilst the Kenseikai registered 110.

Cabinets of 1919 to 1924.—It fell to the fate of the Hara ministry to conclude the treaties of peace ending the World War in 1919, and to send delegates to the Washington Conference in 1921. But before the conference actually began its deliberations, Hara was assassinated by a misguided and youthful megalomaniac on Nov. 4. Viscount Korekiyo Takahashi, Minister of Finance, succeeded to the leadership of the Seiyukai party and assumed the premiership on Nov. 13. There immediately followed an occurrence of great political moment when the Crown Prince Hirohito was appointed as Prince Regent on Nov. 25, owing to the continued indifferent health of the Emperor Yoshihito. Takahashi attempted early in the next year the reorganisation of his ministry, which was a legacy from Hara and was not quite amenable to his leadership. He failed in the enterprise and tendered his resignation.

Adml. Baron Tomosaburo Kato, who had been Minister of the Navy in the past four successive cabinets and the chief delegate to the Washington Conference, was nominated Premier on June 12 1922. He had no party affiliations, but had been assured of the unconditional support of the Seiyukai party; and his colleagues were drafted from the Kenkyukai and the Koyu Club of the House of Peers, both of which maintained close connections with the Seiyukai party. The first thing that Kato did after the assumption of office was to abolish the anomalous institution of the Temporary Diplomatic Investigation Council. Kato took upon himself the faithful enforcement of the Washington treaties and, in domestic affairs, endeavoured to bring the nation out of the business slump and to cope with the social unrest that had been gathering strength. However, before he could accomplish much in internal administration, he died on Aug. 24 1923.

The Cabinet resigned on the advice of the acting Premier, Count Uchida, and Adml. Count Yamamoto, who had lived in retirement since his downfall in 1914, was commanded by the Throne to form a cabinet. Whilst he was busily engaged in the formation of his ministry, there happened the historic earthquake of Sept. 1. Late in the evening of the 2nd, the Yamamoto Cabinet was installed with "national solidarity" as its slogan. Yamamoto gathered round him men of long political experience and recognised ability, and seemed determined to keep aloof from party politics. The Cabinet took prompt and effective steps for the relief of the stricken population, but in considering the reconstruction plans had to face dissensions within the Cabinet itself. Viscount Goto's ambitious project was not fully countenanced by his fellow ministers, and the machinations of the Seiyukai party further complicated the situation. When an attempt on the Prince Regent's life was made by a fanatic on Dec. 27, the Yamamoto Ministry resigned, holding itself answerable for the outrage.

A ministry was formed on Jan. 7 1924 under the premiership of Viscount K. Kiyoura, who was supported by the Kenkyukai of the Upper House. This was again a non-party administration and its marked bureaucratic complexion combined with its apparent weakness soon met with popular disapproval as "a cabinet of the privileged class." At the same time the Seiyukai party, that had long been on friendly terms with the Kenkyukai, divided into two factions, one avowing its support of its old allies,

and the other denouncing the irregularity of non-party methods. The former seceded and set to work to form a new party called the *Seiyu Honto*.

General Election of May 1924.—Amidst such political developments there intervened the general election of May 10, the result of which turned out to be a victory for the Kenseikai party with 162 seats, the Seiyukai obtaining 137, the Seiyu Honto 94, the Jitsugyo Doshikai (Business Men's party) 9, the Shinsei Club 24, the Dokokai 21 and non-party 17. It was the first important instance in which the government party failed to win a general election.

Kiyoura resigned and Viscount Taka-aki Kato, as the leader in the Kenseikai, formed a coalition cabinet on June 11 1924, including Mr. Korekiyo Takahashi (having renounced his viscounty) of the Seiyukai and Mr. Tsuyoshi Inukai of the Kakushin Club. The Kato administration was made historic by the passage of the universal manhood suffrage bill on March 29 1925. All males over 25 years of age could vote and it was estimated that the number of electors would increase fourfold and become about 12,000,000. In April 1925 fissiparous tendencies became discernible in the coalition cabinet, when Takahashi resigned his leadership of the Seiyukai as well as his ministerial chair. In May Inukai also announced his determination to retire from politics. After the succession to the leadership of the Seiyukai of Gen. Baron Giichi Tanaka, the reunion of the Seiyukai and the Seiyu Honto was frequently suggested. The crisis came in July, when the tax reduction scheme invited opposition from the Seiyukai ministers. Kato resigned but was ordered again to form his Cabinet. On Aug. 2 he again became Premier, with his colleagues composed exclusively of the Kenseikai partisans. Kato died on Jan. 28 1926 and his Cabinet was reconstructed under the premiership of Mr. Reijiro Wakatsuki, hitherto Minister of Home Affairs.

Social Changes.—The chronological change from the Era of Meiji (Enlightened Peace) to the Era of Taisho (Great Righteousness) in 1912 incidentally marks an important period in the cultural history of the Japanese people. The wars with China and Russia had given them the assurance that their country was safe from any foreign aggression, the fear of which had been a perpetual nightmare to the founders of modern Japan. Their considerable achievements in the domains of trade and industry had strengthened their belief in the destiny of the nation. Especially the younger generation, whose cradles were neither haunted by the shapes of armed foreign "black ships" nor deluged by the overwhelming influx of novel knowledge and strange customs, were beginning to see that the undigested application of Western laws and institutions would do more harm than good to the national wellbeing. The question in the mind of young Japan was whether it was not the mission of the Japanese people to create a new civilisation by harmonising and uniting the East and West. The external relations of Japan, too, contributed their quota to the cumulative change in the mentality of the people. Korea was annexed; China started a revolution; California legislatively discriminated against Japanese; the World War occurred; and Russia turned Bolshevist—all these quickened national and social aspirations.

At the beginning of the Taisho Era there was social disquietude in the air. The alleged attempt on the person of the Emperor Meiji in 1910—a solitary occurrence in the age-long history of a loyal people—the repeated famines in the northeast districts of Japan, the disastrous eruption of the Sakurajima volcano, the rapid rise in the cost of living, the revelation of naval bribery scandals, the frequent change of cabinets—these had combined to engender misgivings in the people's minds. When the World War came, the Taisho era was but two years old. Profiteers sprang up like mushrooms overnight; into the maw of factories was poured a tremendous army of labour; the cost of living advanced by leaps and bounds; and an age of Western capitalism was in sight. Public sentiment in Japan was further stirred by the Allied assertions that the War was a democratic crusade against the rule of despotism and imperialism. Strikes, which had long been stifled by restraining circumstances, began to be more and more frequently organised. As a consequence of successful strikes in 1917, no fewer than 417 occurred in 1918, a sudden increase in the occurrence coming in the wake of the "rice riot" started by fisherwomen in Toyama; and in 1919 the number increased to 497, which registered the high-water mark of labour agitation. Since the economic panic of 1920, the prospects of lower wages and unemployment have threatened the labourers, and strikes have come to take a defensive rather than an aggressive complexion. There were registered 282 cases of strikes in 1920; 246 in 1921; 250 in 1922; 270 in 1923 and 333 in 1924. These figures are in striking contrast to the average of 30 cases a year for seven years preceding the World War.

In the meantime, no fewer than 389 labour organisations had been formed by 1922. Until 1920, the Yuai Kai founded in Tokyo in 1912 by Mr. Bunji Suzuki had been the only trade union worth mentioning. It was expanded and renamed the "Nippon Rodo Sodomei" (General Federation of Japanese Labour) in 1921, and is considered the most important. Other large unions include the Government Employees' General Federation (Osaka), the Printers' Association (Tokyo), the Osaka Printers' Union, the Japan Seamen's Union (Kobe), the Kanto Transport Workers' Union (Tokyo) and the Federation of Mechanics' Union (Tokyo). Side by side with labour agitation in industries, tenancy disputes in agricultural districts became increasingly frequent. Local tenants' unions were organised by hundreds in the course of 1920–2, and they were amalgamated in the Japanese Farmers' Union (Osaka) and the Kanto Federation of the Japanese Farmers' Union (Tokyo) in 1922. It is significant that labour leaders, however drastic their theories may be, are generally moderate in practice, and that the General Federation of Japanese Labour passed a resolution in Feb. 1924 that when the universal suffrage bill then under discussion became law its members would effectively exercise their franchise. The law was passed in March 1925, and the Labourers' and Farmers' party was organised on March 5 1926 in Osaka.

Culture.—The rise of naturalism in Japanese literature synchronised with the war with Russia (1904–5), the attendant social changes encouraging men of letters to discard the old shibboleth and to proceed to the free, bold and realistic study of human life and nature. (*See* JAPANESE LITERATURE.)

Pure Japanese style painting has successfully been revived and developed in the hands of great artists like Gaho Hashimoto, Gyokusho Kawabata, Kogyo Terasaki, Taikwan Yokoyama and Seiho Takeuchi. In their works are noticeable traces of influence from Western masters. Works after genuine western canons have also been produced by pioneer artists such as Viscount Kiyoteru Kuroda, Fusetsu Nakamura, Saburosuke Okada, Eisaku Wada and Hiroshi Yoshida. They do not yet command the same respect and popularity as those of the native schools, but with the growth of popular appreciation of such paintings and the increase of buildings of a Western type, with their incidental demand for articles of interior decoration, the future development of the Western school of pictorial art seems assured in Japan. In the field of music, native and Western forms had in the past little or no influence upon each other in Japan. But the visits of great artists like Elman and Kreisler, as well as the popularising influence of phonographs, have aroused love and enthusiasm for Western music among the younger Japanese. How this trend will react upon the old Japanese music is yet to be seen.

The Great Earthquake.—On Sept. 1 1923 (11 hr. 58 min. 44 sec. central standard time) a great earthquake visited Japan. The severest shocks were felt along the coast of Sagami Bay in the districts of Hakone, Odawara, Kamakura, Yokosuka, Yokohama and Hojo, but even such distant places as Kobe and Osaka in the west and Fukushima and Sendai in the east were affected. The tremor that shook Tokyo was of secondary intensity. Scientists conclude that the earthquake was caused by a sudden depression in the bottom of Sagami Bay and a corresponding rise of land on its northeastern coast. Fires following the earthquake destroyed three-fourths of Tokyo (nearly 2,000 ac.), and the whole city of Yokohama, and were mainly responsible for the terrible loss of life.

According to the Social Bureau of the Department of Home Affairs, which published its official report in 1926, the casualties were as follows:—

Place	Killed	Injured	Missing	Total
Affected districts . .	91,344	52,074	13,275	156,693
Tokyo (city) . . .	58,104	26,268	10,556	94,928
Yokohama (city) . .	21,384	10,118	1,951	33,453

According to the Department of Education, the foreign casualties in Tokyo and Yokohama were:—

	Number of foreign residents	Killed	Injured	Missing	Total
Chinese . .	4,647	2,011	600	52	2,663
Other nationalities . .	3,616	146	852	715	1,713

The loss of property has been variously estimated, the industrial bank computing it at 4,800 million yen, consisting of 1,000 million yen for government property and 3,800 million yen for that of the inhabitants.

The earthquake occurred almost without warning. A large number of independent fires broke out at the same time, 122 being counted within 30 min. after the earthquake. Many of the fires were due to the combustion of chemicals, outbreaks in restaurants—it being meal-time when the earthquake occurred—and to the intense heat generated. The fire-brigades were in many cases unable to make use of the water-supply, owing to the damage caused to the water-pipes. In Tokyo the greatest tragedy of the earthquake occurred in the ground (230 ac. in extent) belonging to the Army Clothing Department in Honjo, where 40,000 people took refuge, most of them taking with them their belongings. At four o'clock in the afternoon fire approached this enclosure from three sides, and ultimately the whole 40,000 were destroyed in a furious tornado of flame. Brick buildings fared worst in the disaster; wooden-framed buildings of the European style behaved much better than the native ones; and the seismic value of reinforced concrete buildings was fully confirmed, though even they collapsed when their design was seismically imperfect. About 64% of all the buildings in Tokyo were destroyed.

The earthquake coincided with the Cabinet crisis caused by the death of the Premier Tomosaburo Kato, but emergency relief measures were nevertheless quickly and effectively taken. The requisition of foodstuffs and other relief materials was ordered; and Tokyo, Yokohama and its vicinity were placed under martial law. In the trying circumstances, the stricken population in general showed great courage, fortitude and *esprit de corps*. The army and the navy won the gratitude of the nation by their magnificent services in maintaining order and in re-establishing communications. Foreign countries were not slow in showing their sympathies. Their contributions in money and materials amounted to 27,000,000 yen, the largest share being taken by the American Red Cross, which gave more than $11,000,000. The relief services of the American Asiatic Fleet under Adml. Edwin A. Anderson that came to Yokohama from Dairen, and of the American military contingent under orders of Gen. Frank R. McCoy, were timely and efficient.

Undismayed by the appalling calamity, the Government and people immediately proceeded to the work of reconstruction. The official reconstruction plans of Tokyo and Yokohama were considered by the Reconstruction Council and the Reconstruction Board. Viscount Shimpei Goto, Home Minister and President of the Reconstruction Board, first proposed an ambitious plan for Tokyo with a view to reviving from the ashes an ideal modern city. But the Cabinet preferred a less expensive project, which was again drastically curtailed by the Imperial Diet in Feb. 1924. The plan thus decided upon authorises an expenditure of 468,438,849 yen, spread over six years, ending in 1928, to build new and wider streets, a modern sewage system, canals, bridges, parks and better means of transportation, and further to perfect agencies of social service, such as employment bureaux, day nurseries and infirmaries. In 1925 the population of Tokyo registered 1,995,303 and that of Yokohama 405,999 or 85% and 92% of the pre-earthquake population respectively.

II. FOREIGN RELATIONS

General Survey 1910–25.—Having emerged victorious from the Russo-Japanese War, Japan was relieved from the long nightmare that Korea might be engulfed in the Russian hegemony and constitute a permanent menace to her national safety; moreover, the wrong done to her by the three-Power intervention in wresting from her the natural fruits of her victory in the Chino-Japanese War—the Liaotung peninsula—was avenged. But the Russian grip on North Manchuria and Mongolia was not only unabated but, on the contrary, was greatly tightened. There were even fears of a renewed clash between the former foes. Statesmanship, however, counselled Japan and Russia to come to a friendly entente in 1907. A similar understanding between Japan and France followed in the same year. Further, the complicated post-War situation in Manchuria was decisively, if not definitively, disposed of by the Chino-Japanese understandings of 1909. In 1910 and 1916 more definite agreements were reached between Japan and Russia with the view of maintaining the status quo of Manchuria. Korea was, in the meantime, made a protectorate of Japan, and the gradual development of affairs in that country led to the final annexation. The Anglo-Japanese alliance, which had been not only the keystone of Japan's foreign relations but the mainstay of the general tranquillity of Eastern Asia, was renewed (1911).

Whilst Japan's position in the Far East became thus more or less reassuring, the dark cloud of anti-Japanese sentiment on the Pacific coast of the United States loomed up on the horizon. China's revolution in 1911, instead of bringing immediate peace and liberty to the citizens of the Celestial Empire, divided the nation into irreconcilable camps, and contributed to the political instability of the Extreme Orient. This meant an exacting burden upon the diplomatic wisdom and tact of Japan. Japan was, on the one hand, still seriously considering how to cope with the situation in China and, on the other, how to safeguard Japanese residents against discriminatory treatment in the west of America, when the fateful Aug. of 1914 demanded other decisions.

Japan's part in the World War dwindles into insignificance in face of the stupendous efforts of other great Powers espousing the Allied cause. But she contributed what little she could with her very limited national strength and resources. Her geographical situation, however, afforded her, from the economic point of view, a position of vantage. In pre-War days she was still struggling in financial straits as a result of her Russian conflict, but she came out of the World War with overflowing coffers, even if these coffers were of modest dimensions. At the Peace Conference in Paris, she lost her case on the question of racial dignity, but her claims with regard to Shantung and the South Sea Islands were recognised, and her position among the Great Powers was assured. But her immediate outlook in 1920–1 bristled with difficulties and complexities. China had refused to negotiate on Japan's offer to restore Shantung; the Washington Govt. would not agree to the Japanese point of view on the Yap question; several states on the Pacific coast of America were quite determined to abridge the civil rights of Japanese residents; Korean malcontents abroad were in a fitful mood of rebellion; the Siberian situation was far from tranquil. Japan's natural path of development was beset with suspicions and misunderstandings. In these circumstances, Japan welcomed the Washington Conference of 1921–2 as a fitting opportunity for her clearly to expound her foreign policies. Subsequently, the summary exclusion of Japanese prescribed in the American immigration law of 1924 dealt a tremendous shock to the Japanese mind; the Chinese situation continued to be unsettled; and Russia still remained an international enigma. But the progress of affairs in Eastern Asia testified to the sincerity of Japan's pronouncements at the conference table of Washington. Despite the differences which arose over many questions, there has developed a conviction that there would be no solution of the problems involved. At Geneva and elsewhere the pacific attitude of Japan was recognised.

Pre-War Questions

Manchurian Questions.—Prior to the outbreak of the Russo-Japanese War, the growing international rivalry for spheres of influence in the Chinese Empire had convinced the interested Powers of the necessity of establishing the policy of the "open door" and equal opportunities for commerce and trade in that country. That principle was from time to time enunciated by Great Britain in the later decades of the 19th century, but it was reserved to Mr. John Hay, Secretary of State under President McKinley's administration, to make its definite pronouncement to the world. In Secretary Hay's Circular Note addressed to various Powers under date of July 3 1900, it was declared that the policy of the United States was to assure permanent safety and peace to China, to preserve Chinese territorial and administrative entity, to protect all rights guaranteed to friendly Powers by treaty and international law and to safeguard for the world the principle of equal and impartial trade with all parts of the Empire. The doctrine was accepted in principle by Japan, Great Britain, Russia, France and Germany. Japan went so far as to conclude specific agreements for its execution with Russia (July 30 1907) and France (June 6 1907). It was, however, understood that the spheres of influence already established—Great Britain in the Yangtze Kiang valley, Tibet and Weihaiwei; Germany in Kiaochow; Russia in Manchuria and Mongolia; France in Yunnan—were not to be prejudiced by the newly professed principle of commercial impartiality.

The Russo-Japanese War brought about the tenure by Japan in S. Manchuria of a similar position to that which the great Western Powers had held in other parts of China. But "because Manchuria had been the scene of the greatest war of modern times," the world's eye became fixed upon every act of Japan in that region in "an exceptionally rigorous scrutiny" and "the nations behaved as though they expected her to live up to a standard of almost ideal altitude." Meanwhile, China, for her part, fell into a mood of impatient irritation on account of the presumed encroachments upon her sovereignty, and the "rights-recovery campaign," clamorously conducted throughout that Empire, somewhat strained her relations with Japan in the early part of 1909 in respect of various questions in Manchuria. However, in Aug. of that year, a series of agreements was reached between the two States by which all those outstanding problems were composed. Among the rest, Chinese sovereignty over Chientao was confirmed, and arrangements about railways, including that of the Antung-Mukden line, were effected.

From out of the blue, there came from America a proposal for the neutralisation of the Manchurian railways in Jan. 1910. In the view of Mr. Philander C. Knox, Secretary of State, that was best calculated to further the principle of the "open door" by putting an end to the abnormal conditions obtaining in Manchuria. But Russia and Japan could not accede to the scheme, on the grounds that their established rights and interests ought to be respected and that they were by no means threatening the Chinese sovereignty or the "open door" principle. Great Britain kept aloof, declaring that the question should be settled among the immediately interested Powers, namely, China, Japan and Russia. Nor was the proposal to the taste of China, who regarded it as a further encroachment upon her sovereignty. She replied that her treaty obligations with Japan and Russia precluded her from supporting the American idea. And the proposal fell through. Meanwhile, the Russo-Japanese negotiations as to their future attitude in Manchuria and Mongolia came to a satisfactory conclusion and a steadying element was added to the situation in the Far East in the form of an agreement between Japan and Russia, signed at St. Petersburg on July 4, 1910, under which they pledged themselves to maintain the *status quo* in Manchuria and to abstain from any unfriendly competition in the development of that region. The Russo-Japanese *rapprochement* was further solidified, in view of the World War, by the Convention[1] of July 3 1916, which provided that each of the two countries would not become a party to "any political arrangement or combination" directed against the other and that they would take counsel together for the necessary measures, "should the territorial rights or the special interests in the Far East of one of the High Contracting Parties be threatened." The agreement made greatly for the maintenance of good order in the Orient until the Russian Revolution brought about the drastic change of the whole situation. For later developments *see* paragraph on Washington Conference below.

[1] Russian and Japanese notes printed Temperley, *Hist. of Peace Conference*, vi, 634.

The Annexation of Korea.—Japan had waged two wars, one against China and the other against Russia, in order to prevent Korea (*q.v.*) from becoming "a dagger pointed against Japan's heart." In June 1905 she established a protectorate over the Hermit Kingdom so as to put a definite end to the wayward and suicidal diplomacy of the Seoul courtiers, but the whole peninsula could not be cleansed of its inveterate political and social iniquities. The hopelessness of real reform under the existing régime had become manifest; and the assassination of Prince Ito by a Korean in Oct. 1909 was the climax.

The Tokyo Govt. thus came to the conclusion that "the responsibilities devolving upon Japan for the due administration of the country (Korea) cannot be justly fulfilled without the complete annexation of Korea to the Empire." The fusion was accomplished by a treaty concluded between the Governments of Japan and Korea on Aug. 22 1910. It was decided that the ancient name of Chosen should be revived in lieu of Tai-Han and in future be officially used. Under the terms of the treaty the Korean Imperial House was assured of high honours and dignities as well as a liberal grant for maintenance. Japan, at the same time, notified the foreign Powers concerned that their treaties with Korea, including those of extra-territoriality, were all annulled; but that, nevertheless, their vested rights and interests would be fully respected; that the tariffs in force in Korea would be maintained for 10 years; that cabotage would be permitted to foreign vessels for the same period; and that the port of Masanpo would be closed for naval reasons, but Shin Wiju or Gishu would be added to the open commercial ports.

The Anglo-Japanese Alliance.—The general changes of situation in the Orient after the Russo-Japanese War, notably the annexation of Korea to the Japanese Empire in 1910, impelled the British and the Japanese Govts. to revise the Agreement of Alliance concluded in 1905. The negotiations in London between Sir Edward (afterwards Viscount) Grey and Baron (afterward Count) T. Kato ended in the renewal of the Alliance on July 13 1911. The important feature of the new agreement was the inclusion of an Article exempting either high contracting party from the obligation to come to the armed assistance of the other against a third party when a general arbitration treaty was concluded between that other Power and a third party (Article 4). At that particular time a treaty of such a description was under negotiation between the British and the American Govts., and it was with the particular object of excluding the United States from the application of the Alliance that Article 4 was inserted.

The general arbitration treaty failed to obtain the consent of the American Senate for its ratification, but the British and Japanese Govts. undertook on several occasions to make it clear that the spirit in which the article was conceived had not on that account been altered in the least. The Alliance of 1911 was to last for 10 years, and, in the absence of a year's notice from either contracting party to terminate the agreement, it would automatically continue in existence, even after July 1921, until such denunciation was made. The World War, into which Japan readily entered on account of the Anglo-Japanese Alliance, ended with the Treaty of Versailles which brought forth the League of Nations. The question was then mooted, though more academically than politically, whether the Anglo-Japanese Alliance would not be in contravention with the letter of the Covenant of the League, and on July 8 1920 the two high contracting parties addressed a joint note to the Secretary-General of the League to the purport that the Agreement of Alliance would in case of its renewal be made to conform to the Covenant in its form. The renewal of the Alliance was discussed at the British Imperial Conference in London in June 1921; and it was then announced

that, under the terms of the treaty, it would continue, without definite renewal. But at the Washington Conference, in Dec., the agreement made for a four-Power treaty (America, France, England, Japan) provided for the Anglo-Japanese Alliance being brought to an end.

The War and the Peace

The World War.—No sooner had the World War broken out in 1914 than there took place several exchanges of views between the British and the Japanese Govts. as to possible assistance by Japan in the protection of British trade in the Far East. Japan soon made it clear that she was prepared to take the responsibility imposed upon her by the Anglo-Japanese Agreement of Alliance, should the menace of the Germans to British interests necessitate such a step. It was not long before such a contingency arose, and on Aug. 15 1914 the Japanese Govt. sent an ultimatum to Berlin demanding the immediate withdrawal of the German warships from Chinese and Japanese waters and the surrender of Kiaochow to Japan by Sept. 15, with a view to eventual restoration of the leased territory to China; a week was allowed to the German Govt. in which to make a definite reply. On Aug. 23, the term having expired without any answer being forthcoming from the Kaiser's Govt., Japan declared war against Germany. In coming to this decision Japan remembered that it had been through the machinations of the Berlin Govt. that Germany, France and Russia acted jointly in 1895 in "advising" Japan in the name of peace in the Orient, and not without a hint of force, to retrocede to China the peninsula of Liaotung, which had been won by Japan at a heavy sacrifice of life and treasure and ceded to her under the Shimonoseki Treaty, and further that it was barely two years after that incident that Germany had installed herself at Tsingtao on a flimsy pretext. The Japanese nation welcomed the opportunity of eradicating the German menace in the East which owed its inception to such unfortunate circumstances.

The first part which Japan took upon herself to play after she aligned herself with the Allies was the reduction of the German stronghold in the Far East. Tsingtao, on the bay of Kiaochow, had been converted in the hands of the Germans into one of the most impregnable fortresses in the Orient—the "mailed fist" calculated to intimidate any possible objectors to the Kaiser's imperialist aims. It served at the outset of the war as the only base of operations in E. Asia for the German marauders menacing the Allied trade routes. The five German warships forming the main part of Adml. von Spee's squadron had been running amok, not only in Chinese and Japanese waters, but as far as the South Seas. It was imperative to make these raiders homeless, if they could not be captured or destroyed, and the military and naval operations against the redoubtable base, which was under the command of Capt. Meyer-Waldeck and garrisoned by some 13,000 men, of whom 5,599 were German regulars, were started with the utmost dispatch.

On Aug. 27 the blockade of Kiaochow Bay was declared by the Japanese Navy and Lungkow, 150 m. N. of Tsingtao, was chosen as the point for landing troops. The selection of Lungkow as the spot for disembarkation had been agreed upon between the Japanese and British commanders, who saw the necessity of clearing the hinterland prior to the landing of troops at some point nearer the fortress. However, the point being outside the zone of the leased territory, it was thought necessary to have a war zone established, following the precedent of the Russo-Japanese War and negotiations with that view were started between the Japanese and the Chinese Govts. as early as Aug. 20. An understanding was soon come to between the two Governments, and the Peking Govt. issued a declaration establishing such a war zone on Sept. 3. The Chinese Govt., in the meantime, intimated to the Japanese Govt. that it might nevertheless be found advisable to enter a formal protest to Japan against her troops' landing at Lungkow, for the sole purpose of exonerating themselves from all responsibility towards the German Government. Upon Germany's strong protest against permitting the Japanese troops to land in the neutral territory, the Chinese Govt. went so far as to point out that Germany herself had in a measure created the situation through her unauthorised fortification of Tsingtao. For an account of the actual operations and the taking of Tsingtao by the Anglo-Japanese forces, *see* Tsingtao, Capture of.

Although Tsingtao was thus early captured, there still remained the important task of locating and disposing of Adml. von Spee's squadron, consisting of the "Scharnhorst," the "Gneisenau," the "Nürnberg," the "Leipzig," and the "Dresden," which were seriously menacing the Allied commerce in the South Seas. It had further been reported that several German warships were at large in the Pacific Ocean. As early as Aug. 26 the battle cruiser "Ibuki" and the cruiser "Chikuma," and shortly afterwards six more Japanese cruisers, were ordered to join the British China Squadron under the command of Adml. Jerram. There were further dispatched a squadron of eight cruisers to the China and the East Seas and two squadrons—one comprising two battle cruisers, two cruisers, and a division of torpedo destroyers and the other one battleship and two cruisers—to the South Pacific Ocean. The cruiser "Idzumo," which happened to be in Mexican waters, as well as the "Asama" and the "Hizen," were entrusted with the patrol of the western coast of America, in co-operation with the Canadian "Rainbow" and the British cruiser "Newcastle."

In the middle of Sept. a great sensation was aroused by the dramatic appearance in the Bay of Bengal of the German raider "Emden," which had effected her egress from Tsingtao before the blockade was instituted by the Japanese navy. Several British merchantmen fell victims to her ruthless attack in appalingly swift succession, and it was only after two months' strenuous chase by the British and the Japanese squadrons that the "Emden" was sunk by the Australian cruiser "Sydney" near the island of Cocos. In the meantime, Australian and New Zealand troops were being hurried to various theatres of war in Europe, and Japanese warships assisted in the convoy of the transports across the Indian Ocean. At one time, whilst the "Emden" was still working havoc in Indian waters, the "Ibuki" was obliged to convoy no fewer than 38 troopships by herself. Apart from the anxious as well as hazardous task of convoy, Japanese warships were, in Feb. 1915, called upon to hurry to Singapore and land troops there to assist the British forces, side by side with French and Russian marines, in suppressing a mutiny of Indian soldiers who had come under German influence. In 1917, and after, the Japanese Navy undertook the guardianship of the safety of the Indian Ocean as far as the Cape of Good Hope. Von Spee's squadron, as a result of the concerted operation of the British and the Japanese navies, was chased in the direction of Cape Horn towards the end of 1914, and on Dec. 8 was encountered by Adml. Sturdee's squadron off the Falkland Is. and was completely annihilated, with the exception of the "Dresden," which, however, was also sunk by the British off Chile three months later. Meanwhile the German gunboat "Geier" was disarmed and interned at Honolulu, and thus the Pacific Ocean was cleared of the enemy, greatly to the relief of Allied commerce.

The next, and not the least important, contribution of the Japanese Navy toward the successful conduct of the War, was the sending of the cruiser "Akashi" and three destroyer divisions under the command of Rear-Adml. Sato to the Mediterranean. The German submarine warfare was about that time beginning to be carried on in a ruthless manner, and the British Navy had been earnestly requesting Japanese help. Whilst the British, French and Italian forces were engaged in blockading the Adriatic Sea and the Dardanelles, Adml. Sato's squadron assumed the all-important duties of convoying Allied vessels to and fro between ports in the Mediterranean. The Japanese destroyers successfully escorted 21 British warships, as well as 623 British, 100 French, 18 Italian and 26 other troopships or merchantmen, totalling 788 ships, and they cruised altogether 220,000 miles.

The Peace Conference.—At the Peace Conference in Paris in 1919 Japan was represented by Marquis (afterwards Prince Saionzi; Baron (afterwards Viscount) Makino; Viscount (afterwards Count) Chinda; Mr. (afterwards Baron) K. Matsui; and Mr. (afterwards Baron) K. Ijuin. The plenipotentiaries went to

France with the firm conviction, as Baron Makino had made unmistakably clear before he left Japanese shores, that the attitude of Japan at Paris should be, not so much to advance her own case before the comrade nations in the War, as to take counsel with them in the creation of a new world in which justice and humanity would reign supreme and which would assure an enduring peace. The first claim laid on the peace-table by the Japanese delegates was for the recognition of racial equality. The public opinion of Japan demanded that, if a new era of righteousness and fairness was to be established and peace and good-will among men were to be assured for all time, one of the postulates should be the principle of the equal dignity of races. The Japanese nation had been deeply conscious of the discriminatory treatment meted out to its nationals in various parts of the world. It recognised that differences in ability, power and character among men always exist; but it appeared wrong that there should be inequality of opportunities—inequality before the law. The present state of human civilisation having been achieved by a series of social, religious, political and economic emancipations, it seemed certainly to be time that racial emancipation should, in the interests of the real progress of civilisation, be foreshadowed and approved at least in principle. The original Japanese proposal for insertion in the Covenant of the League of Nations read:—

> The equality of nations being a basic principle of the League of Nations, the High Contracting Parties agree to accord, *as soon as possible*, to all alien nationals of the states members of the league equal and just treatment in every respect, making no distinction, either in law or in fact, on account of their race or nationality.

In explaining the Japanese position, Baron Makino made it clear that "the question being of a very delicate and complicated nature involving the play of a deep human passion, the immediate realisation of the ideal equality was not proposed, but that the clause presented enunciated the *principle* only and left the actual working of it in the hands of the different Governments concerned." Every national of the States in the League was expected " to share military expenditure for the common cause and, if need be, sacrifice his own person. In view of these new duties . . . arising before him . . . each national would naturally feel, and in fact demand, that he be placed on an equal footing with the people whom he undertook to defend even with his own life." The Japanese proposal, which was later somewhat modified in terminology in an attempt to meet objections, obtained 11 votes out of 17 in its favour, but it was ruled that unanimity was necessary. Japan abided by that decision, reserving the right to raise the question again at an opportune moment.

Kiaochow.—The disposition as regards Kiaochow was the next question with which the Japanese delegates had to grapple. When the Japanese people gave a hearty send-off to their plenipotentiaries, they had no shadow of doubt as to the final issue of this question. The greater, therefore, was their disappointment, if not stupefaction, when the Chinese delegates came out with a demand for the direct restoration of the ex-German stronghold. Japan claimed Kiaochow in recognition of all her military and naval services. It was at the same time made clear that Japan would be content, having once secured Kiaochow in her hand, not to retain it in her possession, but to offer it to China as a mark of good will and friendship. The Chinese delegates, however, insisted that the declaration of war by China against Germany on Aug. 14 1917 had abrogated all her treaties with Germany, including that of the lease of Kiaochow. Whether a lease treaty is not a sort of *pacta transitoria* is, it was argued, a moot question; it would appear to be contrary to common sense to contend that a paper declaration of war could as if by a magic wand transfer to her possession a formidable fortress which China could never have reduced with her own resources. China's further plea was that her engagement of May 1915 had been made under duress and was therefore null and void. It is a fact, however, that China did not question the validity of that engagement, when she willingly concluded the formal understanding of Sept. 24 1918, which was actually based on the above-mentioned agreement of May 1915, and accepted an advance of 20,000,000 yen under that understanding. The position of Japan, it should be observed, had furthermore been fortified by the previous undertakings of Great Britain, France, Russia and Italy in 1917, to support or at least raise no objection to the Japanese claim. The Supreme Council finally decided in favour of Japan, on May 5 1919 (Arts. 156–158, Treaty of Versailles).

The ex-German islands in the Pacific lying north of the equator, which had been under the Japanese occupation since 1914, were allocated to the Japanese administration under mandate at the Supreme Council held at the Trianon Palace on May 7 1919. They include the Marshall, Caroline, Palau (Pelew), and Marianne (Ladrone) islands.

The Rendition of Kiaochow

With the coming into force of the Treaty of Versailles on Jan. 10 1920 the German rights and interests in Shantung passed to Japan, and the Tokyo Govt., in conformity with their obligation to China, and true to their public avowals (by Baron Makino in Paris on May 4 1919; by Viscount Uchida in Tokyo, May 17 and Aug. 2 1919), immediately instructed Mr. Obata, the Japanese Minister, to invite the Peking Govt. to open negotiations for effecting the restoration of the ex-German possessions in Shantung Province (Jan. 19). It was desired that the necessary preparations for accepting the restoration should forthwith be started, and that China should organise a police force to take over the charge of guarding the Tsinan-Kiaochow railway. As soon as such an organisation was completed—even were it prior to an agreement being reached as to the restoration—the Japanese troops would be immediately withdrawn. Three months passed without any response coming from Peking in reply to the Japanese overtures.

Japan repeated on April 26 her desire to start negotiations, and the Chinese reply (May 22) was that she could not conduct direct negotiations with Japan as to the question of Kiaochow on the basis of the Treaty of Versailles, which she did not sign, and further, that the whole public of China had assumed a strongly antagonistic attitude regarding this question; whereupon the Tokyo Govt. asked the Chinese Govt. to reconsider the matter, assuring the latter that they were ready to begin negotiations at any time China might deem convenient. But Peking again remained deaf, and at the first assembly of the League of Nations, in 1920, Dr. Wellington Koo reserved for " a more appropriate time in the future " the matter of bringing before the League certain "subjects of vital interest to China, affecting international relations."

Independently of the Washington Conference, an informal conversation regarding Shantung was started between the Japanese and Chinese delegates to that conference on Dec. 1 1921, through the personal good offices of Mr. Charles E. Hughes and Mr. Arthur Balfour (afterwards Lord Balfour). After a protracted discussion, especially in respect of the disposition of the railway, a treaty was signed on Feb. 6 1922 under which the restoration of the former German leased territory to China was finally agreed upon. For five months, beginning June of the same year, negotiations as to the execution of the treaty were conducted in Peking, and in Dec. all detailed arrangements were concluded. The administration of Tsingtao was transferred to China on Dec. 10; the Japanese garrison was withdrawn on Dec. 17; the Shantung railway changed hands on New Year's Day of 1923; and thus passed into history the 24 years' episode of Kiaochow Bay.

The Yap Controversy.—The council of the League which met in Geneva on Dec. 17 1920 decided upon the statute relative to " C " class mandates, under the terms of the Covenant of the League (Art. 22, 6) and pursuant to the decision of the Supreme Council on May 7 1919, allocating the ex-German South Sea Islands to Great Britain, Australia, New Zealand and Japan. The Japanese Govt. had been contending that, according to their legal interpretation, the principle of equal opportunities for trade and commerce should, under the Covenant, be assured to " C " class as well as to " B " class mandates (Art. 22, 5) (*see* MANDATES). But in view of the importance of unity and co-operation among the Allied nations, Japan gave her assent to the issue of the statutes, on the understanding that that " decision should

not be considered as an acquiescence by the Japanese Govt. in the submission of Japanese subjects to discriminatory and disadvantageous treatment in the mandated territories, nor have they thereby discarded their claim that the rights and interests hitherto enjoyed by Japanese subjects in these territories should be fully respected."

To the statute relative to the islands north of the equator which came under the Japanese mandate, " as an integral portion of its territory," the United States took exception, on the plea that the island of Yap should not be included in the islands to be so assigned. It was argued that President Wilson had submitted to the Supreme Council his proposal of having that island internationalised for reasons vitally affecting the world communications, and that its decision, published on May 7 1919, should not be regarded as by any means conclusive. Further, the Washington Govt. declared that they had never ratified the Treaty of Versailles and accordingly were not bound by that instrument in any sense; but the United States should, treaty or no treaty, have a voice in the disposition of the affairs immediately arising from the World War. So far as the status of the island was concerned, Japan's position was that, if the published decision of the Supreme Council were not final, she did not know what she could rely upon as definite finality; the Allied Powers in Europe appeared to support the Japanese view. In the presentation of their case, the American Govt. further stated that " even if Yap should be assigned under mandate to Japan, all other Powers should have free and unhampered access to the island for the landing and operation of cables." Japan contended that " the (cables) question seems to be one which should be freely settled by the nation which has the charge of the place." During the Washington Conference an agreement between Japan and the United States was eventually signed on Dec. 12 1921 by which Japan's authority (as the mandatory Power) in Yap was admitted by the United States, while Japan accorded to the United States full rights and facilities regarding cables and other matters.

European Tour of the Crown Prince.—Japan's age-long tradition was broken when an heir to the throne left his native shores on March 31 1921. Crown Prince Hirohito set forth, escorted by Prince Kan-in and Count Chinda, upon a tour of study and observation in Europe. The battleship " Katori," carrying him on board, called at Hongkong, Singapore, Bombay, Port Said, Malta and Gibraltar, en route to Portsmouth, where she anchored on May 8. The reception by King George V. and the public of Great Britain was most cordial and spontaneous, befitting the alliance uniting the two nations for the past two decades. The Imperial tour subsequently extended to France, Belgium, Holland and Italy, and was everywhere attended with success. The Crown Prince returned to Japan on Sept. 31 1921. The minute reports of his foreign tour which daily reached home had a tremendous and almost historic effect in diffusing international and democratic ideas amongst the Japanese people.

The Washington Conference.—In the early months of 1921, when the renewal of the Anglo-Japanese Alliance and the proposal for universal disarmament were simultaneously discussed in Great Britain and the United States, Japanese public opinion evinced misgivings as to the real motives held by the chancelleries at London and Washington. But when President Harding dispatched his informal invitations for an international conference and his sincerity of purpose was evident, the Japanese Govt. entrusted Adml. Baron (later Viscount) Tomosaburo Kato, Minister of the Navy, Baron Kijuro Shidehara, Ambassador to Washington, Prince Iyesato Tokugawa, President of the House of Peers, and Mr. Masanao Hanihara, Vice-Minister for Foreign Affairs, to represent Japan at the conference on the limitation of armaments. Japan's attitude at the conference was to " place all cards face up on the table," and was considered worthy of great credit for enabling the conference to reach a successful end. Coincident with the disarmament conference, the Shantung conversations (*see* above) were started between the Japanese and Chinese representatives and the settlement of the protracted controversy is deemed a happy product of the harmonious diplomatic atmosphere created by the main conference.

In conformity with the agreements of Washington, Japan completely withdrew her garrisons from Hankow in July 1922, from northern Manchuria in Sept. 1922, from Siberia in Oct. 1923 and from Tsingtao in Dec. 1923. With the scrapping of the superdreadnought Tosa on Feb. 11 1925 the provisions of the disarmament treaty were fully carried out, except in the case of the battleship " Mikasa." She was the flagship of Admiral Togo at the battle of the Japan Sea in 1905, and the Japanese people wished to preserve her as a historic memorial. The consent of the signatory Powers was officially obtained, and the " Mikasa," dismantled, lies in Yokosuka Bay as a floating naval museum.

Relations with China

The Chinese Loan Consortium.—A gradual change came about in the opening years of the 20th century in the general policies toward China of the Great Powers, who had become convinced of the fruitlessness of mutual competition; signs also became visible of the altered attitude of Western financiers in regard to the investments in that Empire. In 1908, a British and a German bank undertook to finance in common the Tientsin-Pukow railway. In 1911, a four-Power group consisting of Great Britain, Germany, France and the United States, was formed in connection with the Hankow-Szechwan railway loan, as well as the loan for currency reform in China and industrial enterprise in Manchuria. Japanese and Russian bankers agreed to joint this Consortium in 1912, with the understanding that the special interests of Japan and Russia in Manchuria and Mongolia would not be interfered with in the internationalisation of the Chinese loans. With the inauguration of Mr. Woodrow Wilson as President in 1913, the U.S. Govt. decided to withdraw their bankers from the Consortium, and subsequently the World War prevented Germany from remaining in the financial league. In 1917 the Consortium, now comprising the four Powers, Great Britain, France, Japan and Russia, invited the United States to rejoin in its activities. The American Govt. hesitated at first to respond to this call, but in June 1918 took the initiative for the reconstruction of the financial group.

By that time the Tsarist régime in Russia had come to an end, but the other nations interested expressed their assent to the American proposal; and negotiations were started in May 1919, in Paris, between the financial representatives of Great Britain, France, Japan and the United States, simultaneously with the Peace Conference. After considerable interchange of views, part of which concerned the reservations by Japan as to S. Manchuria and E. Inner Mongolia, an agreement was signed in New York on Oct. 15 1920. The most important feature of the new agreement was that the object was purely and simply economic, being entirely free from any political complexion. All the members were to pool their existing and future loans (*i.e.*, options) both as regards industrial and administrative undertakings, with the exception of the industrial enterprises upon which substantial progress had already been made. As to Manchuria and Mongolia, the Powers arrived at a satisfactory understanding, Japan withdrawing her previous reservations. The statement of the Japanese Govt. issued on April 1 1921 contained the assurance that Japan only desired in those regions definitely to ensure " her national defence and the security of her economic life," and she was confident that she could safely rely upon the mutual trust and friendship of the Powers in regard to the exigencies of any situation that might arise in future.

Equality of opportunity was fully guaranteed to all members, thus eliminating unnecessary and harmful competition. It was believed that this co-operative action of the various banking groups, which alone could offer the enormous amount of capital necessary for the reconstruction of Chinese economic life and for the building of sufficient means of communication and transportation all over her vast territory, would be in the best interests of the Chinese people.

" Twenty-one Demands " upon China.—No country regretted more sincerely the continued internal troubles and disorder in China, which had been divided into warring camps since the Republic was proclaimed, than Japan herself, whose national

destiny is so intimately entwined with that of China. On Jan. 18 1915 the Tokyo Govt., impatient of Chinese diplomacy, presented "21 demands," as they were called. First, China must "give full assent" to Japan's disposal of Shantung and pledge herself not to cede or lease either territory or island to a third power under any pretext. Also China must agree to Japan building a railway from Chefoo to Lungkou, and to the opening of treaty ports by agreement with Japan. Secondly, in South Manchuria and Eastern Mongolia, China recognises Japan's "special position," and grants to Japanese subjects a right or freedom to reside, own land for trade, manufacture or mining, with important railway concessions. Over China's "political, financial or military advisers or instructors," in these provinces, "the Japanese Govt. shall first be consulted." Thirdly, the Hanyehping Company with its mines is to be made "a joint concern of the two nations" in which China shall not "dispose of the rights and property" except "with the previous consent of Japan." Fourthly, "the Chinese Govt. engages not to cede or lease to a third power any harbour or bay along the coast of China." Group V. of the so-called "demands" was presented secretly as "wishes." By Article I. "the Chinese Govt. shall employ influential Japanese as advisers in political, financial and military matters." The "wishes" also cover the employment of Japanese advisers; land ownership by Japanese hospitals, temples and schools; the purchase of munitions of war from Japan; the right to construct the Wuchang-Nanchang and Nanchang-Hangchow railways; the priority of Japanese capital regarding railways, mines and harbour works in Fukien province; and Japanese missionary propaganda. The ambitious programme of the Tokyo Cabinet evoked adverse criticism from various quarters, and it was unfortunate that whatever cogent reasons there might have been, the "wishes" were not placed on the table from the outset as well as the "demands." As to their intrinsic merit, the London *Times* (Feb. 13 1915) observed: "Even in the Peking version . . . these terms do not look harsh or unreasonable in principle."

Even granting that some of the proposals were unwisely conceived, the general belief that Japan purposed at that time to establish a veiled protectorate over China was a misconception of her true attitude. For Japan it was a matter of superlative interest and importance that her neighbours should attain a good government, a prosperous industry and a flourishing trade. For these reasons, Japan pressed the Peking Govt., on May 7 1915, to give a definite answer within a time limit. In the end the Chinese President, Yuan-Shi-k'ai, acceded to the Japanese proposals; and on the 25th of the same month, under the signature of Mr. Hioki and Lu Cheng-hsiang, the Chinese Minister for Foreign Affairs, two treaties were concluded—one respecting the province of Shantung, and the other regarding South Manchuria and Eastern Inner Mongolia—and 13 notes were exchanged.

With reference to Shantung, the Japanese Minister, in an exchange of notes, made the following declaration:—

> If upon the conclusion of the present War the Japanese Govt. should be given an absolutely free disposal of the leased territory of Kiaochow Bay, they will return the said territory to China, subject to the following conditions:
> 1. Opening of the whole of Kiaochow as a commercial port;
> 2. Establishment of a Japanese settlement in the locality to be designated by the Japanese Government;
> 3. Establishment, if desired by the Powers, of an international settlement;
> 4. Arrangements to be made, before the return of the said territory is effected, between the Japanese and the Chinese Govts. with respect to the disposal of German public establishments and properties and with regard to the other conditions and procedures.

China's Pledges.—By the treaty respecting South Manchuria and Eastern Inner Mongolia, the Chinese Govt. pledged themselves that the terms of lease of Port Arthur and Dairen, and of the South Manchuria railway and the Antung-Mukden railway, should be extended to 99 years respectively; the Japanese should be permitted in South Manchuria to lease land for residential, commercial, industrial and agricultural purposes, and further should be free to enter, travel, reside and pursue various vocations; that in Eastern Mongolia Japanese should be permitted to carry on, jointly with Chinese, agricultural undertakings; that Japanese conducting business in those regions should be submitted to Chinese police laws and taxation; that civil and criminal cases should be tried by the Japanese consul or by Chinese officials according as the defendant was Japanese or Chinese, save in cases of land disputes, where a mixed tribunal would have the power of adjudication (all this pending the eventual reform of the Chinese judicial system); that suitable cities and towns would early be opened to foreigners of China's own accord; and that various agreements relating to the Kirin-Changchun railway should early be revised.

At the Washington Conference of 1921–2 the Chinese delegation asked for the annulment of the treaties and notes of 1915 on the ground that they had been wrested from China under duress and without any *quid pro quo*. Baron Shidehara contended that a dangerous precedent would be established in international law if a treaty were to be revoked for the reason that it had been concluded against the spontaneous will of a party. He declared, however, that, in view of the changes that had taken place in the general situation since the signing of those treaties and notes, Japan was ready to modify some of their stipulations. Mr. Hughes claimed for the Americans all rights granted to Japanese nationals under these documents by virtue of the most favoured nation principle, while refraining from touching upon the validity question. Dr. Koo made a reservation as to China's "right to seek a solution, on all future appropriate occasions, concerning those portions of the treaties and notes of 1915 which did not appear to have been expressly relinquished by Japan."

The Ishii-Lansing Agreement.—In the course of the conversations that took place between Mr. Robert Lansing, the United States Secretary of State, and Viscount Ishii, when the latter went to Washington as Japan's special ambassador on the war mission in 1917, it was found advisable that a public announcement of the desires and intentions of the two Governments with regard to China should once again be made "in order to silence mischievous reports" that had been circulated. On Nov. 2 notes were exchanged declaring in part:—

> The Governments of Japan and the United States recognise that territorial propinquity creates special relations between countries, and consequently the Government of the United States recognises that Japan has special interests in China, particularly in the part to which her possessions are contiguous. . . . The Governments of Japan and the United States deny that they have any purpose to infringe in any way the independence or territorial integrity of China, and they declare, furthermore, that they always adhere to the principle of the so-called "open door" or equal opportunity for commerce and industry in China.

In view of the understandings reached at the Washington Conference of 1921–2, the two Governments declared the termination of the Ishii-Lansing Agreement in the form of notes exchanged between Ambassador Hanihara and Secretary of State Charles E. Hughes on April 14 1923.

Japan and Russia

Japanese Expedition to Siberia.—After the Russian revolution in 1917 an anomalous situation developed in Siberia owing to the contact established by German and Austro-Hungarian prisoners-of-war with Bolshevik forces, the former assuming the practical command. These Teutonic-Bolshevik allies seriously threatened the safety of the Czechoslovak troops who had essayed through the only available route of Siberia to join the Allied armies fighting on the Western Front in France. The U.S. Govt. proposed to the Japanese Govt. in the early part of 1918 to dispatch an Allied contingent to Eastern Siberia to assist the Czechoslovaks. To this Japan gave her assent, and on Aug. 11 1918 dispatched a contingent to Vladivostok; the United States and Great Britain also dispatched troops to Siberia. Early in Sept. Khabarovsk was captured by the Allied forces, and during the month of Oct. Bolshevik influence in Eastern Siberia signally declined, and the Czechoslovaks in the interior

[1] For the text see Temperley, *Hist. of the Peace Conf.*, vol. vi., p. 631 *seq.*

succeeded in re-establishing communication with their compatriots in the littoral districts. The Allied successes in Siberia endowed the anti-Bolsheviks, rallying under the banner of Adml. Kolchak, with fresh power; and the authority of the Omsk Govt., established in Nov. 1918, extended as far as the Ural regions by the end of that year.

But in May 1919 the anti-Bolshevik forces sustained a crushing reverse at the hands of the Red Army; and Adml. Kolchak's Govt. first removed from Omsk and then, toward the winter, to Chita. In the face of such unfavourable developments, Japan saw the necessity of speedily arriving at a definite understanding with the U.S. Govt. as to the future dispatch of reinforcements to Siberia. The Washington Govt., however, responded in Jan. 1920 with a sudden decision to withdraw all the American troops and railway experts; firstly, because the repatriation of the Czechoslovak forces was about to be completed, and secondly because the very unstable situation in Siberia would render futile any military assistance to the attempt to establish an autonomous Russian Govt. in Siberia. The American Govt. further stated that if Japan would continue in her endeavours in Siberia single-handed they had no objection whatever. In point of fact, the exigencies of the situation soon obliged Japan to send reinforcements. But the Bolsheviks were in the spring of 1920 fast establishing ascendancy in Eastern Siberia, having their headquarters at Vladivostok, Verkhne Udinsk, and Blagovyeshchensk—the three centres being more or less independent of each other. After the arrest and execution by Bolsheviks of Adml. Kolchak in Feb. 1920, the only remaining Tsarist leader was Gen. Semenoff, who had established his government at Chita and had the whole province of Trans-Baikalia under his sway.

The Nikolaievsk Massacre.—In March 1920 a most sanguinary incident occurred at Nikolaievsk, on the river Amur; all the Japanese residents of that city, men, women and children, numbering over 700, including Consul Ishida and his family, were tortured and massacred by the " Partisans," a Bolshevist guerilla gang infesting the littoral regions. The Japanese Govt. declared on July 3 that as there existed no responsible administrative centre in Russia which could negotiate concerning this flagrant outrage on Japan's prestige at Nikolaievsk, the Japanese forces would occupy certain places in Sakhalin province, pending the establishment of a legitimate government. At the same time, it was made known that Japanese contingents would soon be withdrawn, as in fact they were, from Trans-Baikalia, inasmuch as the Czechoslovak troops had been successfully assisted on their homeward journey (the last troops left Vladivostok in Sept. 1920), but that Vladivostok and Khabarovsk would still have to be garrisoned by a small military force. Upon inquiry from the Washington Govt., it was explained by the Japanese Govt. that Vladivostok was the prolific hatching ground of Korean revolutionary plots, and further that the safety of the Japanese residents had to be provided for and that Khabarovsk had a close strategic connection with Nikolaievsk. As soon as signs became visible of the growing stability of Khabarovsk, in Sept. evacuation of that region was immediately started.

Meanwhile, the Bolsheviks at Verkhne Udinsk began to style themselves the " Far Eastern Republic," and, in concluding an agreement for the suspension of hostilities with the Japanese military authorities in July 1920, drew up a memorandum to the effect that the Republic would follow democratic and not communist principles of administration, and would constitute itself a buffer state in the interests of a speedy return of peace and order to Siberia. Then the movement for the unification of the several " governments " in Eastern Russia was started, and in Nov. the so-called Amalgamation Assembly at Chita declared the independence of the " Far Eastern Republic " (adopting the name at first conceived at Verkhne Udinsk), holding as its territory the Russian provinces east of the Selenga river and professing anti-communist democracy as its basic political principle. The *coup d'état* which was carried out by the reactionary Kappelists in Vladivostok on May 26 1921 showed that the Siberian situation was still as unstable as ever.

In accordance with Japan's pledge at the Washington Conference of 1922, she withdrew her troops from Russian soil except Northern Sakhalin as soon as the situation warranted the withdrawal, namely by Oct. 25 1923. Northern Sakhalin was evacuated on May 15 1925, following an arrangement made at the time of Japan's recognition of the Soviet Government.

Japan's Recognition of Russia.—Geographical propinquity and economic needs made it highly desirable for Japan to re-establish normal international relations with Siberia as soon as the situation warranted such a course. A similar desire was apparently held by the Far Eastern Republic having its capital at Chita, and informal negotiations were conducted between the representatives of the Japanese Govt. and the Chita Govt. at Dairen in Aug. 1921 and at Changohun in Sept. 1922; but no agreements were reached at these conferences. In the meantime, the Far Eastern Republic came to be amalgamated with the Soviet Union. At the end of 1922 Viscount Shimpei Goto, in the private capacity of President of the Japan-Russia Society, invited M. Joffe to visit Japan for the twofold purpose of recuperating his health and of talking informally about Japanese-Russian relations. Private conversations were carried on between Goto and Joffe in the spring of 1923 (Feb.–May) at Tokyo and Atami. Subsequently, the Japanese Govt. officially started the preliminary informal negotiations with M. Joffe in Tokyo in June 1923, with Mr. Toshihiko Kawakami representing it as a plenipotentiary.

The conference lasted until July, but owing mainly to the divergence of views as to the settlement of the Nikolaievsk incident it again failed to arrive at a definite agreement. Then for some months the question of reopening the Russo-Japanese negotiations remained in abeyance. But in Feb. 1924 Russia invited protests from Japan by successive drastic actions, such as the withdrawal of recognition to the Japanese consuls in Vladivostok and elsewhere, the discontinuation of postal services between Vladivostok and Tsuruga, the expulsion of Japanese press correspondents from Russia and the arrest of Japanese military and consular officials at Vladivostok. It was suspected that, in taking such steps, Russia hoped to compel Japan to resume negotiations at an early date. Mr. Kenkichi Yoshizawa, the Japanese Minister at Peking, approached his colleague, M. Karakhan, the Soviet Minister, with insistent demands to make speedy amends for such flagrant irregularities. After several meetings of the two representatives, it was decided that the thread of discussions at the Tokyo Conference would be taken up by them at Peking on May 14 1924. The Peking Conference was protracted to the end of the year, holding no fewer than 77 sessions. At length a " convention embodying the basic principles of the relations between Japan and the Union of Soviet Socialist Republics " was signed on Jan. 20 1925 and came into force on Feb. 26. Through this convention and the accessory papers,

(1) Japan gave full recognition to the Soviet Union, re-establishing diplomatic and consular relations;

(2) Russia formally tendered Japan " an expression of sincere regrets " for the Nikolaievsk massacre of 1920, Japan having withdrawn her claim for reparations and promising the withdrawal of the Japanese garrison in North Sakhalin by May 15 1925;

(3) In laying down the principles for a future treaty of commerce and navigation, Russia recognised the doctrine of private ownership " to the widest possible extent and on condition of reciprocity;"

(4) It was further agreed that propaganda would not be worked either overtly or covertly by the governments themselves or by their official agents;

(5) Regarding the question of natural resources, Russia signified her willingness to grant to Japanese, concessions for the exploitation of minerals, forests and other natural resources in all Russian territories. As for oil, Russia pledged herself specifically to grant to Japanese concerns the privilege of exploiting 50% in area of the oil fields already explored or to be explored on the east coast of North Sakhalin during the period of five to 10 years. Coalfield concessions on the west coast of North Sakhalin and the Dui district were also pledged;

(6) The fishery rights in Russian waters were granted to Japanese in principle, the private *modus vivendi* of 1924 being recognised;

(7) As for debts and obligations, a settlement was reserved for future negotiations on condition that the Japanese Govt. and people would not " be placed in any position less favourable " than that which might be accorded to other governments or nationals.

Mr. Tokichi Tanaka went to Moscow as the first Japanese Ambassador to the Soviet Union in July 1925, and in company with him went a Japanese delegation to negotiate with Russian authorities regarding Sakhalin concessions. A detailed agreement as to oil exploitation was reached in Nov. following, and the foundation of Russo-Japanese economic co-operation was thereby laid.

The Emigration Question

Anti-Japanese Movement in America.—In the opening years of the century, the continuous influx of a large number of Japanese immigrants from the Hawaiian Islands to California had caused much alarm to the labour organisations in that state, and even in wider circles. Anti-Japanese feeling first overtly manifested itself by the attempted segregation in 1906 of Japanese children in the public schools of San Francisco. President Roosevelt early discerned that public sentiment on the Pacific slope towards the Japanese was taking an untoward course, and, bent upon stemming the tide in time, in 1906 he pleaded, in his presidential message to the Federal Congress, that an Act should be passed investing the Japanese, who had " won in a single generation the right to stand abreast of the most intelligent and enlightened peoples of Europe and America," with the right to naturalisation, which had been reserved to " free white persons, aliens of African nativity and persons of African descent." The Congress at Washington, however, did not, or could not on account of the agitation in the West, so proceed with the question. Nevertheless, an informal agreement was reached between the Washington and Tokyo Govts., by which Japan pledged herself that she would not issue passports for the continental United States to those classes of Japanese who would, or might, engage in manual labour. Those Japanese who had previously resided in the United States, or were the immediate relatives of Japanese immigrants already in the United States, or the " settled agriculturists " who were to assume active control of an already established farming interest (only three or four persons actually came under this last category), were to be accepted. Japan promised to observe this arrangement voluntarily, and the sincere efforts of her government in executing it received recognition from many American publicists.

This " gentleman's agreement," as it was generally styled, was confirmed by a declaration on the part of Japan made simultaneously with the revision of the treaty of commerce and navigation in Feb. 1911. However, the feeling against the Japanese in the United States subsequently became more and more pronounced. Apart from sporadic legislation imposing restrictions on them with regard to civil rights, such as marriage and the pursuit of an avocation, the Alien Land Act was passed by the California Legislature in May 1913, and put into force three months later, despite strong Japanese protests and repeated admonitions from President Wilson's Cabinet. This law prohibited aliens ineligible to citizenship of the United States (including companies the majority of whose interests were under the control of such aliens either in point of their number or the amount of capital held) from owning land in the state of California, allowing them only the privilege of leasing land on a three years' tenure. The terminology employed invested this law with an appearance of innocent impartiality, but it was none the less obvious that the Japanese alone would, in point of fact, be the sufferers from a serious discrimination. (The ineligibility to citizenship was confirmed by the United States Supreme Court in a decision on Nov. 13 1922.)

Californian Agitation.—American participation in the World War tended to lull Californian opposition towards the Japanese. But with the termination of the War it was renewed. In spite of the efforts of the Japanese Govt. to respect the susceptibilities of their American neighbours, of which the stoppage of passports in the spring of 1920 to the so-called " picture brides " was an example, the day of the presidential election—Nov. 2—witnessed the passage by the Californians of the most drastic law yet enacted against " ineligible aliens," by which they were deprived of even those rights which they had formerly been allowed to retain of holding land under a three years' lease. The Federal authorities had been averse to such a step, but the " initiative " poll decided in favour of the enactment by a majority of three to one (668,483 to 202,086 votes), and the law came into force as from the Dec. following. Thus in 1921 no Japanese might own or lease land, neither could he act as guardian of his own American-born offspring (who are of right American citizens) in whose name land is held, nor might he possess a share even in American-controlled landowning companies.

Anti-alien land legislation seemed to have become the fashion in 1921, the example set by California being emulated by Nebraska, Idaho, Oregon and Washington; the last two states, be it remarked, had systematically refused to make common cause with California during the past decade.

In this connection there would appear to be some misapprehension with regard to the rights of foreigners in Japan to hold land, and it has been stated that no such rights exist. This is not the case, as all persons, without discrimination, who are not Japanese subjects, may enjoy absolute ownership of land, if they are formed and registered under Japanese law as a juridical person, that is, as a partnership or corporation. There are, in fact, many such corporations in existence in Japan, composed exclusively of aliens.

Foreigners are further permitted to acquire rights in land, other than ownership, on the same footing as Japanese nationals, the following being some of the most important of these rights:—

1. *Superficies.*—This is a right *in rem* by virtue of which land belonging to another person can be used for the purpose of owning thereon structures, trees or bamboos. It can be created even though no structures, trees or bamboos are actually in existence on such land, provided that the object and intention are to use the land for the purposes named. The law contains no limitation upon the period of time for which that right can be created; consequently, a superficies for, say, 1,000 years will sell for a sum closely approximating to the value of a right of absolute ownership.
2. *Emphyteusis.*—This is the right *in rem* to carry on agricultural or stock farming on the land of another person. The period of time for its duration is to be fixed by the parties concerned at not less than 20 years and not more than 50 years.
3. *Lease in Perpetuity.*—This is a lease without limit as to its duration, and for all practical purposes it is as good as ownership. It was originally granted to foreigners within the foreign settlements for a nominal consideration paid to the Japanese Government. Although the foreign settlements were abolished in 1898, perpetual leasehold survives and is still enjoyed by foreigners.
4. *Leasehold.*—This is a right *in personam* effective only as between the parties concerned. When registered, however, it can be set up against third persons as the effect of such registration. The duration period is fixed at 20 years, renewable for a further 20 years from the time of renewal.

The climax of the Anti-Japanese movement was reached when an immigration bill containing a clause excluding Asiatics was passed by the American Congress on May 15 1924. A notable aspect of the controversy was that certain senators imparted to Ambassador Hanihara's phrase " grave consequences," an unintended meaning of a " veiled threat." Fears were expressed that the American Congress might suffer the abridgment of its prerogative to legislate about the question of immigration. The Japanese public keenly resented what they considered an overt affront, since they could not reconcile themselves to a proposal under which the Japanese quota would have been a negligible number of 100 immigrants a year. On July 1 the law came into force, and Japanese friendship toward the United States strengthened by the Washington Conference and American generosity at the time of the earthquake disasters, appeared to decline. But thinking Japanese knew that the American press united in disapproving the action of Congress, and felt that this legislation did not correctly reflect the sentiments of Americans as a whole.

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III. NATIONAL DEFENCE

The Army.—After the Russo-Japanese War six divisions were added to the Japanese Army, making the whole strength 19 divisions and in 1915 two more divisions were established for the defence of Chosen. After the World War it was planned to bring the Japanese military organisation up to the standard of efficiency and equipment necessitated by the lessons of the War. An 18-year reorganisation scheme involving 180,000,000 yen (£18,400,000) was passed by the Diet in 1918, and in 1920 it was decided not only to alter the scheme considerably, but also to expedite its execution and have it completed in 14 years, the estimate passed being 290,000,000 yen (£29,600,000).

Under the new scheme the number of divisions was to remain the same, but as a result of the disbandment of several small units the total peace strength of the army was to be reduced by 56,000 officers and men by 1925, and much of this disbandment has taken place. But, with the evacuation of Hankow and the withdrawal of Japanese forces from Shantung, Siberia and the mainland of Sakhalin, and also from Southern Manchuria, there has been a considerable redistribution of the Japanese Army, which has maintained the total strength of the home forces despite the reduction scheme. In war time this force could be expanded to 41 divisions with a total strength of 1,000,000 all arms. According to the latest budget figures, the total number of effectives in the land forces is 235,056, consisting of 16,879 officers, 216,114 other ranks and 2,063 gendarmerie. A Japanese division, it should be added, is generally composed of two brigades of infantry, one regiment of cavalry, one regiment of field artillery (with the exception of the 9th and 11th divisions, for which a mountain artillery regiment is provided), one battalion of engineers and one battalion of army service.

For the purpose of carrying out the new scheme for military aviation in 1919, the Army Department created an aviation section. In Jan. 1920 a military aviation school was started to train in the first year about 100 students, including both commissioned and non-commissioned officers. The military air service consists of six flying battalions and one balloon corps, and is now equipped with 150 standing machines.

Under the system of conscription, able-bodied males from 17 to 40 years of age are liable for service in the army. Those who have completed the middle school education, or have had an equivalent education, can apply for the volunteer service of one year instead of the ordinary three years' service. A young man who is receiving a liberal education may be exempted from military service until it is finished; residents abroad are also exempted.

The Navy.—As a sequel to the Russo-Japanese War, the Japanese naval authorities came to the conclusion that the most efficient fleet unit would be the so-called "8-8 plan;" viz., a unit consisting of eight battleships, eight battle cruisers and a suitable strength of subsidiary vessels. The Diet agreed to the scheme in principle in 1917, but owing to financial reasons it was decided to start with an 8-4 fleet. In the following year, the Diet passed an expanded plan of 8-6 unit, spread over seven years. On account of the strengthened financial situation, the naval authorities proposed, in Dec. 1920, an additional appropriation of 751,900,000 yen (£76,990,000) beyond the 408,000,000 yen (£41,700,000) previously assigned for warship construction, with a view of completing the 8-8 unit scheme in eight years. The Diet gave its assent to this proposal in passing the Budget for 1921–2, and, according to this plan, Japan was expected to have in commission, by 1927 four battleships, four battle cruisers, 12 cruisers, 32 destroyers, five gunboats, 12 fleet auxiliaries, six minesweepers, and several submarines, thus bringing the strength of the Japanese navy in ships not exceeding eight years in age to eight battleships, eight battle cruisers, 23 cruisers, 73 destroyers, approximately 80 submarines, five gunboats, 27 fleet auxiliaries and 120 submarines. In conjunction with this 8-8 scheme, the expansion of the naval air force was decided upon, and by 1923 the formation of 17 service and two practice corps had been completed.

In 1910 the tonnage of the Japanese Navy was 524,273; in 1920 it was 769,288. In 1920 its strength was 15 battleships, 7 battle cruisers, 16 light cruisers, 14 coast-defence vessels, 8 gunboats, 87 destroyers, 20 torpedo-boats and about 20 submarines.

In accordance with the agreements at the Washington Conference, reduction was made in the naval strength of Japan, including the abolition of the 8–8 fleet programme. The "Hizen," the "Kashima," the "Katori," the "Ikoma," the "Ibuki," the "Kurama," the "Amagi," the "Tosa," the "Atago" and the "Takao" were broken up; the "Satsuma" and the "Aki" were sunk; the "Settsu" was converted to a target ship and the "Akagi" and the "Kaga" to aircraft carriers—all this completed by Feb. 9 1925.

The naval strength of Japan in 1925 was six battleships (191,320 tons), namely, "Nagato" (1919), "Mutsu" (1920), "Ise" (1916), "Hiuga" (1917), "Fuso" (1914), "Yamashiro" (1915); four battle-cruisers, "Kongo" (1912), "Hiyei" (1912), "Haruna" (1913), "Kirishima" (1913); one aircraft carrier (9,500 tons); 16 light cruisers (82,210 tons); 72 destroyers (77,025 tons); 41 submarines (32,838 tons); and two fleet submarines (2,800 tons). In the course of building were two aircraft carriers (53,800 tons); nine light cruisers (73,995 tons); nine destroyers (12,960 tons); four submarines (3,659 tons); seven fleet submarines (11,510 tons) and three mine-laying submarines.

Regarding naval aviation, a new programme passed by the Diet will give the Japanese Navy when completed 17 fleets and 136 planes, stationed as follows: Kosumiga-ura, seven; Yokosuka, five; Sasebo, three; and Omura, two.

See *Armaments Year Book*, League of Nations (Geneva, 1926).

(H. Sa.)

IV. NATIONAL FINANCE

The State Budget.—The table at top of p. 593 shows the increasing figures of the Japanese state budget for the fiscal years from 1910–1 to 1924–5.

Although in the early months of the War the more or less disturbed economic conditions in Japan checked the normal increase of revenue in general, the gradual recovery, followed by the unprecedented prosperity of industry and commerce, caused the revenue to show an upward tendency. From 1916–7 the yield of income-tax, adjusted to meet national needs, had rapidly increased, and receipts from public undertakings and state property contributed enormously to the general growth of the revenue. A war profits tax, enacted in 1918, required of those liable to the tax the payment of either not less than 20% of their income in excess of the average profits of pre-War days, or, in case such could not be ascertained, of 10% of their invested capital.

In addition to the adjustment of the income tax to yield a larger revenue, the "saké" tax, the postal, telegraph and telephone charges and the price of tobacco (a government monopoly) were all increased. Japan emerged from five years of the World War with her financial position considerably strengthened, though during 1920–1 industrial unrest and economic depression reacted adversely on national finance. The Government explored every available channel in order to counteract the loss of revenue by retrenchment.

Emergency Expenditure on Account of the Earthquake.—In the middle of the financial year 1923–4, however, as a consequence of the great earthquake, the Government was compelled to provide for various emergency measures, the reconstruction of the devastated areas, and at the same time to make good the deficiency arising from the reduction of taxes or exemption from taxation and other de-

Budget Figures 1910–25 (in 1,000 Yen)

Year	Revenue			Expenditure			Surplus Revenue
	Ordinary	Extraordinary	Total	Ordinary	Extraordinary	Total	
1910–1	491,331	181,542	672,873	412,009	157,144	569,154	103,719
1911–2	508,558	148,633	657,192	409,889	175,485	585,374	71,817
1912–3	552,085	135,306	687,392	416,895	176,701	593,596	93,796
1913–4	575,428	146,547	721,975	415,635	157,998	573,633	148,341
1914–5	536,342	198,305	734,648	399,225	249,195	648,420	86,227
1915–6	538,999	169,616	708,615	386,516	196,753	583,269	125,346
1916–7	622,052	191,256	813,308	386,065	204,729	590,795	222,513
1917–8	763,760	321,198	1,084,958	437,821	297,202	735,024	349,934
1918–9	911,579	567,536	1,479,115	490,167	526,868	1,017,035	462,080
1919–20	1,063,121	745,512	1,808,633	502,786	669,542	1,172,328	636,305
1920–1	1,174,677	825,975	2,000,652	709,314	650,664	1,359,978	640,674
1921–2	1,283,812	781,899	2,065,711	841,750	648,106	1,489,856	575,855
1922–3	1,428,206	659,139	2,087,345	891,257	538,432	1,429,689	657,656
1923–4	1,303,588	741,464	2,045,052	960,452	560,597	1,521,049	524,003
1924–5	1,265,652	388,458	1,654,110	1,082,400	571,710	1,654,110	..
1925–6	1,299,321	250,493	1,549,814	1,021,763	528,050	1,549,813	..

Note.—The figures to the financial year 1923–4 represent the settled accounts; those for the financial years 1924–5 and 1925–6 the budget estimates.

creases in revenue. Under these exceptional circumstances the Government, in order to avoid any serious weakening of the national finances, curtailed expenditure and postponed public works, and so framed for the financial year a working budget which amounted to 1,292,821,754 yen both in revenue and in expenditure. Of this sum the fall in taxes consequent on the disaster reached an amount of 130,000,000 yen less than the original estimate.

At the 47th extraordinary session of the Diet in 1923 a programme for the reconstruction of Tokyo was agreed upon after discussion, and a supplementary budget was voted for the purpose; out of the total thus voted, 13,180,721 yen was allotted to the fiscal year 1923–4. In addition to the above vote for reconstruction a further sum of 4,883,989 yen was voted to the working budget, so that after these additions the revised working budget for 1923–4 amounted to 1,311,687,188 yen. The dissolution of the 48th session in Jan. 1924 having rendered abortive the general budget for 1924–5, the Government drew up a working budget as follows:—

Revenue and Expenditure in Yen

	Revenue	Expenditure
Ordinary	1,214,788,272	1,028,156,564
Extraordinary	194,265,814	380,897,522
Total	1,409,054,086	1,409,054,086

The extraordinary expenditure includes the following reconstruction appropriations:—

Expenditure in Yen

Reconstruction outlay	..	87,607,000
Tokyo	77,955,000	..
Yokohama	9,652,000	..
Loans	..	1,283,000
Subventions	..	3,816,000
Interest granted for local reconstruction loans	..	38,000
Total	..	92,744,000

In July 1924 a supplementary estimate, consisting of the following amounts, was submitted to Parliament and approved:—

	Yen
(*a*) Supplementary expenditure for reconstruction of Tokyo as a consequence of the earthquake	40,400,000
(*b*) Expenditure for reconstruction work on official buildings, and a grant for damage sustained by local authorities	122,300,000
(*c*) Other supplementary expenditure not concerning reconstruction	102,900

Further Emergency Measures.—As a result of the abnormal economic and financial circumstances, following the earthquake disaster, a number of emergency measures became necessary, of which the following are the principal:—

(1) Of the 84 Tokyo associated banks, no fewer than 74 had their principal offices burnt down, with the result that the banking machinery almost ceased to work. An Imperial emergency ordinance was issued on Sept. 7 1923 proclaiming a moratorium of 30 days within the stricken area on all pecuniary obligations due on or before Sept. 30 1923, under the civil code in force before the catastrophe.

(2) The Bank of Japan having done its utmost to respond to the aforementioned measure by accommodating banks with the funds necessary for resuming their business, an ordinance was promulgated on Sept. 27 under which the Government undertook to indemnify the bank to the extent of 100,000,000 yen in respect of losses incurred in rediscounting the earthquake bills.

(3) The operation of the customs law was temporarily suspended, and import duties were either abolished or reduced until March 31 1924 (*see* TRADE, INTERNATIONAL).

(4) In the stricken area exemption, reduction and deferred payment of taxes were allowed according to the circumstances.

(5) With the assistance of the deposit bureau of the financial department the Hypothec Bank of Japan and the Industrial Bank of Japan liberally financed their clients.

(6) An ordinance was issued by which state aid was to be given to fire insurance companies which voluntarily paid "sympathy money" to policy holders who suffered loss either directly or indirectly from the earthquake. The subsidy was to be repaid in accordance with terms prescribed by the Government.

(7) A law was promulgated by which an import duty—operative from Aug. 1 1924—of 100% *ad valorem* was placed on luxury and certain other articles.

(8) Reconstruction Savings Certificates were issued in small denominations.

Budget of 1925–6.—In drawing up the Budget for the financial year 1925–6 further retrenchment and reforms in finance and administration were effected, and the total estimates (in yen) were as follows:—

Budget of 1925-6 in Yen

Revenue	..	1,524,000,000
Ordinary	1,300,000,000	..
Extraordinary	224,000,000	..
Expenditure	..	1,524,000,000

Compared with the preceding year's estimates there was an increase of 35,000,000 yen in the ordinary expenditure and a decrease of 126,000,000 yen in the extraordinary, making a net reduction of 91,000,000 yen in the total expenditure. The Government adopted the policy of avoiding recourse to public issues, thus relieving the money market from the demands of state finance. At the same time, by the retrenchment of expenditure, it exerted itself to encourage thrift. The chief items of revenue and expenditure for 1925–6 were as follows:—

Revenue and Expenditure, 1925–6 (in 1,000 Yen)

Ordinary Revenue:—	
Land tax	74,004
Income tax	195,855
Business tax	57,282
Tax on liquors	196,377
Sugar excise	70,099
Consumption tax on textile fabrics	53,672
Customs duty	98,825
Other taxes	49,116
Stamp duty	82,142
Receipts from postal, telegraph, telephone services	203,603
Forests	39,288
Profits of monopoly	130,276
Other receipts from public undertakings and state property	22,023
Miscellaneous receipts	18,220
Transferred from special accounts	8,529
Total	1,299,311

Extraordinary Revenue:—	
Proceeds of sale of state property	4,715
Receipts from the issue of public loans	100,000
Local contributions to expenses incurred by the state for the benefit of certain prefectures	13,039
Funds belonging to special accounts transferred	26,077
Surplus of the preceding year transferred	104,119
Miscellaneous receipts	2,540
Total	250,490
Total revenue	1,549,801
Ordinary Expenditure:—	
Imperial household	4,500
Foreign affairs	15,783
Home affairs	41,177
Finance	282,341
Army	170,875
Navy	122,349
Justice	28,515
Public instruction	79,751
Agriculture	21,388
Industry and commerce	3,161
Communications	251,919
	1,021,759
Extraordinary Expenditure:—	
Foreign affairs	3,454
Home affairs	206,500
Finance	38,083
Army	28,514
Navy	105,016
Justice	2,075
Public instruction	19,212
Agriculture	20,690
Industry and commerce	7,646
Communications	96,856
Total	528,046
Total expenditure	1,549,805

Administrative Changes.—The principal changes in the financial and administrative system of the country made after the earthquake are:—

(1) the establishment of a special fund by means of a sum of about 130,000,000 yen to be taken out of the reserve capital of the Imperial mint, this fund to be applied to the improvement of national education and the development of industries in agricultural districts;

(2) the reorganisation of the deposit section of the department of finance by revising the administration and the mode of employing the fund belonging to that section, mainly post-office deposits, and by appointing a commission to advise the finance minister as to the proper method of employing the fund (this commission was set up in April 1925);

(3) the division of the old department of agriculture and commerce into two independent departments, one for agriculture and forestry and the other for commerce and industries (in March 1925);

(4) the creation of several new parliamentary secretarial posts (in Aug. 1924).

The National Debt.—The National Debt stood at 4,553,471,000 yen at the end of Aug. 1925, of which 3,051,455,000 yen represented the internal, and 1,502,016,000 yen the foreign loans. Of the external loans, an amount of 544,975,000 yen was raised in Feb. 1924: in New York $150,000,000 and in London £25,000,000. The proceeds were applied to the conversion and redemption of the outstanding balances of the Imperial Japanese Govt. 4½% loans, first and second series, issued on March 28 1905 and July 11 1905, respectively, and also to meet the expenditure for reconstruction work necessitated by the earthquake of Sept. 1923. The figures of the debt are as follows:—

Debt 1914–25 (in million Yen)

Financial year	Internal loans[1]	Foreign loans[1]	Total	Debt per head in yen
1914–5	991·5	1,514·8	2,506·3	46·968
1915–6	1,028·0	1,461·1	2,489·1	45·976
1916–7	1,097·4	1,370·2	2,467·6	44·919
1917–8	1,159·9	1,338·7	2,498·6	45·911
1918–9	1,268·8	1,311·1	2,579·9	45·976
1919–20	1,482·4	1,311·1	2,793·5	49·297
1920–1	1,809·6	1,424·3	3,233·9	56·506
1921–2	2,184·8	1,359·0	3,543·8	61·187
1922–3	2,450·1	1,358·5	3,808·6	64·887
1923–4	2,576·1	1,621·3	4,197·4	70·595
1924–5	2,822·9	1,506·7	4,329·6	80·000

[1]Amount outstanding at the end of the financial year.

V. ECONOMIC HISTORY

War Conditions.—Before the World War, Japan had already nearly recovered from the effects of the Russo-Japanese War, and her economic activities had been making steady and more or less symmetrical progress. During the early days of the War the disturbance of international commercial relations brought about conditions which affected the Japanese nation in common with the whole world. This state of affairs, however, changed later, when a huge demand arose on the part of the Allied Powers for the supply of immense quantities of munitions of war, and when, in addition, the inability of the European belligerents to continue their overseas commerce on the pre-War scale caused a demand for Japanese products in the markets of India, the South Seas, Australia, South America and even Africa. These factors, together with the natural decline in imports from the European countries at war, conduced to turn the balance of Japanese trade in her favour practically for the first time in 20 years.

A great increase in the amount of specie held by Japan abroad inevitably followed, while the stock of gold accumulated at home rapidly grew. Then the rate of interest was lowered, and the prices of shares began to soar, thus causing general buoyancy in the stock market. As a result Japan was placed in such a position as to be able to redeem her foreign debt and to accord financial assistance to her Allies. This is shown in the following transactions:—

Foreign debt redeemed	
4½% bonds	£20,516,400
Franc bonds	Fr. 200,009,500
Amount lent	
To Great Britain	Y280,000,000
France	126,000,000
Russia	240,053,067

Soon a considerable number of new undertakings, notably in the field of shipbuilding, iron and steel manufacture and the chemical industry were brought into being. The rate of interest once again showed an upward tendency, and the issue of banknotes increased rapidly. The trend of circumstances described above became more and more accentuated as time went on, until at the end of 1916 the premature peace talk engendered a spirit of temporary caution among Japanese manufacturers and merchants.

The general international confusion of 1917, such as the introduction by the Germans of ruthless submarine warfare, the declaration by the United States of war upon Germany, the débâcle of the Russian revolution, and, in addition, the continuous internal troubles of China, all had repercussions upon Japanese commerce. Nevertheless, in spite of the far-reaching effects of these great outside influences, Japan's trade and industry continued on the whole to register a steady development.

Post-War Depression.—With the conclusion of the Armistice in Nov. 1918 the demand for warlike materials came to an abrupt end, and the branches of industry and commerce dealing with iron, steel, copper, dyestuffs and chemicals received a sudden and serious blow. There were even signs of economic depression, but the revived demand for foodstuffs and industrial materials necessary for the economic reconstruction of Europe, coupled with the trade activities in the United States, temporarily maintained a prosperous state in Japan's commerce. A telling blow to trade and industry was administered, however, by the financial panic which occurred in April 1920, due to over-speculation and the misuse of credit in certain quarters.

Readjustment.—Following the setback of the preceding year the economic market had to devote itself in 1921 to the work of readjustment, which caused general lethargy in industrial enterprises and dullness in commercial transactions. It was in these circumstances that in June 1922 the Government declared a new policy of financial and administrative retrenchment and readjustment, which was rigorously pursued until the whole outlook became distinctly brighter; demand for money in the home-market declined, the balance in foreign trade improved, and the issue of banknotes decreased. In the latter part of

Nov. of the same year, however, this tendency was suddenly checked by the suspension of business of a few provincial banks. Emergency measures were successfully taken by the Government as well as by the Bank of Japan, but at the end of the year money was still very tight and demands upon the bank for advances reached an enormous amount, with the result that a new record was established in the issue of bank-notes.

In 1923, while the economic conditions of the country were still in a state of unrest, Japan was suddenly visited by the unparalleled catastrophe on Sept. 1, when the earthquake and conflagration in the Kwanto district caused terrible loss of life as well as severe material destruction. The effect on the country's sound economic and industrial foundation, however, was not very serious, because the area devastated covered only a consuming part of Japan, not a producing part. But the effect of the disaster on the money market was felt to such a degree that for a time absolute financial confusion seemed imminent. Fortunately, emergency measures were promptly and effectively taken by the Government, the Bank of Japan and the other financial authorities to restore order in the business world. At the end of Sept. 1925 the first step was taken towards the return to a gold standard, when a shipment of 4,000,000 gold yen was consigned by the Bank of Japan to the Federal Reserve Bank in New York. On Dec. 19 the removal of the embargo on the shipment of silver bullion was announced.

Prices.—The following table shows, by wholesale price numbers based on Oct. 1899, the rise in prices of commodities in Tokyo between 1913 and 1924:—

Prices of Commodities
(Oct. 1889 = 100)

	1913	1916	1919	1923	1924
Rice	183	116	390	277	327
Wheat	146	140	294	205	233
Soya beans	142	136	284	225	253
Salt	230	209	314	356	380
Soy	103	104	255	233	200
Sugar	243	258	472	378	360
Saké	130	131	233	250	244
Tea	113	128	235	303	341
Eggs	117	114	263	214	212
Cut tobacco	129	129	162	178	178
Cotton yarn	154	155	567	275	352
Raw silk	118	155	274	279	239
Habutae	83	105	200	200	185
Timber	112	112	257	300	271
Steel bars and rods	82	233	276	150	129
Coal	134	145	421	311	334
Firewood	151	140	355	373	311
Charcoal	115	111	278	326	301
Kerosene oil	160	219	484	280	345
Japanese paper	127	160	285	325	371
Foreign paper	113	218	504	233	235
Average	137	153	324	270	276

Population, Production and Trade

Population.—The first national census took place on Oct. 1 1920. The following table gives the census figures for Japan proper, Formosa and Japanese Sakhalin, together with those obtained for Korea from the local registrars' records. The figures for Japan proper (area 148,756 sq. m.) show that she ranks sixth in order of population among the countries of the world, her number only being exceeded by those of China, India, Russia, the United States and Germany. With regard to the density of population, Japan proper (376 per sq. m.) ranks third, following Belgium (658), the Netherlands (536) and above Great Britain (374).

	House-holds	Population (1920)		
		Male	Female	Total
Japan proper	11,222,053	28,044,339	27,918,714	55,963,053
Taiwan (Formosa)	690,000	1,893,541	1,761,767	3,655,308
Karafuto (Japanese Sakhalin)	22,087	62,327	43,572	105,899
Chosen (Korea)	3,297,285	8,903,000	8,361,119	17,264,119
Total	15,231,425	38,903,207	38,085,172	76,988,379

The following table gives the census figures for 16 cities with a population numbering more than 100,000:—

Principal Cities

	House-holds	No. of Pop.		House-holds	No. of Pop.
Tokyo	456,820	2,173,201	Hakodate	29,155	144,749
Osaka	276,331	1,252,983	Kure	28,268	130,362
Kobe	138,986	608,644	Kanazawa	29,287	129,265
Kyoto	128,892	591,323	Sendai	21,861	118,984
Nagoya	92,426	429,997	Otaru	21,275	108,113
Yokohama	95,241	422,938	Sapporo	20,038	102,580
Nagasaki	37,036	176,534	Kagoshima	19,942	103,180
Hiroshima	34,553	160,510	Yawata	22,322	100,235

There are 31 cities with a population of from 50,000 to 100,000; 136 with from 20,000 to 50,000, and 374 from 10,000 to 20,000. On Oct. 10 1925 the second national census took place, but at the time of writing the full figures are not available. The results received to date show that Japan proper has a population of 59,736,000, including 30,012,000 males, an increase of 3,772,947 since the 1920 census. On Oct. 1 1924 the population of Japan proper was estimated at 59,138,900, which represented a yearly increase of about 800,000 for the five years ending 1924. In point of birth-rate, however, a tendency to decline has already set in, 36·2 per 1,000 in 1920 being the high-water mark.

Agriculture.—Japan, in common with most European countries, has witnessed a decrease in the number of people engaged in agriculture. During 1916 and 1917, when Japan was putting forth her greatest effort in producing munitions of war for the Allies, the number of those actually holding land decreased to the extent of 20,800 and 36,400 respectively; whilst in 1918, when the war boom in industry was practically over, the gain to agriculture was only 20,200 persons. This migration of the agrarian population toward cities, together with the modern industrial tendency of the nation, is making it more and more difficult for landowners to find tenants. Rural reorganisation has been an economic problem for some time.

Farmers and Tenant Farmers

	Farmers cultivating own land	Tenant farmers	Farmers combining tenantship
	%	%	%
1908	33·27	27·58	39·15
1923	30·60	28·23	41·17

The high proportion of small holders in Japan is characteristic of the agricultural life of the country, as is shown by the following table giving the percentage of total landholders with holdings of under 1·23 ac., etc.:—

	Under 1·23 ac.	Over 1·23 ac.	Over 2·45 ac.	Over 4·90 ac.	Over 7·35 ac.	Over 12·25 ac.
1908	37·28	32·61	19·51	6·44	3·01	1·15
1923	35·11	33·59	21·39	5·88	2·57	1·46

Rice still remains the staple food of the country, and the area under cultivation is nearly twice that devoted to the production of barley, rye and wheat. Intensive cultivation of all crops is carried out, and the limit of return has actually been reached in some cases.

Cotton, hemp and indigo were all retrogressive, the cotton chiefly owing to the large imports of cheaper cotton from abroad. The following table shows the area under cultivation and the production of the chief food products:—

Principal Crops

	Area under Cultivation		Production	
	1914 Hectares	1923 Hectares	1914 Hectolitres	1923 Hectolitres
Rice	3,008,298	3,121,363	102,834,926	100,056,199
Barley	611,218	473,859	17,225,132	13,701,265
Rye	721,306	557,774	13,001,461	10,564,001
Wheat	474,721	483,833	8,096,399	9,366,031
		1922		1922
Millet	203,087	151,630	3,984,178	3,511,698
Beans	589,694	580,712	8,256,823	8,278,735
Buckwheat	160,222	124,624	2,469,232	1,984,797
Rapeseed	123,092	90,609	1,593,065	1,229,310
			Metric tons	Metric tons
Potatoes	83,125	100,102	879,385	915,379
Sweet potatoes	302,493	288,372	3,679,155	3,768,963
Seed cotton	2,452	2,105	3,081	1,876
Hemp	10,926	10,023	9,469	11,815
Indigo (leaf)	4,476	4,652	8,176	8,333
Sugar-cane	22,414	25,711	1,001,078	812,489

Industrial Development.—Although the expansion of Japanese industries was enormous during the World War, the rate of progress registered in the pre-War period of 1908–13 had also been remarkable. In 1908 there were 11,390 industrial establishments and 196 Government factories; in 1913 the Government factories had decreased to 188 (in 1918 there was a further drop to 161), but the other industrial establishments had increased in number to 15,811, or by 38·8%. By 1918 the figure had risen to 22,391, an increase of 41·6% on 1913 and 96·6% on 1908. In a decade, that is to say, Japan had practically doubled the number of factories in operation; but the after-War trade depression affected industrial development to some extent.

The following table illustrates the development:—

Industrial Progress

	No.	Motors	Kilowatts	Operatives	
				Men	Women
Government factories					
1913 (Mar. 31)	188	5,211	217,965	99,992	29,994
1918 (Mar. 31)	161	7,014	269,475	123,087	36,349
1922 (Dec. 31)	..	8,679	635,112	124,725	43,429
Industrial establishments					
1913 (end of)	15,811	19,084 / 1,330	1,122,597	375,596	540,656
1918 (end of)	22,391	41,689 / 878	2,006,098	646,115	763,081
1922 (end of)	46,427	86,312 / 804	2,942,730	834,314	856,705

Shipbuilding.—In 1898 a steamer of 6,000 tons, the first large boat to be built in a Japanese yard, was completed by the Mitsubishi dockyard at Nagasaki for the Nippon Yusen Kaisha. Subsequently the same dockyard and the Kawasaki establishment constructed steamers of over 10,000 tons, as well as cruisers for the Imperial Japanese Navy and for China. In 1912 these two dockyards had reached such a high state of development that each was entrusted with the building of a dreadnought of 27,500 tons. Soon after the outbreak of the World War the private shipyards enlarged their capacity for building and made marked progress, though handicapped by an inadequate supply of materials and skilled labour. But the yards have been suffering from post-War depression, and also from the effects of the Washington Agreement (*see* WASHINGTON CONFERENCE); being obliged to curtail the scope of their work, and, in some cases, completely to suspend it.

The number and total tonnage of ships launched in the years 1913, 1918, 1921–4 is as follows:—

	Steamships		Sailing Vessels		Total	
	No.	Tonnage	No.	Tonnage	No.	Tonnage
Ships launched						
1913	115	51,525	659	43,598	774	95,123
1918	443	540,531	1,804	161,964	2,247	702,495
1921	69	226,081	12	1,711	81	227,792
1922	57	71,076	14	2,167	71	73,243
1923	56	74,284	1	2,500	57	76,784
1924	39	71,440	6	1,006	45	72,446

With regard to her merchant fleet, Japan advanced during June 1914 to June 1920 from sixth to third position among the world Powers, since at the latter date she possessed 2,996,000 tons as against 1,708,000 tons in 1914, thus emerging after the War with an increase of 1,288,000 gross tons.

Raw Silk and Silk-Weaving.—The manual dexterity peculiar to Japanese women is a factor which ensures the lasting prosperity of Japan's raw-silk industry, and when full advantage has been taken of the various modern processes of production in silk filatures enhanced benefit should accrue. Japanese silk goods have made great progress, and particularly silk pongee, which has now practically driven the Chinese product from the markets of the United States. At the end of 1922 there were 2,863 factories engaged in the silk industry, employing 23,893 male and 262,732 female operatives.

Cotton Spinning.—In spite of the difficulties during the World War of importing from Great Britain and the United States sufficient machinery to meet the enhanced demand for cotton yarn, the spinning-mills of Japan prospered exceedingly. The paid-up capital invested in the mills at the end of June 1920 was 248,180,000 yen, equivalent to an increase of 288% over the pre-War figure; whilst the number of spindles in use in 1918 was 3,384,800, and in June 1920 3,689,000, compared with 2,409,900 in 1914. At the end of 1918 there were 6,710 factories, with 65,316 male and 218,041 female operatives, the total number of workers in the textile industries being 777,655. The latter figure includes about 25,000 who are engaged in the production of knitted goods, consisting principally of gloves, stockings and underwear, in which a large trade, chiefly with British India, has grown up in the last few years. As knitting was formerly entirely a domestic industry, there have been difficulties in producing goods of uniform quality for export, and a system of inspection was therefore instituted towards the end of 1917, under which the exportation of articles of inferior quality was prohibited. Previous to the War, the average output of knitted goods was 6,660,000 doz., valued at 8,937,000 yen, but during the five years of the War the output averaged 15,143,000 doz., valued at 23,073,000 yen. According to the report of the Cotton Spinning Association, at the end of 1923 the factories numbered 241, with an aggregate paid-up capital of 376,273,000 yen, while the spindles numbered 4,422,000.

Iron Foundries.—Before the War there were only some 20 iron foundries in Japan, but the difficulties experienced during the War in obtaining from abroad the large quantities of iron and steel required to meet the boom in industry resulted in the establishment of over 250 foundries before the close of 1919. In 1914 the output of pig-iron amounted to 302,000 tons and of steel materials to 283,000 tons. In spite of the slump in the iron industry which occurred after the Armistice, 613,000 tons of pig-iron and 553,000 tons of steel materials were produced in 1919. The total investments in iron foundries at the end of 1921 amounted to 350,000,000 yen. In the same year the working capacity of the ironworks was 1,412,000 tons of pig-iron, 1,033,000 tons of steel, and roughly 1,450,000 tons of steel materials; while the actual output amounted to less than one-half the capacity, *i.e.*, 556,531 tons pig-iron and 557,826 tons steel materials.

Machine and Tool-Making.—At the end of 1922 about 6,720 factories were engaged in various forms of machine-making; and also in many branches of metalwork and metalware. The manufacture of machinery for the production of electric apparatus and lamps, as well as the construction of dynamos, telephones, railway signals and measuring instruments, are practically new growths of the iron and steel industrial activity.

Dyestuffs.—The manufacture of dyestuffs was an untried industry in Japan prior to the War, and in 1913 no fewer than 6,000 tons of dyestuffs, valued at 8,000,000 yen, were imported for use in the cotton and silk industries. After the outbreak of the War the cessation of foreign supplies, chiefly derived from Germany, compelled Japan to make an effort to become, to some extent, self-supporting. In 1915 certain dyes were produced, the largest quantity being sulphuric black, then alizarin, acid blue and aniline salt. These were followed by yellow, red and blue acid, yellow and red direct, and purple, blue and brown basic colours. Early in 1916 the Government started and subsidised the Japan Dyestuff Manufacturing Co., which later succeeded in producing an artificial indigo, though only on a laboratory scale. By 1918 they were in a position to export Japan-made dyes, but within a short time foreign dyes reappeared on the market, apart from the German indemnity dyestuffs which arrived in May 1921. Though the *ad valorem* duty was raised to 35% in 1920, these foreign products almost strangled the infant industry. In 1923, 23 factories, with a capital of 13,565,500 yen, were in existence.

Chemicals.—The manufacture of chemicals in Japan does not owe its inception to the War, but its great development and the many innovations introduced were the direct result of War-time conditions. There was, however, a sharp decline in the prosperity of the chemical industry immediately after the Armistice. In 1916 the Government set up a subsidised company for the production of glycerine, and as the result of extensive investigations at the industrial institute into the qualities of seaweeds and vegetable ash, the production of basic chloridised alkali increased from 2,000 tons in 1913 to 10,000 tons in 1917. The match industry, which formerly derived chlorate of potash from European sources, by the end of 1917 was able to depend on the home supply, and gained an important place in export trade; but of late, owing to the advance in price of raw materials, and also the rise in wages at home, the industry has been beaten, chiefly by the Swedish match industry, especially as regards exports.

The soda industry, although it existed as long ago as 1880, did not reach a high standard of technical perfection before the War, and also failed to satisfy the total annual requirements in caustic soda, amounting to about 25,000 tons. During the War, however, the number of factories increased to about 20, and the annual production rose to 14,000 tons in 1918 and 20,000 tons in the following year.

Some of the chief products in the chemical industry are: sulphuric, hydrochloric and nitric acids, sodium sulphate, carbonate of soda, caustic soda, iodine, potassium iodine, potassium chloride, ammonium sulphate, acetic acid, acetone and wood spirit.

JAPAN'S FOREIGN TRADE

The rapidity with which Japan's foreign trade had developed, both in volume and extent, during the half-century preceding 1925 provides a remarkable record in commercial history. The total value of exports and imports, which in the first year of Meiji (1868) amounted to the insignificant total of 26,000,000 yen (£2,650,000), increased 10-fold in 1895, 100-fold in 1917, and 167-fold in 1920; and though

in the three following years it had shown a great decrease, the trade for 1924 again mounted to 4,260,623,000 yen.

Favourable Balance.—The most striking progress was made during the World War, when Japan's foreign trade leapt from 1,362 million yen (£139,000,000) in 1913 to 4,284 million yen (£438,000,000) in 1920; although it should be remarked that these figures do not correctly represent the proper rate of increase in the volume of trade, owing to the inflation of prices. In the very beginning the War reacted prejudicially upon foreign trade, as well as upon other branches of the country's commerce and industry, and the first appreciable effect of the War in increasing trade showed itself in the returns for 1915, when the adverse balance which had obtained for 20 years—with the exception of the years 1906 and 1909—was superseded by a favourable one. This favourable tendency was accelerated until the excess of exports over imports attained 371,000,000 yen (£38,000,000) in 1916 and 567,000,000 yen (£58,000,000) in 1917.

The sudden expansion of trade due to the War was occasioned both directly through the great demand by the Allied belligerents for munitions of war; and also indirectly through the temporary retirement of the great industrial Powers of Europe from the arena of world commerce and trade. Soon after the outbreak of the War Japanese goods—chiefly consisting of semi-manufactured and finished articles, such as cotton fabrics, leather goods, watches, silk tissues and so forth—found their way in large quantities not only to the established markets in the Far East, but also to various quarters of the world hitherto but little explored by Japanese traders, namely, the South Seas, South America and even Africa. The most conspicuous expansion, however, was effected in the exports to China and India, and, until the outbreak of the Russian revolution in 1917, large shipments of munitions of war and foodstuffs to Vladivostok for use in European Russia assisted to augment the volume of trade with Asia. The United States began to buy heavily in 1916, when the figures advanced from 204,000,000 yen (£20,900,000) in the preceding year to the substantial amount of 340,000,000 yen (£34,800,000) the goods purchased consisting mostly of raw silk, " habutai " (silk piece goods) cotton yarns, cotton fabrics and tea. British America and also Mexico increased their orders from Japan, and the South American trade showed such prospects as to induce Japanese companies to open shipping facilities to Brazil through the Straits of Magellan.

The import trade, which had been on the wane in the early days of the War, commenced to revive in 1916, owing to larger purchases of raw materials and semi-manufactured goods, such as raw cotton, iron, wool, crude caoutchouc, flax and jute. By far the largest volume of raw cotton came from British India, but the United States had doubled her exports of that article to Japan as well as of iron in a twelvemonth. Australia supplied Japan largely with wool.

An Adverse Balance.—The War was the cause of serious vicissitudes in 1917, and in a measure militated against the expanding trend of Japan's commerce. The entry of the United States of America into the War, with its attendant embargo on steel, iron and gold, temporarily disturbed the economic equipoise of the Far Eastern empire. The Russian revolution and the subsequent repudiation of all foreign liabilities by the Bolshevik commissaries introduced a fresh factor of discouragement in the export trade of Japan. The internal political feuds in China would also have dismayed Japanese exporters but for the tremendous appreciation in the price of silver, which resulted in maintaining an abundant demand for Japanese articles. But in spite of all, Japan's foreign trade made progress more or less on the lines previously indicated, until a complete change in the situation was brought about by the conclusion of the Armistice in the autumn of 1918. The demand for munitions of war naturally came to an end, but the rate of exchange on Europe continued at a high level. At home the cost of production had greatly increased owing to the advance in wages and the higher prices of industrial materials, while the enriched public demanded a higher proportion of the necessaries of life. An anti-Japanese boycott was proceeding in China to add to the curtailment of Japan's exports.

All these circumstances, reinforced by the Imperial ordinance of Nov. 1919 for the regulation of the price of commodities, temporarily exempting certain foodstuffs and industrial materials from import duties and restricting the exportation of cotton yarns, reversed the balance of foreign trade, which had been favourable to Japan for the preceding four years. This unfavourable tendency continued in succeeding years, showing an adverse balance of trade in 1920 as high as 387,780,170 yen. The Government had under consideration several suggestions as to the best method of bringing about an improvement in foreign trade, but, though no special steps were taken, there were prospects of improvement, owing to the certainty that the economic condition of the country was advancing little by little, and in view of the fact that the adverse balance of 1922 was only 252,856,414 yen—a decrease of 135,000,000 yen compared with the year 1920.

Unfortunately, however, the great earthquake of 1923 dissipated these anticipations, for, on the one hand, the export trade declined sharply owing to the burning of large stocks of raw silk, silk fabrics, etc., and the partial destruction of the productive capacity of cotton yarn, cotton fabrics and other articles usually so prominent among the exports; while, on the other hand, the volume of imports continued to increase, due to the abnormal increase in the demand for wool, woollen yarn, etc. Also, in order to facilitate the supply of goods after the earthquake, an Imperial ordinance was promulgated, providing for the suspension until March 31 1924 of import duties on rice, beef, etc., and for the suspension or reduction of import duties on certain other necessaries of life, tools, machinery and materials for construction and civil engineering, with the result that imports were stimulated.

Thus the excess of imports over exports in 1923 reached the huge amount of 534,479,850 yen. In 1924 the tendency became even more pronounced—the amount being 646,157,000 yen—and this in spite of the expiration of the ordinance just mentioned, and the introduction of a tax of 100% imposed from June 1924 on the value of certain luxury articles. The excess of imports was chiefly due to the purchase of materials necessary for reconstruction.

Foreign trade prospects in 1925, however, were considerably brighter, owing to the fact that fewer reconstruction materials were being imported, while the economic conditions of Japan were becoming normal again, and the " Buy Japanese goods " slogan was having effect. In the latter part of the year 1925 such an excess of exports over imports shown would counteract to a great extent the excess of imports over exports shown during the first six months of that year.

The following table gives the foreign trade of Japan for 1913–25, and the movement of coin and bullion:—

Foreign Trade (in 1,000 Yen)

	Merchandise		Gold and Silver Bullion and Specie	
	Exports	Imports	Exports	Imports
1913	632,460	729,432	27,093	1,021
1914	591,101	595,736	29,650	9,107
1915	708,307	532,450	44,566	24,297
1916	1,127,468	756,428	28,079	101,030
1917	1,603,005	1,035,811	153,736	392,225
1918	1,962,101	1,668,144	938	5,016
1919	2,098,873	2,173,460	5,054	327,477
1920	1,948,395	2,336,175	3,897	404,727
1921	1,252,838	1,614,155	..	138,622
1922	1,637,452	1,890,308	2,180	1,672
1923	1,447,751	1,982,231	5,466	196
1924	1,807,258	2,453,390	5	4,099
1925[1]	1,656,188	2,033,345	4,008	138

[1] Up to end of Sept.

Exchange.—The dollar rate, which dropped to $38.50 per 100 yen at the end of 1924, rose by the middle of April 1925 to $41.50, this being the highest figure during the first half of 1925. At the end of Nov. 1925 it stood at about $42.00. In the sterling exchange steady improvement was also perceptible, the rate having risen from 19¼d. in Jan. 1925 to 21 1/16d. per yen in the middle of Nov. 1925.

Distribution of Foreign Trade.—The geographical distribution of Japan's remarkable expansion in foreign commerce according to continents is as follows:—

Exports by Continents (in 1,000 yen)				
To	1913	1920	1923	1924
Asia	275,928	998,374	587,397	757,061
America	191,761	632,245	634,212	782,882
Europe	147,225	195,590	79,838	175,051
Australia	8,638	58,115	32,639	41,907
Africa	1,846	39,620	25,240	41,202
Imports by Continents (in 1,000 yen)				
From	1913	1920	1923	1924
Asia	348,055	942,547	814,470	998,603
America	127,035	910,648	546,832	721,325
Europe	220,290	305,318	437,457	581,091
Australia	14,943	62,459	96,623	119,971
Africa	7,189	88,449	22,716	22,072

In receipt of exports from Japan the United States of America (41%) has always headed the list, the zenith of purchase being reached in 1919—828,097,621 yen; China (including Kwantung Province) follows with 23%; and then come British India (7%), France (5%), Hongkong (4%). The percentages refer to Japan's export trade in 1924. Notable, also, are the advances of Australia, the Philippine Islands, Germany, Italy, Peru, Belgium and others in the scale of demand for Japanese goods.

As regards imports into Japan, British India, which had been the chief supplier for several years precedent to the World War, yielded her place to the United States in 1916. The import trade of Japan in 1924 was shared by the United States of America (27%), China (17%), British India (16%), England (13%), Germany (6%), Australia (5%), Dutch Indies (4%), Canada (2%).

The following tables show the development of Japan's foreign trade in the more important commodities:—

Principal Exports (in 1,000 Yen)

	1914	1919	1924
Silk (raw, waste, floss)	161,797	623,618	706,220
Habutai	30,890	101,289	57,368
Silk tissues	34,022	162,476	125,842
Cotton yarn	78,554	114,232	109,537
Cotton tissues	34,840	280,311	326,750
Woollen tissues	1,198	11,124	2,401
Hosiery	..	..	22,024
Braids	14,355	20,014	9,170
Matches	11,052	32,968	9,212
Copper	28,467	25,889	2,366
Coal	23,914	37,723	22,396
Potteries	5,913	22,629	25,435
Paper	2,826	25,402	15,582
Aquatic products	13,416	16,191	24,786
Tea	12,709	18,402	12,781
Refined sugar	12,382	21,627	28,967

Principal Imports (in 1,000 Yen)

	1914	1919	1924
Raw cotton	218,974	667,866	605,271
Wool	14,783	61,304	88,041
Woollen and worsted yarns	4,140	668	63,510
Woollen tissues	10,225	12,301	61,648
Oil cake	34,864	135,188	103,674
Iron	36,319	227,797	196,398
Sulphate of ammonium	15,145	27,435	26,543
Coal	6,690	18,588	29,057
Timber	1,490	10,889	129,076
Paper	4,886	18,386	27,360
Machinery	24,494	89,221	128,345
Rice	24,823	162,070	70,804
Sugar	21,678	58,183	63,849
Wheat	8,488	38,530	73,839
Beans and peas	13,320	35,302	60,877

Communications

Railways.—The first railway line in Japan was opened to traffic in 1872, subsequent development of the railway being chiefly in the hands of private companies. In March 1906 the railway nationalisation law was passed, and in the next two years the Government gradually assumed control of some 17 leading railway companies. On the completion of nationalisation the Government possessed 4,371 m. of railway, representing a capital of 700,000,000 yen. By the end of 1917 the process of absorption was practically complete. In the decade 1913–23 the mileage of the state railway system increased fron 5,473 m. to 7,013 m., and in the same period the number of passengers carried increased from 167,773,143 to 512,754,754. A marked advance was seen in the financial year 1918–9 in the receipts, which amounted to 104,135,074 yen, while in 1922–3 the receipts were 199,877,464 yen. A railway tunnel between Moji and Shimonoseki, under the Shimonoseki Straits, has been projected and its construction is expected to be started in 1927. This tunnel, which will be completely under the sea for one mile, will connect the island of Kiushu with Honshu on the mainland.

Posts.—The postal service of Japan has developed steadily, both in extent and efficiency, since 1908. There are three grades of post-office, known as first, second and third class. The first class is confined to the larger cities, such as Tokyo and Osaka, and these offices not only act as supervising offices for those of lower category, but also control maritime affairs in their respective districts. The great majority of the post-offices belong to the third grade, and are conducted on a contract system, which has proved eminently satisfactory. The post-offices in Japan include in their operations such diverse matters as the carrying, within limits as to size and weight, of every kind of freight, the collection of taxes and bills, the distribution of advertisements, and the paying of pensions and annuities on behalf of the national Treasury. The post-offices also undertake the business of state life insurance by a simplified process for the benefit of the middle and working classes. The expansion of the postal services is shown in the following table:—

Postal Service

End of fiscal year	Number of post-offices	Number of messages	Number of parcels
1909–10	6,946	1,464,557,721	20,281,823
1911–2	7,166	1,634,423,611	23,178,936
1913–4	7,268	1,798,716,674	25,370,165
1915–6	7,358	1,888,002,293	26,128,093
1917–8	7,647	2,362,802,401	33,243,648
1919–20	7,900	3,359,758,218	41,308,098
1920–1	8,025	3,815,527,979	43,322,650
1921–2	8,230	4,001,817,560	48,936,915
1922–3	8,477	4,126,958,030	51,355,991

The post-office savings bank was first inaugurated in 1875, and the rate of interest was raised from 4·2% to 4·8% in April 1915. The number of depositors increased from 11,882,069 on March 31 1913 to 27,057,867 in 1922, the deposits having advanced in the same period from 191,122,853 yen to 994,976,098 yen.

Telegraphs.—Since 1879 Japan has belonged to the International Telegraph Convention, and in June 1908 she ratified her membership of the International Wireless Union. The expansion of her home telegraph service has been noteworthy. In 1910, with a total of 3,951 telegraph offices, 101,500 m. of wires were in use and 28,205,032 messages were sent; in 1923 there were 6,460 offices, 156,662 m. of wires in use, and 71,592,928 messages were transmitted.

Wireless.—Japan associated herself with the International Wireless Union in 1908. In addition to the main wireless station of Funabashi, erected in Nov. 1916, Japan has 11 other Government stations, with a daytime transmission distance varying between 300 and 600 nautical m., the night distance being between 1,000 and 1,800 nautical miles. Two of these stations, Choshi and Osezaki, have been reconstructed and have a daytime transmission power of 1,500 nautical m., with 3,000 m. at night. In the twelve months ended March 31 1914 there were 36,313 wireless messages, and 172,853 in 1922–3.

Telephones.—When first inaugurated in Dec. 1890 the telephone service failed to attract many subscribers, but its popularity gradually increased. The authorities started in 1909 a system of giving preference for an installation in consideration of a payment varying between 150 and 285 yen, according to locality, and this system, which has been very successful, still obtains. The maximum annual charge for the telephone service is 66 yen and the minimum 36 yen, according to locality, and at the end of the fiscal year 1922–3 there were 415,058 subscribers and 3,988 telephone offices, besides 1,538 fitted with automatic apparatus. In the same period the length of telephone lines was 14,526 m., the length of wires 1,197,861 m. and the number of messages in the year was 1,933,759,123.

See *Japan Year Book* (annual, Tokyo); reports of the American Bureau of Commerce and of the British Department of Overseas Trade. (K. M.)

JAPANESE LITERATURE (*see* 15.168). *The Taisho Era.*—The glory of Meiji was, alas, not to be sustained. Whether the mistake lay with the old giants of the Meiji era or in the insufficiency of their sons it is impossible at this close range to decide. In the later years of the Meiji period it became obvious that the spirit animating the intellectual and literary leaders was dying; some of the old magic still clung to the name of the dynasty, but nothing more. The new writers lacked the capability for sustained effort, their works were spasmodically produced, and were often completely without style. There was an unrestrained crudeness about the new literature which horrified those who still remembered the early Meiji period.

The change was almost complete when the young men began banding themselves together into various associations, such as the "New Romanisation Society" (Shin Romaji Kai), the "Foreign Language Research Society" (Gaikokugo Kenkyu Kai), the "Japanese Script Society" (Nipponji Kai), etc. These unofficial organisations achieved very little, except of positive harm. Americanisms, cant and slang terms, undistinguished from "standard English," were imported freely and incorporated into novels, belles lettres and even scientific treatises. The free-verse writers of England and America must be held respon sible

for a peculiarly unpleasing form of composition which, while entirely foreign to the genius of the Japanese language, was adopted by the writers of this period in place of the *tanka* and *hokku* as the only possible style of poetic composition. The actual result of these liberal importations from foreign fields was the flood of ineffective and often vulgar books offered to foreign students as Japanese contemporary literature. While book-production was never so ample, it was never so uniformly devoid of merit.

The Meiji era translations of European classics and contemporary works, though marred by many faults of inexperience, are still to be preferred to later versions. Bacon, Shakespeare, Macauley, Milton, Byron, Shelley, Keats, Victor Hugo, de Maupassant, Dante, Heine, were all retranslated under this dynasty. The new translations are, however, far from being reliable. In many cases, whole sections of the original are left untranslated at the whim of the editor. Despite this, the character " zen " (complete) is found on the back of the book and on the title-page. This renders such versions useless for class-work or even for purposes of reference. In other cases, scenes which are purely national in the original work are recast, details being altered to suit Japanese surroundings. Thomas Hardy's novels suffer particularly in this unnatural transmutation: in one or two popular translations now in vogue Hardy becomes merely a mediocre Bakin leading some dull puppets over dreary Japanese marshes.

Russian Influence.—The outstanding literary feature of the Taishō era is the inundation of Japan by Russian works. Tolstoi ceased to be fashionable; Andreyev, Balmont, Sologub, Pushkin, Zinaida Hippius, Lermontov, Gogol, Tchekhov and Turgeniev held the imagination of youthful Japan during these years. Although no further impulse was needed, it was supplied by the signing of the Russo-Japanese Treaty early in 1925, when numerous societies for the encouragement of research into Russian literary and philosophic fields sprang into existence. Russian plays were hastily and imperfectly translated into Japanese (*The Cherry Orchard* was a noteworthy exception), and produced by Japanese actors at the Little Theatre in Tsukiji, Tokyo.

The modern native literature borrowed most of its colour and much of its form from Russia. Gogol, in his more dreary moods, was freely translated into novels of social life, and the sentimentality so characteristic of the true Japanese novelist becomes tinctured with a despair imported from the Siberian steppes. Arishima Takeo, an idol of the young reader in modern Japan, demonstrated this phase not only in his novels, but in his life and death. He was a married man, drawn by " misunderstandings " into an intrigue with a woman journalist (the " new woman " of his later novels). The truth of the affair was never revealed; in true dramatic fashion, Arishima and his paramour committed " *shinju* " (double suicide for love), in a house in an unfrequented country place. This happened in 1922, and it can be safely asserted that Arishima was more loved after his well-staged exit than he was during his lifetime. Obituary notices drew parallels between this successful writer and such dimly envisioned figures as Gogol and Andreyev. That the points of contact were more imaginary than real did not deter editors from flights of the wildest fancy as to the effect Arishima's death would have on Russia and the world generally.

The new-world treatment of women engaged the attention of writers of all classes, and political writers condemned the drastic changes proposed by the novelists. Women in Japan began to assert themselves, they emerged from the obscurity of feudalism into the open highway of competition with men. Journalism, government departments, politics, municipal undertakings, social work, all claimed the attention of intelligent women. Foremost, perhaps, not only of modern woman-novelists but of all since the days of Murasaki Shikibu is Mrs. Yayoi Nogami, wife of Nogami Toyoichiro, the greatest living Japanese authority on the classical drama (Nō), and translator of Bernard Shaw. A later novel of hers, *Kaishin Maru* (The Sea-god Ship), is justly esteemed above all contemporary works.

Notable Writers.—No account of modern Japanese literature would be complete without reference to certain writers who, in spite of their lack of real merit, have captured and held the popular imagination. Natsume Sōseki is chiefly remembered for his *Wagahai wa Neko de Aru* (I am a Cat) and *Botchan* (The Boy). He died before the full force of change induced by indiscriminate importation had been felt, and his work was modelled rather on the later Meiji style. " *The Two Kikuchi,*" as they were familiarly called (Kikuchi Kan and Kikuchi Yuhō), devoted themselves to the writing of novels in which women's problems are discussed and advanced views of social life are set forth. Kume Masao, Satomi Ton and Akutagawa Ryunosuke, also, in some measure gratified the current passion for original styles and exotic scenes. Kurata Hyakuso is regarded as the leading spirit of modern Japanese drama; one of his plays, *The Priest and his Disciples,* has been translated into English and published with the original text by Glenn Shaw (Tokyo, 1923). The sex-novel of Europe has its imitations in works by Tanizaki Junichirō and Morita Sōhei. Tanizaki writes very colloquially on the subject of hysterical women, psychoanalytic studies in the West providing him with unlimited material. Morita Sohei was once considered a very brilliant writer, his *Baien* (Sooty Smoke) being an exceptional success. It is an autobiography or diary of the new woman, and, from the Japanese point of view, Morita has solved the problem of woman definitely and finally. At the time of the issue of *Baien,* Morita's style became settled and followed closely the best traditions of mid-Meiji; this no doubt accounted later for his lack of popularity. He afterwards turned his attention to translations of Ibsen's plays, but his " originals " were English versions, and it readily appears from the Japanese that Morita frequently failed to understand the text he was translating. Ibsen's *Doll's House* (Morita's Japanese translation) was performed at the Imperial Theatre in Tokyo in 1923.

Matsuura Hajime was the only literary man of this period who remained true to the best traditions of his country's literary history. Unaffected by the many new movements for the development of art, letters and the drama, he is the foremost poet and essayist of modern Japan. In 1925 he resigned his professorship at the Imperial University in Tōkyō, " as a protest against the insincerity and shallowness of modern academicians, artists and writers, who would profane the shrine of pure art by setting up base images of foreign clay." He published two volumes of his university lectures on literature among his other writings, and it is probable that his works will be ranged alongside the best productions of the Meiji era by the literary historian of the future. In his *Bungaku no Byakkō* (The Pure White Light of Literature) Matsuura displays a sensitiveness and purity of ideal which had been lost to Japan since the close of the Nara period.

The constitutional ban on revolutionary and socialist doctrines resulted in the issue of a complete Marxian library and a series of handbooks purporting to be short cuts to Bolshevism. Imperfectly conceived dogmas were presented in attractive guise as the European panaceas: for all Japan's troubles there exists a very simple melting-pot, and this is a weird communism in which the state should be a machine very far removed from the activities of daily life. " Freedom " became the slogan of Young Japan, but the " freedom " publications are very pale shadows of their European parents, and even omit to define the freedom to which they relate. (A. N. J. W.)

JAQUES-DALCROZE, ÉMILE (1865–), Swiss composer and teacher of musical eurhythmics, was born at Vienna July 6 1865, of French-Swiss parents. He went to Geneva in 1875 where he attended the college and the university, and followed the courses at the Conservatoire. He then studied (1887) at the Conservatoires of Vienna and Paris and completed his musical education under Délibes. In 1886 he accepted the post of *chef d'orchestre* at Algiers. He then returned to Vienna and studied composition under R. Fuchs and A. Bruckner. After the death of Hugo de Senger, he directed the sol-fa and harmony courses at the Conservatoire of Geneva (1891). He has written

many charming songs, including *Chansons populaires*, *Chansons du coeur qui vole*, *Chansons de route*, etc. These are written in the simple form of the folk song and have obtained great popularity, not only in Switzerland, but in other countries. His other musical compositions are very numerous, and include three string quartettes, two violin concertos and several orchestral suites; also symphonies and choral works on a large scale such as *La Veillée* (1893) and *Le Festival Vaudois* (1903).

Among his other descriptive compositions may be mentioned: *Le violon maudit* (1893), *Janie* (1893), *Sancho Panza* (1897), *Le poème alpestre* (1896), *Le bonhomme jadis* (1905), *Les jumeaux de Bergamo* (1908), *Echo et Narcisse* (1912), *La fête de Juin* (1914), *Les premiers souvenirs* (1918), *La fête de la jeunesse* (1923), etc. His great work has been the development of the eurhythmic instinct, particularly in children, and since 1915 he has been the director at Geneva of the *Institut Jaques-Dalcroze*, which he originally founded at Hellerau in Bavaria. His method consists of a development of the instinct for rhythm in close conjunction with the sense of hearing and the instinct for tone, and is based on defined relations between bodily movements and the movements of sound. Special schools, based on the Dalcroze Method have been founded in London, Paris and elsewhere. The system may be studied in the following works by É. Jaques-Dalcroze: *Rhythmic Movements* (1920); *Rhythm, Music and Education* (1921); *The Importance of being Rhythmic* (1925); and *The Eurhythmics of Jaques-Dalcroze*, by various authors (1912). (*See* EURHYTHMICS.)

JASPAR, HENRI (1870–), Belgian politician, was born at Schaerbeek, Brussels, July 28 1870. While Minister of Economic Affairs in Nov. 1918, he organised the reconstruction of Belgian industries; becoming deputy for Liége in 1919. In 1920, having been appointed Minister of the Interior and afterwards Minister for Foreign Affairs, he endeavoured, during the Inter-Allied Conference in which he took part, to strengthen the entente between England, France and Belgium, and to secure reparations and security for his own country. In 1922 he negotiated a pact of security and guarantee with England; this, however, owing to the defeat of the French Govt., failed to come into operation. Belgium's entry into the League of Nations was due to the efforts of M. Jaspar, as also was her representation on the Permanent Court of International Justice at The Hague. In July 1921 he concluded an economic agreement between Belgium and Luxembourg and other commercial treaties. He took part in the Dawes Plan negotiations in 1924, but resigned as Minister for Foreign Affairs on March 11 on the rejection by the Chamber of the Franco-Belgian Convention. In May 1926 took office as prime minister and minister of the interior. (*See* BELGIUM.)

JASTROW, MORRIS (1861–1921), American Orientalist, was born in Warsaw, Poland, Aug. 13 1861, but went to Philadelphia at the age of five. Educated at the schools of that city and in the University of Pennsylvania, he studied subsequently at the Universities of Leipzig, Breslau, Paris and Strasbourg, returning in 1885 to the University of Pennsylvania as professor of Semitic languages and librarian. He died June 22 1921 at Jenkintown, Pa. He published numerous works on the religions and civilisation of Babylonia and Assyria, and, in connection with the World War: *The War and the Baghdad Railway* (1917); *The War and the Coming Peace* (1918); *A Gentle Cynic* (1919); *Zionism and the Future of Palestine* (1919).

JAURÈS, AUGUSTE MARIE JOSEPH JEAN (1859–1914), French socialist leader, was born at Castres, Tarn, Sept. 3 1859, of an old but not very prosperous local family. His ancestors on his father's side included two admirals, of whom one was ambassador to Spain and to Russia, and Minister of Marine. His mother's family included distinguished professors, of whom one was for a long time mayor of Castres. Jean Jaurès was of pure bourgeois stock. His father, a man of exceptional physique and of a lively intelligence, carried on at Castres various commercial activities, but without much method or practical sense. His mother exercised a real influence over her sons, and Jean had always a deep reverence for her. Her prudent intelligence and her good sense made her the true soul of the family and the educator of her children. A strictly orthodox Catholic, but without fanaticism, she inspired in her sons a respect for all sincere beliefs and opinions.

Jaurès began his studies at a private school; then, with his older brother, who became an admiral, he entered, thanks to a scholarship, in Oct. 1868, the college at Castres. He was a pupil of exemplary conduct and remarkable intelligence, devoted to his work, "le premier en tout." Mingling little in the rough games of his comrades, he possessed already that depth of serious gravity which he preserved all his life under the cloak of his natural liveliness and unfailing good humour. This "rare combination of high intellectual qualities" obtained for him a scholarship at the Collège Sainte Barbe at Paris, where he went in 1876. He was enabled thus to pursue his studies for two years at the Lycée Louis le Grand and to prepare himself for the entrance examinations of the École Normale Supérieure, to which he was admitted in 1878 with the first place. His career there was the most brilliant possible, and his fellow students, among them being Henri Bergson, predicted for him a great political future.

After having passed the "concours d'agrégation" Jaurès was elected, in 1881, professor of philosophy at the Lycée d'Albi. In 1883 he became lecturer in the University of Toulouse. But he had already set his mind upon a parliamentary career, although his mother did her best to dissuade him. At the legislative elections of Oct. 4 1885 he stood for the department of the Tarn and was elected deputy, heading the list with 48,000 votes. He was 26 years old. During the first two years of his term, he took little part in debates. His poetic and burning eloquence embarrassed parliamentarians accustomed to the so-called "britannique" eloquence of Clemenceau, Waldeck-Rousseau, Ribot, Pelletan, Freycinet and others. His maiden speech was delivered Oct. 21 1886 on a question relating to primary education. In 1887 he spoke three times; but the following year, more self-confident and more familiar with the peculiar atmosphere of the Chamber, he made numerous speeches, some of them very important, on the most diverse subjects, which he approached each time with an amazing competence and a constantly growing sense of authority. On every question with which he dealt, he adopted a courageous attitude which showed him incapable of sacrificing his principles to parliamentary compromise or to motives of self-interest. Without allying himself to any party, he devoted himself passionately to the public good and to the general welfare; but at the close of the session the meagre results of his efforts discouraged him so much that he decided to abandon politics, and asked to be reinstated in his post of professor at the University of Toulouse.

However, upon the insistence of his friends, Jaurès consented to stand for Parliament once more. Before dissolution, the Chamber had substituted the "scrutin d'arrondissement" for the "scrutin de liste" and Jaurès presented himself in the first district of Castres, which had long been in the hands of the reactionary parties. But on Sept. 22, at the first poll, he found himself in a minority of 856 votes though he himself had obtained almost 9,000.

In Nov. Jaurès resumed the professor's chair. His lectures were now thronged with students, workmen, middle class folk, other professors, men of science, men of learning. During this period he wrote his theses for the doctorate. His French thesis was entitled *De la realité du monde sensible*. In his Latin thesis he traced the origins of German socialism *De primis socialismi germanici lineamentis apud Lutherum, Kant, Fichte et Hegel*. About this time an ardent religious revival had stirred the imagination of many liberal minds. The questions thus raised were discussed by Jaurès in his lectures; but his robust and healthy rationalism resisted the tendencies of the day, just as later he opposed the vogue of pragmatism. An admirer of Renan, he would not admit dilettantism in matters of religion and the "subjectivism of faith" never had any attractions for him.

In the midst of the formidable labours which his personal work and the preparation of his lectures involved, Jaurès found time to comment regularly on topics of the moment in the impor-

tant local organ *La Dépêche*. There his ideas on politics and economics were seen to turn more and more towards Socialism, to which, at the close of 1890, he at last publicly announced his adhesion. At the same time, public life claimed him again. On July 27 1890 at a local election, he was chosen municipal councillor of Toulouse, and his colleagues appointed him forthwith deputy mayor, in special charge of public education. He took thus an important part in elevating the school of medicine into a faculty. After the strike at Carmaux, in the course of which he defended the claims of the miners, Jaurès was elected deputy, in 1893, at a local election, and his term of office was renewed at the general elections of 1894. Defeated again in 1898, he was re-elected in 1902; and his electorate remained faithful to him from that time on.

In Parliament, as soon as he returned, he assumed a position of great authority in politics. He took a large part in the debates on the Panama and Boulangist crises, in discussions of agrarian and colonial questions, on fiscal policy and protectionist measures, on syndicalism and the separation of Church and State, on military laws and electoral reform. In the Dreyfus affair his energetic intervention captured the Socialist party, which hesitated at first to take part in a conflict which seemed not to concern the proletariat. He carried on a formidable campaign in favour of the condemned and innocent man, a "living witness to military lies, to political cowardice, to the crimes of authority," nor did he cease until Dreyfus was definitely rehabilitated. His speeches and his articles on this affair are collected in one volume called *Les Preuves*, a masterpiece of analysis and eloquent logic.

Led by the logical development of his metaphysical and religious ideas to social conceptions which obliged him to accept the Socialist teaching, Jaurès adhered closely to the Socialist party, which at each new election gained a larger number of representatives in Parliament. But he realised at once that the fragmentation of Socialists into groups and sects would be a source of political weakness and an obstacle to the ideals of social justice and the liberation of humanity which he wished to attain. For him the "sublime joy of leading all men towards the fullness of humanity," lay in the effort to achieve these ideals. The socialism of Jaurès differs essentially from the Marxian doctrine, the principle of which is pseudo-scientific. "Our socialism," writes Jaurès, "is French in origin, French in inspiration, and French in character." His ultimate aim was harmony founded on justice. Social harmony implies the disappearance of an injustice which provokes conflicts, hatreds and their horrible consequences, an injustice originating in capitalist ownership. Jaurès was a socialist because "the domination of one class is an outrage against humanity." Into this doctrine he breathed his own glowing and generous ideas and, at the same time, drew from it the strength with which he animated it. "No serious social programme can be realised without a definite social doctrine," he wrote, and for him the whole socialist ideal must inspire organic reformatory action and thus establish a socialism, democratic, republican and lay.

All socialist sects have the same social ideal, but their differences in tactics and methods paralyse common action. Jaurès strove to bring about unification. At the Congress of 1901, a section of groups rallied to him under the name of the *parti socialiste français*, while the others formed the *parti socialiste de France!* After the Amsterdam Congress in 1905, the two groups coalesced and Jaurès became, in fact, their moral and intellectual chief. Thereafter his political activity was bound up with that of the unified Socialist party, whose parliamentary activity he directed with great skill. He drafted most of the resolutions at Socialist congresses and defended them in an admirably conciliatory spirit.

His philosophy of history, unlike that of Marx, did not hold that the development of human society is subject to a blind determinism; he postulated for it an intelligent directing force and an ideal wisdom. "History," he wrote, "although a phenomenon which develops according to mechanical laws, is nevertheless an aspiration to realise itself according to an ideal law. . . . The universe is but an immense, a vague, aspiration towards order, beauty, liberty." To conform to this aspiration, Socialism, according to Jaurès, should seek reform to bring about a less contradictory social order, whose institutions would be less exclusive, less bitterly egotistic, less mischievous, which would cease to perpetuate strife, hatred and want; which would permit men to pass from a state of brutal competition and conflict to the state of co-operation; which would transform the economic passivity of the masses into initiative and responsibility, in which social energies, instead of being wasted on sterile and insane conflicts, would be co-ordinated for common action. To uphold these convictions, Jaurès, after the Amsterdam Congress in 1905, struggled alone against the entire International for a share of power and for the preservation of the democratic-socialist *bloc*. He violently attacked and denounced as impotent the German Social Democracy which dominated the Congress and was supported by the old French Socialist organisations. On April 17 1904 Jean Jaurès, with Aristide Briand, founded *l'Humanité*, which has become the daily organ of the Socialist party. His daily leading article in it was written for the most part from his seat in the Chamber.

Jaurès early discerned the danger which threatened the world. He foresaw that the unstable equilibrium of the Triple Alliance and the Triple Entente was bound to end in a catastrophe, and he wished to avert it by the simultaneous international action of the proletariat. A passionate lover of France, he sought to spare his country the horrors of devastation by war. While he maintained that a democracy should not have an aggressive policy, he did not deny the duty of every nation to defend itself. To prevent misunderstanding between socialism and patriotism he wrote: "A nation which could not count, in days of crisis or when its life is in danger, upon the national devotion of the working class, would be a wretched thing indeed." He supported the policy of arbitration and all measures to secure international peace, but at the same time, in the name of the workers of France, he insisted "that the nation organise all its military forces, irrespective of class or caste, for the sole purpose of national defence." Against Germany, militarist and absolutist, stood France, a nation in arms, practising "a policy of supreme national defence which would lead not only to peace but to the assurance of peace." Jaurès expounded and developed his ideas on the organisation of "a nation in arms" in his book, *L'armée nouvelle*.

The policy of world-wide solidarity which Jaurès proclaimed was of no avail against the blind forces which precipitated the War, but Jaurès continued to strive for peace. On July 28 1914, before the outbreak of war, he, and some of his most eminent Socialist colleagues, went to Brussels to confer, in the name of the French Socialist party, with representatives of international labour on the best means of averting the threat of war, which he still thought could be avoided. But he was none the less full of anguish over the fate of France, compelled to defend herself against aggression. On this subject, he certainly felt no hesitation, for he had always been animated by the purest patriotism.

"Il y a un groupement historique qui s'appelle la France, qui a été constitué par des siècles de souffrances communes, d'espérances communes; les lentes formations monarchiques en ont peu à peu juxtaposé et soudé les morceaux, et les ardentes épreuves de la Révolution l'ont fondu en un seul métal. C'est la patrie française . . . Oui, il y a des luttes, des antagonismes profonds de classe. Mais quels que soient ces luttes politiques, ces divisions économiques, ces antagonismes sociaux, ils ne peuvent pas porter atteinte à l'idée même de la patrie. . . . Si notre patrie est menacée . . . nous serions des premiers à la frontière pour défendre la France dont le sang coule dans nos veines, et dont le fier génie est ce qu'il y a de meilleur en nous."

These noble words leave no doubt as to the attitude which Jaurès would have taken, or of the rôle which he would have played in the "holy war for our beloved France if ever she were attacked." But on the very eve of mobilisation, in Paris, on July 31 1914, at 9:40, Jaurès succumbed to the bullets of an assassin—a wretched half-wit, impelled to this stupid crime by the calumnies of the adversaries of the great tribune. His obsequies were celebrated on Aug. 4 in the midst of an immense

popular gathering, and his body was interred at Albi. In 1925 his mortal remains were brought back to Paris, and, borne on the shoulders of his faithful miners of Carmaux, deposited in the Panthéon. (Ed. He.)

JEBAVÝ, VÁCLAV (1868–), Czech poet universally known as Otakar, Březina, was born at Počátky, Bohemia, Sept. 13 1868. After an education in science he became a secondary school teacher in Southern Moravia, where he lived a life of contemplative seclusion, declining the honours and material advantages offered him by the Government. His published works consist of five books of poetry: *Secret Distances* (1895); *Dawn in the West* (1896); *Polar Winds* (1897); *Temple Builders* (1899) and *The Hands* (1901), and a volume of prose essays, *Music of the Springs* (1903); besides a number of poems scattered in various literary papers.

Březina is admittedly the greatest modern Czech poet, and is even judged by some foreign critics to be the greatest mystic poet of all nations. His development as a mystic philosopher and religious visionary passed from the subjective pessimism of his early poems, through a transcendental revelation of mystic realities, to an evolutionary optimism and a joyful belief in cosmic brotherhood. His art manifests an analogous development from an intimate lyrical impressionism through ecstatic incantations of a high-priest and a seer to an impersonal, super-personal, dythyrambic poetry of the elements, suns and stars, and of human effort, suffering and mystic destiny. His diction is so concentrated and pregnant with thought that it presents considerable difficulty at first reading; but this is more than compensated for by the superlative beauty and entrancing music of his verse, the remarkable wealth of his imagery and the extraordinarily human and personal appeal of his philosophy which has its roots in the mystic tradition of the medieval Czech religious sects. He brought Czech poetical language to a stage of perfection which it had never before attained and which is difficult to surpass.

See Paul Selver, *Anthology of Modern Slavonic Literature* (1919); *Modern Czech Poetry* (1920), and *A Study in Czech Literature* (1921). (J. Cl.)

JELLICOE, JOHN RUSHWORTH JELLICOE, 1st Earl (1859–), British Admiral, was born Dec. 5 1859, the son of J. H. Jellicoe, a captain in the mercantile marine. His great-grandfather was Sir James Whalley Smyth Gardiner, the third and last baronet of that name. Educated at Rottingdean, he entered the navy as a Naval Cadet at the age of thirteen. He obtained his commission as sub-lieutenant in 1880, and his hard work and marked ability won him three first class certificates in his three examinations for the rank of lieutenant. He soon developed a strong interest in gunnery and joined the Royal Naval College in 1883 for the theoretical part of the course for gunnery lieutenant, where he distinguished himself by winning a special £80 prize. The following year he spent in H.M.S. "Excellent," and became a fully qualified gunnery officer. From now onwards gunnery was his speciality, though his interests were by no means confined to this branch.

His first sea-going ship as a gunnery lieutenant was H.M.S. "Monarch," in which he served from 1886 to 1888. During his first year on board he went to the rescue of the crew of a stranded steamer, taking charge of a gig, manned by volunteers. The boat upset in a heavy sea and he and the crew saved themselves with difficulty. He received the Board of Trade silver medal for his plucky effort. After two years on the senior staff of the Gunnery School, he was appointed to the Admiralty as an assistant to the director of naval ordnance. In 1893 he was promoted to commander, and shortly afterwards was appointed to H.M.S. "Victoria," flagship of Admiral Sir George Tryon, commander-in-chief of the Mediterranean Fleet. When the "Victoria" was rammed and sunk by the "Camperdown," Commander Jellicoe had to take to the water. As he was seriously ill at the time he would have fared badly but for the support he received from a young naval cadet, Mr. P. D. Roberts-West, until rescued.

Commander Jellicoe soon recovered and two months later was appointed to the battleship "Ramillies" which flew the flag of the new commander-in-chief, Admiral Sir Michael Culme-Seymour. After a three years commission in that ship he was promoted to captain on Jan. 1 1897, and served on the Ordnance Committee. In 1898 he was appointed to the command of H.M.S. "Centurion," where he became flag captain to Admiral Sir Edward Seymour, commander-in-chief of the China Station. As the latter's chief of staff he took part in the expedition to relieve the legations in Peking during the Boxer rising in 1900. During these operations Captain Jellicoe was badly wounded. He was subsequently awarded the C.B. for these services.

Service at the Admiralty.—He returned to the Admiralty in 1902 to be the naval assistant to the controller (Third Sea Lord). Here he acquired an insight of the work of that department which was to be of great value to him later. In Aug. 1903 he went to sea again to take command of the fine armoured cruiser "Drake" for a year. The year 1905 saw him in the responsible post of director of naval ordnance at the Admiralty. During his period of office he did much to further the advance of long range firing and to assist the development of naval gunnery on lines which more closely approximated to the real conditions of war. Towards the end of his time he reached the top of the captains' list and was promoted to flag rank in Feb. 1907. In Aug. of that year he hoisted his flag afloat in H.M.S. "Albemarle" as rear-admiral in the Atlantic Fleet. The appointment was for a year's duration only, when once more he returned to the Admiralty, this time to become a member of the Board as Third Sea Lord and Controller of the Navy. In Dec. 1910 he was appointed acting vice-admiral in command of the Atlantic Fleet, being confirmed in that rank in the following November. At the end of the year he transferred his flag to H.M.S. "Hercules," on appointment to the command of the 2nd Division of the Home Fleet.

In 1912 important gunnery experiments were carried out by two battleships of this division, the "Thunderer" and "Orion," the former being fitted with this system of director firing which Sir Percy Scott had been perfecting. The trials culminated in competitive firings which took place under Admiral Jellicoe's personal supervision. It was as a result of these practices and largely due to Admiral Jellicoe's insistent pressure that this most valuable system was adopted as the primary one for laying and firing the guns of practically all classes of H.M. ships. The event may be regarded as yet another milestone on the path of that gunnery progress for which he was greatly responsible. After a year in this command he returned to the Admiralty to rejoin the Board as Second Sea Lord.

The War Period.—He left Whitehall temporarily in 1913 to become commander-in-chief of the "Red" fleet during manoeuvres, flying his flag in H.M.S. "Thunderer," but had returned to the Admiralty, when, on the eve of War, he was sent to join the Home Fleet at Scapa as second in command. The period of command of Admiral Sir George Callaghan was due to expire in a few months and Vice-Admiral Jellicoe had already been designated as his successor. When war could no longer be averted, it was considered desirable that the change in this most responsible naval command should not be delayed and Sir John Jellicoe was appointed commander-in-chief with acting rank of admiral. He had to perform a peculiarly difficult and trying duty in relieving his former chief, who was trusted and respected in an unusual degree throughout the fleet. That he achieved it so successfully was due to the chivalrous attitude of these two flag officers towards each other and to the very high reputation and strong personal regard which Sir John himself enjoyed.

Admiral Jellicoe was confirmed in his rank in March 1915, and for two years bore the exceptionally heavy burden of organising and training the Grand Fleet and keeping it ready for battle. His great command was put to the test at the battle of Jutland. Now that the full details of that action are better understood, the skilful handling of the British forces against an elusive enemy in conditions of low visibility and approaching darkness, is being increasingly appreciated. The German fleet escaped at night and took refuge in harbour with many ships severely damaged, and such was the impression left by Jutland that Germany

never again risked a meeting with the Grand Fleet. The fruits of Admiral Jellicoe's leadership on that day and of his incomparable services throughout his period of command were seen in the historic surrender of German ships at the end of the War.

In the latter part of 1916 Admiral Jellicoe was invited to become First Sea Lord and regretfully left his last and greatest command afloat to take up that appointment. It was largely due to his tireless labours and wide experience that the grave danger of the German submarine menace was eventually overcome, although others reaped where he had sown. He left the Admiralty at the end of 1917. After the Armistice he was sent on a special mission to visit the Dominions and advise on the post-War organisation of their navies. On this tour he flew his flag in H.M.S. "New Zealand." He was promoted to Admiral of the Fleet in 1919 and the following year was made Governor of New Zealand. During his four years in this high office he greatly endeared himself to the people of that Dominion.

For his services in the War Admiral Jellicoe received the thanks of Parliament and a grant of £50,000, and at the end of 1918 he was raised to the peerage as Viscount Jellicoe of Scapa, subsequently taking the additional title of Viscount Brocas of Southampton. On his return from New Zealand and in recognition of his services as governor he was, in 1925, created an Earl. He received the K.C.V.O. in 1907, G.C.B. in 1915 and G.C.V.O. in 1916; he also holds a number of foreign orders. He married, in 1902, the daughter of Sir Charles Cayzer, Bart., and has four daughters and a son and heir, Viscount Brocas, who was born in 1918. Earl Jellicoe possesses in remarkable degree the power of inspiring others with his own loyalty and singleness of purpose. Few naval commanders since Nelson's time have enjoyed such devotion and confidence as he did as commander-in-chief of the greatest fleet that ever set forth to do battle. (E. A.*)

JELLINEK, GEORGE (1851–1911), Hungarian jurist (*see* 15.315), died at Heidelberg, Jan. 12 1911.

JENA, UNIVERSITY OF (*see* 15.315).—In 1910 the number of students was 1,946 and in 1925 it had risen to 2,153, when it had 271 foreign students, of whom 69 came from Latvia and 49 from Russia. The faculty of medicine is specially attractive to foreign students. The university library possesses 325,000 volumes and a large collection of pamphlets.

JENSEN, JOHANNES VILHELM (1873–), Danish author, was born at Farsö, North Jutland, Jan. 20 1873, of a family of peasant extraction. He studied at the University of Copenhagen and afterwards travelled extensively, writing a number of novels, sketches, essays and letters of travel and some volumes of poetry. Jensen belongs to the new school of Danish literature which came into being about 1900. Influenced by Whitman, Kipling and H. C. Andersen, he repudiated the Brandes school with its imitation of French literature and wrote of nature and outdoor life. Among his novels may be mentioned: *Kongens Fald* (1899–1902), a historical novel of the 16th Century; *Madame d'Ora* (1904); and *Den lange Rejse* (1908–21) describing the evolution of the Northern race from the glacial epoch to the time of Columbus. In *Himmerlandshistorier* (1898–1910); *Skovene* (1904); *Eksotiske Noveller* (1907–15) and *Myter oš Jagter* (1907–24) he described life and scenery in his native country and abroad with brilliant imaginative talent and mastery of language. Jensen, who became a firm believer in evolution, adopted in later years a purely atheistic and biological view of life. See Otto Gelsted, *Johannes V. Jensen* (1913).

JENSEN, WILHELM (1837–1911), German author (*see* 15.321), died near Munich Nov. 24 1911. His last work was *Fremdlinge unter den Menschen* (1911). See W. Barchfeld, *Wilhelm Jensen als Lyriker* (1913).

JERSEY CITY, N.J., U.S.A. (*see* 15.331), produced 5,000 different kinds of articles in its 1,325 industrial plants in 1925. Because of the diversity of its industries and the staple character of their products, Jersey City was less affected by the War than some manufacturing cities, and suffered less in the succeeding depression. The aggregate value of manufactures rose from $125,775,000 in 1909 to $374,183,000 in 1919; and then, after falling to $289,796,274 in 1921, rose again to $313,999,142 in 1923. The average number of wage earners in factories for the same years was 25,454; 36,981; 30,026; 33,264.

The most important new industry is the manufacture of radio apparatus and supplies, for which several plants were established in 1924 and 1925. The population in 1910 was 267,779; in 1920, 298,103, including 8,000 negroes and 76,294 foreign-born (a slight decrease), of whom 14,855 were Italians, 12,451 Irish, 12,145 Poles and 11,113 Germans. In 1925 the official estimate was 315,280. A development plan, prepared about 1920, provides, among other engineering improvements, for the construction of a bulkhead across a part of Newark Bay, by which one square mile of territory suitable for industrial sites will be added to the area of the city. By improvements in the fire department, the city secured a rating in class A for fire insurance. Boyle's Thirty Acres, widely advertised as the largest arena in the world, was opened in 1921. The opening of the Hudson Tubes (1909) gave some impetus to building in the residence section on "the hill," which was thereby brought within eight min. of the financial district of New York. The completion of the double-tube vehicular tunnel in 1926 makes the connection still closer. The commission form of government was adopted in 1913.

JERUSALEM, Palestine (*see* 15.331), is now the seat of the Government of Palestine under the mandate given to Great Britain in July 1922 and the chief town of its province. A large hospice outside the Jaffa Gate, which was built and endowed by the German Empress in 1910, is used as Government House. The population in 1922 was 62,678, of whom 33,971 were Jews. An Armenian Patriarch was elected in 1921 with the formal approval of King George, and the position of the Orthodox Patriarch of Jerusalem has been confirmed by a commission appointed by the British administration.

On Dec. 9 1917 Gen. Allenby made an unostentatious entry into Jerusalem. Military administration was carried on until 1920, when a civil administration with an advisory council was set up. Since 1917 much good work has been done in the city, which under the Turkish régime was squalid and filthy. The streets are scavenged and thoroughly cleaned, and work has been begun on a drainage system. The old and inadequate water supply from Solomon's Pools has been replaced. The ancient aqueduct leading from the springs of Birket-el-'Arub, 14 m. distant, to Solomon's Pools has been cleared, and is used in part to lead the water to a large reservoir, whence it is distributed by gravity to Jerusalem. There is a second reservoir at Lifta, giving a total supply of 150,000 gal. daily. Since the completion of the installation the amount of water used in Jerusalem has increased tenfold. A town plan and civic survey have been made and several garden villages in the neighbourhood designed. The houses have been numbered and the streets named; some roads have been widened, and in 1924 King George V. avenue was opened. Laws have been promulgated against large shop signs and advertisement boardings, a chamber of commerce has been formed and a telephone system installed.

Roads fit for motor traffic all the year round have been made to Jaffa, Jericho, Hebron and Damascus. There is, however, no longer through railway connection with Cairo, as the swing bridge over the Suez Canal at El-Qantara was removed in 1920 at the instance of the Suez Canal Co., and the canal has to be crossed by ferry. The Government department of antiquities, founded soon after the establishment of the British administration, has the archaeological schools of the different nations under its control, with the assistance of an advisory board of representatives from the schools. Previously all antiquities found their way to Constantinople, but over 6,000 specimens have now been catalogued as a nucleus of a Palestine museum at Jerusalem. Excavating is only permitted to recognised scientific bodies.

Much good work has recently been done by the Palestine Exploration Society. The citadel has been cleared of débris and modern accretions, as also the Cotton Bazaar; the ornate clock tower on the Jaffa Gate has been removed and re-erected, shorn of its trimmings, in Allenby square, and the walk on the ramparts in part reinstated. Important excavations on Mount

Ophel have also been recently carried out by the society, following earlier efforts on the site in 1909–11 and 1913–4. Remains have been found of the north wall and tower of the Jebusite fortress, which was conquered by King David and formed the site of his city; and it is hoped to discover his tomb. In 1920 the ruins of a 4th-century church of much interest were discovered by Franciscan friars in the course of digging foundations for a church in the Garden of Gethsemane, and its excavation was completed by the Dept. of Antiquities. In 1921 the ancient school of St. Etienne, founded by French Dominicans, became the headquarters of the French Archaeological Society. The foundation stone of a Hebrew university was laid in 1918 on Mount Scopus, but until 1924 there was no teaching organisation. An institute of Jewish studies was started in that year, and in April 1925 the university was formally opened by Lord Balfour. The foundation stone of an institute of physics and mathematics was laid the day after the opening of the university.

JERUSALEM, UNIVERSITY OF.—The idea of creating a university in Jerusalem was first put forward in 1882 by Dr. Schapira, *Privatdozent* in mathematics in Heidelberg. After preliminary steps it was approved by the 11th Zionist Congress in 1913, and a committee of the congress purchased a site on Mt. Scopus (near the Mount of Olives) in 1914, the foundation stone was laid in 1918 by Dr. C. Weizmann, the president of the Zionist organisation, and the university was formally opened by Earl Balfour on April 1 1925. The object of the university was twofold; to carry out research in all departments, and teaching especially in the departments of Jewish and Oriental Studies, for which the university should be a world-centre. Departments of chemistry including physical chemistry, microbiology and Jewish studies are in existence, and there is an important agricultural research institute at Tel-Avio in connection with the university. The library already contains over 120,000 volumes and the estimated recurring expenditure for 1926 is £45,000. The scientific research is especially directed with a view to the material development of Palestine. See *The New Palestine* (New York) for March 27 1925.

JESPERSEN, JENS OTTO HARRY (1860–), Danish philologist, was born at Randers, Denmark, July 16 1860. He graduated in modern languages at the University of Copenhagen in 1884 and gained his doctor's degree in 1891 by a thesis on English laws. In 1893 he was appointed professor at the University of Copenhagen. From 1909–10 he lectured at Columbia University, New York. He produced a number of books on English grammar, the history of language, general phonetics and the philosophy of language, many of which were written in English. A practical philologist, Jespersen's view of the development of language was influenced by Herbert Spencer and Wilhelm Ostwald. His most important works are *Progress in Language* (1894); *Phonetics* (1897–9); *Growth and Structure of the English Language* (1905, Prix Volney, 1906); *Lehrbuch der Phonetik* (1913); *Language, its Nature, Development and Origin* (1922); *Philosophy of Grammar* (1924).

JESUS CHRIST: *see* BIBLICAL CRITICISM; CHRISTIANITY.

JEWISH LITERATURE: *see* HEBREW LITERATURE.

JEWS (*see* 15.371).—The Jewish population of the world on the outbreak of War in 1914 may be estimated at about 14,900,000. Of these, two-thirds were concentrated in eastern and south-eastern Europe, including (in round figures) just under 7,000,000 in Russia, 2,250,000 in Austria-Hungary and nearly 250,000 in Rumania. Of the remainder, about two-thirds lived in the United States, which had a Jewish population of close on 3,000,000, leaving a balance of about 1,500,000 for other parts of the world. There were about 600,000 Jews in Germany, and about 500,000 in the British Empire, including 250,000 in Great Britain and Ireland.

I. THE PRE-WAR PERIOD

Events in Russia.—In the years immediately preceding the World War, the condition of the Jews in Russia went from bad to worse. The legal restrictions by which the Jews were harassed were vigorously enforced and in some respects made still more burdensome. In 1910 there was a round-up of Jews in Kiev. Jewish houses were systematically raided by the police, and hundreds of families, who were unable to prove their right of residence, were abruptly expelled. The expulsions continued in 1911–2 and were extended to other cities in which only privileged Jews were permitted to reside—notably Moscow, St. Petersburg and Kursk—as well as to a large number of villages in various parts of the pale of settlement, where the government's policy was to confine the Jews to the towns.

During the same period further disabilities were imposed on the Jews in the sphere of education. In 1910 the percentage rule, which limited the number of Jewish pupils to a fixed proportion, was extended to schools of surgery and dentistry and to the schools of painting and architecture in the St. Petersburg Academy of Fine Arts. The percentage rule was even applied to the Jewish secondary schools, which had hitherto been exempted as private institutions. As a result promising young Jews and Jewesses, who found higher education out of their reach in Russia, began to leave the country in increasing numbers to pursue their studies abroad. A third line of attack was marked by what was known as the "scheme for the Russification of commerce." This scheme, designed to drive the Jews out of Russian trade, was launched during the premiership of M. Stolypin. M. Kokovtzeff, who succeeded M. Stolypin in 1911, viewed it with misgiving, but the anti-Jewish forces were too strong for him and, though never formally approved by the Govt. or the Duma, the scheme was put into practical operation, existing restrictions being used to cripple public companies under Jewish management and generally to discourage Jewish commercial enterprise. In Russian Poland the Jews also suffered severely from an economic boycott organised by the Warsaw Nationalists, whose candidate for the Fourth Duma was defeated by Jewish votes at the election of 1912. At Easter, 1911, a Christian boy was killed at Kiev. The anti-Semites at once accused the Jews of ritual murder, and a Jew named Beilis was arrested. Beilis was kept for more than two years awaiting his trial which ended in Nov. 1913 in his acquittal.

In the Third Duma a bill for the abolition of the pale of settlement received a considerable measure of support, while the Fourth Duma also contained liberal-minded elements. But though the Jews were not altogether friendless, their position grew worse rather than better. The Govt. remained fixed in its determination to crush them, and Jewish life in Russia presented a picture of almost unrelieved gloom.

Jews in Southeast Europe.—In Rumania the Jews were subjected to much the same treatment as in Russia. In one respect their position was even worse. Jews, as such, were deemed by the Rumanian Govt. to be aliens, even though they were native-born and had no claim to any other nationality. As a sequel to the Berlin Treaty of 1878, under which the Powers recognised her independence, Rumania undertook in 1880 to give the Jews liberal facilities for naturalisation. Had this pledge been fulfilled, their status would have been gradually regularised, but the spirit in which it was carried out is shown by the fact that between 1880–1913, about 200 Jews were actually naturalised out of a Jewish population, mainly native-born, of over 200,000. The Rumanian declaration of war on Bulgaria in 1913 brought 15,000 Jewish reservists to the colours. This produced a certain revulsion of feeling and it looked for a moment as though at last the Jewish soldiers would now be naturalised *en bloc*. A few individual applications were granted, but the anti-Jewish forces soon regained the upper hand, and the elections of 1914 brought into power a reactionary Govt. from which Jews had nothing to hope.

In Austria-Hungary the Jews were subject to no legal disabilities. In 1912–3 there were various affrays between Jewish and German or Polish students at the universities of Vienna, Czernowitz and Lemberg, but these incidents, though symptomatic, were in themselves of no great consequence. In Morocco the Jews suffered severely from an outbreak of disorder in 1912, when mutinous troops of the Sultan's army sacked the Jewish quarter at Fez, 60 Jews being killed and many severely wounded. A considerable number of Jews were affected by the territorial

changes resulting from the Balkan Wars of 1912–3, and more especially by the transfer of Salonika from Turkey to Greece. Among the 200,000 inhabitants of Salonika there were about 90,000 Jews, who played a predominant part in its commercial life. Though the Greek Govt. gave satisfactory assurances, the change of sovereignty was viewed by the Jews with misgivings which have proved not altogether unfounded.

As a result of the conditions prevailing in Russia and Rumania, Jews continued to emigrate overseas in large numbers. Some of them settled in Palestine, where Jewish colonisation was making gradual progress with the support of Baron Edmond de Rothschild and under the inspiration of the Zionist Movement The great majority, however, made their way to the United States, where 495,459 Jewish immigrants were officially recorded in the five years 1910–4 (*see* MIGRATION).

II. EFFECTS OF THE WAR

The War completely changed the face of the Jewish world. In the Russian Empire it brought the Jews political emancipation, but it also brought them unspeakable suffering and ended by submerging them in the flood of anarchy which followed the collapse of orderly government. As a result, the influential Jewish community in the United States increased to 3,600,000 persons. Finally, the War led up to the Balfour Declaration, which foreshadowed the establishment under international guarantees of a national home for the Jews in Palestine.

Eastern Europe.—The crowded Jewries of eastern Europe felt the full impact of the War from the outset. The Russian pale of settlement became almost at once a theatre of operations. So, too, did Galicia, with its poverty-stricken Jewish population of over 800,000. The Jews were bound in any case to suffer in common with their neighbours, but their miseries were aggravated by wholesale deportations. Within a year of the outbreak of war, nearly 1,500,000 Jewish refugees had been set adrift. To make matters worse, the Polish Nationalists vigorously pursued their vendetta against the Jews and revived the boycott which began in Warsaw in 1912. So pitiful was the condition of the Jews that the Russian Govt. which had already made substantial grants to the Petrograd Jewish Relief Committee, eventually issued, as a temporary measure, a decree permitting the Jews to reside freely in any of the towns of the Empire, with certain specified exceptions, of which the most important were Petrograd and Moscow. This decree was dated Sept. 3 1915. The concessions thus granted gave the Jews some relief, though its effect was minimised by the illiberal spirit in which it was administered.

Public opinion was ripe for much more sweeping reforms. Of this there was ample evidence in the friendly welcome which the Jewish refugees received from their Christian neighbours in their new homes, in the action of a number of important public bodies who petitioned the Govt. in favour of the emancipation of the Jews, and in the protest of many enlightened Russian patriots against a policy which they regarded as detrimental to Russian interests and inconsistent with the spirit of unity which the national crisis demanded. But the reactionary traditions of the old régime were too powerful. Nothing was done for the Jews in 1916, and the inquiries of other Allied Govts., which were sympathetically interested in their case, showed that they had nothing to hope for.

It was not until the revolution of 1917 that their emancipation became a possibility. The Jews whole-heartedly supported the revolution, and one of the first acts of the Lvoff Govt. was to issue a decree, dated April 3 1917, for the repeal of "all restrictions of a religious and national character." This decree at one stroke relieved the Jews of all disabilities, and it only remained for them to take their place in the new Russia. There was much discussion in Jewish circles as to what that place should be, and there was a strong feeling in favour of what was called national autonomy, the suggestion being that the Jews should be recognised as a national unit and enjoy, in common with every other nationality in Russia, a limited measure of self-government.

The Jews had hardly been emancipated before these dreams were rudely shattered by the seizure of power by the Bolsheviks. Among the Bolshevik leaders and their satellites were a certain number of Jews, none of whom, however, played any part in the Jewish community, or had any ties with it beyond their Jewish birth. The great majority of the Jews sided with the moderates and suffered accordingly under the Soviet régime. The communal organisations were broken up, and many of their leaders were imprisoned. Living, as most of them did, by trade, the Jews suffered severely from the economic débâcle which the Bolshevik revolution brought with it, and to add to their distress it became increasingly difficult to send them relief from abroad.

In Rumania the conditions of the Jews remained as deplorable as ever, though they did not suffer from the War in the same degree as in Russia. On May 11 1917, representatives of the committee of native Jews were received by the King, who gave them vague but encouraging assurances. There, however, the matter ended and nothing was done for the Jews until a limited measure of emancipation was dictated by the Germans in the Treaty of Bucharest. The relief thus granted was of little practical value, and there was no change in the policy of the Rumanian Govt., which continued to harass the Jews and treated them with exceptional harshness in the occupied province of Bessarabia.

United States.—As already stated, one result of the disruption of Jewish life in eastern Europe was that the centre of gravity tended to shift to the United States. An American Jewish relief committee, later incorporated in the joint distribution committee, was founded in 1914 and took the lead in organising relief work among the Jews in the stricken areas in eastern Europe and elsewhere. The funds raised for this purpose in the United States during the War and the post-War period are stated to have reached a total of $60,000,000. American Jewry was also active in the defence of Jewish rights in eastern Europe, though in this field at least an equally prominent part was played by the English Jews, who also contributed considerable sums for relief work. At the same time, the American Jews began to play a part of growing importance in the Zionist movement, and were concerned in the negotiations leading up to the Balfour Declaration, of which President Wilson was a consistent and influential advocate (*see* ZIONISM).

III. THE JEWS UNDER THE PEACE TREATIES

The territorial changes which followed the War closely affected the Jews of eastern and southeastern Europe. Two-fifths of them were taken over by Poland, which had more than 3,500,000 Jews among its 27,000,000 inhabitants. About 250,000 Jews were included in Lithuania, about 100,000 in Latvia and about 8,000 in Estonia. Only 3,000,000 Jews remained under Russian rule, as compared with about 7,000,000 in 1914. Of these, two-thirds were in the Ukraine. About 350,000 Jews were left in Austria and about 500,000 in Hungary, as compared with about 2,250,000 in the former Austro-Hungarian Empire. Of the remainder, about 350,000 passed to Czechoslovakia, while as a result of the annexation of Transylvania and the Bukowina, together with the Russian province of Bessarabia, Rumania increased her Jewish population from a little over 200,000 to more than 1,000,000. These changes of allegiance were in themselves not necessarily for the worse, but they involved the disruption of old-established communities and broke them up in fragments, each of which had at once to reorganise its internal life and establish a *modus vivendi* with new and in most cases none too friendly rulers.

The Peace Conference.—It was in these circumstances that the Jewish problem was brought to the attention of the Peace Conference. It presented itself in a twofold aspect. The Allies had already undertaken to facilitate the establishment of a national home for the Jews in Palestine. This undertaking held good, but it was none the less necessary to define and safeguard the rights of the Jewish minorities in eastern and southeastern Europe. As to what those rights should be Jewish opinion was divided. The east European Jews themselves, speaking through their representatives on a body known as the committee of Jewish delega-

tions at the Paris Peace conference, demanded the recognition of the Jews in the succession states as "national minorities" enjoying a substantial measure of self-government. This view was supported by the Jewish delegates from the United States but was opposed by those from Great Britain and France, who limited themselves to a programme of "minority rights" not implying the creation of anything in the nature of a state within the state.

This more moderate claim was eventually conceded in the Minority Treaties, of which the first was signed by Poland on the one hand and the principal Allied and Associated Powers on the other on June 28 1919. This treaty makes it impossible for Poland to create a class of foreigners possessing no national status, such as the Jews had been in pre-War Rumania. Racial, religious and linguistic minorities are to enjoy complete equality before the law, the free use of their own languages, the right to control their own religious, educational and social institutions and an equitable share of public funds allotted to educational, religious or charitable purposes.

Over and above these provisions, which apply to minorities generally, the treaty specifically empowers the Jews to appoint local committees for the management of their own schools and provides that they shall not be under any disability by reason of their refusal to attend courts of law or vote at elections on the Sabbath. Poland recognises these stipulations as matters of international concern and agrees that they shall be guaranteed by the League of Nations. The league formally guaranteed the treaty on Feb. 13 1920.

Similar obligations, in each case guaranteed by the league, were accepted by Czechoslovakia, Yugoslavia, Rumania, Austria, Hungary and Bulgaria. One important result of these transactions was the emancipation of the Jews in Rumania, including the inhabitants of the old kingdom, as well as of the territories annexed as a result of the War. After the close of the Peace Conference, undertakings on the lines of those contained in the Minority Treaties, though on the whole less stringent, were secured by the Council of the League from Lithuania, Latvia and Estonia. It was only in the exceptional case of Poland that it was thought necessary to make express provision for the Jews, but if the rights which they shared with other minorities were respected, they had little to fear.

Jews in Eastern Europe.—While the Minority Treaties were being negotiated in Paris a dangerous situation was developing in eastern and southeastern Europe. The Jews were in an unenviable position, both in the succession states, where an intolerant Nationalism was in the ascendant, and in what was left of the dismembered empires, where scapegoats had to be found for the humiliations of the peace settlement. They were peculiarly exposed to attack in the atmosphere created by Bolshevism in Russia and its momentary irruption into Hungary.

The Tsarist régime had subjected the Jews to a pitiless and systematic persecution. Most of them threw themselves, when the revolution came, on to the side of the Moderates, but among them were some who, goaded to desperation, developed what may be called a destructive mania. There was no Jewish blood in Lenin himself, but both in Russia and in Hungary a prominent part in the Bolshevik movement was played by men who, though long dissociated from the Jewish community, were nevertheless of Jewish birth. In both countries the overwhelming majority of the Jews were anti-Bolshevik, not only on grounds of principle, but also because the bulk of them were traders and belonged to the very class which had most to lose from a Bolshevik victory. Nevertheless, the enemies of the Jews branded them indiscriminately as Bolsheviks, and the alarm which the Bolshevik menace excited in Europe at the close of the War gave an impetus to reactionary forces which singled out the Jews as their targets.

In Poland the Armistice was followed by a series of anti-Jewish excesses which led the British Govt. to send out Sir Stuart Samuel on a mission of inquiry. The Samuel report shows that in disorders which occurred in the year after the War not less than 348 Jews were killed and a much larger number wounded. The more serious excesses were confined to the areas of Lemberg, Pinsk and Vilna, where Poland was still at war with the Ukrainians and the Bolsheviks, but there were spasmodic outbreaks in many parts of Poland proper, and throughout the country the Jews were suffering from a sustained commercial boycott.

In Hungary, the collapse of the Bolshevik revolution under Béla Kun led to a violent reaction, which vented itself in attacks on Jewish life and property, while the sufferings of the Jewish population were aggravated by acute economic distress. There were also disturbing, though less violent, outbreaks of anti-Semitism in Austria and in various parts of Germany, more especially in Bavaria. But the principal storm-centre was in southern Russia, where the Poles, the Bolsheviks and the armies of Gen. Denikin fought over the body of the still-born Ukrainian Republic. The British Minister in Warsaw reported in June 1920 that "the massacres of Jews by Ukrainian peasant bands can find, in their extent and thoroughness, no parallel except in the massacres of Armenians in the Turkish Empire" (Sir H. Rumbold to Lord Curzon, in *Report of Sir S. Samuel on His Mission to Poland*, Cmd. Paper 674, 1920). It was not until 1921 that the storm began to die down. By 1922 the Soviet Govt. which was now in possession, had restored some measure of order, but massacre was succeeded by famine and pestilence. Early in 1923 there were reported to be 100,000 homeless Jewish orphans in the Ukraine, and in Odessa the Jewish death-rate in 1922 is said to have reached 200 per 1,000. In Soviet Russia there were no massacres, but though order was fairly well maintained, the Jews suffered from the Communist régime, which deprived them of their livelihood as traders, waged war on Judaism in common with other religions, and was ruthless in its measures against "counter-revolutionaries," with whom it was disposed to class the Zionists and, indeed, all Jews who clung to their religious or national traditions.

As a result of the conditions thus created in eastern Europe, 200,000 destitute Jewish refugees were set adrift in the borderland between Russia, Poland and Rumania. Responsibility for their maintenance and eventual evacuation was assumed by the Jewish Colonisation Assn. and other Jewish bodies. As late as the end of 1925 there was still a residue to be provided for, but the bulk of the refugees had by that time either been repatriated to Russia or been enabled to find new homes in the United States, Canada, Cuba, Argentina, Mexico or Palestine. This was only one, though it was the most poignant, aspect of the problem of the Jewish emigration. Throughout the crowded Jewries of eastern Europe there was a growing desire to escape from conditions which seemed to hold out little prospect of a tolerable future. Between 1919–23, 238,000 Jews emigrated to the United States, while between 1919–25, 67,000 Jews emigrated to Palestine. In 1924 the Johnson law virtually closed the United States to emigrants from eastern Europe. There was no longer room for immigrants in Great Britain, and Palestine stood by itself as the one country in which the Jews had in principle an assured right of entry under an international guarantee.

The Period Since 1922

Since 1922 there have been no anti-Jewish excesses on the scale of those which occurred immediately after the War, though in many parts of Europe there have been spasmodic outbreaks. Nor have the Minority Treaties been entirely ineffective in safeguarding the rights of Jews, though it has occasionally been suggested that they have not been an unmixed blessing, in so far as they may have tended in some cases to keep minorities and majorities apart. But though anti-Semitism has changed its character, it has by no means ceased to give trouble. It has shown itself in particular in systematic attempts to limit the number of Jews in schools and universities by means of a *numerus clausus*. Action on these lines has been semi-officially taken in Poland and Austria, but the leading case is that of Hungary, where a *numerus clausus* based on legislation enacted in 1920 has been openly enforced. The matter has been brought before the League of Nations as the guarantor of the minority clauses of the Treaty of Trianon. The Council decided in Dec. 1925 to take no immediate steps, in view of the Hungarian Govt.'s

assurance that the law was an emergency measure which would be amended in the near future. In Poland, anti-Semitism has mainly taken the form of a commercial boycott combined with administrative pin-pricks, the cumulative effect of which has been to place the Jews at a disadvantage in every walk of life. Since 1924, however, the situation has shown some improvement, and in the summer of 1924 a more favourable atmosphere was created by a formal reconciliation between the Govt. and the Jewish group in the Chamber of Deputies. There is no reason to doubt the Government's sincerity, but at the end of 1925 it had still to be seen whether it would be able to translate its assurances of goodwill into substantial concessions.

In Rumania the emancipation of the Jews has been almost completed, and only a few exceptional cases remain in dispute. On the other hand, the Jews are living under the shadow of an anti-Semitic agitation which gives them no peace. If they have been saved from serious excesses, it is due solely to the energy with which the Govt. has intervened to keep order. The same is true of Austria. Vienna is a hot-bed of anti-Semitism, and serious rioting took place during the Zionist congress which met there in the summer of 1925. In Lithuania, where the Jews at first received liberal treatment, the short-lived Ministry of Jewish Affairs was abolished in 1924, and the Jews, like the Poles, have suffered severely from the intolerant Chauvinism which is now in the ascendant. In Soviet Russia the condition of the Jews is more desperate than in any other part of eastern Europe. Elsewhere they may at least hope for better days, but under the Communist régime there can be no future for the traders who form the great bulk of the Jewish population.

Land Settlement and Zionism.—In these circumstances, experiments have been made in the settlement of Jews on the land. Of these the most important is that undertaken in 1925 by the American Jewish relief organisation known as the Joint Distribution Committee, which has made arrangements with the Soviet Govt. for the colonisation of an extensive tract of land in the Crimea. By a large body of Jewish opinion in the United States the project has been viewed with misgiving, not so much on its merits, as because it has been suspected of being backed by forces unfriendly to Zionism. It has thus had the indirect effect of provoking Zionist demonstrations on an unparalleled scale, culminating in Nov. 1925 in a conference at Baltimore at which representatives of almost all sections of American Jewry pledged themselves to support the establishment of the Jewish national home in Palestine. This incident served to illustrate both the growing strength of the Zionist movement and the importance of the part which American Jewry has begun to play in Jewish affairs. When the Jewries of eastern Europe were engulfed in the War, the centre of gravity at once began to shift to the United States, and the change in the balance of forces has since become yet more marked, though American Jewry is still in process of building up a Jewish tradition. In the United States, as in England, the Jews did not escape the back-wash of the anti-Semitic agitation which swept over Europe after the Armistice and in both countries they have been to some extent on the defensive against hostile propaganda, though it has not been of a character to cause them serious anxiety.

The history of the Jews as a body during the past 15 years is unhappily bound to be, for the most part, the history of their reactions to anti-Semitism. In this somewhat sombre picture Palestine stands out in sharp relief as the scene of a Jewish renaissance in which the Jews, as such, are beginning to express themselves as a constructive force. It is for this reason that the establishment in Palestine of the Jewish national home has kindled the imagination of a multitude of Jews in all parts of the world, who see in it, not merely a promise of relief for the victims of persecution, but the hope of a happier and more dignified future for the Jewish race as a whole (*see* ZIONISM).

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(L. ST.)

JEX-BLAKE, SOPHIA (1840–1912), British medical practitioner, was born Jan. 21 1840 at Hastings, Sussex. After holding a post as mathematical tutor at Queen's College, London, she studied the education of girls in America and became a pupil of Dr. Elizabeth Sewell and later of Dr. Lucy Sewell. Returning to England in 1868, in 1869 after some difficulty she was admitted with other women students to classes in medicine at Edinburgh University and in 1871 to hospitals. After attempting unsuccessfully to compel the university authorities to grant her a degree, she returned to London in 1874 and was largely instrumental in establishing the London School of Medicine for Women. In 1877 she obtained the M.D. degree of Berne and became a licentiate of the College of Physicians, Dublin. In 1878 she began practice in Edinburgh, where in 1886 she established the Edinburgh School of Medicine for women. She retired in 1899 and died at Mark Cross, Sussex, Jan. 7 1912. Her written works include *Medical Women* (1872) and *American Schools and Colleges* (1886). Her niece Katherine (b. 1860) became mistress of Girton College, Cambridge, in 1916; and another niece, Henrietta (b. 1862), became principal of Lady Margaret Hall, Oxford, in 1909. Both retired in 1921.

JIREČEK, HERMENEGILD, RITTER VON SAMAKOW (1827–1909), Bohemian jurisconsult (*see* 15.417), died in Hohenmauth (Vysoké Mýto) Dec. 29 1909. KONSTANTIN JOSEF JIREČEK (1854–1918), nephew of the above, archaeologist and historian, died in Vienna Jan. 10 1918.

JOB ANALYSIS.—This term, widely used since the World War, was applied by the personnel division of the American army to the analysis of occupational activities into their components, by means of which job specifications were drawn up showing exactly what a worker in each occupation was expected to do and be. On the basis of these specifications men were selected to fill positions such as those of chauffeur, gunsmith, etc. After the War the concept of job analysis was carried into industry, education and allied fields, where it is applied not only to the work involved in a trade or part of a trade, but also to the work involved in a profession. In view of this wide use of the term, analysis as it is employed in all kinds of occupational activities must be considered.

Though the term "job analysis" is recent, the technique it employs is not new. Under the term vocational analysis, investigators in vocational guidance have for some years analysed vocational activities into their component parts so as to secure a basis on which a person can choose a vocation. A pioneer study of this nature, *The Machinist,* was made in 1910 by Frederick J. Allen for the Vocation Bureau of Boston, Mass. Similar studies have followed in a number of other communities and for a number of other occupations. Again, the technique, if not the name, was used by the efficiency engineers of the early part of the 20th century. Taylor and others, in endeavouring to discover the unnecessary motions made by workers in industrial operations and in establishing standards of efficient performance, made analyses, dividing each job into units as minute as possible.

Community Surveys.—Educators have used the term and the method in seeking to establish a scientific basis for organising and teaching courses in vocational training. In 1914 the city

of Richmond, Va., organised a survey of the community in order to discover its vocational opportunities and needs. Similar surveys followed in other cities, one of the most thorough being that of Cleveland. These surveys employed the method of job analysis, and their reports contain fairly detailed classification and descriptions of the operations involved in the various vocational activities in the communities. In addition to these surveys, analyses have been made in a more or less laboratory manner, having as their aim the dissection of vocational activities for the purpose of formulating methods of giving instruction. Under these circumstances Charles Allen formulates the steps to be taken as follows: (*a*) divide the work into unit operations; (*b*) divide each operation into operating points; (*c*) divide the operating points into two kinds, machine operating points and human operating points. These are then taught to apprentices as units or are put together into projects and taught as larger units.

Analyses by even more strict laboratory procedure have been carried out, chiefly by psychologists, in the effort to discover facts about learning which could be put to use in the training of apprentices. Bryan and Harter investigated telegraphing and discovered the rate at which learners could receive and send at various stages of their progress. Book made a similar study of typewriting. Wells and, later, Hoke investigated, among other things, the nature of the errors which a typist makes. On the basis of these facts a teacher of typewriting can direct a learner in the avoidance of errors and the more rapid acquisition of skill.

Procedure.—Analysis should be made from a number of points of view. Especially is this necessary when made for the purpose of drawing up job specifications or qualifications that must be possessed by the worker. Economic questions should be answered, such as how much money may be earned, how the demand for workers fluctuates, etc. From the physical point of view the analysis should specify the movements that the worker makes, the weights to be lifted and the like. Physiological data should be gathered showing such things as preferable age, height, sensory acuity and also liability to accident or to occupational disease. The psychological phase of the analysis involves a statement of the mental processes involved in the work, the degree of intelligence required, amount and kind of education, temperamental requirements. From the sociological point of view, inquiry should be directed toward the class of workers engaged in the occupation, their nationality, family status, etc. Thus true analysis requires and results in a complete, all-round view of occupational activity.

Prominent Errors.—In carrying out such complex investigations some mistakes are made, such as those due to the temptation to rely on opinions obtained by questioning workers and their employers. This "questionnaire method" has received severe condemnation from scientists and should be used sparingly by investigators in the field of job analysis. In the first place it yields chiefly opinions showing what some one thinks the work is like. Secondly, it usually states the components of the job in general, abstract words such as "accuracy," "quickness" and the like, which do not characterise any occupation in particular, being required in hundreds of different jobs.

Too great dependence on psychological tests is another error. There is a procedure whereby a number of psychological tests are chosen which seem to resemble the work being analysed. Those tests in which the good workers excel and the poor workers fall short are considered to call forth the same mental activities as those required in the job and to constitute therefore the analysed components of the work. As a matter of fact such an assumption is not valid. The activities called forth by the tests are merely test-activities and nothing more. No one can say that they are identical with the psychological processes of the work under consideration.

Scientific Method.—In formulating a procedure which promises scientifically valid results, and will be applicable regardless of the ends for which an analysis may be made, the underlying requirement is that the procedure must conform to the rigid technique of scientific method. It must be unbiassed and dominated only by the desire for the exact determination of conditions. Thorough analysis can be carried on only by trained scientists, though they must have the co-operation and assistance of experts in the occupational fields as well.

In conducting an analytic investigation the first task is to survey the entire vocational field in which the activity lies, to determine its relation to the social organisation, then to divide it into its occupational sections. These are to be described in terms of their relations with each other and their relation to the whole field. Then each occupational section is described and divided into smaller units. This division may be made by mere observation, and the operations may at first be described in qualitative terms, but the descriptions should also be couched in quantitative terms.

Use of Measurements.—Measurement is an indispensable part of the process. The early quantitative analyses of Taylor were made with a stop-watch reading in fifths of a second. As the principle of measurement has become more widely extended, however, there has come a demand for measurements of greater precision, made with instruments used in the psychological laboratory for the measurement of intervals of time as small as one-thousandth of a second. For example, pictures have been made of the eye-movements made by proof-readers. The chronocinematographic method of Gilbreth offers much promise for the exact measurement of motions and time intervals involved in work operations. Motion pictures of the worker at his work are taken, in which is placed a clock that measures time in millionths of an hour. The background in each picture is cross-sectioned into squares of predetermined size. By examining the exact position of the worker in each succeeding picture in relation to these squares and to the time-recorder it is possible to determine how much he has moved and at what rate.

Developments in Britain.—Excellent analytic work is being done in England by the Industrial Fatigue Research Board, organised during the World War for the purpose of assisting workers to do their work with as little fatigue as possible. The board has made analytical investigations on such matters as rest pauses, conditions affecting accidents, elimination of waste motion. Though these analyses were instituted primarily to discover and eliminate the causes of unnecessary fatigue, the results have been found useful in other ways, especially in giving a basis for more effective training of apprentices.

Some indication of the fundamental part which job analysis can play will be furnished by this list of ends which have motivated the various analyses that have been made: elimination of waste motions; determining standard day's tasks; wage setting; figuring accurate costs; arranging grades and routes of promotion; inventing trade tests; establishing a curriculum for vocational education; determining methods of teaching vocational activities; securing a basis for choice of a vocation; securing job specifications for the selection of workers. *See* also INDUSTRIAL PSYCHOLOGY; INTELLIGENCE TESTS.

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(H. D. K.)

JOFFRE, JOSEPH JACQUES CESAIRE (1852–), French soldier, was born Jan. 12 1852 at Rivesaltes, at the edge of the Eastern Pyrenees. According to a tradition preserved in the family, his stock is Spanish and noble, and its proper name is Goffre. His great-grandfather fled from Spain for political reasons, came to France, gave his name the French spelling of Joffre, and became a merchant. The grandson of this first Joffre adopted the trade of a cooper. He had 11 children, one of them being the future victor of the Marne.

The studies of young Joffre at the École Polytechnique were interrupted by the Franco-German War and he took part in the defence of Paris in 1870. Afterwards he passed out from the Polytechnique into the engineers and worked on the fortification of Paris. In 1876 he was promoted captain. The loss of his wife so affected him, however, that he applied for a transfer to

Indo-China, where he took part in the occupation of Formosa in 1885 and remained three years at Hanoi as chief of engineers. In 1888 he returned with General Mensier to Paris. In 1889 he entered the railway regiment. In 1892 he was sent to Senegal to build a railway from Kayes to Bafoulabe. At the end of 1893, a column commanded by Colonel Bonnier marched on Timbuktu *via* the Niger. Joffre, who was a major, was ordered to form a second column, which was also to march on Timbuktu by the left bank of the river. He left Segou on Dec. 27, to receive the news at Goundam at the end of Jan. that Colonel Bonnier had been murdered on the 15th. Nevertheless, he continued his march on Timbuktu undaunted, and entered the town on Feb. 12 1894 after marching 813 kilometres. Some years later he went to Madagascar to form the base at Diego-Suarez. He was appointed general of brigade in 1900 and general of division in 1905. While commander of the II. Army Corps at Amiens he was called to the Conseil Supérieur de la Guerre in 1910. This council, re-established in 1872, consisted of the generals who in time of war would have the chief commands. General Joffre was entrusted with the direction of the lines of communication.

Under the system then existing, the vice-president of the Higher Council became in time of war commander-in-chief of the armies in the field. But in time of peace he had very little authority over his future subordinates. He could not determine either promotion or commands. The real authority lay with the chief of general staff of the army. General Michel, vice-president of the Higher Council, resigned in July 1911, and the Minister of War, M. Messimy, decided to unite the functions of vice-president and those of chief-of-staff of the army in one person, so that in the eventuality of war, the chief of the general staff would become commander-in-chief. Who was to exercise these united duties, which constituted a position of considerable power? M. Messimy thought of General Pau, who refused on the ground that he had only 18 months' more service on the active list. General Galliéni was due to pass into the reserve even sooner. M. Messimy's choice accordingly fell on Joffre, who was only 59 years old, and had therefore five years more on the active list.

For three years Joffre exercised complete authority over the army. He had laid his plan of campaign, known as Plan 17, before the Conseil Supérieur on April 18 1913. Germany having declared war on France on Aug. 3 1914, he took up the post of commander-in-chief on the 5th. From this day on, the history of his life for more than two years was that of the War itself. This silent general, jealous of his authority but undismayed by the most tragic events, had to bear on his broad shoulders a weight which only his coolness and energy enabled him to sustain. After having attempted in vain to throw himself on the flank of the advancing Germans, he was obliged to withdraw his left wing a considerable distance. He resumed the offensive on Sept. 6, and threw the Germans back to the Aisne in the memorable battle of the Marne. He attempted then to turn their right wing, a frustrated manoeuvre which ended with the rival fronts resting on the sea. The Germans first made the attempt to break the allied line on the Yser in Nov. 1914, and they failed. The French, in turn, tried vainly to break the German front in Champagne, in the Woevre, in Artois and simultaneously in Artois and Champagne (Sept. 1915).

These checks, following on rash promises and high hopes, had alarmed public opinion. A campaign was conducted against the commander-in-chief, on the one hand by the friends of General Galliéni, who accused general headquarters of having stolen the glory of the Marne; and on the other by the yet more powerful friends of General Sarrail, whom General Joffre had relieved of his command in July 1915. They reproached general headquarters for their blind confidence in 1914. They accused Joffre of rejecting all superior authority and organising a regular government at Chantilly. So long as Millerand was Minister of War he protected the commander-in-chief. But Millerand was replaced on Oct. 30 1915 by General Galliéni. Joffre had served under the latter at Madagascar, and Galliéni had suggested Joffre to Messimy in 1911 for the post of chief of general staff. But at the beginning of the War, Galliéni, although designated successor to Joffre, had been left as military governor of Paris instead of being called to general headquarters. Then came the battle of the Marne, followed by rivalry, if not between the two commanders, at least among their general staffs. On Dec. 3 1915, however, General Joffre received, instead of the simple command of the north and northeast, the supreme command of all the French Armies, an appointment which put under his authority the Army of the Orient, commanded by none other than General Sarrail. But trouble was not slow in arising. On Dec. 16 the Minister for War demanded information on the state of the defences before Verdun. On the 18th he received a stiff reply from General Joffre, who offered to resign. Galliéni answered on the 22nd that Joffre enjoyed the complete confidence of the Government. Nevertheless, two months later, on Feb. 21 1916, the Germans attacked in front of Verdun, and the defences, which were incomplete, were forced in as far as the line of forts, to a depth of eight kilometres in four days. On March 7 Galliéni read to the council of ministers a memorandum pointing out the necessity of reforming the high command. His advice was not accepted; he was also ill; he therefore resigned, and was replaced on March 17 by General Rocques.

The new Minister was a personal friend of General Joffre. Nevertheless, the campaign against him lasted throughout 1916. This was partly due to the apparently indecisive result of the great Allied battle on the Somme, and the personal quarrel between Sarrail and Joffre continued. Finally, General Nivelle, commander of the II. Army operating before Verdun, having retaken the fort of Douaumont, appeared as a possible successor to Joffre. A decree of Dec. 13 1916 conferred on Joffre the title of technical adviser to the Government in matters concerning the direction of the War. He continued to hold the title of commander-in-chief of the French Armies. General Nivelle received the command of the north and northeast—that is to say, of the French front. The Army of the Orient again became independent of general headquarters.

What was this post of commander-in-chief and technical adviser? The Senate demanded an explanation. In a secret committee, which sat from Dec. 19 to 23, M. Briand, as Prime Minister, explained the decree of the 13th. The title of commander-in-chief was left to a man who had played an historic part and who deserved every consideration; but it implied no authority either over General Nivelle or General Sarrail, who remained free to conduct operations as they wished. Joffre would be consulting member in the War committee, which was merely an organ of preparatory work, its decisions being submitted to the council of ministers. However, on Dec. 13, M. Briand had made changes in the Cabinet, and had called General Lyautey to the Ministry of War in place of General Galliéni. Lyautey arrived in Paris on the 24th. He considered the post of commander-in-chief and technical adviser granted to General Joffre as incompatible with the authority of the Minister of War. These two offices were suppressed, but in compensation, General Joffre was created Marshal of France on Dec. 26. In the spring of 1917 he made a journey to North America. The Academie française made him a member on Feb. 14 1918, and he took his seat there on Dec. 19th. (H. Bl.*)

JOHANNESBURG (*see* 15.431).—In 1921 the population of the municipal area was 282,921, and of the suburbs 5,210. Of the inhabitants 151,836 were whites and 6,229 Asiatics. In 1911 the population was 237,104, compared with 155,642 in 1904. Its prosperity is bound up with the gold mines of the Witwatersrand, and it is the centre for the other municipalities on the Rand. Between 1910 and 1925 the town council acquired and worked all public utility services and the live-stock and produce markets. Law courts, a town hall and a municipal art gallery were completed by 1915. In 1922 the University of the Witwatersrand was constituted; it had grown out of the South African school of mines and technology. New buildings for it were erected in Milner Park, the site being given by the town council. In 1922 the

Anglican diocese of Johannesburg was created. A cathedral in the Romanesque style was designed, the Lady Chapel being first built. On the other hand, the Asiatic and native locations at Vrededorp, within a mile of the centre of the city, remained in an insanitary and shocking condition. The South African Asiatic Inquiry Commission wrote of the location in 1920: "It is difficult to conceive a worse slum existing in any part of the world." Certain reforms followed, and in 1924 the Union Government took powers to enforce throughout the Union decent conditions in native locations.

Johannesburg was the scene of riots in 1913–4 arising out of strikes by white miners and railwaymen, and in 1915, when, following the sinking of the "Lusitania," German property valued at fully £500,000 was destroyed. In 1917 the first South Africa trade union congress was held in the city. In 1919 there were strikes and disturbances among the native workers in the mines. Early in 1922 the white miners on the Rand went on strike; the movement was captured by communists and developed into an armed revolt, with street fighting extending to the centre of the city. Prompt action crushed the revolt by the end of March.

JOHN, AUGUSTUS EDWIN (1879–), British painter, was born at Tenby, Wales, Jan. 4 1879. He received his art education at the Slade School, London, and afterwards worked in Paris, later spending some time in Provence. He became a regular exhibitor at the New English Art Club, and in 1901–2 was teacher of art at University College, Liverpool, returning to London in 1902. His earlier work includes "The Way Down to the Sea" (1906), "The Kitchen Garden," "The Smiling Woman" (1910) and "The Mumpers" (1912). For the Arts and Crafts Exhibition at Burlington House, London, 1916, he executed a mural decoration illustrating "Peasant Industry." During the World War he held a commission as official artist in the Canadian Corps, and exhibited at the Canadian War Memorial Exhibition, 1919, a cartoon for a large decoration, "Canadians opposite Lens." He was later commissioned to paint the chief characters of the Peace Conference. He also painted portraits of Mr. Lloyd George (1916), Mr. Bernard Shaw (1916), Lord Fisher (1917), Lord Sumner (1918–9) and the Marchesa Casati (1918–9). His etchings form an important part of his work, the majority being produced between 1901–10. He is represented in the Tate Gallery by several pictures, including "The Smiling Woman," "Peasant Industry," "Robin," (1917–8), and "Rachael," and in the Print Room of the British Museum. His early work, with its definite contour enclosing areas of colour, relates him to the *quattrocento* Italian painters. Distortion for personal emphasis and decorative effect is another marked characteristic. In 1921 he was elected A.R.A. The Alpine Galleries Exhibition held in London (1923) showed John's versatility and energy in astonishing degree, interest being especially roused by his portrait of Mme. Suggia, the large imaginative composition entitled "Symphonie Espagnole"—in the vein of El Greco—and the studies of "Gitanas."

JOHNS HOPKINS UNIVERSITY (*see* 15.460).—The period from 1910 to 1925 was one of marked expansion. The productive endowment rose from some $4,500,000 to more than $21,000,000. The faculty grew from 189 to 394, with 67 additional instructors in the afternoon, evening and summer courses; students from 752 to 4,260 (2,601 not being candidates for degrees); the library from 148,242 to 273,652 bound volumes. Frank Johnson Goodnow, of Columbia University, constitutional adviser to the Republic of China, succeeded Ira Remsen as (third) president in Oct. 1914. Upon an initial state appropriation of $600,000, continued by annual grants of $50,000, a School of Engineering was opened in 1913, with instruction in civil, electrical and mechanical branches, extended in 1924 to include gas engineering, through gifts of the Southern Gas Assn. for five years. For this school two laboratories and a power-house have been erected.

In 1916 the move from the old site to Homewood was completed except for chemistry, which occupied its new laboratory in 1924. The tract is expertly developed, the arrangement of buildings a Latin cross, the style Colonial. A war memorial dormitory was opened in 1923 in the name of the alumni. An ingeniously equipped laboratory in plant physiology, botanical garden and arboretum, athletic fields and concrete grand-stand complete the development to 1925.

In 1909 the university, in co-operatoin with Goucher College, initiated college courses for teachers (now the College for Teachers); in 1911, summer courses; in 1916, evening courses, without degrees, for technical workers and in business economics. Extension to other state centres was authorised in 1917. A School of Business Economics, providing academic training for business careers, and conferring the degree of Bachelor of Science in economics, was opened in 1922.

Teaching in Medicine.—Medical development was pronounced in this period. The university received from 1913 to the present, gifts and grants to about $20,000,000. The clinical departments of medicine, surgery, pediatrics, obstetrics, psychiatry and ophthalmology were placed on a full-time basis. The General Education Board led with several large grants in all these cases, besides two laboratories—the new Hunterian (1915) and the pathological (1923)—and $3,000,000 for expansion now in process, including central heating plant (1925). Capt. Joseph R. DeLamar, who died in 1918, left bequests amounting to over $3,700,000 to date. In 1923, $2,000,000 was voted by the Carnegie Corp. for a new dispensary, and a similar amount was raised to endow the university Dept. of Psychiatry and the Phipps Psychiatric Clinic at the Johns Hopkins Hospital, one-half coming from the founders, Mr. and Mrs. Henry Phipps. In 1925, the Wilmer Ophthalmological Institute, named after the first director, Dr. William Holland Wilmer, with endowment of the university Dept. of Ophthalmology, was established at the hospital on a fund of $3,000,000 raised. Advanced ophthalmological training in America is thus for the first time possible. The university has also profited from the establishment of the three other clinical institutes at the hospital, Harriet Lane Home for pediatrics (1912), Brady Urological Institute (1914) and the Woman's Clinic for obstetrics (1923), all teaching hospitals staffed from the school.

In 1918, under the direction of Dr. William H. Welch, assisted by Dr. William H. Howell, former dean of the School of Medicine, a School of Hygiene and Public Health was opened, with an annual grant from the Rockefeller Foundation, which in 1922 became an endowment of $5,000,000, with another million for a building, which was completed and occupied in 1925. This is the only institution of its kind in the United States, and, placed alongside the Hospital and the School of Medicine, it creates one of the strongest medical centres in the Americas. The main objects of this school are to train for public health work, promote investigation and disseminate sound hygienic knowledge. The degrees granted are Doctor of Public Health, Doctor of Science in Hygiene and Certificate in Public Health. Of the 150 students enrolled in 1924–5, 42 came from foreign countries. In 1925 the Institute of Biological Research was established on a five-years' grant from the Rockefeller Foundation, and in the same year announcement was made of the Walter Hines Page School of International Relations, a pioneer memorial to a former fellow. A minimum endowment of $1,000,000 was being sought in 1925, and it was announced that the school was expected to open in 1927.

Scientific Expeditions.—The university dispatched four scientific expeditions abroad during this period, two botanical to Jamaica in 1910 and 1919, and two geological to South America, for the first detail cross-section of the Andes, in 1919 and 1924, while a fifth, to the Near East for archaeological exploration and excavation (1924), was under the conduct of a faculty member. Publication was very active, a current report recording some 600 printed contributions a year.

War Services.—The institution's service in the World War was prompt, notably its staffing of Base Hospital No. 18, which crossed with the first contingent and provided the A.E.F. with its chief consultants in medicine, surgery, genito-urinary diseases and medicine to the Air Service. An ambulance unit was

organised. Schools of navigation and marine engineering, under the Shipping Board, were operated. The laboratories were turned over to experimentation, while large numbers of the faculty and students scattered to a great variety of service, field and civilian. Twenty-four, who made the supreme sacrifice, are memorialised on marble in Gilman Hall. (M. L. R.)

JOHNSON, HIRAM WARREN (1866–), American politician, was born at Sacramento, Cal., Sept. 2 1866. He entered the University of California, but did not finish his course. He became a reporter, at the same time studying law in his father's office; was admitted to the bar 1888, and practised with his father and his brother in Sacramento. In 1902 he opened an office in San Francisco, where he became widely known in 1906–7 for the vigour and success with which, as prosecuting attorney, he proceeded against dishonest public officials and corporations. He was elected Governor of California for the term of 1911–5; and in 1912 was an unsuccessful candidate for vice-president (on the ticket with Theodore Roosevelt), as nominee of the National Progressive party, which he had helped to organise. As governor he signed in 1913 the Webb anti-alien bill, designed to prohibit the ownership of land in California by Japanese, although the President had asked for delay. He was re-elected governor 1915–9, but resigned in 1917, having been elected a U.S. Senator. He opposed many of the policies of President Wilson's administration and declared that a league of nations would involve the United States in European wars. At the Republican National Convention in 1920 he had considerable support as presidential candidate, especially from those opposed to the League of Nations and the Treaty of Peace as submitted to the Senate. He was re-elected U.S. Senator for the term 1923–9.

JOHORE: *see* MALAY STATES.

JOINTS AND SINEWS: *see* MANIPULATIVE SURGERY.

JONES, ROBERT EDMOND (1887–), American theatrical designer, was born at Milton, N.H., Dec. 12 1887. He graduated from Harvard University in 1910 and began designing scenery for the theatre in New York City the following year. He attracted attention by the boldness and originality of his conceptions and exerted a marked influence in American theatrical art. Among the plays for which he designed the stage settings were *The Man Who Married a Dumb Wife*, for Granville Barker (1915); *The Jest* (1919), *Richard III* (1920) and *Macbeth* (1921), for Arthur Hopkins; *The Birthday of the Infanta* for the Chicago Opera Association (1920); and *Beyond* and *Desire Under the Elms* for the Provincetown Playhouse (1924). He published with K. MacGowan *Continental Stagecraft* (1922) and *Drawings for the Theatre* (1925).

JONES, THOMAS RUPERT (1819–1911), British geologist (*see* 15.500), died at Chesham, Bucks. April 14 1911.

JONESCU, TAKE (1858–1922), Rumanian statesman, was born at Ploesci Oct. 26 1858, and after studying law in Paris was in 1884 elected a deputy. He was Minister of Public Instruction and Finance in various Conservative Cabinets until 1908 when he founded the Conservative-Democratic party. In 1912 his group formed a Coalition Cabinet under Maiorescu, in which Jonescu was Minister of the Interior. He represented Rumania at the Peace Conference of Bucharest in 1913, and in 1914 he negotiated at Athens the peace between Greece and Turkey. When the World War broke out, Jonescu was, from the first, in favour of intervention on the side of the Allies. In 1918 he went to Paris, and as head of the Rumanian national committee he contributed greatly to the re-integration of Rumania in her rights as an ally when Germany was finally defeated. Jonescu was appointed foreign minister in April 1920, in the Averescu Govt. and, together with Dr. Benes and Ninčič, the Czechoslovak and Yugoslav foreign ministers, he laid the foundation of the Little Entente (*q.v.*). In Dec. 1921 he was entrusted by the King with the formation of a new Cabinet on the understanding that he should endeavour to govern with the same Chambers. This proved to be impossible and on Jan. 18 1922 he resigned. He died in Rome June 21 1922.

JORDAN, DAVID STARR (1851–) (*see* 16.406), American educationalist and naturalist, was born at Gainesville, N.Y., Jan. 19 1851. He studied at Cornell University and at the Indiana Medical College. He was instructor in botany at Cornell 1871–2, and professor of natural history at Lombard University, Ill., 1872–3. He taught in the Indianapolis high schools 1874–5, in which latter year he was appointed professor of biology at Butler University, Indianapolis. In 1879 he became professor of zoology at Indiana University, of which institution he was made president in 1885. In 1891 he was appointed president of Leland Stanford Jr. University, becoming its chancellor in 1913 and retiring in 1916. He was a member of the U.S. Fish Commission, 1877–91, 1894–1909; U.S. Commissioner in charge of fur, seal and salmon investigations for Alaska; and international commissioner of fisheries for Canada and the United States, 1908–10. He was active in promoting the cause of international peace, being chief director of the World Peace Foundation, 1910–4, president of the World's Peace Congress, 1915, and vice-president of the American Peace Society.

He was the author of a large number of books, among which are *Fishes of North and Middle America* (with B. W. Evermann, 4 vol., 1896); *Evolution and Animal Life* (with V. L. Kellogg, 1907); *World Peace and the College Man* (1914); *Classification of Fishes* (1922), and *Days of a Man* (autobiography in two vol., 1922).

JORGA, NICOLAS (1871–), Rumanian historian and statesman, was born at Botosani June 17 1871. At the age of 13 he was already writing articles on foreign politics in the *Românul*, a provincial newspaper. At 19 he finished his university studies in Jassy and went to Paris, Berlin and Leipzig. In 1894 he was appointed professor of universal history at the University of Bucharest. A man of great culture, Jorga made extensive researches in libraries and archives abroad and collected notes referring to the history of the Rumanian nation. As a result of his researches, he published over 20,000 documents in the *Annals* of the Rumanian Academy, of which he became one of the most prominent members.

Jorga produced numerous biographical and historical works, as well as many volumes on Rumanian art, towns, monasteries and historical monuments. He wrote several plays (historical dramas and comedies) which form part of the repertory of the Rumanian national theatres. He became also the director of *Neamul Românesc*, the official organ of the National Rumanian party. Jorga was for many years the chief of the nationalist party, which fused with the National party of Transylvania and the followers of Take Jonescu under the name of the National Rumanian party.

Among his best known works are: *Geschichte des rumänischen Volkes* (1905); *Geschichte des osmanischen Reiches*, 5 vol. (1908, etc.); *The Byzantine Empire* (Engl. trans. by A. H. Powles, 1907), and *Histoire des états balcaniques jusqu'à 1924* (1925). He also wrote numerous historical works in French, Italian and Swedish.

JOURNALISM: *see* NEWSPAPERS.

JOUVENEL, HENRI DE (1876–), French politician, was born in Paris April 2 1876. Having secured his degree in philosophy, he adopted a political career. Secretary of the committee of democratic conferences in 1900, he was made *chef de cabinet* in the ministry of justice in 1902, and *directeur de cabinet* in the ministry of commerce in 1905. He entered journalism shortly afterwards as chief correspondent on *Le Matin*. In Jan. 1921 M. de Jouvenel was elected Senator for the Corrèze. As member of the foreign affairs commission, he played an important part in the debates of the Senate, and attracted much attention by his ardour and outspokenness. He was chosen by M. Poincaré in 1922 to represent France on the Assembly of the League of Nations where he was instrumental in admitting Abyssinia to the League, and took an active part in the work of the commission of intellectual co-operation. He again represented his country in the League in 1924, and also became Minister of Public Instruction in the second Poincaré Cabinet in the same year. In 1925 he was appointed French high commissioner in Syria in succession to General Sarrail, whose administration had been signalised by serious disturbances. De Jouvenel at once set himself to the task of pacification, but realising the need of amicable relations with neighbouring countries he went to Angora early

in 1926 and prepared a treaty with Turkey to be ratified by the French Government.

JOWETT, JOHN HENRY (1864–1923), British divine, was born near Halifax, Yorkshire, Aug. 25 1864. He was trained for the Congregational ministry at Airedale College, Bradford, the University of Edinburgh and Mansfield College, Oxford. In 1889 he was elected minister of a Congregational church at Newcastle-upon-Tyne, which pastorate he held until 1895 when he was chosen to succeed Dr. R. W. Dale at Carr's Lane Chapel, Birmingham. During the 15 years of his ministry there his reputation as a preacher grew steadily, and his name became known, not only throughout Great Britain, but also in America. In 1911 he went to the United States to become pastor of Fifth Avenue Presbyterian Church, New York. After the signing of the Armistice in 1918, he returned to London as minister at Westminster Chapel, Buckingham Gate, London. In 1920 his health began to fail, and two years later he was obliged to retire. He died Dec. 19 1923. In the course of his career he was chairman of the Congregational Union and president of the Free Church Council.

Jowett published a number of books of a devotional character, including *The High Calling* (1909); *Our Blessed Dead* (1909); *The Whole Armour of God* (1916); *The Friend on the Road* (1921); *Life in the Heights* (1924). See A. Porritt, *John Henry Jowett* (1924).

JOYCE, JAMES (1882–), Irish author, was born in Dublin Feb. 2 1882, and was educated at Clongowes Wood College, Belvedere College, and at University College, Dublin. His first published work was a small volume of lyrics, *Chamber Music* (1907). *Dubliners*, a set of tales and studies of Dublin personalities, followed in 1914, a novel, *A Portrait of the Artist as a Young Man*, in 1916, and *Exiles*, a play in 1918. Meanwhile Joyce had left Ireland, and lived abroad, in Rome, Zurich, Trieste and Paris. In 1922 appeared the fruit of his work between 1914 and 1921, *Ulysses*, published in Paris. This book, conceived and executed on a very ambitious scale, attracted much attention among critics and men of letters, in France as well as in England and America, as a portent of certain modern tendencies in the development of the novel; but its legally restricted sale, apart from its grammatical, verbal and moral difficulty, has left it little known to the general public.

JOYNSON-HICKS, SIR WILLIAM (1865–), British politician, eldest son of Henry Hicks, of Bexhill, was born on June 23 1865. The additional name of Joynson was assumed on his marriage in 1895 to Grace, daughter of Richard Hampson Joynson, of Chasefield, Bowdon. From 1888 he practised as a solicitor in London. He contested N. Manchester (1900) and N. W. Manchester (1906) as a Conservative, both unsuccessfully, but in 1908 he won the latter seat from Mr. Winston Churchill, who had sought re-election on his appointment as President of the Board of Trade. At the first general election of 1910, however, he was defeated. He returned to Parliament in 1911 as member for the Brentford division of Middlesex, and from 1918 represented the Twickenham Division. During the latter days of Mr. Lloyd George's administration Sir William—he had been created a baronet in 1919—was prominent among those who favoured the withdrawal of the conservatives from the Coalition, and in the Conservative Govt. which was formed by Mr. Bonar Law in 1922 he was successively Parliamentary Secretary to the Overseas Trade Department, Postmaster-General and Paymaster-General and Financial Secretary to the Treasury (with a seat in the Cabinet). When Mr. Baldwin succeeded Mr. Bonar Law as Prime Minister (1923), he became Minister of Health and, in Mr. Baldwin's second administration (1924) he was appointed Home Secretary. Sir William took an active part in the affairs of the Church of England and was recognised as one of the lay leaders of the Evangelical party. He did valuable work in connection with the development of automobilism in Great Britain—notably as chairman of the motor legislation committee of the House of Commons—and is the author of *The Law of Heavy and Light Mechanic Traction on the Highways* (1906).

JUBALAND, East Africa, formerly a province of Kenya Colony. On June 29 1925 the sovereignty over some 36,000 sq. m., the greater part of the province, and including the port of Kismayu, was transferred from Great Britain to Italy. Trans-Juba (Oltre Giuba) the ceded territory, which adjoins Italian Somaliland, was placed under a high commissioner, directly dependent on the Colonial office in Rome. Before the transfer the river Juba (*see* 15.531) formed the frontier. The valley of the Juba is fertile, the rest of the area is semi-arid. The inhabitants (some 150,000) are Somalis whose chief wealth is in cattle and camels. (*See* KENYA; SOUTH AFRICA: HISTORY.)

The British White Paper *Treaty Series No. 29* (*1925*) gives the text of the Anglo-Italian treaty and a map. See also R. Cani, *Il Giubaland* (Naples, 1921).

JUDAISM: 1910–25 (*see* 13.186).—It is no exaggeration to say that the 15 years under review have been to Israel a period of woe and disaster, as well as of consolation and hope, such as no similar period since the Dispersion.

Russia.—The darkest part of the picture is Russia, the fountain in modern times of the old Jewish life and, before the War, the home of one-half of the world's Jewish population. When the period opened, Mendel Beilis, and with him Judaism as a religion and the whole Jewish people, stood arraigned in the courts of the Tsar at Kieff to answer the hideous charge of ritual murder. In vain the friends of humanity in England, France and Germany protested that this accusation of religious cannibalism was an utterly baseless libel on Judaism, an insult to Western culture, and a dishonour to those who formulate it. The Russian bureaucracy recoiled from no means that would insure the conviction of Beilis, as it would have furnished a convenient apologia for pogroms, past and future. However, in Nov. 1913, an all-Russian jury acquitted Beilis.

One other instance to show the atmosphere in which Russian Judaism had to live during the last years of the Romanoffs. In the same year, at the International Congress for the Suppression of the White Slave Traffic held in London, Hertz called the attention of the world to the infamy of the Tsarist "yellow ticket," by which any Jewish woman, if she was willing to be registered as a prostitute, was permitted free and unrestricted residence throughout the Empire; whereas all other Jews and Jewesses were confined to the pale of Settlement, which was one of the fiercest battlegrounds of the World War.

The Jewish cities were taken and retaken by the rival armies, with attendant bombardments, burnings and pillagings. Added to these were the summary expulsions and calculated inhumanities which the Russian military authorities perpetrated against the Jewish population. As a result, scores of important communities were ruined, and their religious institutions, their rabbinical academies, together with every form of Jewish cultural activity, destroyed to their foundations. Of the surviving communities, hundreds were later annihilated during the massacres of the Jewish population in the Ukraine during the years 1919–21, massacres that for thoroughness and extent are surpassed by those in Armenia alone.

The Russian revolution completed this break-up of Russian Jewry and its religious life. At first constitutional, the revolution brought full religious emancipation to all, but in the unique persecution of all religion that began soon after the Bolshevists came into power, Judaism had to suffer most. Jewish communists have, from the first, taken a sinister delight in the proscription of all Jewish religious teaching—whether in the rabbinical colleges, in the elementary religious schools or even in homes. Synagogues were confiscated and converted into workmen's clubs (as late as Sept. 14 1925), and even into stables.

During 1925 the bitter fight against religion seemed to have relaxed somewhat, and Christian and Mahommedan bodies are now allowed to give religious instruction to small "groups" of their children after school hours. In the case of Jews, however, two children have been declared to constitute a school, and subject to the dire penalties for teaching religion or Bible to children at a school. Religious instruction is therefore given clandestinely, underground or in lofts and at midnight, as in the days of the Inquisition. In Dec. 1925 two teachers were sentenced at Kieff to six months imprisonment with hard labour

for this offence; and 200 children were imprisoned at Vinnitza, Podolia, for refusing to betray the name and whereabouts of their religious teachers. Zionists were pursued with a Tsar-like ferocity, hundreds of them having been banished to Siberia. The use of Hebrew as a bourgeois language is suppressed.

These persecutions called forth among the faithful remnant a new fervour and a deeper self-sacrifice for their faith; but Jewish institutional religion became paralysed in Soviet Russia, and the religious outlook for the growing generation is dark indeed. Before the War, the intense religious and intellectual life of Russian Jewry was duly reflected in the works of a whole galaxy of rabbinical, Hebrew and Yiddish writers. With the outbreak of hostilities all Hebrew and Yiddish publications of any kind were forbidden. After the revolution there was a brief literary revival, which was soon strangled by the Bolshevists.

Poland, Baltic and Balkan States.—Jewish religious life has in the main resumed its pre-War aspect in Poland, the Baltic and the Balkan countries, despite the economic ruin of a large portion of the Jewries wrought by racial hatred and social unrest in those politically immature states. In Poland a widely ramified net of Hebrew-speaking schools, both elementary and secondary, has been founded by the *Tarbuth* organisation, and is recognised by the Government. In Greece, the only large, and autonomous Jewish community of Salonika is declining in consequence of the failure of the Greek Govt. to keep the solemn pledges it gave to respect the Jewish Sabbath. Its important rabbinate is unfilled. In Turkey, the status of all religions has undergone violent transformation under the secularising Kemalist *régime*. The activities of the Chief Rabbinate, which hitherto had practically the same powers as the Patriarchates of other denominations, were limited to ecclesiastical matters, and the congregations were organised on autonomous lines. The Chief Rabbi, Chacham Bashi Bijerano, introduced far-reaching reforms in the Jewish law of divorce. These have, however, not found recognition with the rabbinic authorities of other lands.

France and Central Europe.—Judaism in France has been strengthened by the accession of the important religiously conservative congregations of Alsace-Lorraine; as well as by the Moroccan communities now under French control. In 1924, the Grand Rabbi of France, M. Israel Levi, appealed to the leaders of east European orthodoxy to consider the enactment, in accordance with rabbinic law, of modifications in certain aspects of the Jewish marriage and divorce law (Agunah). Italian Jewry found itself threatened by the new education law, with its compulsory Catholic instruction.

Even a graver danger is its dearth of native rabbis. In Geneva Jewish questions of great religious consequence are often discussed. In Feb. 1925 a proposal was submitted to the League of Nations Commission of Inquiry into the reform of the calendar to introduce" blank days" (*i.e.*, the last day or days of the year to be considered outside the calendar). As one result of this would be a constantly backward moving day of rest, the proposal was strongly and successfully opposed by the representatives of the Jewries of the East and of the West. In Germany, Czechoslovakia, Austria and Hungary, the War and the dire conditions that followed it are responsible for the impoverishment of the Jewish schools of learning and the thinning of the ranks of the scholars and students.

Literature.—Among the noteworthy productions in the study of Judaism written during this period by Central European scholars are the works of the neo-Kantian philosopher Hermann Cohen, *Die Religion der Vernunft aus den Quellen des Judentums* (1919), the magnum opus of Immanuel Loew, *Flora der Juden*, of Simon M. Dubnow, *Weltgeschichte des Jüdischen Volkes* (World History of the Jewish People) in 10 vol. appearing in German and Hebrew (1925, etc.), of Ismar Elbogen, *Der Jüdische Gottesdienst*, on the Jewish Liturgy (1913), of S. Krauss, *Talmudische Archäologie*, 3 vol., on Jewish life in Talmudic times, and the *Monumenta Talmudica* (1914, etc.). The following savants died in the period under review: Wilhelm Bacher, Abraham Berliner, David Hoffmann, D. H. Müller, A. Harkavy, A. Epstein, Hermann Cohen and Jakob Guttmann.

British Empire.—In England Dr. Hermann Adler, the Chief Rabbi of British Jewry, died in 1911, and was succeeded by Dr. J. H. Hertz. In 1913 a Yeshivah—an institution devoted exclusively to Talmudic instruction—was for the first time opened in London. After the cessation of hostilities a comprehensive educational scheme was launched as a Jewish war memorial; and in 1920 the Chief Rabbi started on the first pastoral tour ever undertaken to the Jewish communities of the British overseas dominions. The Liberal Jewish movement, inaugurated at the beginning of the century, finally established itself by the erection of a synagogue in 1925. An attempt to attach a Liberal wing to Jews' College—the theological seminary of the Orthodox congregations—met with strong opposition. In Anglo-Jewish scholarship there are Principal Büchler's learned monographs; Israel Abrahams' *Studies in Pharisaism and the Gospels* (1917, etc.); Jacob Mann's *Jews in Egypt* (1920–2); and M. Gaster's *Exempla of the Rabbis* (1924). *The Pharisees* (1924) —by R. T. Herford, a Christian scholar—is a remarkable achievement. Israel Zangwill has produced a translation of Ibn Gabirol's Poems, *Selected Religious Poems* (1923); Nina Salaman, of Yehudah Halévy; and Dr. A. Cohen, of Berakhoth, *The Babylonian Talmud* (1921). Among popular works, there are C. G. Montefiore's books *Liberal Judaism* (1903–24) and the Chief Rabbi's anthology, *A Book of Jewish Thoughts* (1917 and 1920).

The United States.—The 3,600,000 Jews of America have now their own English version of the Bible, the result of many years' labour on the part of a group of scholars, among them Solomon Schechter and Joseph Jacobs. America has acquired great Jewish libraries, that of the New York Jewish Theological Seminary (including the Elkan Adler collection) being the largest in the world. The older rabbinical colleges are workshops of Jewish learning. To these have been added the Yitzchak Elchanan Yeshivah and the Jewish Institute of Religion, representing the two religious poles in American Judaism. Of scholarly works, there appeared Schechter's *Studies in Judaism*, third series (1924), H. Malter's *Saadia Gaon* (1921), J. Jacobs' *Jewish Contributions to Civilisation* (1919) and Israel Davidson's *Thesaurus of Mediaeval Hebrew Poetry*, vol. i. (1924).

The New Diaspora.—Eastern European Jewish emigrants, fleeing from racial hatred and economic ruin, find the doors of the United States all but barred and bolted to them. In consequence, they are scattered and dispersed to distant lands where grave dangers await their Jewishness and Judaism. Outside the Argentine Republic, the fresh arrivals find in most Latin-American countries little organised Jewish life and, too often, total abandonment of Judaism on the part of the earlier settlers. The Jewish Colonisation Assn. of Paris appointed I. Raffalovich as Grand Rabbin of Brazil to lay the religious foundations of the new Jewish centres in the youngest diaspora. Mention must also be made of the praiseworthy efforts of Dr. J. Faitlovich to bring the forgotten Jewish tribes of Abyssinia—the Falashas—into touch with the general body and religious currents of European Jewry.

Palestine.—The brightest spot on the Jewish horizon throughout this period is Palestine. The beginnings of the Jewish revival in the Holy Land date from long before the Balfour Declaration, when Eliezer ben Yehudah began his gigantic undertaking to make Hebrew the language of everyday speech, as well as of instruction in schools. One half of his monumental *Dictionary of the Hebrew Language, Ancient, Mediaeval and Modern*, was published in his life-time. Palestine became the home of Ahad Ha'am—the philosopher of Zionism—and of Ch. N. Bialik, the great neo-Hebrew poet. A Rabbinate for the whole of Palestine was called into existence, with A. I. Kook (Ashkenazi) and Jacob Meir (Sephardi) as joint Chief Rabbis. A Communities' Ordinance will, it is hoped, be promulgated, providing a democratic religious organisation for the Jewish population of the Holy Land.

The zenith of the spiritual revival was reached when the Hebrew University was opened by the Earl of Balfour on April 1 1925. It may be some time before the Jerusalem University fulfils the hope of being the sanctuary of the Jewish genius;

but a land focuses a people and calls forth, as nothing else can, its spiritual potentialities. It is the ardent faith of the architects of the New Palestine that the resurrection of the Jewish people on its own soil will reopen its sacred fountains of creative energy. As of old, only a remnant will return to the land of their fathers. But it is the national rejuvenation of that remnant that may open a new chapter in the annals of the human spirit. *See* JEWS.

BIBLIOGRAPHY.—*Reports*, for the years 1911–25, of the London Jewish Board of Deputies, Anglo-Jewish Assn., and the American Jewish Committee. The surveys of the year in the *American Jewish Year Book* in *Jahrbuch für jüdische Geschichte und Literatur*, and in *The Jewish Chronicle* at the end of the Jewish Year. General summaries of the Jewish situation covering longer periods are presented in the opening addresses at Zionist Congresses and in those of the Chief Rabbi at the Conferences of Anglo-Jewish Preachers. See J. H. Hertz, *Decade of Woe and Hope* (1923). (J. H. H.*)

JUDD, CHARLES HUBBARD (1873–), American psychologist, was born at Bareilly, India, Feb. 20 1873. He came to the United States in 1879, and graduated from Wesleyan University, continuing his studies at the University of Leipzig (Ph.D., 1896). He taught philosophy and psychology at Wesleyan University, New York University and the University of Cincinnati, 1896–1902. From 1902 to 1909 he was a member of the faculty of Yale University, becoming professor of psychology and director of the psychological laboratory. In 1909 he was appointed professor and head of the department of education and director of the school of education at the University of Chicago, where he served also for a period as chairman of the department of psychology. He took part in educational surveys of Cleveland, Denver, St. Louis, the States of Texas and Utah and the New York State rural survey.

His published works include *Psychology, General Introduction* (1907); *Psychology Laboratory Course* (1907); *Psychology of High School Subjects* (1915); *Introduction to the Scientific Study of Education* (1918); and *Psychology of Social Institutions* (1926).

JUDICIAL REFORM.—By judicial reform is here meant changes in municipal law which have for their object the classification and simplification of law or improvement in the administration of justice. It includes, therefore, the more orderly expression of the law as well as changes in the training and qualifications required of members of the bar in the organisation of courts and in judicial procedure. On the other hand, the term does not include those changes in municipal law induced by changes in political, social or economic conditions. The article deals only with the United States, as changes in this direction in other countries from 1910 to 1926 have not been very serious.

Characteristics of the Bar in the United States.—Since the close of the Civil War (1865) judicial reform in the United States, though encouraged and in a sense started by general public criticism of existing conditions, has been carried out only as the result of the efforts of the legal profession.

A member of the bar in the United States is one who has a right to practise in one or more courts of record. The bar in the United States or in any state is not a legally organised body. While each member of the bar of a court has, as such, rights and duties, the members as a group are not a corporation and do not as a body have any privileges or duties. They have not the right to exclude others from being admitted to practice, or even to determine the standards which must be complied with by those seeking the right to practice. They have not the right to establish rules for the regulation of the fees to be charged clients nor to prescribe the conduct to be followed by members of the bar in the practice of law, and they cannot disbar any member of the bar for unethical conduct.

Sources of Judicial Reform.—Judicial reform in the United States, therefore, has come, not through an officially organised bar with definite legal powers, but rather as the result of the action of voluntary associations of members of the legal profession—judges, practitioners and law teachers.

These voluntary law associations are of two kinds—selective and scientific. There are over 400 selective bar associations. These choose their members from the lawyers within a definite territory rather than from the practitioners at a particular court, though, practically, they never admit a person who is not a member of the bar of some court. Thus, there is a national bar association known as the American Bar Assn. founded in 1878, and a state bar association in each of the states, as well as local bar associations in all the large cities and in many of the counties. There has been no integration of these associations. A lawyer may be a member of the American Bar Assn., his state association and his local county or city association. As the name under which they are here classified indicates, these associations are all organised on the selective principle. The fact that a person is a member of the bar of a particular court, as for instance, the bar of the highest court of his state, while it may be a prerequisite for admission, does not entitle him to membership in a bar association. Before admission to a particular bar association his application must be passed upon by a committee of the association, the thoroughness of the scrutiny varying with different associations and in the same association at different times.

With the exception of a few local associations which date from the first part of the 19th century nearly all the local, as well as all the state bar associations, and also the American Bar Assn. have come into existence since the close of the Civil War. The several scientific legal societies are the American Institute of Criminal Law and Criminology, the American Society of International Law, the American Judicature Society and The American Law Institute. All are of comparatively recent origin. They are all nation-wide in membership and each has been founded to carry on investigation and promote improvement in law, either generally or with reference to particular subjects. Besides these associations the Assn. of American Law Schools, composed of some 60 schools conforming to certain standards of admission, organisation and conduct, has done much to promote improvement in legal education.

The American Bar Assn. and practically all the state and nearly all the local bar associations have committees which from time to time submit to their respective associations drafts of proposed legislation relating to the organisation of the courts or to procedure and other matters pertaining to judicial reform. If the association approves the draft, the committee will be authorised to submit it to the Legislature of the state and urge its adoption. Rules of court, as well as legislative changes in procedure and cognate matters, usually have their origin in the action of these bar associations.

Classification of Recent Judicial Reforms.—In recent years such judicial reforms as have taken place in the United States may be classified as follows:—

1. Those designed to elevate the character and improve the efficiency of the members of the bar.
2. Those designed to improve court organisation.
3. Those designed to unify, clarify or simplify existing law.
4. Those designed to improve procedure.

Reforms Designed to Improve the Efficiency and Elevate the Character of Members of the Bar.—The existing requirements for admission to the bar are usually a general education equivalent to graduation from a high school (the school in which students prepare for college or university), followed by three years of legal study either in a law school, or in a lawyer's office. Two states require at least a year in a lawyer's office irrespective of the amount of law school training received, and in some of the southern states the required period of legal study is still only two years. Comparing the present requirements with those of the last quarter of the 19th century a decided elevation of standards and improvements in the methods of examination is observed. This has been due in the main to two factors: the development of good law schools in the majority of the states, especially the schools connected with the great state universities where the tuition is practically free, and the activities of the selective bar associations. Nearly all of these associations have committees on legal education and admission to the bar and in many states these committees have been active in urging on courts and Legislatures the necessity for more stringent requirements. In this movement for the elevation of educational standards the American Bar Assn. has taken the lead.

The legal training of the would-be practitioner being now, especially in the larger centres of population, left almost exclusively to the law schools, the selective law associations are taking a constantly increasing interest in the ethics of members of the bar. A code of legal ethics has been formally adopted by the American Bar Association. In some of the larger cities committees appointed by the local judges at the instances of the bar association make an exhaustive examination of the history of each applicant for admission with the view to determining his character. There is in most of the counties and in the larger cities a committee of censors either appointed by the judges or by the local bar association. These committees receive complaints against attorneys, and where they believe the complaints well founded and the matter serious, institute in the courts proceedings for disbarment.

Reform in the Organisation of State Courts.—The unit of state court organisation in the United States was, and largely still is, the county or a unit called the judicial district composed of one or more counties. The principal trial court of each county or district is independent of similar courts in other counties or districts of the state. From each of these county or district courts there is an appeal on questions of law to an appellate court of state-wide jurisdiction. In some states there are two appellate courts, one for cases involving comparatively small amounts, and in some other states a system of intermediate appellate courts, the case on appeal going from the trial court first to the intermediate appellate and finally to the highest court.

As legal business in the larger states increased the first tendency was to create two or more county courts with co-ordinate jurisdiction in the counties in which a city was situated. Thus, in the city of Philadelphia, which is territorially co-terminus with the county of the same name, there are five separate courts each having identical civil jurisdiction.

The striking feature of the state court organisation in the United States is the absence of any co-ordination of the various state courts for the efficient carrying on of judicial business. Some progress has been made toward better co-ordination. In many states, as in New York, the state has been divided into judicial districts, each district including several counties, though the extent to which the courts in each district have been welded into a single and simple organisation varies. Again, in some states power has been given to the highest appellate court, or to the chief justice of such court to transfer temporarily a judge sitting in one county or district which has little judicial business to a county or district where the judges need assistance. There still remains, however, though in varying degree in the several states, much to be desired in the way of greater unification of court organisation.

Though little definite progress toward this goal has been made in the last 25 years, there now exists a general recognition of its importance. Perhaps on account of the difficulties involved, the initial steps toward better court organisation have come, not so much through the selective bar associations as through a single scientific legal association—the American Judicature Society. This society was organised in 1913. It has drafted acts establishing a unified system of courts for a large municipality and for a state as a whole. The reforms embodied in these acts usually involve changes in state constitutions as such constitutions invariably contain at least the general framework and often the detailed organisation of the state courts. The more recent state conventions called to draft new state constitutions have embodied in part at least the suggestions of the society, but the constitutions themselves have failed of adoption, though the failure cannot be ascribed to the embodiment of the reforms suggested but rather to a general reaction on the part of the electorate against any constitutional changes. In Louisiana a partial adoption of the suggestions of the society has been effected, and one city—Detroit—has adopted a unified criminal court, the only one in the country.

Though the record of the attempts to adjust court organisation to the needs of modern America is significantly small, there is every sign that the next decade will witness considerable progress, and this because there has already been adopted in several important states acts which create judicial councils with power to collect data concerning judicial administration and the operation of the rules of procedure.

Reform in the Organisation of the Federal Courts.—The Federal courts, other than the Supreme Court of the United States, were re-organised by the Act of Congress of March 3 1911. Prior to the Act, while continental America was nominally divided into nine judicial circuits, the real division for all practical purposes was the district, a much smaller unit. In each district there was a district court and a circuit court, the district court having Federal criminal jurisdiction and jurisdiction in a few classes of civil cases. The circuit courts were the principal Federal civil courts of first instance. There was an appeal directly from the district and circuit courts to the Supreme Court of the United States. The Act referred to abolished the circuit courts, made the district court a court of first instance in practically all Federal civil and criminal matters and divided the United States into nine circuits, with a circuit court of appeal in each circuit to act as an intermediate appellate court on questions of law. The re-organisation of the lower Federal courts has proved of very considerable practical advantage while the establishment of the circuit courts of appeal has greatly relieved the Supreme Court. Had such relief not been given, the great increase in the number of Federal cases, owing partly to the natural growth of the country and more especially to the adoption of prohibition and its enforcement by Federal statute, would have created a congestion of cases in the Supreme Court which would have indefinitely delayed all appeals.

Reforms Tending to Unify Existing Law—The existence of 48 separate state jurisdictions naturally leads in practice to a wide diversity in legislation. Again, while all the states, except Louisiana, have the English common law as modified to meet local conditions, there is no Federal supreme tribunal to reconcile conflicting interpretations of the common law by the highest courts of the several states, and therefore, there exists a very considerable diversity in the law. The fact that land law, or the law of inheritance, or even the criminal law varies from state to state causes little or no inconvenience. The United States, however, has attained a remarkable degree of uniformity in economic and social conditions. Economically and socially it is one nation. Diversity in commercial law, therefore, or the law of personal property, or the law of marriage and divorce is a fruitful source of much inconvenience and considerable injustice. One of the objects of the formation of the American Bar Assn. was to promote uniformity of legislation and of judicial decision throughout the United States. The group, who in 1878 founded this association, as early as 1881, began to take steps to effectuate this purpose.

The principal outcome of their efforts was the establishment in 1892 of the National Conference of Commissioners on Uniform State laws. This conference is composed of delegates appointed by the governors of the several states, usually under state Acts authorising the appointment. As its name indicates, its object is to draft statutes which it recommends to the state Legislatures for adoption. In 1925 the conference had drafted during the 33 years of its existence 34 Acts. Many of these Acts which deal with commercial subjects have been widely adopted not only by the states but by Alaska and the island possessions of the United States—the Negotiable Instruments Act by 54 jurisdictions; the Warehouse Receipt Act by 48; the Bills of Lading Act by 26. The experience of the conference would seem to show that it takes from 20 to 25 years from the adoption of a uniform commercial Act by the conference before it is generally adopted in all the more important states. The conference is not confining its activities to the preparation of commercial Acts. Its Desertion and Non-Support Act has been adopted in 21 states. On the other hand, its draft Act relative to judicial procedure in divorce and its draft Acts dealing with social legislation have met with little acceptation, though many of the provisions of such an Act as the Child Labor Act have been incorporated into subsequently adopted state statutes on the subject.

The Clarification and Simplification of the Common Law—Work of The American Law Institute.—Perhaps the most important of the legal institutions which the United States owes to England is the common law system of expressing and developing law. The fundamental feature of the system is the general judicial recognition that a decision of a court in one case has a degree of binding force when later a case arises which presents similar or analogous facts. The common law is the law developed and expressed by judicial decisions. As a whole the decisions of the English and American courts form one of the two great systems of law in force in the world to-day, the Roman Law, the ultimate principal source of the codes of continental Europe and Central and South America, being the other.

The characteristic difference between a principle of law founded on decisions of the courts and a principle expressed in a statute is that the former, or common law principle, is never absolutely binding on a court. The power that makes can always modify if the strict application of the prior rule to the instant case would, in the opinion of the court, produce injustice. The common law, therefore, has a flexibility which the law of statutes and codes does not possess. This flexibility often prevents injustice. Systems of law, however, as human beings, have the defects of their qualities. There is an element of uncertainty in the common law from which law expressed in properly drawn statutes is free. This uncertainty has not often proved a serious defect when the law is expressed and developed by one court or group of courts organised in a unified system. But in the United States with 48 separate state jurisdictions and a large number of Federal courts distinct from the state courts, the conflict between the decisions in different states and between the states and the Federal courts, as well as the uncertainty as to the law in any one state, produces the most unfortunate consequences. When law is uncertain persons with just claims hesitate to assert their rights while opportunity is given to the party with an unjust claim or defence to begin or prolong litigation. Besides all this the common law system tends to accumulate a bewildering mass of precedent.

The multiplication of decisions regarded as precedent is a growing evil even where the precedents are confined to the decisions of a single jurisdiction. But in the United States there are 48 separate state jurisdictions, each with its separate system of courts, as well as the entirely separate system of Federal courts. The reported decisions in the United States already number (1926) approximately 700,000 cases recorded in about 11,000 volumes, and to this mass there is being added annually some 153,000 printed pages. To this accumulation of American precedent must be added the decisions of the English courts and the courts of other parts of the British Empire in *pari materia*, any one of which may be cited as persuasive authority in an appropriate case. It has become manifest that the whole common-law system threatens to fall through the accumulation of an undigestible amount of authority.

The conditions described have given rise to an attempt on the part of the American legal profession to preserve the common-law system by producing an orderly expression of the common law, which, though it will not have the binding force of statute law, will at least be regarded as having an authority far superior to that accorded any existing legal treatise.

The organisation undertaking the execution of this work is The American Law Institute, founded in 1923. The institute is a voluntary organisation with two classes of members—life members and official members. The number of life members is limited to 750, the membership being confined to the leading judges and lawyers in the several states. The official members are the members of the Supreme Court of the United States, the chief judge of the court of last resort in each state, the senior judge of each of the nine Circuit Courts of Appeal, the deans of the law schools belonging to the Assn. of American Law Schools, the president and principal officials of the American Bar Assn., the presidents of the state bar associations and the presidents of the principal scientific legal societies. The orderly expression of the common law on which the institute is engaged is called the Restatement of the Law.

The work on this Restatement has been (1926) under way for three years. Already tentative drafts of parts of the law of Contracts, the law of Torts, the law of Agency and the law of Conflict of Laws have been printed and distributed to the members and to the profession generally for criticism and suggestion with a view to improvement. The plan of work adopted is to have the preliminary drafts prepared by a reporter for the consideration of a small group of persons especially cognisant of the subject of the draft. When the smaller group of experts has, by conference and discussion, produced a draft satisfactory to it, the draft is sent to the council of the institute, a body of some 33 judges and lawyers of national reputation, and later, as amended by the council, the draft is distributed as a tentative draft to the members of the institute. The object of this elaborate machinery is not only to insure that the final draft when officially published shall be well done, but that the legal profession as a whole, especially the leading members thereof, shall have such a part in its preparation that they will feel responsible for the work and give to it on final publication that authority which it is essential it should possess if it is to counteract the existing tendency toward uncertainty and confusion as to what the law is.

Whether regarded from the point of view of expenditure of money, time or skilled professional labour, no work of equal importance or magnitude has ever been undertaken by the members of any legal profession. Indeed, the only work to which it can be compared is the work on the Code, the Digest and the Institutes of the Roman law by Tribonian and his associates undertaken at the direction of the Emperor Justinian. That work, however, as well as the modern Code Napoléon and the more recent codes of the nations of continental Europe and South America have had behind them the sanction of the state. The analogous work on the common law on the other hand, is being undertaken by the lawyers of America as a voluntary enterprise, though they have turned to one of the great public foundations—The Carnegie Corp.—for the necessary financial assistance.

(W. D. L.)

The Reform of Procedure

Inheriting from the colonies, which in turn had copied and adapted it from familiar English sources, the early courts of the several sovereign states followed the system of procedure in lawsuits known as English common-law pleading, a system based upon writs or forms of action, through which certain rights could be enforced in formal manner. The rapid territorial extension of jurisdiction and the growth of cities, with corresponding complexities in the nature of rights to be asserted and wrongs remedied, soon began to cause gradual modification in each state by statutes passed from time to time, as shortcomings in the simple legal machinery of formerly rural communities were apprehended. There was no uniformity in these efforts, but generally speaking, such legislative alterations were limited in scope, probably because usually inspired by difficulties arising in specific cases, and the principal outlines of common-law pleading remained intact. During the first half of the 19th century, the chief result of these improvements was to permit some fusion of the forms of equity with common law.

However, in 1848, New York adopted a Code of Civil Procedure introducing a system of procedure and pleading which was rapidly copied by other, and adopted by new, states until to-day it is in use in well over half of all. This was the culmination of an agitation and effort for procedural reform largely led by David Dudley Field, based upon earlier writings of Jeremy Bentham in England, Edward Livingston in Louisiana, and Napoleon's Code of Civil Procedure. The objects of the New York Code whose provisions can be found almost verbatim in most other American procedural codes, were to consolidate all forms, writs and causes of action into one simple universally applicable form, to remove all distinctions between law and equity, to permit free joinder of parties and causes of action, and to substitute for the previously highly technical and formal language used in the written statements required of parties, a simple, cogent and natural style of expression more in accord with the practice of daily life.

With regard to all but the last of these objects, the code has been successful. Its benefits were felt even in England, where its example was persuasive in forwarding the reforms introduced by the Common Law Procedure Acts of 1852 and 1860, and later the great Judicature Acts of 1873 and 1875. These, in turn, influenced the American Codes, which, since their first enactment, have not remained static but have, just as has the procedure in the so-called common-law states, been frequently amended and, in some cases, improved, by legislative act. In many non-code states most of the procedural reforms of the codes have been adopted without wholly abandoning distinctions and formulas traditionally dear to practitioners trained to revere them.

While the Federal Courts in each state are required by the Conformity Act to follow the procedure of the state in actions at law, they are free of such restriction in proceedings in equity, and on that side their practice is uniform throughout the country. The Federal Equity Rules of 1912, promulgated by the Supreme Court in that year, are another landmark in the struggle for reform of procedure, simplifying and modernising, as they did, a technical but important class of litigations, not only locally but in every state in the Union.

Since the great period of commercial expansion which culminated in the Spanish-American War, the best minds at the American bar have more and more had forced upon them an appreciation of the inadequacy of the courts to dispose efficiently of the volume of work being brought into them. Inspired by the delays and uncertainties which marred the work of the regular courts of law, two strong movements away from the courts have manifested themselves. First is the tendency to create administrative quasi-judicial tribunals, manned presumably by experts and unhampered by the traditions and rules of evidence and procedure which strike the average layman and legislator as being responsible for the clumsiness of the courts. In Federal matters instances are the Interstate Commerce Commission, the Federal Trade Commission, the appeal boards for taxes and customs, and numerous minor bodies in government departments; in the individual states the Workmen's Compensation Boards and the Public Utility Commissions show a similar drift.

Insofar as such bodies relieve the courts of difficult and technical questions of fact, they are an unmixed blessing; at the same time it is unavoidable that they are creating, each in its peculiar field, bodies of precedent and law which are making ever more difficult and multifarious the science of jurisprudence. The second tendency away from the courts is the reaction of the business man rather than the legislator, impatient of the ignorance of juries and the stump speeches of eloquent counsel. This induces the growth of arbitration of commercial disputes by trade bodies or organisations on behalf of their members. Large classes of commercial differences are thus kept out of the courts and, as knowledge of the benefits to be gained by this method, and confidence in it, spreads, it will be more and more resorted to.

In another direction it has been sought to improve procedure by creating special courts such as courts for administration of estates of decedents, municipal courts with strictly urban jurisdiction, juvenile courts, domestic relations courts, conciliation courts and similar divisions. In these cases, the procedure prescribed is generally less elaborate and more expeditious and *ad hominem* than in the courts of general jurisdiction. To suppose, however, that there is satisfaction with the results so far accomplished is an error, for many influences are at work to negative the value of the real improvements which have been attempted.

To-day, the greatest promise for reform in methods of procedure lies in the spread of admiration in the U.S.A. for the success achieved by the English courts in simplifying procedure, under the system introduced in the Judicature Acts, by which procedure is regulated not by statutory enactment but by flexible rules made by the courts themselves. A strong movement has developed for the adoption of this system both in the Federal courts and in the state courts in the U.S.A., forwarded by the writings and utterances of Chief Justice William H. Taft and Mr. Elihu Root among public men, Dean Roscoe Pound of Harvard, Dean John H. Wigmore of Northwestern and Prof. Edson R. Sunderland of Michigan among scholars, Thomas W. Shelton of Virginia, Moorfield Story of Massachusetts and others among practising lawyers, and most of all, by the American Judicature Society and its secretary, Herbert Harley, under the munificent endowment of Charles F. Ruggles of Michigan. The success of the nation-wide improvement in Federal equity practice under the rules of 1912 has demonstrated the efficacy of this line of approach.

BIBLIOGRAPHY.—Roscoe Pound has prepared a complete bibliography of procedural reform which he has brought down to 1920 in the form in which it is printed in 5 Mass. *Law Quarterly*, 332. See also Hepburn: *Development of Code Pleading* (Cincinnati, 1897); Rosenbaum: *The Rule-making Authority in the English Supreme Court* (Boston, 1917); *Bulletins of American Judicature Society;* and Annual Reports of American Bar Association. (S. R.)

JUGOSLAVIA: *see* YUGOSLAVIA.

JUMPING: *see* ATHLETICS.

JUTLAND, BATTLE OF.—Called by the Germans the battle of the Skagerrak, this battle was fought in the North Sea between the British Grand Fleet, under Adm. Sir J. R. Jellicoe, and the German High Seas Fleet, under Adm. Reinhard Scheer, on May 31 1916. The scene of the main action was about 75 m. from the Dutch coast in the neighbourhood of lat. 57° N. long. 6° E. The encounter is memorable as being the only occasion throughout the World War on which the rival battle fleets met, also for the fact that it left the British fleet undisputed master of the German one up to the day of the latter's surrender. As a test of modern naval material it was prolific in lessons for both sides.

I. INTRODUCTORY

The movements of the fleets and squadrons were necessarily governed to a large extent by highly technical considerations, and the battle is not an easy one for the layman to follow without a painstaking study of its successive phases and the motives which produced them. Moreover, in order to obtain a true perspective of events it is necessary to keep in mind the following fundamental facts:—

(*a*) The Allied cause rested absolutely on the retention by Britain of that sea supremacy of which the Grand Fleet was the fulcrum.

(*b*) By the date of Jutland Germany's surface navy had already been rendered largely immobile and her mercantile marine had been swept off the seas.

(*c*) It was the definite policy of the British naval command to bring the German main fleet to action and annihilate it if possible, but there was no intention to gamble with the Allied fortunes by seeking an engagement in waters where mines, submarines and shore defences would give the enemy a definite advantage, nor under conditions where the outcome would be largely dependent on chance, such as a fleet action at night.

(*d*) It was the definite policy of the German High Command not to risk a decisive action until, by a process of attrition, the British forces might have become so weakened as to give good prospects of success.

(*e*) It was to pursue this policy of attrition that Scheer set out prior to Jutland, his object being to lure the British fleet out in the hope of falling on a section of it before it could be supported; but the last thing he intended or desired was to meet a united Grand Fleet.

The order of events can be conveniently summarised as follows:—

1. The German plan to entice the British fleet to sea while submarines were lying in wait for it, and in the hope of concentrating the High Seas Fleet on a detached part of it.
2. The sailing of the rival forces, neither realising the full significance of the coming impact.
3. The first contact and battle-cruiser action on the run south to the High Seas Fleet.
4. Beatty's run north leading the High Seas Fleet up to the Grand Fleet.
5. Jellicoe's main engagement with his combined Grand Fleet against the combined High Seas Fleet.
6. The German fleet's break-through the British destroyer flotillas at night, and the failure to send intelligence to Jellicoe which resulted in the escape of the enemy next day.

Situation before the Battle.—Adm. Jellicoe[1] has summarised the causes which led up to Jutland as follows:—

[1] Earl Jellicoe's Personal Narrative of the Battle of Jutland in *These Eventful Years*, p. 327.

TABLE I.

SCAPA FLOW

Unit	Ships	Commander
Fleet Flagship and attached ships	Iron Duke 1 Destroyer 1 Flotilla Leader 1 Light Cruiser	Admiral Sir John Jellicoe.
First Battle Squadron 6th Division 5th Division Attached	Marlborough, Revenge, Hercules, Agincourt Colossus, Collingwood, Neptune, St. Vincent 1 Light Cruiser	Vice-Admiral Sir C. Burney. Rear-Admiral Gaunt.
Fourth Battle Squadron 4th Division 3rd Division	Benbow, Bellerophon, Temeraire, Vanguard Royal Oak, Superb, Canada and fleet flagship (Iron Duke)	Vice-Admiral Sir D. Sturdee. Rear-Admiral A. L. Duff
Third Battle Cruiser Squadron, attached Second Cruiser Squadron also attached	Invincible, Indomitable, Inflexible 2 Light Cruisers Minotaur, Hampshire, Cochrane, Shannon	Rear-Admiral Hood. Rear-Admiral Heath.
Fourth Light Cruiser Squadron Fourth Flotilla Eleventh Flotilla (part) Twelfth Flotilla	5 Light Cruisers 2 Flotilla Leaders and 17 Destroyers 1 Light Cruiser and 4 Destroyers 2 Flotilla Leaders and 14 Destroyers	Commodore Le Mesurier. Captain C. J. Wintour. Commodore Hawksley. Captain Stirling
INVERGORDON		
Second Battle Squadron 1st Division 2nd Division Attached	King George V., Ajax, Centurion, Erin Orion, Monarch, Conqueror, Thunderer 1 Light Cruiser	Vice-Admiral Sir M. Jerram. Rear-Admiral Leveson.
First Cruiser Squadron Eleventh Flotilla (part)	Defence, Warrior, Duke of Edinburgh, Black Prince 1 Flotilla Leader and 10 Destroyers	Rear-Admiral Sir R. Arbuthnot. Commander Sullivan.
ROSYTH		
Battle-Cruiser Fleet Flagship	Lion	Vice-Admiral Sir D. Beatty.
Fifth Battle Squadron	Barham, Valiant, Warspite, Malaya	Rear-Admiral Evan-Thomas.
First Battle Cruiser Squadron	Princess Royal, Queen Mary, Tiger	Rear-Admiral de Brock.
Second Battle Cruiser Squadron	New Zealand, Indefatigable	Rear-Admiral Pakenham.
First Light Cruiser Squadron	4 Light Cruisers	Commodore Alexander-Sinclair
Second Light Cruiser Squadron	4 Light Cruisers	Commodore Goodenough.
Third Light Cruiser Squadron	4 Light Cruisers	Rear-Admiral Napier.
First Flotilla (part) Thirteenth Flotilla Ninth Flotilla (part) Tenth Flotilla (part) Attached	1 Light Cruiser and 9 Destroyers 1 Light Cruiser and 10 Destroyers 4 Destroyers 4 Destroyers Engadine, Seaplane Carrier	Captain Roper. Captain Farie. Commander Goldsmith. Commander Hodgson. Lieut.-Commander Robinson.

1. The pressure of the British blockade had led to insistent calls for action by the German fleet.

2. Scheer, who had assumed command of the High Seas Fleet in Jan. 1916, was chafing under his enforced inactivity.

3. A strong protest from President Wilson had caused the withdrawal of German submarines from the trade routes and thereby rendered them available for enterprises of a military character.

4. Scheer may have been led to believe that the steps announced in England to prevent a recurrence of such episodes as the Lowestoft raid, indicated that some division of the Grand Fleet was intended.

While Scheer was planning a new attack on the east coast of England, certain changes had, in fact, been made in the distribution of the British forces. Jellicoe, with the main part of the Grand Fleet, was still at Scapa Flow awaiting the completion of the outer defences of the Firth of Forth before transferring his base to the more southerly harbour, but he had detached the 5th Battle Squadron of four fast "Queen Elizabeths"[1] to replace the 3rd Battle-Cruiser Squadron of three "Invincibles," which were at Scapa for gunnery practice, and sent them to reinforce Beatty's Battle-Cruiser Fleet at Rosyth. A third force, consisting of the 2nd Battle Squadron, 1st Cruiser Squadron and a destroyer flotilla, was based on Invergordon.

THE FORCES ENGAGED

The Grand Fleet.—Immediately prior to the battle of Jutland the following was the distribution and composition of the British forces which took part in the action:—

At Harwich were five light cruisers and about 20 torpedo craft under Commodore Tyrwhitt, and at Sheerness was the 3rd

1 "Barham," "Valiant," "Warspite" and "Malaya." The "Queen Elizabeth" herself was in dock.

Battle Squadron consisting of the "King Edward" and the "Dreadnought" flying the flag of Adm. Bradford. These two commands, however, took no part in the battle.

The High Seas Fleet.—The main German forces, in preparation for Adm. Scheer's project, had been concentrated in the Jade Basin. They were organised as follows:—

TABLE II. *German High Seas Fleet*

Unit	Ships	Commander
Fleet Flagship	Friedrich der Grosse	Vice-Admiral Scheer.
First Battle Squadron		
1st Division	Ostfriesland, Thüringen, Helgoland, Oldenburg	Vice-Admiral Schmidt.
2nd Division	Posen, Rheinland, Nassau, Westfalen	Rear-Admiral Engelhardt.
Second Battle Squadron		
3rd Division	Deutschland, Hessen, Pommern	Rear-Admiral Mauve.
4th Division	Hannover, Schlesien, Schleswig-Holstein	Rear-Admiral F. von D. zu Lichtenfels.
Third Battle Squadron		
5th Division	König, Grosser Kurfürst, Kronprinz, Markgraf	Rear-Admiral Behncke.
6th Division	Kaiser, Kaiserin, Prinzregent Luitpold	Rear-Admiral Nordmann.
Destroyer Flotillas	3rd, 5th, 7th and half 1st Flotillas	Commodore Michelsen.
SCOUTING FORCES		
First Scouting Group Flagship	Lützow	Vice-Admiral Hipper.
Battle Cruisers	Seydlitz, Moltke, Derfflinger, Von der Tann	
Second Scouting Group	6 Light Cruisers	Rear-Admiral Boedicker.
Fourth Scouting Group	5 Light Cruisers	Commodore von Reuter.
Destroyer Flotillas	2nd, 6th and 9th Flotillas	Commodore Heinrich.

Attached to the High Seas Fleet were sixteen U boats and ten "L" class airships, but these took no part in the action.

The following is a summary of the principal armaments of the capital ships of the rival fleets:—

In preparation for the execution of this scheme the U boats had already set out in order to be in their appointed stations by May 23, while some six or eight Flanders submarines had gone north to reconnoitre between Norway and the Firth of Forth. From that date to June 1 was the period during which it was intended to bring off the bombardment. But the weather continued to be unfavourable for airship reconnaissance. Scheer would not risk an advance on the English coast without ample warning of the approach of the British fleet, meanwhile the limit of endurance of his submarines was nearly spent.

TABLE III. *Comparison of British and German Capital Ships at Jutland and Their Main Armaments*

BRITISH					GERMAN		
No. of each Class	Total Turret Guns				No. of each Class	Total Turret Guns	
	15 in.	14 in.	13·5 in.	12 in.		12 in.	11 in.
2 Revenge	16	..	..	..			
4 Barham	32	..	..	..	4 König	40	..
1 Canada	..	10	..	..	4 Kaiser	40	..
1 Erin	..	..	10	..	4 Thüringen	48	..
1 Agincourt	..	..	..	14	4 Westfalen	48	..
3 Iron Duke	..	..	30	..	4 Deutschland *	..	16
3 King George V.	..	..	30	..	2 Preussen *	..	8
4 Orion	..	..	40	..			
2 Colossus	..	..	..	20			
1 Neptune	..	..	..	10	(*Pre-Dreadnought type.)		
3 St. Vincent	..	..	..	30			
3 Bellerophon	..	..	..	30			
28 Battleships	48	10	110	104	22 Battleships	176	24
1 Tiger	..	..	8	..	2 Derfflinger	16	..
3 Lion	..	..	24	..	1 Seydlitz	..	10
2 Indefatigable	..	..	..	16	1 Moltke	..	10
3 Invincible	..	..	..	24	1 Von der Tann	..	8
9 Battle-Cruisers	..	..	32	40	5 Battle-Cruisers	16	28
37 Capital Ships	48	10	142	144	27 Capital Ships	192	52
	Total Turret Guns			344		Total Turret Guns	244

To sum up the British Fleet consisted of 37 capital ships, 8 armoured cruisers, 26 light cruisers and 80 flotilla leaders and destroyers. The German Fleet consisted of 27 capital ships, 11 light cruisers, 63 flotilla leaders and destroyers.

THE GERMAN PLAN

An order issued to the High Seas Fleet on May 18 ran as follows:—

The bombardment of Sunderland by our cruisers is intended to compel the enemy to send out forces against us. For the attack on the advancing enemy the High Seas Fleet forces to be south of the Dogger Bank, and the U boats to be stationed for attack off the East Coast of England. The enemy's ports of sortie will be closed by mines.

This order may be taken as defining the strategy of the enemy on the above date.

On May 30, when he could wait no longer, he abandoned the bombarding plan and ordered Hipper, with the Scouting Forces to sail next day and to demonstrate off the southwest coast of Norway. This he anticipated would soon be known to the British Admiralty, and he hoped, by following the Scouting Force with the battle fleet, but keeping out of sight until the enemy appeared, that he might fall on a detached portion of the Grand Fleet, which would probably be sent out to protect the cruiser patrol and shipping to the northward. But events turned out otherwise.

II. THE PRELIMINARY ACTIONS

The Grand Fleet Sails.—The British Naval Intelligence Dept. was, however, already aware both of the movement of German submarines and that there was a "certain liveliness" in the Jade Roads, and Jellicoe was warned that a large operation on the part of the enemy appeared to be imminent. At 5:40 P.M. on May 30 the commander-in-chief and the admiral commanding the Battle Cruiser Fleet were sent orders to proceed to the predetermined rendezvous eastward of the Long Forties[1] in readiness for eventualities. A warning was also sent to the Harwich Forces and 3rd Battle Squadron at the Nore. By 10:30 P.M. the three sections of the Grand Fleet had left their respective bases at Scapa Flow, Invergordon and Rosyth and were heading

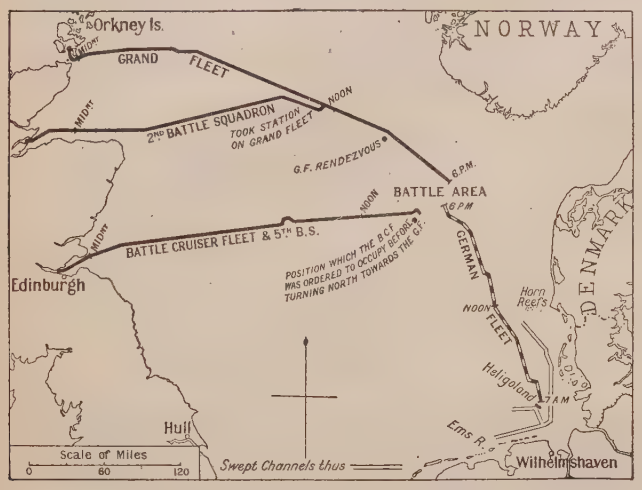

FIG. 1.—Approach of Rival Fleets.

out across the North Sea. The main battle fleet shaped course to a rendezvous in lat. 57° 45′ N. long. 4° 15′ E. where the forces under Adm. Jerram from Invergordon would meet him at 2 P.M. next day. Beatty, with the Rosyth force, was making for a point 69 m. S.S.E. of the battle fleet's position. (*see* fig. 1.) These dispositions would enable the battle fleet to intercept an enemy trying to attack the 10th Cruiser Squadron on the northern patrol, while the Rosyth force would guard against a raid.

When the British fleet put to sea 13 hostile submarines were lying off the coast; also U-67 was south of the Dogger Bank; and U-75, having laid the mines, which afterward sank the "Hampshire," was on her way home. The German submarines made few ineffective attacks; but in the main the under-water craft, as usual, proved unable to prevent free movement of the fleet.

To Jellicoe the position was by no means clear when he set out. The evidence pointed to another cruiser raid being afoot, but a misleading telegram sent from the Admiralty during the forenoon of May 31 informed him that directional wireless signals placed the German fleet flagship in the Jade river, thereby leaving Jellicoe with the impression that there was no reason for undue haste and he regulated his speed so as to economise his destroyers' fuel consumption.

First Contact.—Hipper, with the scouting forces left the Jade at 2 A.M. on May 31 and steamed northward, keeping well out of sight of the Danish coast. Scheer followed 50 m. astern with the battle fleet. During the early morning the German commander-in-chief received wireless reports from his U boats, but these proved vague and misleading, so much so that far from gleaning that a combined advance was being made by the British forces, he alludes to "our hope of meeting with separate enemy divisions" as being "likely to be fulfilled."[2]

At 2 P.M. Beatty, having arrived at his rendezvous, prepared to turn north in accordance with his instructions. Then followed one of those seemingly trivial events which are sometimes destined to have momentous issues. A stray merchant steamer attracted the attention of Commodore Alexander-Sinclair in the "Galatea," on the eastern wing of the light cruiser screen. He stood on to the E.S.E. to examine her. Simultaneously the "Elbing," on the western wing of the German scouting force, sighted the same steamer and detached a destroyer to investigate. Another instant and the rival warships had seen each other. At 2:20, just as Beatty had turned to the northward, "Galatea" hoisted the signal "enemy in sight." (See fig. 2.) The result was to hasten a meeting which otherwise would, most probably, have occurred further North and therefore nearer the British battle fleet. Beatty at once set out to cut off the line of retreat of the enemy's light cruisers towards Horn Reefs, but finding that they were apparently following the "Galatea" to the northwest, he hauled round more to the northward. He had been steering northeast for some 10 minutes when the heavy smoke of Hipper's five battle cruisers was sighted on his starboard bow, whereupon he turned back to the east.

Owing to the greater visibility to the westward, Hipper had already sighted the six British battle cruisers, and now realised that they were heading to cross his stern and cut off his line of retreat, and that he must hasten to fall back on the battle fleet. Beatty, knowing nothing of the greater forces to the south, could only regard this as a golden opportunity for getting to grips with the enemy. There followed a hot running fight to the southward between the opposing battle cruisers. The 5th Battle Squadron under Rear-Adm. Evan-Thomas which had been stationed five miles astern, panted after them trying to get into action. (*see* fig. 2.)

THE BATTLE CRUISER ACTION

At 3:34 Beatty formed the battle cruisers into single line, increased to 25 knots and made for the enemy. About this time the "Engadine" sent up a seaplane which reported Hipper's course south. This is noteworthy as being the only occasion on which British aircraft was used throughout the operations, and the report failed to reach the battle-cruiser's flagship. At 3:45, however, the enemy could be made out distinctly from the "Lion," and Beatty formed his ships on a line of bearing north-

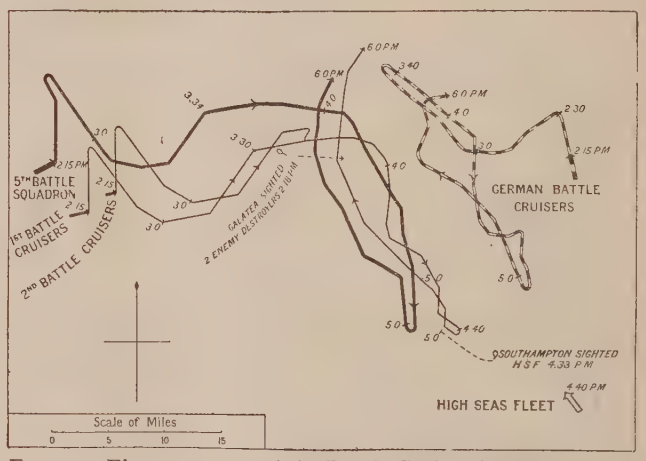

FIG. 2.—First contact and the Battle Cruiser Action. (2:15 P.M. to 6:0 P.M.)

west to clear the smoke and bring their guns to bear, while he turned to E.S.E. At about 3:48 fire was opened almost simultaneously on both sides at a range of approximately 16,000 yards.

The British battle cruisers were at considerable disadvantage, for they showed up well against the western sky, while visibility to the eastward was poor for observing their fire. German accounts agree that the British firing during this part of the action was somewhat ragged, while they pay high tribute to that of the 5th Battle Squadron when it got within range. The better protection of the enemy's battle cruisers and the better shell with which the heavy guns of his fleet generally were provided stood him in good stead, while the confusion in the interpretation of the signals for distribution of fire added to the disadvantages of the British battle cruisers.

[1] The Long Forties are about 60 m. east of the Scottish Coast.
[2] *Germany's High Seas Fleet in the World War*, Adm. Scheer, p. 141.

The range was rapidly decreasing as the courses of the rival forces converged. A few minutes after 4 P.M. the "Lion" was heavily hit by a shell from the "Lützow" which plunged into her midship turret and killed nearly the whole of the gun's crew. But for the presence of mind and devotion to duty of Major F. J. W. Harvey, R.M.L.I., who when mortally wounded saw to the flooding of the magazine, the flagship would doubtless have been destroyed. Up to this time, owing to a misunderstanding, the "Derfflinger" had been left unfired at, but was now engaged by the "Queen Mary." In the rear of the line the "Von der Tann" and "Indefatigable" were fighting a furious duel when a salvo of three shells from the former crashed into the vitals of the British ship; she fell out of the line sinking by the stern, at 4:06 P.M another salvo hit her and with a rending explosion she turned over and sank with her 57 officers and 960 men. Now came a moment's respite; both sides, finding the fighting too hot, decided to open the range, and soon the German shells were falling short and their fire ceased.

Meanwhile Evan-Thomas, by cutting corners, had manoeuvred the 5th Battle Squadron into range, and shortly after 4 o'clock the "Barham" opened fire on the "Von der Tann" at about 19,000 yards. In spite of the poor visibility the battleships' firing was very accurate, and Hipper had to take to zigzagging to dodge the great 15 in. salvoes. Nothing but the poor quality of the British shells, which burst without penetrating the enemy's armour, could have saved his rear ships from destruction. The van of the German line was not long out of action.

At 4:10 Hipper turned inwards two points while Beatty, having established sufficient overlap, started to press his way to the eastward again. The effect was to close the range rapidly and the engagement was fiercely renewed.

The "Lion" seems to have been still enveloped in the smoke of her burnt-out turret, and practically invisible, with the result that she was left in peace while the "Seydlitz" concentrated her guns with those of the "Derfflinger" on the "Queen Mary." The latter was fighting gallantly when at 4:26, a salvo crashed into the "Queen Mary" forward, a red flame shot up and an explosion rent her asunder. In another instant only a great pall of smoke marked the grave of this noble ship and her 57 officers and 1,209 men.

About this time a subsidiary battle was being fought between the lines. The 13th Destroyer Flotilla, having attained a suitable position, was launched to attack. At the same moment a German flotilla advanced into the arena making for the 5th Battle Squadron. The two flotillas met; the enemy destroyers fired twelve torpedoes at long range and hastily retired before the superior gun-fire of the British craft. Evan-Thomas swung his Battle Squadron away two points and safely avoided the torpedoes. Part of the British flotilla chased the fleeing enemy towards the van of the German battle cruisers, while Commander Bingham in the "Nestor," followed by the "Nicator," pursued those making for the rear. When within 5,000 yd. of the "Lützow," the two destroyers fired their torpedoes, but Hipper adopted the same dodging tactics and swung his ships away while the torpedoes ran clear or fell short of their mark. The gallant pair of destroyers pressed on and fired more torpedoes at a range of only 3,500 yd. under a hail of shell from the enemy's secondary armament. The "Nicator" escaped, but the light cruiser "Regensburg" appeared suddenly from behind the battle cruisers and crippled the "Nestor" with two shots in her boiler. The "Nomad," another destroyer, was also hit and left helpless between the lines. Another small force of British destroyers had accounted for two of their opponents, "V.27" and "V.29," when at 4:43 the "Lion" ran up the destroyers' general recall. Events suddenly took a new and dramatic turn. To Hipper, sorely pressed ahead and astern, came welcome and timely relief. The German battle fleet was in sight.

German Battle Fleet in Sight.—The head of the German battle fleet was first sighted by the "Southampton" in which was Commodore Goodenough leading his 2nd Light Cruiser Squadron about two miles ahead of the "Lion." At 4:33, he made the signal "battleships southeast." Holding boldly to his course he was soon able to identify the High Seas Battle Fleet in full array. Mindful of the extreme importance of his information, he sent a wireless message direct to Jellicoe. Within ten minutes of this signal being dispatched the commander-in-chief had quickened the pulses of his own great command with the signal "enemy battle fleet is coming north."

Goodenough stood down to within 13,000 yd. of the enemy so that he could identify him in detail before turning north under a hail of shell fire. An admirable piece of cruiser work had not only galvanised many and far distant forces into activity, but it had crystallised the whole position for the British commands. Beatty also held his course until the German battle fleet was in sight, then, at 4:40, he turned 16 points in succession and started the run north, assuming the rôle of the pursued instead of that of pursuer. To Scheer it seemed as if his opportunity to fall on a detached part of the British fleet had come, but Beatty was happy in the knowledge that if the enemy was not frightened off prematurely he would be confronted with the whole Grand Fleet.

Fortunately Hipper was too occupied with the British destroyers' attacks to be able to take advantage of the target presented by the British battle cruisers as they wheeled in succession round the same point. By 4:50 Beatty with his line now reduced to four ships had straightened up on a northerly course and was re-engaging his late enemy. Hipper had just resumed his southerly course, after turning away from the British destroyers, when a torpedo hit the "Seydlitz" tearing a huge hole under water and putting a 15 cm. gun out of action. The ship's stout construction saved her, however, and she kept her place in the line. By 5 P.M. Hipper, too, had turned 16 points to the northward and taken up his station ahead of the battle fleet. Meanwhile the 5th Battle Squadron could not see the "Lion's" flag signal to turn about. Adml. Evan-Thomas saw Beatty turn, but was intent on hanging on to the rear of the enemy's battle cruisers, who were still on a southerly course, with the result that the two British squadrons passed each other at high speed. The "Lion" now repeated the signal to turn, direct to the 5th Battle Squadron, but before it could be obeyed, that squadron found itself under the guns of the German battle fleet.

Evan-Thomas turned 16 points at practically the same instant as Hipper, but in the process the "Barham" received a heavy shell which cost her casualties and the use of her wireless gear. The rear battleship of the line, the "Malaya," was a target for at least a whole division of enemy battle ships and suffered even more severely.[1] For some 20 min. she was straddled again and again and received serious damage below the waterline, but held on and eventually the whole squadron forged ahead and got clear. A plucky attempt by the destroyers "Onslow" and "Moresby" to attack the enemy battle cruisers just as they had turned north was defeated by the German light scouting group, but the "Moresby" stood on to within 8,000 yd. of the enemy's battle fleet and fired a torpedo at the third ship of the line; it did not take effect, but both destroyers escaped miraculously under a very hot fire. Scheer continued to hasten north after the apparently hard-pressed British squadrons. As he did so the motionless "Nestor" and "Nomad" came drifting down between the lines. They scorned surrender and fired their last torpedoes at the oncoming battleships but without effect. A moment later they were overwhelmed in a storm of shell. The undaunted "Nestors" gave three cheers for their sinking ship and sang a verse of "God Save the King" before the crews took to boats and Carley rafts, from which they were chivalrously rescued by enemy destroyers.

Once the 5th Battle Squadron had shaken off the German battle fleet the firing slackened. At 5:40 Hipper's squadron reappeared out of the mist and there was a temporary burst of firing from the British battle cruisers and the leading battleships, but Beatty was intent on joining his commander-in-chief and was reserving his forces for the greater issues impending.

[1] "Barham" lost 26 killed and 37 wounded, "Malaya" 63 killed and 33 wounded.

III. THE MAIN ACTION

Meeting of the Battle Fleets.—Coming down from the northwest was Jellicoe in the "Iron Duke," at the head of a centre division of his six lines of battleships, each in single line ahead at manoeuvring distance apart. Directly ahead of him was the 4th Light Cruiser Squadron which with the destroyer flotillas was acting as an anti-submarine screen. Further ahead and spread for scouting were the 1st and 2nd Cruiser Squadrons. Twenty-one miles to the eastward were Hood's three ships of the 3rd Battle Cruiser Squadron, with two light cruisers and four destroyers.

Up to 2:45, the fleet had been steaming at economical speed, but, with the arrival of wireless messages indicating the presence of an enemy to the southward, the commander-in-chief increased to 17 knots and ten minutes later to 18 knots. Course was shaped southeast by south for Horn Reefs as previously arranged. At 3:59, as soon as he learnt that the enemy's battle cruisers had been sighted, Jellicoe increased to 20 knots and then sent Hood on to Beatty's support, so that when the report was received that the enemy's battle fleet was coming north there was nothing better to be done at the moment than to stand on as he was doing. The battle fleet was closed up in cruising formation, and it would have been useless, indeed dangerous, to deploy into line of battle until it was known on what bearing the enemy would be met. The leaders of divisions were already disposed at right angles to the most likely line of bearing on which to sight the enemy in order that they might wheel their ships into line with a minimum of delay. So the rival battle fleets approached, charging towards each other at a rate of nearly 40 knots, but as yet out of sight.

When in due course contact was made it did not come about quite as Jellicoe expected. The "Iron Duke" and "Lion" had communicated their respective positions from time to time, but zig-zagging and many other alterations of course had caused both flagships to be out in their reckoning. The "Iron Duke" was in fact some $4\frac{1}{2}$ m. ahead (*i.e.*, to the southeastward) and the "Lion" $6\frac{3}{4}$ m. to the westward of their estimated positions as they approached each other. The reports of the enemy received by the commander-in-chief were therefore somewhat perplexing, and by the time it became evident that the German Battle Fleet would be met on a starboard bow bearing instead of right ahead it was too late to alter his dispositions. Hood, also, was thrown out in his calculations. Steering as he thought to join Beatty he found himself on the opposite side, *i.e.*, to eastward of the enemy. It was at this juncture that fighting broke out with renewed vigour.

At 5:40 the Battle Cruiser Fleet converging on the 1st Scouting Group, from the westward, saw the "Lützow" and her consorts emerging from the mist. Fire was opened at a range of about 14,000 yards. This apparently disconcerted Hipper, who turned away to the eastward. Hardly had he done so before he heard the guns of the 3rd Battle-Cruiser Squadron engaging his 2nd Scouting Group. The trap was closing in on him, but as yet he was unaware of the far greater menace to the northward; but he seems to have sensed danger and at 6:34, hotly pursued by Beatty, he turned southeast only to see his light cruisers being attacked by four British destroyers. These latter he took to be the forerunners of the British Battle Fleet and, now thoroughly alarmed, he doubled right back to southwest to seek the cover of his own battleships. In fact what he had seen were Hood's light forces. These had been hotly engaged with Boedicker's 2nd Scouting Group. In the initial skirmish the "Chester"[1] was badly mauled by the German light cruisers, but they in turn suddenly found themselves overwhelmed by the fire of the three "Invincibles." The "Wiesbaden" was reduced to a wreck and the "Pillau" and "Frankfurt" were badly damaged and only escaped by using their torpedoes, which forced Hood to turn away and break off the pursuit.

The destroyers which Hipper had seen were part of the 4th flotilla. Led by the "Shark," they gallantly went for the "Regensburg" and nine or ten enemy torpedo craft which seemed to be preparing to attack the 3rd Battle-Cruiser Squadron. In the course of this encounter the "Shark" was severely battered and eventually sank, fighting to the last under her mortally wounded captain, Commander Loftus Jones.[2] Hood avoided this attack by turning his squadron sharply to starboard; and almost at the same instant he sighted the "Lion" racing up from the westward. He turned to meet her and then swung his squadron into station ahead of the Battle Cruiser Fleet and led the line on a south-easterly course. Jellicoe was left in doubt until the very last minute as to the exact position of the enemy. Somewhere to the southward was the High Seas Fleet, but between him and his adversary were battle cruisers, cruisers and destroyers belching smoke and gun fire and obscuring his view. Beatty, hot on the heels of his own particular quarry again, had lost sight of the enemy battle fleet and at the moment could not answer the commander-in-chief's urgent enquiry. Nine minutes the latter waited, then at 6:10 repeated his question "Where is enemy's battle fleet?" The first definite information came from the "Barham," now rapidly closing with the 5th Battle Squadron from the southwest. She reported "Enemy's battle fleet S.S.E." At 6:14 the "Lion," having regained touch, reported it too, bearing S.S.W.

The Deployment (see fig. 3).—Within a minute of the "Lion's" report, Jellicoe had ordered the fleet to deploy on the port or easterly column. The manoeuvre was a vital one and the commander-in-chief made a masterly decision. Had he followed his

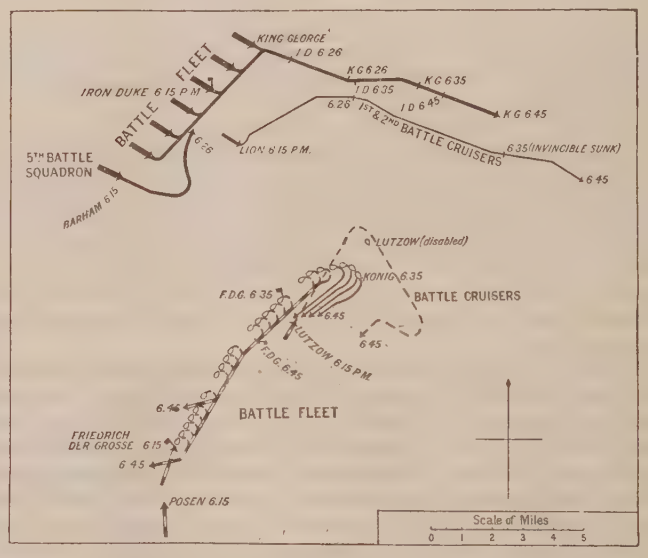

FIG. 3.—Deployment of British Battle Fleet, and first retirement of German Fleet. (6:15 P.M. to 6:45 P.M.)

natural inclination to deploy to starboard, *i.e.*, on the side toward the enemy, the ships on that wing would have found themselves at grave disadvantage; the enemy would have been able to concentrate his fire on them while they would have been masking the other columns until each could turn up in rear in succession. Moreover, the head of the British line would have had to make a sharp turn to port at once to prevent the enemy crossing the "T." It is not too much to say that had Jellicoe made a wrong decision at this moment irretrievable disaster might have followed. As it was the Grand Fleet was placed at the outset in a position of overwhelming tactical advantage.

The deployment, it will be seen, developed in the form of an obtuse-angled "L," one arm of which steadily lengthened to envelop the head of the enemy's line, while, during the process, the British ships could give each other the maximum of support. The battle cruisers hurried to their station at the head of the line, the 5th Battle Squadron slipped into place astern, cruisers and destroyers automatically took up their pre-arranged positions. The whole was a magnificent piece of fleet work, the culmination of fine organisation and training and a clear indication

[1] Boy Jack Cornwell was awarded a posthumous V.C. for his exemplary conduct in this action.

[2] Awarded a posthumous V.C.

of a high standard of leadership on the part of the flag officers commanding the several divisions and squadrons.

But now a tragedy occurred in the foreground of this impressive scene. Up to the moment of deployment Arbuthnot in the "Defence" with his 1st Cruiser Squadron had been scouting ahead of the battle fleet, but on contact being made, it became his duty to engage the enemy's cruisers. Boedicker's 2nd Scouting Group was faintly visible to the southward and, followed by the "Warrior," Arbuthnot turned to pursue them. He was about to deliver a *coup de grâce* to the now blazing and disabled "Wiesbaden," when out of the mist came both the British and German battle cruisers hotly engaged. Holding on tenaciously, close across the bows of the "Lion," the two cruisers soon found themselves in a hurricane of fire as Hipper endeavoured to cover the stricken "Wiesbaden." Two great salvoes hit the "Defence" in quick succession and at 6:19 Arbuthnot and his flagship disappeared in a sheet of flame. The "Warrior" limped away, and was only saved for the time being by the battleship "Warspite" performing an involuntary circle round her, owing to the sudden jamming of the latter's steering gear. Clear of the fighting, the sea-plane carrier "Engadine" made a brave effort to tow her home, but the "Warrior" had to be abandoned at 7 A.M. the following morning and eventually sank.

As the cloud of smoke over the spot where the "Defence" had gone down rolled away, the full measure of his peril was revealed to Scheer. The High Seas Fleet was heading into the crook of the rapidly extending arm of the whole combined British Battle Fleet. It seemed to Jellicoe a glorious opportunity to fall on his enemy and crush him. The signal was actually hoisted for the Grand Fleet to close, when the commander-in-chief realised that his line had not yet straightened out, and the battle cruisers were not yet clear of his van; to turn to S.S.E. by subdivisions, as he wished, was not practicable at the moment. He had to cancel the signal and hold on on a course which nevertheless sharply converged with that of the enemy battle fleet.[1]

Now yet another misfortune befell the British. Proudly leading the 10-m. line of capital ships, was Hood in the "Invincible." Having closed to a bare 9,000 yd., she was furiously engaging the "Derfflinger," hitting her again and again with well directed salvoes, when the "König," leading the van of the enemy battle fleet, came to the rescue of the battle cruiser. Once again the plunging shell sought the vitals of the lightly armoured British ship; the "Invincible" was torn asunder, her stem and stern rising high out of the water before she disappeared (6:34). With her went Hood, who had so finely upheld the traditions of his historic name, and his splendid crew of over a thousand officers and men. The British battle cruisers had indeed suffered heavily. Valuable as their work had been in bringing about the main action, they were clearly unsuited for "in-fighting." From now onwards they rightly confined themselves to harassing the van of the enemy when opportunity served, leaving the battleships to take the shock of closer contact. But close contact was the last thing Scheer was seeking. He was in a trap and needed all his wits to escape impending disaster.

The possibility of such a situation had not been overlooked by the German commander-in-chief, and he had practised his command in a manoeuvre known as the *Gefechtskehrtwendung*, which was really an "emergency retirement." In this the destroyers dashed out, fired their torpedoes "into the brown," and put up a smoke screen while each big ship did a right-about turn and retreated precipitately. This manoeuvre he ordered when at 6:35 he found battleship after battleship of the Grand Fleet concentrating on the head of his line. It was not unattended with risk, but it was boldly ordered and skilfully executed. (See fig. 3.) In less than three minutes the evasive enemy had disappeared for the first time. The destroyer attack had not been pressed home, and, although some of the British battleship divisions swung away momentarily to avoid the torpedoes, the course of the fleet as a whole was not deflected. Burney's flagship, the "Marlborough," was hit by a torpedo, but the damage was not so great as to force her to leave the line. The German light cruiser "Wiesbaden," now the only enemy in sight, came under a heavy fire and in ten minutes, a blazing wreck, she sank from sight.

Jellicoe, too, had foreseen the problem which now confronted him, and he had not been alone in seeking, for some time past, a satisfactory solution; it was agreed by the highest tactical authorities that to follow directly in the path of an enemy's battle fleet in a position where it could obtain the maximum advantage from torpedoes and mines,[2] was sheer foolhardiness. In fact, he had already summed up the situation when he wrote "Nothing but ample time and superior speed can be an answer, and this means that unless the meeting takes place fairly early in the day, it is most difficult, if not impossible, to fight the action to a finish." In point of fact, so little was the Grand Fleet superior to the High Seas Fleet in speed that even had Jellicoe pursued it directly it is doubtful whether he would have caught up with it before nightfall. It was now 6:40. There remained little more than two hours daylight. The enemy was out of sight somewhere to the south and west, but another advantage which the deployment to port had given was the overlap to the eastward which the Grand Fleet had secured. (See fig. 4.) Jellicoe was therefore in a position to work his way steadily between the High Seas Fleet and its possible lines of retreat to the German coast, and this he proceeded to do. At 6:44 he turned his divisions southeast. Simultaneously Goodenough turned south and led his Light Cruiser Squadron to look for the enemy. By 7 he was able to report the hostile battle fleet bearing S.S.W.

Five minutes before this Jellicoe had altered course to south, and now, knowing that he was again in a position of considerable tactical advantage, he ordered a turn of "3 points to starboard together" to close more rapidly. About this time a number of reports of submarines were being made to the commander-in-chief. The "Lion" had just reported sighting one, the "King George V.," leading the battle fleet, sent a warning that a submarine was just ahead of the "Iron Duke," then the "Duke of Edinburgh" reported one "2 points from right ahead." It is now known that there were no submarines in the vicinity, but these reports could not well be ignored, so Jellicoe took the best course possible and turned directly towards the supposed menace. Incidentally this brought the course of the fleet back to south and re-formed the divisions into line ahead, the leaders being disposed quarterly. Hardly was the turn completed before the enemy reappeared out of the mist.

The Battle Fleets Re-engage

Having extricated his fleet from one trap it seems incredible that Scheer should have deliberately walked into another (see fig. 5). In his official despatch[3] he says: "It was as yet too early to assume night cruising order. The enemy could have compelled us to fight before dark, he could have prevented our exercising our initiative, and finally, he could have cut off our return to the German Bight." If ever there was a man who wanted to avoid decisive action it was the man who penned those words, yet in the next paragraph of his despatch he makes the illogical statement: "There was only one way of avoiding this: to deal the enemy a second blow by again advancing regardless of the consequences, and to bring all the destroyers to attack." The manner in which the High Seas Fleet renewed the action was such that its course was practically at right angles to that of the Grand Fleet, whose battleships were stretched across his bows so that they could concentrate on the leading German ships, while those in rear trailed astern out of action. The evidence goes to show that Scheer hoped to pass astern of the British line and thence make his way to the eastward, possibly engaging a detached force en route. If he had succeeded, he could then have made for

[1] The Grand Fleet deployed on a course southeast at 6:15. The deployment (excluding the 5th B.S.) was completed by about 6:40. The German battle fleet approached on a northeasterly course. At 6:27, the "König," leading battleship, turned east, the remainder following in succession (see fig. 3).

[2] Adm. Jellicoe had been informed by the Naval Intelligence Dept. that the German capital ships were known to carry mines.

[3] Battle of Jutland Official Despatches, p. 594.

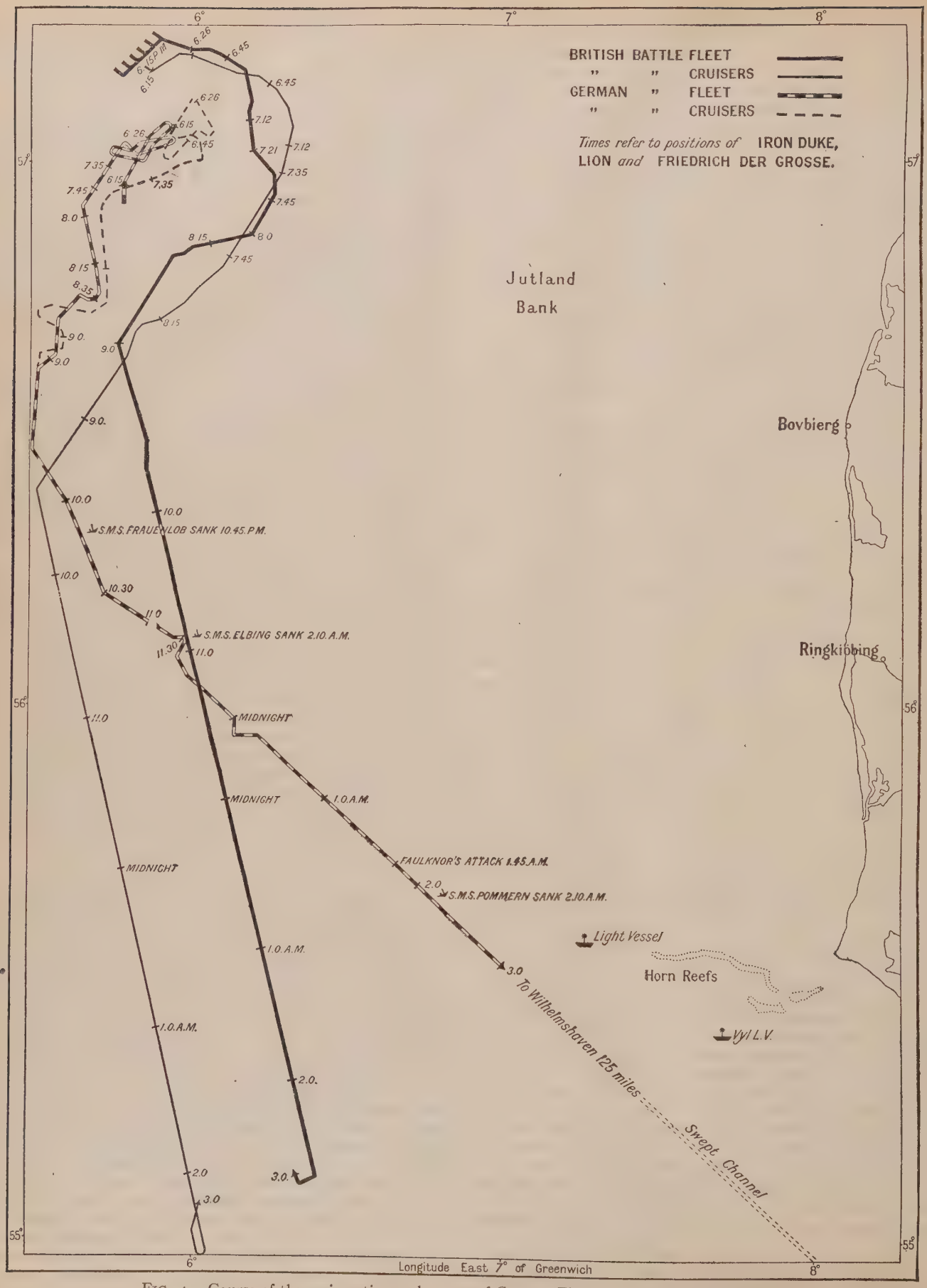

FIG. 4.—Course of the main action and escape of German Fleet. (6:15 P.M. to 3:00 A.M.)

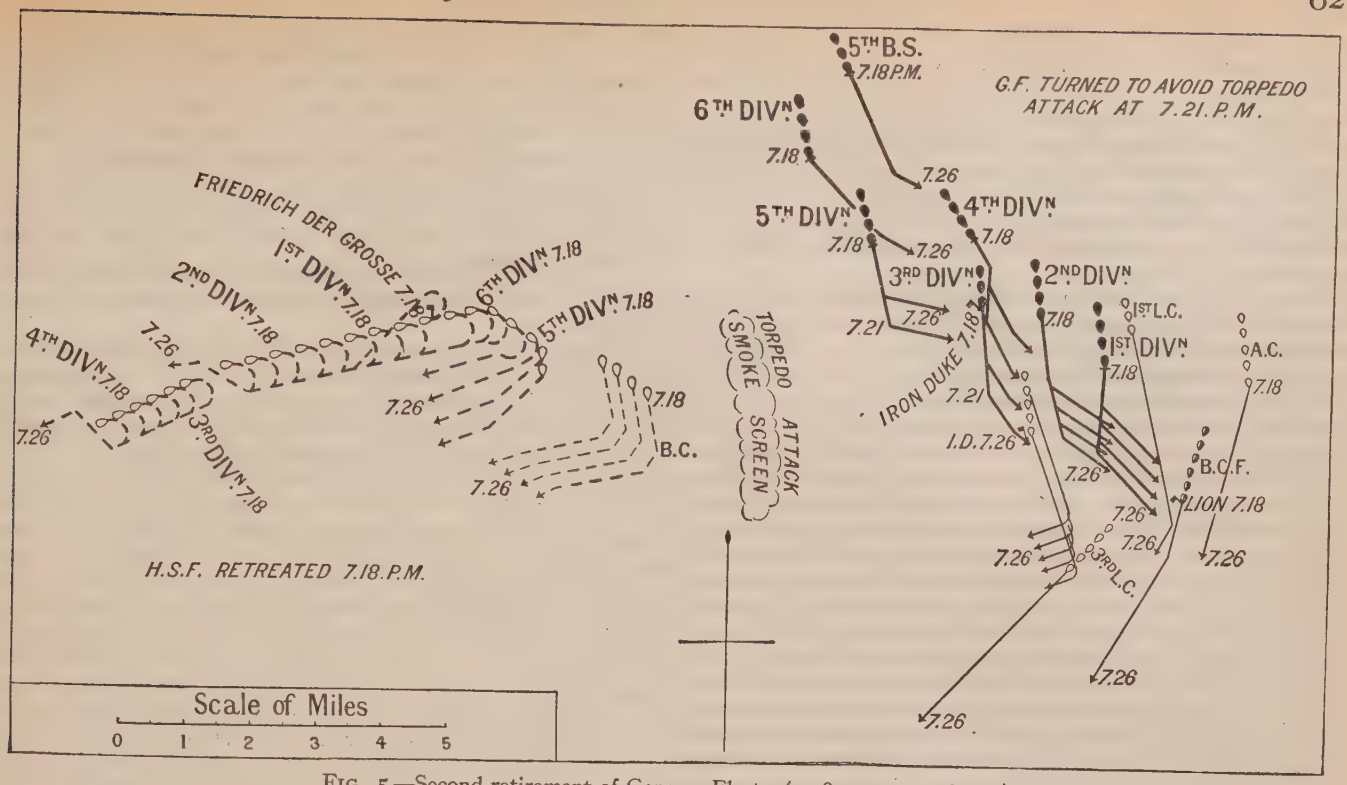

FIG. 5.—Second retirement of German Fleet. (7:18 P.M. to 7:26 P.M.)

home, fighting a rearguard action with the attendant difficulties for his enemy.

But Jellicoe had forestalled him. The British Battle Fleet was fair across his path and, in the low visibility prevailing, the commander-in-chief had not risked dividing his forces. First some enemy light cruisers appeared to the southwest of the "Iron Duke." A few minutes later, at 7:12, the 1st Battle Squadron at the northward end of the line was seen to open fire. The "Marlborough's" gunnery efficiency had not been impaired by her underwater injuries, and she discharged salvo after salvo at the "König" as the head of the enemy battle fleet came into sight. The rest of the squadron took up the engagement and soon the leading German ships were smothered in shell at a range of less than 9,000 yards. At 7:13 the "Iron Duke" came into action again. Once more the Grand Fleet was in a position of overwhelming tactical advantage and ship after ship joined her fire and picked out a battleship or battle-cruiser target as occasion offered. Meanwhile a small force of enemy destroyers had developed an attack which caused Sturdee to swing his 4th Division away two points to avoid their torpedoes. Directly the attack had expended itself, he turned back to the course of the fleet, approximately south, which brought him into line astern of the 3rd Division led by the "Iron Duke."

Jellicoe had been holding steadily on his course across the head of the enemy, but seeing his rear divisions in some danger of segregation he ordered them to form astern of him, while the "King George" was directed to lead the van into line ahead. And now the full fire-effect of the British battleships was rapidly developing, and Scheer saw that his leading ships were in danger of annihilation; another "right-about turn" was imperative. But the enemy seemed right on top and half round him. Drastic measures were necessary to get clear. The German battle cruisers would have to be sacrificed, if need be, to save the battle fleet. He made a signal to them which, read literally, meant "charge the enemy; ram; ships are to attack without regard to consequences." At the same time the destroyers, once again, were launched *en masse* to attack.

The "Lützow" had been completely disabled in the first contact of the main engagement, and was still ablaze and out of action. Hipper had not yet been able to get on board another battle cruiser, but Capt. Hartog, in the "Derfflinger" with the remaining three, led off gallantly on what the Germans have called a "death ride." To make matters worse, the British battle cruisers which had been working round on the outer arc of the circle, so to speak, were now coming into action again. So the enemy's 1st Scouting Group became the centre of a perfect hurricane of fire. The "Derfflinger" had two turrets shattered to bits and was being hit again and again, the "Seydlitz," "Moltke" and "Von der Tann" were also suffering severely when the welcome signal came permitting them to withdraw. By 7:20 the German Battle Fleet had repeated its former tactics and was retreating pell-mell to the westward behind a dense smoke screen put up by its destroyers. The latter pressed on to attack with more determination this time. There was no other enemy in sight so Jellicoe was free to concentrate his attention on this one. A heavy fire was opened on the oncoming torpedo craft which made them loose their torpedoes at long range. At 7:21 the British commander-in-chief swung his ships away in two quick successive turns of two points each before the torpedoes could reach the line. The result was that this attack was completely foiled. A second and third attack were countered by Commodore Le Mesurier's 4th Light Cruiser Squadron which, crossing from its station on the disengaged bow, drove furiously at the enemy. One German destroyer, "S.35," was sunk and several badly damaged. Jellicoe was, for the time being, in complete ignorance of what his main enemy was doing, but directly the torpedo attack had spent itself he, at 7:35, swung the fleet back five points to starboard and steered S.by W. (see fig. 4.)

Beatty had by now worked his way round to the starboard bow of the Battle Fleet and was heading southwest. At 7:40 he signalled to the commander-in-chief to say that the enemy was about 10 m. N.W. by W. But the "Lion" was quite out of sight from the fleet flagship, and her own position, as she gave it, was obviously wrong. Jellicoe, however, turned southwest, on the same course as his battle cruisers. At 7:45 Beatty again reported the position of the enemy, this time adding that the latter's course was about southwest. This signal was made to the "Minotaur" by searchlight, passed by her to the "King George V.," who passed it on to the "Iron Duke," where it did not arrive till 7:59. Jellicoe promptly turned the battle fleet west by divisions, and increased to 17 knots to regain touch with the

enemy. Hardly had he done so before a wireless message came to hand from Beatty saying: "Submit van of battleships follow battle cruisers. We can then cut off whole of the enemy's battle fleet." The commander-in-chief at once ordered Admi. Jerram to comply with this request, but, owing to the unavoidable delay in cyphering, transmitting and decyphering the message, the "Lion" had by then lost sight of the enemy; moreover, the battle cruisers were not in sight from the "King George V." In point of fact, the battle fleet was already steering straight for the enemy.

Although he had twice butted his head into trouble and twice withdrawn it considerably battered, Scheer was loath to be forced further to the westward and away from home. So, at 7:53, he hauled round and made his way tentatively to the southward. (*see* fig. 4.) Jerram had been somewhat at a loss to carry out his orders, but hearing gunfire on the port bow, he turned his division towards it, and at 8:21 was heading W.S.W. The firing came from Rear-Admi. Napier's 3rd Light Cruiser Squadron, which was engaging the 4th Scouting Group at the head of the High Seas Fleet. After a sharp conflict the enemy turned away and disappeared. Meanwhile, Beatty, who was also steering west, had again sighted the German battle cruisers and beyond them the pre-Dreadnought battleships steering south. He thereupon turned in succession to W.S.W. and opened fire. An attempt by hostile destroyers to attack the British battle cruisers was frustrated by Le Mesurier's light cruiser squadron. Beatty held on his course and was beginning to inflict severe punishment on the sorely stricken enemy battle cruisers; but they could stand no more, and, running out of action to the westward, sought cover behind the old ships of Admiral Mauve's 2nd Battle Squadron.

Meanwhile Jellicoe had good reason to be satisfied with the situation. His battle cruisers had made contact, he was between the German fleet and its own coast, and he seemed on the point of renewing the engagement. At 8:28 he turned by divisions to southwest and stood down on a converging course expecting momentarily to meet his adversary. But Scheer foresaw the impending collision, indeed his headmost ships were already in the track of the on-coming storm. He had no intention of suffering again from its full blast, and by 8:35 he had turned hastily to the westward and disappeared before the British battle fleet came in sight. So the firing died away and now the mists of night rolled down between the rival forces. It was past 9:00 before Jellicoe was fully informed as to the situation; then he received a message from the "Lion" reporting that at 8:40 the enemy's battle cruisers and pre-Dreadnought battleships bore from that ship N. 34° W. 10 to 11 m. and were steering southwest. Beatty at the same time made his position and gave his course also as southwest.

It was now an hour after sunset and growing darker every moment. The hazards of a fleet action at night were unthinkable to a wise commander. It only remained for Jellicoe to maintain his position between the enemy and the German coast until he could fight to a finish the next day. He therefore set about making his dispositions for the dark hours.

IV. EVENTS OF THE NIGHT

There were three potential lines of retreat for the High Seas Fleet. (*see* fig. 1.) The northerly one led to Horn Reefs, and thence down the swept channel inshore of the Amrun Bank minefield to the mouth of the Jade; the second would be reached by a southerly course to a swept channel which led eastward close to Heligoland; lastly, there was the swept channel which led from the vicinity of the Ems river parallel to the coast to the entrance into the Jade. (See fig. 1.)

Jellicoe's Dispositions.—At 9:17 Jellicoe ordered the fleet to take up night cruising stations. This meant that the battle fleet were to close up into three parallel columns with the 5th Battle Squadron, now consisting of three ships only,[1] on the port quarter. Beatty had already anticipated his commander-in-chief's wishes and having taken station ahead and placed the 1st and 3rd Light Cruiser Squadrons to the southward and westward of him, assumed the course and speed of the fleet; these were south, 17 knots. Five miles astern of the battle fleet Jellicoe massed his destroyer flotillas. This had the following advantages:—

(*a*) It covered the rear of the fleet from attacks by hostile flotillas.
(*b*) It increased the chances of intercepting the enemy should he endeavour to make to the eastward, and of obstructing his passage by torpedo attacks.
(*c*) It kept the Grand Fleet destroyers clear of their own battleships and therefore minimised the chances of disastrous mistakes in the dark.

The value of these dispositions was to some extent diminished by the difficulty of communicating their purport to commanding officers, especially those of the innumerable destroyers, but, in effect, the British fleet ploughing through the night presented a living wall of steel barring the enemy's passage home.

Scheer's Return.—Scheer also prepared for the night. His 1st Battle Squadron led the line and was followed by the 3rd Battle Squadron; then came the older ships of the 2nd Battle Squadron and lastly the three sorely wounded battle cruisers.[2] The light cruisers of the 2nd and 4th Scouting Groups were stationed near the head of the battle fleet, while in advance of all were the majority of the German destroyers groping like antennae into the darkness. About 9:30 Scheer started to feel his way to the eastward, the van of his line turning S.S.E.$\frac{1}{4}$E., a course which headed for Horn Reefs. Shortly after 10:00 his advanced light cruisers came into contact with the right wing of the flotillas bringing up the rear of the Grand Fleet. A sharp fight took place in which the "Castor," leading the 11th flotilla, was severely handled. The near-by destroyers would probably have retaliated with more effect had they not been deceived by the enemy making part of the British challenge for the day. This he appears to have picked up through indiscreet flashing signalling between the "Lion" and "Princess Royal," about half an hour previously.

The High Seas Fleet recoiled slightly after this brief encounter, but even the rival forces continued to converge and now Goodenough's light cruisers once more came into the forefront of the scene. He had been keeping in touch with the "Marlborough's" division, but owing to the under-water injuries of the flagship, the latter was lagging nearly three miles astern of its proper station. The "Castor's" engagement had put the "Southampton" and her consorts on the alert, and they were well prepared when, about 10:30, they suddenly found themselves abreast the 4th Scouting Group. A fierce contest ensued. The "Southampton" was the most vigorously assaulted. Her upper deck became a shambles and she was blazing like a haystack from cordite fires, but in the midst of this holocaust she fired a torpedo which sunk the "Frauenlob" with all hands. At the end of a quarter of an hour the enemy had had enough and drew off into the darkness. The German light cruisers had already reported the presence of enemy light forces and the order stationing the British destroyer flotillas astern had been intercepted and translated to Scheer by a shore wireless station. From these reports he probably realised that our battle fleet had drawn ahead. In any case he was determined to force his way to the eastward. At 10:30 he turned back to S.E.$\frac{1}{2}$E. heading direct for Horn Reefs Light Vessel.

The British Destroyers in Action.—The rest of the story of that night is one of sudden encounters with an enemy fighting desperately to get home while the British destroyers gallantly threw themselves in his path whenever opportunity served. The German fleet was frequently in a state of much confusion, the "Elbing" was rammed by the "Posen" and later had to be sunk to prevent capture. The "Rostock" was torpedoed by the 4th Flotilla and also had to be sunk. On the British side the destroyers suffered severely. About 11:30 the "Tipperary" was so badly damaged by gunfire that she sank the next morning. The "Spitfire" met the great battleship "Nassau" nearly end on, tore twenty feet from the latter's plating and carried it off

[1] The "Warspite" after her involuntary circle at 6:20 P.M. continued to have trouble with her steering gear. At 7:00 she withdrew from the action and at 8:50 was ordered back to Rosyth. She had been badly hit in the earlier fighting.

[2] The "Lützow" was limping along to the northward sinking deeper and deeper by the bows. At 2 A.M. she had to be abandoned and was afterwards sunk with a torpedo.

on her forecastle. She was badly damaged but had done good execution with her small gun armament, putting out the big ship's searchlights and causing a number of casualties.

The shock of this conflict again caused the German fleet to waver and the leading battleships turned away nearly eight points to the westward, but Scheer was adamant in his determination to break through at all costs while darkness gave hope of escape. He forced his van back, and by 11:34 the "Westfalen" was again leading the line to the south-eastward. In another encounter a few moments later the "Broke's" steering gear was disabled and she and the "Contest" rammed the "Sparrowhawk," and the latter had to be sunk the next day. Between midnight and 12:30 A.M. the "Fortune" and "Ardent" were sunk and the "Porpoise" disabled by gunfire, and the "Turbulent" was rammed and sunk with all hands. Again and again the British light craft attacked, but from now onwards the enemy held his course; and the tragedy of that night was that no accurate information of the German battle fleet was vouchsafed to Adm. Jellicoe.

Admiralty Messages.—Two reports, based on intercepted wireless messages, were sent to Jellicoe by the Admiralty. One, despatched at 9:58, received in the "Iron Duke" about 10:23, but not decyphered and read until 11, gave an obviously wrong position of the rear ships of the enemy battle fleet at 9 P.M. A second message, despatched at 10:41, received at 11:05, and read about 11:30, stated that the German battle fleet had been ordered home at 9:14, battle cruisers in rear, course S.S.E. ¾E., 16 knots. This latter was a summary of several intercepted signals but most unfortunately it omitted the fact that Scheer, at 9:06, had made an urgent call for airship reconnaissance off Horn Reefs at daylight, clearly indicating his intended line of retreat. The second Admiralty message referred to the enemy's movements at 9:14, but at 11:38 Goodenough's report was received[1] saying: "Have engaged enemy cruisers at 10:15 bearing W.S.W.," and about the same time the "Birmingham" also reported from astern: "Battle cruisers probably hostile in sight northeast course south" (11:30). These reports came from ships which had actually sighted the enemy long after the time referred to in the Admiralty messages. They indicated that he had not yet turned home. The "Birmingham," unfortunately, sighted the German heavy ships at a moment when they had turned away from our torpedo attacks, his report therefore was misleading, but other ships might have saved the situation.

At 11:35 the "Valiant," last ship but one of the 5th Battle Squadron, noted what appeared to be "two German cruisers with at least two funnels and a crane amidships, apparently steering to the eastward at a high speed."[2] These details make it certain that the ships were battleships and should have been recognised as such. The "Malaya," the last ship of the squadron, had a clearer view and noted at 11:40 "enemy big ships, three points abaft the starboard beam, steering the same way as ours." By the flash of an explosion the leading ship was seen to have "two masts, two funnels and a conspicuous crane (apparently "Westfalen" class)."[3] It was obvious that the enemy's main fleet had closed in from the westward and was edging its way across the wake of the 5th Battle Squadron, yet for some inconceivable reason these two ships neglected to report what they had seen. Had they done so it would have greatly increased the chances of an overwhelming victory next day. The courage and self-sacrifices of the British destroyers did not provide the one thing lacking, *i.e.*, information. Before the curtain of darkness had lifted, Scheer had hacked his way through the light forces and passed to the eastward.

Scheer was not yet out of the wood, however. About 1:45, just as a faint grey light was heralding the approaching dawn, Capt. Stirling, in the "Faulkner" with his fine 34 knot 12th Flotilla, sighted large ships on his starboard bow, steering a southeasterly course. Even as he manoeuvred to attack he thought to send a wireless report to his commander-in-chief. The attack, carried out with the greatest dash and gallantry, resulted in the battleship "Pommern" being sunk without a trace. Again Capt. Stirling made his wireless message, but neither of his reports reached the "Iron Duke." About 2:25 in the growing light, the "Champion" with three destroyers sighted the enemy. One of the latter, the "Moresby," broke off at once and made a plucky attack which sank the German destroyer "V4," but the "Champion" turned to the eastward and made no report.

At 2:39 A.M. Jellicoe turned north. He had been left with the impression that the enemy had been following him south and now, with daylight rapidly returning, he was anxious to get in touch with a view to renewing the engagement. It had been his intention to close Horn Reefs at dawn, but the night fighting had scattered his flotillas and he deemed it imprudent to thrust into enemy waters until he could collect a destroyer screen. A signal from the Admiralty, despatched at 1:48 A.M. but not received in the "Iron Duke" until 2:40 informed the commander-in-chief that enemy submarines were apparently coming out from German ports. The battle fleet formed single line on the northerly course so as to be ready for emergency in the early morning haze, and so, retracing his path, Jellicoe expected momentarily to fall in with his destroyer flotillas and possibly the damaged "Lützow." Tyrwhitt's Harwich Force had, at last, been ordered to sea, and by 3:50 A.M. he was under way, much too late to be of service. From 3:15 A.M. Zeppelins began to be sighted and at 3:42 A.M. the battle fleet had turned expectantly towards the sound of guns, but found that it was only some British cruisers engaging one of the enemy airships. It was obvious, however, that by now the position of the British fleet must be known to the German command. The hope of meeting the enemy which had been growing fainter was finally shattered by an Admiralty message received at 4:15 A.M. saying that at 2:30 A.M. the High Seas Fleet was only 16 m. from Horn Reefs steering S.E.b.S. at 16 knots.

Beatty was still clinging to the idea that the enemy was to the south-westward, and asked permission to sweep in that direction; but at 4:30 A.M., having re-formed into cruising formation, Jellicoe regretfully made the signal "Enemy fleet has returned to harbour." Scheer reached Horn Reefs Light Vessel about 3 A.M. There he lingered for a short space receiving reports from his airships and taking stock of the condition of his fleet. At 3:30 A.M. he was informed that the "Lützow" had had to be sunk. The rest of the 1st Scouting Group was in no condition for serious action, the battleships which had been in the van had also suffered considerably, and he had only three light cruisers serviceable; moreover the visibility was such that he could not rely on airship reconnaissance. Indeed many of the reports which he received from this source have since been proved to be very inaccurate. A policy of discretion was obviously dictated, and he gave the order for the whole fleet to return to harbour. On the way in, the battleship "Ostfriesland" struck a mine laid in the channel by the British destroyer "Abdiel" but got home.

The losses may be summarised as follows:—

Ships	British	German
Battleships	Nil	1
Battle Cruisers	3	1
Cruisers	3	Nil
Light Cruisers	Nil	4
Torpedo Craft	8	5

Personnel	British	German
Officers (killed)	328	160
Men (killed)	5,769	2,385
Officers (Prisoners)	10	Nil
Men (Prisoners)	167	Nil
	6,274	2,545

[1] The delay was due to "Southampton's" wireless gear having been shot away.

[2] "Valiant's" report in Jutland despatches, p. 211.

[3] "Malaya's" report in Jutland despatches, p. 220.

On the face of them these figures would appear to leave the balance of Jutland in favour of Germany, so far as destruction of men and ships is concerned, but the value of the battle must be measured in its after effects and not in its momentary losses. There Britain was the gainer.

Results.—The broad effects of Jutland are a matter of history, but they may be summarised as follows:—

1. The High Seas Fleet after "consistently refusing action and manoeuvring with the sole object of returning safely to its base," as Jellicoe has put it, left the Grand Fleet in undisputed possession of the arena.

2. Although the German High Command must have realised that the Grand Fleet as a "fleet in being" was the fulcrum of the whole Allied cause, the High Seas Fleet only once left the Heligoland Bight after Jutland; this was on Aug. 19 of the same year. On this occasion Scheer was warned by airship reconnaissance that the British Battle Fleet was advancing to meet him, whereupon he returned to his base.

3. In Nov. 1918 Scheer ordered the High Seas Fleet to sea "to break the blockade." It was to have been a final bid for victory, but inaction had only served to crystallise the memories of Jutland; the crews refused to weigh anchor. This mutinous outbreak at Wilhelmshaven widened the fissure which shortly afterwards engulfed the whole German cause.

4. The full fruits of Jellicoe's domination of the German Fleet at Jutland were yielded on Nov. 21 1918, when Beatty received the surrender of the greater part of the High Seas Fleet.

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JUVENILE COURTS: *see* CHILDREN'S COURTS.

KAISER, GEORG (1878–), German dramatist, was born at Magdeburg Nov. 25 1878, the son of a merchant. Educated in his native city, he became a merchant and joined the staff of the Deutsch-Ueberseeischen Elektrizitäts-Gesellschaft, Buenos Aires. After three years he was forced to return to Germany owing to ill-health. He lived for some time at Magdeburg and at the Seeheim (Mariners' Home) in Berlin. In 1903 he published his first drama and from that time onwards wrote numerous farces, and plays dealing with social and ethical problems. In 1920 he was prosecuted for embezzlement and sentenced to a term of imprisonment. His work attracted considerable attention both in his own country and abroad. His play *Von Morgen bis Mitternachts* was produced in English as *From Morn to Midnight* at the Regent Theatre, London, in 1926.

His works include: *Die jüdische Witwe* (1911); *König Hahnrei* (1913); *Die Bürger von Calais* (1914); *Von Morgen bis Mitternachts* (1916); *Die Sorina* (1917); *Die Versuchung* (1917); *Gas* (1918 and 1920); *Die Koralle* (1918); *Die Flucht nach Venedig* (1923); *Kolportage* (1924).

KALA-AZAR (*see* 15.637).—In 1881 a malaria-like fever, with great enlargement of the spleen, was found to be causing serious mortality at the foot of the Garo Hills in Assam, from whence it spread slowly eastward during the next two decades over some 200 m. of the Brahmaputra valley, carrying off about one-third of the inhabitants.

Causation and History of Parasite.—It was attributed by successive investigators to hookworm disease, epidemic malaria, and Malta fever respectively, until in 1903 Leishman and Donovan independently discovered its cause in a new minute protozoal parasite, Leishmania donovani, found in the spleen. In the following year L. Rogers developed a flagellate stage of the organism in cultures, and suggested a biting insect, probably the bedbug, as its carrier, a supposition which was supported by Patton demonstrating the flagellate stage of the parasite in bedbugs fed on the blood of kala-azar patients in 1905. But in 1925 Knowles and Napier, of the Calcutta School of Tropical Medicine, appear to have solved the difficult problem by incriminating a sand fly, Phlebotomus argentipes, as the true agent in transmitting the disease; this minute insect, together with kala-azar cases, being far more prevalent in areas of Calcutta with much vegetation than in the more crowded Indian quarter. After the discovery of the causative parasite in 1903 it was soon found that what had for a century been called malarial cachexia in Bengal was nothing but a widely distributed sporadic form of the Assam epidemic kala-azar, the virulence of the latter being due to its invasion of an area previously free from the disease. The disease is now recognised as being very prevalent over all Bengal, Bihar, the eastern part of the United provinces and in Madras, but the comparatively dry Punjab and north-west frontier are practically free from the disease, a certain degree of humidity being necessary for it. A form of kala-azar especially affecting children is also prevalent all round the Mediterranean basin and in Egypt and the Soudan.

Symptoms.—Kala-azar is characterised by very prolonged fever, often typhoid-like in the early stages, and frequently showing two or three rises and falls in 24 hours, the characteristic double remittent fever, but with long intervals of low continued or intermittent fever, the total duration being seldom less than seven months and often extending, with periods of freedom from fever, over several years; accompanied by extreme wasting, very great enlargement of the spleen, and later of the liver, some anaemia and extreme reduction of the white corpuscles of the blood, which lowers the resisting power of the patients to secondary infections with septic diseases, pneumonia, dysentery and phthisis, which are far more frequently the ultimate cause of death than the original disease, the case mortality having been until recently from 80 to 96%.

Prophylaxis and Treatment.—As the result of his Assam researches of 1897, L. Rogers established a house and site infection of kala-azar and worked out a system of moving the sites of the villages and tea garden coolie lines, whereby the further progress of the epidemic up the Assam valley was checked for many years. J. Dodds Price successfully applied the same plan to stamping out the disease from a number of badly infected tea estates, thereby saving the industry in the Nowgong district. The debilitating effects of the 1918 influenza pandemic led to a recrudescence of kala-azar in the Assam valley, including the more eastern and little infected area. Fortunately by this time an effective treatment had been discovered in intravenous injection of tartar emetic and other antimony preparations, which now enables some 90% of the cases to be cured; a greater saving of life perhaps than has been effected in any such fatal illness by modern medical research, with the result that many thousand cases have been treated successfully each year in Assam and Bengal. Given adequate funds and organisation, this, the most terrible of tropical fevers, might be nearly stamped out of the large areas which it has decimated for centuries past and further epidemics prevented. See L. E. Napier and E. Muir, *Kala-Azar* (1923). (L. Ro.)

KAMERUN: *see* CAMEROONS.

KANSAS (*see* 15.654).—The population of Kansas on July 1 1925, according to the State census of that date, was 1,812,936, as compared with 1,769,257 by the Federal census of 1920. The estimated population on July 1 1926 was 1,820,296. Four cities (Kansas City, Wichita, Topeka and Hutchinson) had over 25,000 inhabitants in June 1926. 43.5% of the population lived in cities and towns of over 1,000 inhabitants. In the ten years from 1915 to 1925 the rural population increased only 5,000 while the urban population increased 135,000.

Agriculture.—Kansas is pre-eminently an agricultural state. It is the largest producer of wheat and corn taken together in the Union. The wheat crop in 1924 was 151,690,970 bu., and the corn crop was 118,789,236 bushels. The crops next in importance were oats and barley. There is an extensive livestock industry.

Mineral Products.—There are considerable deposits of bituminous coal along the eastern border of the state; production amounted in 1924 to about 4,150,000 short tons. Natural gas yielded 27·8 billion cu. ft. in 1920. There has been little effective control of the distribution of gas, and distributing companies have fixed rates in total disregard of their original contracts. The most striking development of the decade in this field had been in the production of petroleum which stood at only 3,000,000 barrels in 1914, jumped to 36,500,000 in 1917, reached the peak at 45,500,000 in 1918 and stood at 28,483,000 in 1924. The supply of materials for cement seems inexhaustible and the value of this product is exceeded only by those of oil, coal and gas. Kansas ranks fourth in the Union in the production of salt, of which the production in 1924 was reported by the State Geological Survey at 794,303 short tons, valued at $3,176,000. The Joplin zinc and lead field overlaps the southeast corner of the State, but while the field approaches exhaustion on the Missouri side, it is capable of indefinite development in Kansas. The output of zinc in 1924 was 105,392 short tons, valued at $13,700,960.

Manufactures and Transport.—Federal statistics distinguish 36 industrial groups in each of which the value of the annual output exceeds $300,000. The larger interests are based upon products of agriculture. The largest is the slaughtering and packing of meat, which in 1923 produced products valued at $224,661,483 —almost one-tenth of the total output of the United States. Nearly the whole of this industry is localised in Kansas City. The next largest industry is the milling of flour, which is widely distributed over the State. Slaughtering and milling together contribute considerably more than half the value of the manufactured products of the State. Railways and the industries subsidiary to them employ a large part of the labour of the State.

The railway mileage was 9,384 in 1923. The electric interurban railway mileage was 582 in 1923. With the building of hard-surfaced roads motor-bus lines are superseding electric railways.

Constitution.—Kansas in 1925 was still governed by her original constitution, adopted in 1859. Twenty-one amendments were made prior to 1910 and seven have been added since that time. The suffrage was extended to women in 1912, and under pressure of the World War the suffrage was limited in 1918 to citizens of the United States. Provision was made for recall of public officers in 1914, but the Supreme Court decided that the clauses are not self-executing, in that they make no provision for special elections, and the Legislature has not seen fit to give them effect. The constitutional requirement that all property be taxed at a uniform rate has delayed tax reform. An amendment permitting the classification of property for purposes of taxation was rejected by the people in 1914 and 1920 but finally carried in somewhat altered form in 1923. Two amendments were adopted in 1920. One, resulting from the efforts of Gov. Allen to reduce farm tenantry, authorised the creation of a fund to assist in the purchase of farm homes. The other so far removed the prohibition of State action in works of internal improvement as to allow the State to assist counties in building roads. No action has been taken by the Legislature under either head.

Legislation.—Generally speaking, legislation has followed the drift in other states. An exception was the " blue sky " law, for the regulation of investment companies, passed in 1911 and amended in detail in 1913 and 1915. It prohibits the sale in the State of stocks not approved by a board, consisting of the Secretary of State, the Attorney-General and the State Bank Commissioner, and thus prevents the floating of worthless securities. It has been extensively copied in other states. Another step in advance was the act of 1913 which provides for the nomination and election of judges by separate ballots without party designation. Since 1910 the administration of the State has become centralised to a high degree. The first step was taken in 1913 in reference to the various educational institutions, and in 1925 all the higher educational institutions were put under the control of a single board called a Board of Regents, consisting of nine members appointed by the governor for terms of four years and electing their own chairman. A provision that part of the board retire annually is intended to give it permanence and remove it from political control. An attempt, made by Gov. Capper in 1917 and renewed by Gov. Allen in 1921, to consolidate on a similar plan the various bureaux that compose the State Board of Agriculture did not succeed. In 1911 the State Board of Railroad Commissioners was superseded by a Public Utilities Commission, modelled on the commissions already established in New York and Wisconsin, to which was given supervision of all public utilities in the State.

The Eighteenth (Prohibition) Federal Amendment was ratified Jan. 14 1919. In 1919 a general strike in the coal-fields broke out, which suspended production and threatened a coal famine in the midst of an exceptionally severe winter. Gov. Allen took over the coal-mines and began their operation by means of volunteers recruited chiefly from among the students in the educational institutions, and called the Legislature in special session to provide against the recurrence of such conditions. The result was the passage in 1920 of an act which created a Court of Industrial Relations, consisting of three members. The act declared the manufacture of food and clothing, the mining of fuel and transport to be essential industries and " affected with a public interest " to such a degree as to justify public control. The right of collective bargaining was recognised but strikes were prohibited and the court was given authority, either on its own initiative or on complaint, to investigate and to issue orders regulating limitation of production, hours and conditions of labour, and rate of wages. Originally the Public Utilities Commission was merged in the Industrial Court, but in 1921 the former was re-established—a separate body and the Labour Bureau and the Industrial Commission were merged in the latter. Finally in 1924 the Tax Commission, the Public Utilities Commission and Court of Industrial Relations, including the Department of Labour, were consolidated in a single board of five members called the Public Service Commission. The power of the court to fix wages has been annulled by the courts but in other respects it functions satisfactorily operating with the Bureau of Labour as a department of the Public Service Commission. A considerable number of cities have abandoned the old city council form of government. An act passed in 1907 and amended in 1909 and 1913 authorised the adoption of a commission form of government in cities of the first and second class. Up to 1917, 54 cities reorganised under this law. In 1917 the Legislature authorised the city-manager plan. All cities that have reorganised since then (14 by 1925) have adopted this plan.

History.—Kansas has been overwhelmingly Republican in politics and there has been practically no Democratic press in the State. The following have been governors since 1909: W. R. Stubbs, Rep., 1909 and 1911. G. M. Hodges, Dem., 1912. A. Capper, Rep., 1914 and 1916. H. J. Allen, Rep., 1918 and 1920. J. Davis, Dem., 1922. S. Paulen, Rep., 1924.

Bibliography.—Session laws and Senate and House journals are issued after each legislative session. The last edition of the *Compiled Statutes* was issued in 1923. Reports of executive departments are brought together in a collective volume entitled *Combined Department Reports.* Other important publications are the *Biennial Reports* of the State Board of Agriculture and the State Board of Health and the collections of the State Historical Society. The State Library issued in 1920 a reprint of the *Proceedings of the Constitutional Convention of 1859,* with much supplementary historical matter, edited by H. G. Larimer. (F. H. H.*)

KANSAS CITY, Kan., U.S.A. (*see* 15.660), annexed about 1,000 acres of territory between 1910 and 1920 and over 2,000 more, including Rosedale, in the following years. Its area is now (1926) 23 square miles. The population in 1920 was 101,177 (104.9 males to 100 females), of whom 14,405 were negroes and 11,721 foreign born; in 1925 the state census gave it as 116,053. The meat packing industry, in which the city ranked next to Chicago, continued to overshadow all other industries, contributing 75–80% of the total value of factory products within the city limits, which totalled $164,081,000 in 1909, $468,686,000 in 1919, $235,561,733 in 1921 and $262,446,752 in 1923. The packing industry and the livestock market illustrate the economic unity of the two Kansas Cities. The packing houses are on the Kansas side; the state line runs through the stockyards, of which 92% are in Kansas; the livestock exchange is in the Missouri city. By 1925 over $7,000,000 had been invested in the water, light and power plant; the park area had been increased to 300 acres; the connecting boulevards to 25 m. and plans for 50 m. more had been made by the city planning commission. A zoning ordinance was adopted in 1924. A city hall was erected in 1911; a memorial building, dedicated to those who lost their lives in the wars of the country, in 1925; and a beautiful county court house was under construction in 1926.

KANSAS CITY, Mo., U.S.A. (*see* 15.661), the nineteenth city in point of size, and the seat of a Federal Reserve Bank, was in 1924, with its contiguous neighbour across the state line, the largest market in the country for hay, stock and feed cattle, and stock hogs. It ranked first in distribution of lumber, seeds, kaffir corn and agricultural implements; second in meat-packing and as a live-stock and horse and mule market; third in manufacture of flour and soap and as a grain market; fifth in capacity of grain elevators; sixth in post-office receipts; and tenth in bank clearings.

The population in 1920 was 324,410, of whom 30,719 were negroes and 27,320 foreign born; in 1925, according to the official estimate, it was 367,481. In 1924 the output of the manufacturing plants of Greater Kansas City was valued at $604,526,719; the goods distributed by the wholesale houses at $727,327,171. Manufacturing was increased after the World War by the establishment of branch plants of many eastern firms. The making of open-hearth steel for local consumption developed. Large oil refineries were built, with direct pipe-lines from the producing fields. Transportation facilities were increased by auto-bus lines over hard-surfaced roads built in every direction; and by the Kansas City Terminal Railway, which

operates a system of depressed tracks, constructed at a cost of $50,000,000, and a Union passenger station opened in 1914.

By 1925 the public school system included 90 elementary schools, five senior and three junior high schools, a teachers' college, a junior college, 31 combination and special schools; a bond issue of $5,000,000 for new buildings and equipment had just been authorised. The common "chest" for 45 philanthropic agencies was nearly $1,000,000; a city plan had been adopted (1922); there were 3,470 ac. in the parks and playgrounds, 95 m. of continuous boulevard, an exceptionally fine baseball park and 10 golf courses; a comprehensive zoning ordinance had been passed (1923); a new water supply plant to cost $11,000,000 was under construction; the Liberty Memorial, designed as the central feature of a group of buildings for cultural purposes, was nearing completion opposite the Union Station Plaza. The cost of living in Kansas City is relatively low (94·4% of the average for 31 American cities, Dec. 1924). In 1925 a new charter—the fourth prepared within eight years, and the third submitted to the voters—was adopted by a large majority, setting up the council-manager form of government.

KAPOK: *see* CELLULOSE; FIBRES.

KAPP, WOLFGANG (1868–1922), German politician, was born in New York July 24 1868. He was the son of Friedrich Kapp, a National Liberal member of the Reichstag in Bismarck's time, and grew up under the Bismarckian influences. Having held various minor official posts, he founded the agricultural credit institute in East Prussia, which achieved great success in promoting the prosperity of landowners and farmers. He was consequently in close touch with the Junkers of East Prussia and during the World War made himself their mouthpiece in an attack on Bethmann Hollweg (*Die Nationalen Kreise und der Reichskanzler* (1916). He was also one of the founders of the "Vaterslandspartei." For a brief period in 1918 he was a Conservative member of the Reichstag.

Kapp remained in the background till March 12 1920, when the Republican Govt. suddenly issued an order for his arrest. It became known that he had organised, with General von Lüttwitz and other officers, a conspiracy to occupy the Government offices, and assume power in Berlin. This he actually succeeded in doing on the morning of March 13. Kapp was installed in the Imperial Chancellary and at once styled himself "Chancellor of the Reich." President Ebert and most of his ministers fled, first to Dresden and then to Stuttgart. The Kapp Govt. was, however, short-lived. The working classes of Berlin rendered its continuance impossible by declaring a universal strike, and on the evening of March 17, Kapp and Lüttwitz fled to Berlin. Warrants were issued for their arrest, but Lüttwitz disappeared completely, and Kapp eventually escaped by aeroplane to Sweden. In April 1922 he returned to Germany and was immediately arrested for high treason, but he died on June 12 from the consequences of an eye operation at Leipzig, before the case was heard.

KARACHI, India (*see* 15.672), has grown very rapidly, and the population, which was 216,883, half Hindu and half Moslem, in 1921, has nearly doubled since 1901. In 1920–1, 364 plans for new buildings were approved, and 367 in 1921–2. Among notable public buildings are the municipal offices, begun before the World War but unfinished in 1923; the fine Port Trust offices and customs house (1915); a small causes court, revenue office and paper currency office; the Jehangir Kothari hall; a home for poor and defective persons, a new maternity home, and a Welfare Association building; a masonic temple, a commercial college and several schools. The foundation stone of a new building for the chamber of commerce was laid in 1924. A parade with terraces and a pier to the water's edge was opened at New Clifton in 1921, and a People's Park has been laid out in the old bed of the river Lyari. A new embankment road skirts the old town and forms the southern boundary of the park. A contract was placed in 1925 for a new conduit from Malir, 16 m. long, to increase the supply.

Karachi is a progressive port with a great future. It receives the produce of the Punjab, Sind, Baluchistan, Afghanistan, much of Rajputana, and part of the United Provinces, while the Delhi trade has shown a tendency to pass through Karachi rather than Bombay. The great Sukhur barrage scheme, which received official approval in 1921, will bring the exportable produce of a further 3,500,000 acres to the port. Trade has recovered gradually from the effects of the War, and the exports are largely wheat. The imports are mostly cotton and woollen goods and yarn. A new boat basin was built in 1911, a wharf for coasting steamers in 1912 and work on other extensions is in progress. It is planned to build 13 new berths on the west side of the harbour. Land for six berths was reclaimed in 1923–4, and it is hoped that three berths, each 550 ft. long, will be finished by 1927. The North-Western Railway, on which Karachi is dependent, is now double-tracked as far north as Samasata.

KARNEBEEK, HERMAN ADRIAAN VAN (1874–), Dutch statesman, was Netherland's delegate to the Second Peace Conference at The Hague in 1907. In 1911 he became burgomaster of The Hague, holding this position until 1918, when he was appointed Foreign Secretary. In 1921 he presided at the second Assembly of the League of Nations.

KÁROLYI, MICHAEL, COUNT (1875–), Hungarian politician, born on March 4 1875, and descended from a famous and wealthy family, Count Károlyi, after a delicate childhood, took his degree at Budapest University, exhibited keen interest in horse breeding and horse racing and became, in succession to his uncle, president of the Hungarian Co-operative Society (Hangya). He then travelled a good deal, spending much time in Paris. In 1902 he stood for Parliament as a Liberal but was defeated. In 1905 he was elected to a short Parliament and took no further part in Hungarian public life until 1909 when he became president of the Hungarian Agricultural Society, and worked for the creation of an agrarian Centre party. He then resigned from the conservative Agricultural Society and, having come under the influence of the writings of Karl Marx, became leader of the Radical wing of the Independence party, and led the Parliamentary opposition against Count Stephen Tisza, then Prime Minister, with whom he fought a duel.

Opponents of Count Károlyi have maintained that his jealousy of Tisza and his enmity against the older statesman were the dominating motives of his career. Count Károlyi, in his autobiography, *Fighting the World*, while admitting that it was Tisza who drove him into a democratic camp, has maintained that his political ambitions were to break the relations between Austria and Hungary, substituting for them a Russo-Hungarian *rapprochement*, and also to destroy the capitalist system. In order to provide party funds for these purposes he entered into secret negotiations with the French Govt. and visited America. His return from that country coincided with the outbreak of the World War and he was interned in France, but was soon released on the understanding that on reaching Hungary he would do his best to bring the War to a speedy conclusion. He then seceded from the Independence group and founded the Károlyi party for the purpose of breaking with the Germans and entering into a separate treaty of peace. In spite of these opinions he married, on Nov. 7 1914, the step-daughter of Count Julius Andrássy, a statesman with utterly opposite views, and became an officer in the National Defence Hussars. He concentrated his activities throughout the War on pacific aims in the hope that their realisation would achieve in Hungary the enactment of universal suffrage, socialisation of industry and the division of land amongst the people.

On Oct. 25 1918, when the War was clearly lost, Count Károlyi founded the National Council composed of his own personal supporters, Social Democrats and Radicals. The Werkerle Cabinet resigned, and Count Hadik was appointed Premier by King Charles. On Oct. 30 there was a revolution, led by the Soldiers' Council and supporters of the National Council, who occupied practically all strategic points in Budapest. The next day Count Hadik resigned and in the name of King Charles Archduke Joseph had no alternative but to appoint Count Károlyi as Prime Minister, who then took the oath of allegiance to the King. The same day, Oct. 31 1918, Count Tisza was assassinated in his Budapest home by revolutionaries. On Nov.

16 the Hungarian People's Republic was proclaimed at a public meeting under the auspices of the National Council, and full powers were entrusted to the Cabinet of which Károlyi was Prime Minister. On Jan. 11 1919 the National Council formally proclaimed Károlyi as President of the People's Republic.

It was a short-lived triumph. The forces of disruption and discontent soon got completely out of hand and on March 21 1919 Count Károlyi handed over the Government to the Soviet of Bela Kun. Count Károlyi remained in the country unmolested until the eve of the collapse of terrorism and then left Hungary for Czechoslovakia. Later he was expelled from Italy for Communist propaganda and made his headquarters in Paris, visiting the United States, where he was prohibited by the Government from continuing propaganda presumably against the Hungarian Govt., which might have affected the League of Nations' loan for Hungarian reconstruction.

The High Court of Hungary found, after public trial at which Count Károlyi was legally represented, that on account of his actions during the War and in organising the revolution he was guilty of high treason and felony. As a result of that verdict Count Károlyi's estates were confiscated, a large portion of them being divided under Land Reform, among some 5,000 smallholders. Other accusations made against Count Károlyi by his fellow-countrymen were that by his systematic encouragement of mob-law and military indiscipline and by his weakness as Prime Minister and President he was the direct cause of the Bolshevist reign of terror and the subsequent occupation of Hungary by the Rumanian Army. It is further officially maintained that by negotiating a separate armistice with Gen. Franchet d'Esperey at Belgrade Károlyi deprived Hungary of many territorial and other rights to which she was entitled under an armistice previously concluded by Gen. Diaz on the Italian front with the Austro-Hungarian armies. (W. Go.*)

KATA THERMOMETER.—In considering measurement of ventilation we must bear in mind that the ordinary thermometer merely gives the average temperature of its surroundings. While the human body produces heat, and all day long is keeping itself at body temperature, the thermometer does not produce heat, but just registers the effect of the surrounding atmosphere upon itself. An instrument is needed, then, to indicate the cooling and evaporating power of the air.

The Kata thermometer is such and is far more indicative of human feeling than the ordinary thermometer. It records not only the effect of the temperature of the surrounding air on the cooling of its surface when at body temperature, but of the wind and any movement of the air, and also how quickly cooling takes place when its surface is wet, as the skin is when perspiration is going on. The Kata thermometer is a large-bulbed alcohol thermometer of standard size with stem graduated from 100° to 95° Fahrenheit. It is warmed up in hot water till the meniscus rises above 100° F.; the bulb is then dried, and the rate of cooling of the meniscus from 100° to 95° F. taken with a stop-watch. From a factor number determined for each instrument the cooling power is deduced in millicalories (1/1000 gramme calorie) per sq. cm. of the surface of the bulb at body temperature per second. In still air the dry Kata thermometer has a cooling power of about 10 at 0° C., and about 5 at 20° C.; with a wind of 9 m. per hour it has a cooling power of about 40 at 0° C., and 20 at about 15° or 16° C., and so on with different rates of wind. Wind is far more important than temperature to the cooling of the body; thus the still air is easily borne. In the case of the wet Kata thermometer a wet muslin glove covers the bulb. In factories, schools, etc., the reading of the cooling power of the dry Kata thermometer should not be less than 5–6 with a temperature of about 60° F., 7 at 70 and 8 at 80°, otherwise the efficiency of the worker and pupil will tend to go down. Observations made by the Industrial Fatigue Board in pottery, boot and shoe, cotton and printing works, showed that a great number of readings were below 6. The general mortality is greater in the trades with the lower readings. Great improvements could yet be made in this respect. See Medical Research Council, *Special Report, No.* 73 (1923). (L. E. H.)

KATO, TAKA-AKIRA, Count (1859–1926), Japanese statesman (*see* 15.696), resigned his post as ambassador in London in Dec. 1913, having in the previous year been created a baron. Returning to Japan, he joined Prince Katsura's third Cabinet as foreign minister for the third time but resigned soon after. He then reorganised the Doshikai, created by Katsura, and renamed it the Kenseikai or Constitutionalist party, of which he became president in 1913 (*see* Japan). In April 1914 he joined the Okuma Cabinet as foreign minister, resigning in 1915. It was during his incumbency that Japan sent the so-called 21 demands to China. In Aug. 1915 he was elected a crown member of the house of peers and in the following year was created a viscount. The following decade proved a quiet period for Kato, but in 1924 he became premier of the Coalition Cabinet of the Kenseikai, the Seiyukai and the Kakushin Club. His administration was made historic by the passage of the universal manhood suffrage law. Owing to dissensions among members of the Cabinet, Kato reorganised his Ministry on Aug. 1 1925, forming it exclusively with members of the Kenseikai party. On Jan. 28 1926 he died in Tokyo while in office. The Emperor, learning the gravity of his illness, conferred upon him the dignity of count.

KATSURA, TARO, Prince (1847–1913), Japanese soldier and statesman (*see* 15.697).—In Aug. 1911 he resigned the premiership in favour of Marquess Saionzi, after completing the work of financial reform and treaty revision which he had undertaken, and received the rank of prince. On Dec. 20 1912 he again accepted office as Premier. In Feb. 1913, however, a vote of censure on the Premier was moved in the Diet for the alleged misuse of imperial rescripts, and on Feb. 10 the Prince resigned office. His health was already failing, and he died in Tokyo Oct. 10 1913.

KAVALLA (*see* 15.701).—This port on the coast of eastern Macedonia, with an exposed harbour, has a population of about 20,000. The immediate hinterland is a rich tobacco-growing country, but Kavalla is handicapped by the fact that the railway from Salonika to Dedeagach runs through Drama, 22 m. inland from the coast, with no branch line to Kavalla. Kavalla has belonged to Greece since the Balkan War of 1912–13. It was coveted by Bulgaria as a maritime outlet, and M. Veniselos was inclined to concede it to her, but this policy was ruled out by the outbreak of the second Balkan War. After the outbreak of the World War, when Bulgaria was still neutral, the British Govt. attempted to attach Bulgaria to the Allied cause by offering to cede Cyprus to Greece, on condition that Greece ceded Kavalla to Bulgaria. This offer was rejected by King Constantine's Govt.; Bulgaria intervened on the side of the Central Powers; and Kavalla has remained under Greek sovereignty, though the Bulgarians occupied it during the Salonika campaign. During the negotiations over the peace treaty of Neuilly (*q.v.*) with Bulgaria, M. Veniselos offered to connect Kavalla with the already existing narrow-gauge railway in the Struma valley, which runs from the Bulgarian side of the frontier to Sofia. This would have contributed to the fulfilment of Article 48 of the treaty, in which the principal Allies assured to Bulgaria an economic access to the Aegean Sea; but no action has been taken upon the offer of M. Veniselos. See *Handbook of Macedonia*, (British Admiralty, 1920).

KEANE, JOHN JOSEPH (1839–1918), American Roman Catholic archbishop (*see* 15.706), died at Dubuque, Ia., June 22 1918. He had retired in 1911.

KEITH, SIR ARTHUR (1866–), British anthropologist, was born at Old Machar, Aberdeen, Feb. 5 1866. He studied medicine at Aberdeen University; University College, London; and Leipzig. He lectured extensively on anatomy and surgery, became a leading authority on anthropology, and an expert on the reconstruction of prehistoric man from fragments or fossil remains. He was Fullerian professor of comparative anatomy at the Royal Institution from 1917 to 1923, became conservator of the Museum and Hunterian professor at the Royal College of Surgeons in 1908 and acted as honorary secretary of the Royal Institution from 1923. He was secretary and later president of the Anatomical Society of Great Britain, president

of the Royal Anthropological Institute (1913–7), and in 1913 was elected F.R.S. and *membre de la Société d'anthropologie de Paris*. He was knighted in 1921, and was designated as president of the British Association for 1927. (*See* MAN, EVOLUTION OF.)

His published works include *Introduction to the Study of Anthropoid Apes* (1897); *Human Embryology and Morphology*, 4th ed. (1921); *Ancient Types of Man* (1911); *The Human Body* (1912); *Antiquity of Man* (1915, 2nd ed. 1925); *Menders of the Maimed* (1919); *Engines of the Human Body* (1919, 2nd ed. 1925); *Nationality and Race* (1919); and *Religion of a Darwinist* (1925).

KELANTAN: *see* MALAY STATES.

KELLER, ALBRECHT (1845–1920), German painter (*see* 15.718), died in Munich July 13 1920.

KELLERMANN, BERNHARD (1879–), German novelist, was born at Fürth on March 4 1879. In his early books he endeavoured to describe his emotional experiences, *Yester und Li* (1904), *Ingeborg* (1906), *Der Tor* (1909), English translation *The Fool* (1925). As the result of his travels abroad he wrote *Das Meer* (1910), English translation *The Sea* (1925), an exotic novel, and his Japanese book *Sassa Yo Yassa* (1912), the main part of which is devoted to a description of Japanese dances. His novel *Der Tunnel*, dealing with the future, chiefly concerns the relations between Europe and America and caused a great sensation on its appearance in 1913. He wrote articles on the World War in his capacity as correspondent, and also produced two books, *Der Krieg im Westen* (1915) and *Der Krieg im Argonnerwald* (1916). After a long interval he published in 1920 his novel on the German Revolution, *Der 9. November*, English translation *The 9th November* (1925), and later still his novel *Schwedenklees Erlebnis* (1923). In addition to a further novel, *Die Heiligen* (1922), he also wrote the drama *Die Wiedertäufer von Münster* (1925).

KELLOGG, CLARA LOUISE (1842–1916), American singer (*see* 15.719), died at New Hartford, Conn., May 13 1916. She was the author of *Memoirs of an American Prima Donna* (1913).

KELLOGG, FRANK BILLINGS (1856–), American diplomat and lawyer, was born at Potsdam, N.Y., Dec. 22 1856. In 1865 he went with his parents to Minnesota, where he studied law and was admitted to the bar in 1877. He practised in Rochester, Minn., for 10 years, removing in 1887 to St. Paul. He was retained as special counsel for the United States in the actions against the Paper Trust and the Standard Oil case. He also appeared as special counsel for the Interstate Commerce Commission in the investigation of the Harriman railways, and for the United States in the action to dissolve the Union Pacific and Southern Pacific railway merger. He was a delegate to the Republican National Conventions of 1904, 1908 and 1912, and was elected U.S. Senator from Minnesota for the term 1917–23. He was also U.S. delegate to the fifth International Conference of American States at Santiago, Chile, 1923. In 1924 he was appointed ambassador to Great Britain, succeeding G. B. M. Harvey. He resigned in Feb. 1925, to accept an appointment as U.S. Secretary of State. In this capacity he took a firm stand in support of United States citizens whose property rights in Mexico were threatened by proposed Mexican legislation.

KELLOGG, VERNON LYMAN (1867–), American zoologist, was born at Emporia, Kan., Dec. 1 1867. He graduated from the University of Kansas, subsequently studying at Cornell University, Leipzig and Paris. He was successively assistant and associate professor of entomology at the university of Kansas, 1890–4, and professor of entomology and lecturer in bionomics at Stanford University, 1894–1920. Having acted as a director, in Brussels, of the American Commission for Relief in Belgium, 1915, he served as assistant to the U.S. Food Administrator, 1917 and in various capacities with the American Relief Commission in Poland and Russia, 1918–21. He became permanent secretary and chairman of the division of educational relations of the National Research Council, Washington, D.C., 1919. He wrote *American Insects* (1904); *Evolution and Animal Life*, with D. S. Jordan (1907); *Darwinism To-day* (1907); *The Animals and Man* (1911); *Headquarters Nights* (1917); *Herbert Hoover, the Man and His Work* (1920); *Nuova, or the New Bee* (1921); *Human Life as the Biologist Sees It* (1922); *Mind and Heredity* (1923); and *Evolution* (1925).

KENDAL, WILLIAM HUNTER (1843–1917), British actor (*see* 15.727), died in London Nov. 7 1917.

KENT, ROCKWELL (1882–), American painter, was born at Tarrytown Heights, N.Y., June 21 1882. His early education was obtained in a boarding school in Connecticut. He studied architecture for a time, but turned to painting, and was a pupil of Robert Henri. Of a roving disposition, he went to sea as ship's carpenter, painting what he saw in his travels, and writing his impressions. His work was quite individual in its character, and attracted great attention by its unique qualities of light and shade. He also produced some book illustrations. His chief paintings in the United States are "Marine" in the Metropolitan Museum, New York City, and "Lone Woman" and "Mother and Child," in the Brooklyn Museum. He wrote two books of travel *Wilderness* and *Voyaging*, and contributed to magazines.

KENTUCKY (*see* 15.740), a State of the United States of America. The population in 1920 was 2,416,630, as compared with 2,289,905 in 1910—an increase of 5·5 per cent. There were 1,227,494 males and 1,189,136 females. The whites numbered 2,180,560, an increase since 1910 of 7·5%; the negroes, 235,938, a decrease of 9·8%; foreign-born whites, 30,780. The density in 1920 was 60·1 to the sq. m.; in 1910, it was 57%. The urban population increased from 24·3% in 1910 to 26·2% in 1920. The estimated population of 1925 was 2,488,423. The population of towns with over 20,000 inhabitants in 1910 and 1920 was as follows:—

	1910	1920
Louisville	223,928	234,891
Covington	53,270	57,121
Lexington	35,099	41,534
Newport	30 309	29,317

Education.—The large number of illiterates reported in 1910 (208,084) led to the creation of two illiteracy commissions in 1914 and 1918 respectively. In Rowan county in 1911 night schools for adult illiterates were inaugurated. A compulsory attendance law, consolidated schools, better organisation, and more revenue, reduced illiteracy from 12·1% in 1910 to 8·4% in 1920. An Act of 1920 granted to counties and cities ample taxing powers to provide for their schools. The census reported 702,391 children of school age, of whom 654,092 were enrolled in 1925. High schools shared in this expansion, increasing from 83 in 1910 to 493 in 1924. New State normal schools were established in 1922 at Morehead and Murray.

Agriculture.—The number of farms increased from 259,185 in 1910 to 270,626 in 1920, but improved land decreased from 14,354,471 acres to 13,975,746 acres, despite the efforts of the reclamation service, which expended $1,620,027 in the counties bordering on the great rivers and in the western coal area. This drainage and flood-prevention work involved 471,874 acres. The number of farm owners increased from 170,332 in 1910 to 179,327 in 1920; the number of tenants decreased in the mining counties and increased in Mason, Boyle, Mercer, Fayette, Bourbon, and Jessamine. The value of farm property rose from $773,797,880 in 1910 to $1,511,901,077 in 1920. The average value of farms in 1910, $2,452, rose to $4,823 in 1920, and the average value of the land from $21.83 per acre to $48.62. Live stock on Jan. 1 1925 included 334,000 horses, 272,000 mules, 536,000 milch cows, 433,000 other cattle, 715,000 sheep and 859,000 swine. The total value of live stock in 1920 was $148,125,506. The total value of farm crops in 1924 was $200,760,000; in 1925, $178,816,000.

Field crops in 1920 were valued at $347,338,888; and in 1924 at $200,760,000. Low tobacco prices in 1913 and 1920 led to demands for co-operative marketing associations, of which the most notable were organised under the Bingham Act of 1922. In general, these efforts were successful, although the dark tobacco "pool" released its members from their contracts in 1925. Tobacco is the chief crop: in 1922 there were 525,000 acres under cultivation yielding 446,290,000 lb. worth $87,019,000

but in 1924 corn (76,200,000 bu.) exceeded in value the tobacco yield.

Minerals.—The output of coal rose from 14,623,319 tons in 1910 to 55,187,000 tons in 1925; to provide for the increased output, most of which was produced in the eastern counties, the Louisville and Nashville Railroad constructed 333 m. of track and expended $30,000,000 during the decade of 1910–20. Because of low prices, petroleum was only marketed in small quantities before 1916. Stimulated by the War demand, prices rose from $2.05 per barrel on Jan. 1 1917 to $4.50 at the close of 1920. The following table shows the production during certain periods:

	No. of barrels produced	Value
1919	9,226,472	$24,459,016
1920	8,949,185	33,556,241
1925	7,064,553	14,129,106

The most productive pool, Big Sinking, was opened in Lee county, and a new field appeared in the south western counties, centering about Allen and Warren. In many locations the drillers opened gas wells which have reduced the State's dependence on West Virginia's supply, and Mt. Sterling, Winchester, Paris, Lexington, Frankfort, and Louisville now obtain natural gas. The principal oil refinery is at Louisville. From 1909 to 1919 the capital invested in mines, quarries and wells rose from 26 to 201 millions, or 651%; the value of products from 12 to 98 millions, or 715%. The value of manufactured products in 1921 was $302,742,000.

Communications.—Steam railway track increased from 3,641 m. in 1910 to 3,956 m. in 1923. There were 493 m. of electric railway track in 1924. Additional pipe-lines for oil were supplemented by river boats, for which locks were built by the United States Government. The state highway commission, set up in 1920, which had an income in 1924 of $11,157,000, controlled 2,360 m. of road in 1925. A new bridge has been erected at High Bridge; and, near by, the Dix river dam, developing 30,000 H.P. of electric current.

Finance.—The old revenue system, based on a general property tax, proved inadequate to meet the cost of progressive legislation. The Assembly in 1917 created a tax commission and classified grouping replaced the old property tax, so that the rate on general property became 50 cents per $100 assessed valuation. There is a graduated inheritance tax. Increased by licence and franchise revenues, the general fund is apportioned to various purposes. Under the new law, bank deposits rose from $11,000,000 in 1916 to $179,000,000 in 1917; assessed values from $922,000,000 in 1917 to $2,184,202,703 in 1925; railway valuations from $160,000,000 in 1917 to $233,372,000 in 1924. The total revenue in 1925 was $25,038,577. On July 1 1926 the bonded debt was $3,959,298. A floating debt, in the form of treasury warrants, sometimes exceeds $10,000,000.

Legislation.—The Acts of the General Assembly contain many provisions in regard to labour, education, and public health. The Child Labour Act of 1908 was improved in 1910, 1912, 1914 and 1916. Other progressive laws cover the subjects of tax reform, prisoners, banking, insurance, vital statistics and sanitation. In general the Assembly has welcomed all offers of Federal co-operation in matters of agricultural extension, road-building, and public health. An Act of 1920 to prevent the sale of worthless securities was due to the speculation in oil shares after 1916. A series of Acts permits all cities to adopt the commission plan.

History.—The increase of prices during the World War brought prosperity to purveyors of coal, petroleum, live stock, food and tobacco, and lured many producers into unwise ventures where they suffered severe losses after 1920. Kentucky felt keenly the advent of national prohibition, inasmuch as her distilling industry in 1914 occupied first place, with an output valued at $48,862,526. Between 1910 and 1925 the Democrats controlled the Assembly and elected three governors: J. B. McCreary (1911–5), A. O. Stanley (1915–9) and W. J. Fields (1923–7). The Republicans in 1919 elected as governor E. P. Morrow, who had been defeated by only 471 votes in 1915. They chose as United States senators, R. P. Ernst in 1920 and F. W. Sackett in 1924, in which year, for the first time in her history, Kentucky cast all her electoral votes for the Republican party. In 1912 the 120th county (McCreary) was organised out of parts of Pulaski, Wayne, and Whitley. In Nov. 1917 the United States Supreme Court declared void Louisville's race-segregation ordinance.

BIBLIOGRAPHY.—On the administrative features see *Report of the Efficiency Commission*, 2 vol. (Frankfort, 1924); education, *Public Education in Kentucky* (N.Y., 1921); history, *History of Kentucky*, ed. by C. Kerr, 5 vol. (Chicago, 1922). (E. T.*)

KENYA COLONY, formerly known as British East Africa (*see* 4.601), has an area (1926) of about 223,000 sq. miles. In 1925 the greater part of the province of Jubaland (*q.v.*) was ceded to Italy. Population 1926 census: Europeans 12,529, Asiatics (ex-

cluding Arabs) 26,789, Arabs 10,557, Africans (estimated) 2,483,500. A census of non-natives taken in 1926 gave the following result: Europeans 12,505; Indians 26,758; Arabs 10,552; others 3,821. An unofficial estimate placed the natives at some 2,600,000. The Arabs are people long settled in the coast lands; the other Asiatics are mainly British Indians (22,822 in 1921). The chief towns are Mombasa and Nairobi (*q.v.*).

I. POLITICAL HISTORY

Kenya presents problems not found in other parts of tropical Africa, where the white population is practically confined to officials, missionaries and traders, inasmuch as it contains an elevated area of about 15,000 sq. m. where climatic conditions have made it possible for a European community to make a permanent home. Indian population presented another racial factor, and the task of the administration was largely to reconcile the claims of the Europeans with those of the Indians, and the claims of both races with the rights and interests of natives.

White settlement in the highlands began in 1904; the census of 1911 showed 3,175 Europeans in the country, as against 11,886 Asiatics. The settlers had the advantage of finding the Uganda railway built. They engaged in stock-raising and grew coffee, maize, wheat, barley, flax and vegetables. In the lowlands, sisal, tobacco and coco-nut plantations were started. For manual labour they were dependent on the natives, and the bulk of the

farm work was done by the Kikuyu, a tribe with an aptitude for agriculture. Sir Percy Girouard (governor 1909–12) achieved the somewhat difficult task of working harmoniously with the settlers, whose grievances then were chiefly over the delay in getting land grants, but who were already beginning to claim a share in the government. The next year (1913) was most noticeable for the acute controversy which arose over a missionary conference at Kikuyu, when the Bishop of Mombasa (Dr.W.G. Peel) officiated at a communion service in a Presbyterian church at which Anglicans, Presbyterians, Wesleyans and others communicated. Apart from the theological controversy this service aroused, it served to draw attention to the fact that, up to that period, by far the greater part of the work not only of Christianising but of civilising the natives and giving them industrial as well as literary education was in the hands of missionaries.

The War Period.—The World War caused a setback in the economic conditions of the country. The majority of the white male settlers went on active service and agriculture and stock-raising suffered in consequence. Very heavy demands were also made on the natives, who had to supply carriers, transport oxen and meat to the troops. They responded well to these demands and large numbers of natives joined the combatant ranks. After the War a brief period of revival in trade was followed by a longer period of depression. Major-General Sir Edward Northey, who took over the governorship on Jan. 31 1919, had to deal with the difficulties created by a period of change and strain. The white settlers were restive, the Indians were demanding political rights, the natives were in great need of careful guidance—so that on the one hand they should cultivate their reserves and on the other hand supply the labour required for public works and the farms and plantations of Europeans. To add to the trials of the people, white, black and brown, a currency crisis arose through the rise in the exchange value of the rupee—the Indian rupee being the legal currency. An ill-advised stabilisation of the rupee at 2s. in Feb. 1920 was quickly followed by the introduction of a coinage based on British currency. In May 1921 the shilling (divided into 100 cents) was made the standard coin. These currency troubles inflicted much hardship on the producing classes. Dissatisfaction arose also over the great difficulties encountered in carrying out a scheme launched in 1919 to establish ex-soldiers from Great Britain on the land. By 1924, however, the settlement was, on the whole, a success. Over 700 farms out of 1,000 granted to ex-combatants were being worked.

Change of Status.—During this period of strain the change from a protectorate to a crown colony was effected (July 1920). The new colony was named after Mount Kenya, the most commanding natural feature of the country. The coast lands which formed part of the Sultanate of Zanzibar were not annexed but became the Kenya Protectorate. In 1919 a change in the constitution had introduced, for Europeans, an elective element in the Legislative council, 11 single-member constituencies being created, with adult franchise on a residential qualification. At the same time two members were nominated to represent the Indian community. This discrimination against Indians was deliberate. Sir Edward Northey, the then Governor, stated in July 1919 that "though Indian interests should not be lost sight of, European interests must be paramount." Prolonged agitation followed. The Indians claimed equal rights with Europeans and a common franchise, and they had the strong and unremitting support of the Government of India. The white settlers, to whom the development of the country's resources was very largely due, vehemently contested the claims of the Indians, most of whom were clerks, mechanics, shop assistants, small traders and labourers, though they included professional men and merchants of high standing. The whites further alleged that the Indian influence on the natives was bad.

The whole question came under consideration by the British Govt., whose decision was given in the Kenya White Paper in July 1923. The most significant part of this decision was that—

> The interests of the African natives must be paramount, and that if, and when, those interests, and the interests of the immigrant races [European and Asiatic] should conflict, the former should prevail. As in the Uganda Protectorate, so in the Kenya Colony, the principle of trusteeship for the natives, no less than in the mandated territory of Tanganyika, is unassailable.

In respect to the franchise the British Govt. decided on a communal system of representation—that is, separate electoral rolls for Europeans, Indians and Arabs. The 11 seats on the Legislative Council for Europeans were retained; five seats on the council were allotted to the Indians and one seat to the Arab community, all on an elective basis; while one member was nominated specially to represent the natives. By means of other nominated members the Government, however, retained control of the council. The franchise apart, the British Govt. decided against the segregation of Indians in townships, but the practice which had been followed of reserving land in the highlands for Europeans was maintained.

The European community, despite some disappointment, loyally accepted the British Govt's. decision; the Indians continued their agitation—which included a refusal to pay the poll tax—and refused to elect members to the council. In Dec. 1924, however, more moderate counsels prevailed and it was decided to accept seats on the council. This settlement was largely due to the wisdom and courage of Sir Robert Coryndon, who became governor in Sept. 1922, and, while a firm upholder of native rights, fully recognised the work done by the Europeans and the services rendered by the Indians. Sir Robert died at Nairobi on Feb. 10 1925 and was succeeded by Sir Edward Grigg.

In respect to the natives, the policy of the administration was to guide them through their own chiefs and tribal organisations, and gradually to teach them the art of government. These efforts, supported by the missionaries and by many of the white settlers, met with a considerable measure of success. In 1922 they were extended to include, in addition to medical, educational and other services, direct encouragement of stock breeding and agriculture in the native reserves. This lessened the potential supply of labour for the Europeans, some of whom held that the first duty of the native was to work for the white man—though figures showed that the natives working on European farms increased from 53,000 in 1919–20 to 87,000 in 1923–4. Compulsory labour for private persons had been definitely prohibited in 1920. The root of the labour difficulty was that the population was insufficient for the intensive cultivation both of the European farms and the native reserves. In 1925 certain companies obtained permission to import labourers from Portuguese East Africa.

In 1924 a parliamentary commission, of which Mr. Ormsby-Gore was chairman, spent two months in Kenya, one of its main objects being to consider plans for the development of East Africa as a whole. It was followed in Feb. 1926 by a conference at Nairobi of the governors of all the East African territories. The parliamentary commission wrote in terms of high praise of the European settlers, "pioneers in a hurry," who desired to build in the highlands "a distinctive type of British civilisation" while obtaining "a more complete inter-relation and co-operation between the European and the African than exists either in South or West Africa."

II. ECONOMIC CONDITIONS

Under agreements reached in May 1926 the Masai reserves were increased by a portion of the disputed area known as the "Promised Land." The triangular portion of the Yatta plateau, which was to have been included as far as the Wakamba Reserve was omitted, as no natives have occupied it.

Kenya depends almost wholly on agriculture (including stock-raising), and development is largely a matter of increased means of communication. External trade passes through Mombasa (*q.v.*). The railway to that port also carries the produce of Uganda. Since 1917 Kenya and Uganda have formed an administrative unit for customs purposes, and there is complete freedom of trade between the two territories. The figures of trade therefore represent the total of both territories. On analysis it is shown that Kenya takes the bulk of the imports and Uganda supplies more than half the exports. The value of com-

mercial imports into Kenya in 1913–4 was £2,147,000, the value of exports £1,482,000. For 1924, a normal year, the value of imports for consumption in Kenya was £4,038,000, while the domestic exports of Kenya were valued at £2,239,000. The chief exports from Kenya were coffee, maize, hides and skins (the last chiefly from native reserves). Kenya coffee is of high quality and is much favoured on the London market. It was not until 1922 that serious efforts were made to cultivate cotton, and the area in Kenya suitable for cotton is not very large. Up to 1925 the output was small but prospects were encouraging. The main mineral export is carbonate of soda from the Magadi lake.

Communications.—The transport system of Kenya and Uganda is under one administration, known officially as the Kenya and Uganda railway, marine and ancillary services. Since April 1921, when a central railway council was instituted the revenues from this source have been devoted exclusively to transport purposes; and in Feb. 1926 the office of High Commissioner of Transport was created, it being held by the Governor of Kenya. In 1911–2 a branch line (91 m.) was built to the Magadi soda lake; another railway (32 m.) was built from Nairobi to the Thika river (towards Mount Kenya). In 1915–6, for military purposes, a railway was built from Voi *via* Taveta to Kahe in (then) German East Africa. It links the Uganda railway with the Tanga railway. The Voi-Taveta line was bought by the Uganda railway in 1923 and reconditioned.

In 1921 a bold policy of railway development, accompanied by harbour improvements, was adopted, both to meet the needs of the settlers in the Uasin Gishu and Trans-Nzoia districts and the requirements of Uganda for the transport of its cotton crop. It was decided to build a line from Nakuru on the Uganda railway across the Uasin Gishu plateau to the border of Uganda, whence it would be continued to the Nile. By 1925 this railway had reached Turbo, 145 m. from Nakuru, and the next section of 75 m. to Tororo, inside the Uganda Protectorate, was under construction. In 1923–6 the Nairobi-Thika line was extended another 90 m. to Nyeri, and other smaller branch lines built. Road development was slow, but a motor road was made from Nairobi to Tanganyika Territory and another motor road from Nairobi to the Sudan. There are aerodromes at Kisumu and Nairobi.

Revenue.—Since 1912 the country has been self-supporting. Between 1909–10 and 1913–4 revenue increased from £503,000 to £1,123,000 and expenditure from £669,000 to £1,115,000. In 1920–1, the last year in which the railway returns were included in the ordinary budget, the figures were, revenue £2,978,786, expenditure £2,976,960, a surplus of £1,826 only. In 1922 and 1923 expenditure considerably exceeded revenue, but in 1924 revenue was £2,111,665 and expenditure £1,861,511—a surplus of £250,054—evidence that the years of acute commercial depression had passed. At the end of 1924 the funded public debt of Kenya was £8,500,000, incurred principally for transport development. The railway revenue in 1924 amounted to £1,635,000, and the gross expenditure to £878,000.

The Kenya White Paper (Cmd. No. 1922) of 1923 and the Report of the East Africa Commission (Cmd. No. 2387) 1925, are important British official publications, of which a full list is given in the *Colonial Office List* (London, yearly). See also the annual *Reports* issued by the Colonial Office, and the annual railway, native administration and other *Reports* issued at Nairobi; Lord Cranworth, *A Colony in the Making* (1912) and *Profit and Sport in British East Africa* (1919); C. W. Hobley, *Bantu Beliefs and Magic* (1912); Norman Leys, *Kenya* (1924); *A Handbook of Kenya Colony and Protectorate*, a British Admiralty publication (1920); *The East African Red Book, 1925–6* (Nairobi, 1925), and the *Year Book and Guide to South and East Africa* (London, annually). (F. R. C.)

KENYON, SIR FREDERIC GEORGE (1863–), British scholar, was born in London Jan. 15 1863. Educated at Winchester and New College, Oxford, he became a fellow of Magdalen College, Oxford, in 1888. The following year he was appointed an assistant in the British Museum, and became in 1898 assistant keeper of MSS. In 1909 he was appointed director and principal librarian. Created K.C.B. in 1912, he was president of the Classical Association in 1913, of the British Academy 1917–21 and of the Society for the Promotion of Hellenic Studies 1919–24. In 1918 he became professor of ancient history in the Royal Academy. He was created G.B.E. in 1925. Among his numerous published works are three editions of Aristotle's *Constitution of Athens* (1891, 1904, 1920); *Classical Texts from Papyri in the British Museum* (1891); *Catalogue of Greek Papyri in the British Museum* (1893, 1898, 1907); *Our Bible and the Ancient Manuscripts* (1895); *Palaeography of Greek Papyri* (1899); *Handbook to the Textual Criticism of the New Testament* (1901, 1912). A student of Elizabeth and Robert Browning's poetry, in 1912 he edited the centenary edition of Robert Browning's works. In 1914 he published an account of the buildings of the British Museum.

KER, WILLIAM PATON (1855–1923), British man of letters, was born at Glasgow Aug. 30 1855 and educated at Glasgow University and Balliol College, Oxford. He was elected fellow of All Souls College in 1879, professor of English literature and history at Cardiff in 1883 and of English literature at University College, London, in 1889, a post which he held until 1922. In 1920 he was elected professor of poetry at Oxford. His studies of mediaeval literature were specially noteworthy, and among his publications were *Epic and Romance* (1897); *The Dark Ages* (1904); *Essays on Mediaeval Literature* (1905); *Sturla the Historian* (1907); *The Art of Poetry* (1923); and a number of collected essays and lectures published in 1925. But these last works of this singularly inspiring teacher, a scholar of wide and humane sympathies, were posthumous. He died suddenly in the Alps, at Macugnaga on July 17 1923 and was buried there.

KÉRATRY, ÉMILE, COMTE DE (1832–1904), French author and politician (*see* 15.753), died in Paris April 7 1904.

KERENSKY, ALEXANDER FEODOROVICH (1881–), Russian politician, was born at Simbirsk, and studied at the University of St. Petersburg, where he took his degree in law, and afterwards joined the St. Petersburg Bar. In 1912 he was elected to the Fourth Duma and joined the Labour Group. He was in reality an adherent of the Social Revolutionary party, but as it was impossible in those days to enter the Duma under this flag he chose the Group of Toil (Labour) in preference to the Social Democrats, whom he considered to be too pedantic and distant from the people. As a member of the Duma he attained a certain notoriety by impassioned speeches, but he was never conspicuous for constructive statesmanship. When the first revolutionary Government was formed Kerensky was nominated Minister of Justice and was for a short time head of the provisional Government. (*See* RUSSIA.)

KEY, ELLEN (1849–1926), Swedish author, was born Dec. 11 1849 at Sundsholm, the daughter of Emil Key and Countess Sophia Posse. She early showed a keen interest in religious, literary and political affairs and lectured on various subjects in her native village. In 1868 her father became a member of the Riksdag, and the family accordingly moved to Stockholm. It was then that she started to contribute to the feminist periodical *Idun*. In 1879, owing to family misfortune, she was forced to adopt the teaching profession. She also established lecture courses for young women. Her success as a lecturer was such that she was able to abandon teaching, and in 1903 went abroad on a number of lecturing tours. She wrote numerous works in many languages, chiefly concerned with the welfare of women and children. Her liberal theories concerning love and marriage at the time met with great opposition. She died in April 1926. Her principal work is *Tankebilder*, "Ideas," 2 vol. (1898); and *Lifslinjer*, Eng. tr. "Lines of Life," 3 vol. (1903–6).

See G. Monod in *La Revue Bleue* (1907) and E. Faguet in *La Revue Latine* (1907).

KEYES, SIR ROGER JOHN BROWNLOW (1872–), British sailor, was born Oct. 4 1872 and entered the navy in 1885. He took part in the Vitu expedition in 1890 and for his service in China in 1900 was promoted commander. From 1905 to 1907 he served as naval attaché at Rome, Vienna, Athens and Constantinople. In 1912 he was appointed commodore in charge of the submarine service. During the World War he took part in the battle of Heligoland Bight, Aug. 1914, and in the Cuxhaven

raid. In 1915 he became chief of staff to Admiral de Robeck, in command of the Eastern Mediterranean Squadron in the Dardanelles. He was promoted rear-admiral in 1917, appointed director of plans at the Admiralty and later took command of the Dover Patrol. In this capacity he directed the naval raid on Zeebrugge and Ostend, April 23 1918, and was rewarded with the K.C.B. In 1919 he was created a baronet and received a grant of £10,000 in recognition of his services. He commanded the Battle Cruiser Squadron of the Atlantic Fleet from 1919 until 1921 when he was promoted vice-admiral and became deputy-chief of the naval staff. In 1925 he was appointed commander-in-chief of the Mediterranean Station.

KEYNES, JOHN MAYNARD (1883–), British economist, was born at Cambridge, June 5 1883, the son of John Neville Keynes, registrar of Cambridge University. Educated at Eton and King's College, Cambridge, where he was 12th Wrangler (1905), and president of the Union Society (1905), he entered the civil service in 1906 and from 1906 to 1908 served at the India Office. He was a member of the royal commission on Indian finance and currency 1913–4, and in 1915 he joined the Treasury, where during the World War he did important work in connection with loans to the Allies. At the Paris Peace Conference he was the chief representative of the Treasury and deputised for the Chancellor of the Exchequer on the Supreme Economical Council, Jan.–June 1919. He advocated certain principles which he considered should be applied to the financial and reparation clauses of the Peace Treaty with Germany and when they were rejected he signified his disagreement with the treaty by resigning in June 1919, and published in the same year his famous *The Economic Consequences of the Peace*. He was made fellow and subsequently bursar of King's College, Cambridge. In 1924, he became chairman of *The Nation*, Ltd. In 1925 he married Lydia Lopokova, the famous Russian dancer. His works include *Indian Currency and Finance* (1913); *A Treatise on Probability* (1921); *A Revision of the Treaty* (1922); and *A Tract on Monetary Reform* (1923).

KEYSERLING, HERMANN, COUNT (1880–), German philosopher, was born at Könno in Livonia on July 20 1880, of a noble family. Until he was 14 years of age, Keyserling remained on the Könno and Rayküll estates. He then went to the Russian school at Pernau, and afterwards studied geology and zoology at Geneva, chemistry at Dorpat, and geology at Heidelberg. In 1902 he became a doctor of philosophy and in 1903 went to Paris, where he wrote criticisms on art, and also philosophical articles. His first literary works were *Das Gefüge der Welt* (1906) and *Unsterblichkeit* (1907). During the years 1907–11 he travelled in Europe. In 1910, the *Prolegomena zur Naturphilosophie* appeared, and he then turned his attention to the study of metaphysics. In 1919 he married the granddaughter of Prince Bismarck. His principal work is *Das Reisetagebuch eines Philosophen* (1919), which has been translated into English as *The Travel Diary of a Philosopher* (1925). He also founded the "School of Wisdom" at Darmstadt. See H. Keyserling, *Der Weg zur Vollendung* (Darmstadt, 1919).

KHIVA (*see* 15.777), was once the capital of the Khroahrezm Republic, whose territory has now been absorbed into Turkmenistan (*see* SIBERIA). Khiva has always held a unique status in Russian Asiatic dominions and even now is understood to be itself, together with a small area surrounding the town, administered directly from Moscow, though the surrounding country forms part of other political units.

KIAMIL PASHA (1832–1915), Turkish statesman, was the son of an artillery officer, Salih Agha. Having completed his military training in Egypt as a cavalry lieutenant, he was appointed by the Khedive, Abbas Pasha, tutor in English to his son Ibrahim Pasha. In 1861 Kibrizli Mehemmed Pasha took him into the service of the Ottoman Government. He was twice governor of Jerusalem and three times governor of Beirut. In 1878 he was appointed governor of Kossova and soon afterwards of Aleppo, with the rank of Pasha. He resigned as the result of the British protest against his conduct during the Armenian revolt at Zeitoun, and returning to Constantinople became Under-Secretary for the Interior. In 1881 he became minister of Evkaf, and after the resignation of the Kutchuk Said Pasha Cabinet in that year, Grand Vizier. In spite of his forced resignation from the governorship of Aleppo he steadily pursued a pro-British policy. He resigned the Grand Vizirate in 1887 owing to Russian intervention, but was reappointed in 1896. He was dismissed by Sultan Abdul Hamid, however, owing to his proposal that a Cabinet responsible to the nation should be formed, and was sent to Smyrna as governor, where he remained for 12 years.

After the promulgation of the constitution (1908) Kiamil Pasha joined the Kutchuk Said Pasha Cabinet and soon after became Grand Vizier for the third time. He was, however, strongly opposed by the Union and Progress party. During the Balkan War (1912) he became Grand Vizier for the fourth time, but was forced to resign in 1913 as the result of a military coup d'état and the unpopularity of the peace terms accepted by him. He retired to Egypt, and although he returned later to Constantinople he was forced by the Government immediately to leave. He went to Cyprus and died there in 1915. Kiamil Pasha knew English, French and Arabic and published a book on Turkish history in three volumes.

KIEL CANAL (*see* 11.816 and 15.787).—The Kiel Canal connects the North Sea and the Baltic. The sluices at the entrances at Holtenau (the harbour of Kiel) and Brunsbüttelkoog (mouth of the Elbe) are 1,082·6 ft. long, 147 ft. wide and 45·9 ft. high. The canal is 53·3 nautical m. long and 37·07 ft. deep. Vessels are admitted on it which do not exceed the following dimensions: depth 29·7 ft., width 131·2 ft., length 1,033·5 ft., height of masts over the water line 131·2 feet. Steam and motor-propelled vessels pass up the canal under their own power. The highest speed permitted is 8·1 knots, the lowest 5·4. Other vessels are tugged, either by private tugs or the tugs of the canal administration, as desired. Pilots are compulsory. They come on board outside the canal wharves in front of the entrances and are advisers to the ships' captains, who remain responsible for the conduct of their ships while using the canal.

Management.—The Kiel canal is owned by the German Reich, which administers it through the Reichskanalamt in Kiel. The managing director in Kiel and the port captains at the entrances to the canal are in charge of the shipping and the administration of their sluices under the Reichskanalamt. Special officials are in charge of the preservation of the canal works. Art. 380–386 of the Treaty of Versailles (June 28 1919) lay down certain regulations respecting the Kiel Canal. Canal and pilotage dues are limited to a rate sufficient to cover the cost of administration, maintenance and improvements. All mercantile and war vessels of nations at peace with Germany have permanent free use of the canal, without special permission, and on an equal footing (but as foreign ships of war pass through German territorial waters in approaching or leaving the canal they are expected to obtain permission through diplomatic channels). Subjects, goods and vessels of all nations enjoy equal treatment as regards payments and attention. Traffic on the canal is subject only to general police, shipping and sanitary and customs regulations. Goods in transit arrive under seal or are accompanied by customs officers and are not subject to any further customs formalities. In the event of violations of any of these conditions, or of disputes as to the interpretation of them, any interested Power can appeal to the jurisdiction instituted for the purpose by the League of Nations. A local German authority at Kiel is qualified to deal with disputes in the first instance.

The Kiel Canal being the safest, most convenient, shortest and cheapest route from the North Sea and the Baltic is increasingly used by merchant vessels. In 1913, 53,382 ships passed with 10,350,000 tons net displacement; in 1924, 45,843 ships with 14,070,000 tons net displacement. (M. C. M.)

KINDERSLEY, SIR ROBERT MOLESWORTH (1872–), British financier, was born Nov. 21 1872 and educated at Repton School. He entered upon a business career in London and became a partner in the banking firm of Lazard Bros. and Company. During the World War he became widely known to the public as president of the National Committee for War Savings. His

services were recognised with the award of a K.B.E. in 1917 and three years later he was created G.B.E. He became a director of the Bank of England and in 1924 was appointed a member of the body which prepared the Dawes scheme after inquiring into Germany's capacity to pay her War debts. (*See* SAVINGS MOVEMENT.)

KINEMATOGRAPH: *see* MOTION PICTURES.

KING, WILLIAM LYON MACKENZIE (1874–), Canadian statesman, was born at Berlin—now Kitchener—Ontario, Dec. 17 1874, the son of John King and Isabel Grace, daughter of William Lyon Mackenzie, M.P., who had been prominent in the struggle for political freedom in 1837. He was educated at Toronto University, and became fellow of political economy in the University of Chicago and of political science in Harvard University. Mr. King entered the public service of Canada in 1900 as deputy Minister of Labour, and acted as editor of *The Labour Gazette* for some years. He was chairman of several royal commissions on industrial and immigration problems. In 1906 he represented Canada in negotiations with the British Govt. on immigration from Britain, and in the same year the honour of C.M.G. was conferred on him. He was Canadian representative to the Govt. of India on immigration from the Orient and was one of the British delegates on the International Opium Commission in China in 1909. He was elected as a Liberal member of Parliament for North Waterloo in 1908, and in 1909 was appointed Minister of Labour in the Laurier administration.

From 1914–7, under the auspices of the Rockefeller Foundation, Mr. King investigated the subject of industrial relations, and afterwards wrote *Industry and Humanity, a Study in the Principles Underlying Industrial Reconstruction* (1918), as well as other studies on economic subjects. During the World War he assisted leading industrial corporations in America to maintain a continuous maximum output of essential war supplies, and industrial representation plans were drafted under his direction which were adopted by the Colorado Fuel and Iron Co., the Bethlehem Steel Corporation, the Bethlehem Shipbuilding Corporation, the General Electric Co., the Consolidation Coal Co., the International Harvester Co. and other industrial corporations in America. At the National Liberal Convention at Ottawa in 1919 he was selected as the successor to Sir Wilfrid Laurier, and became leader of the Opposition in the same year. In 1921 he became Prime Minister of Canada, and in this capacity he attended the Imperial conference in 1923.

As Premier.—Mr. King's administration followed the Coalition Govt. which had been created during the War, and, although formerly there had been two parties in the House, a third party, known as the Progressives, was also returned in the general elections of 1921. It was this party which supported the Liberal Government. On the dissolution of the House in 1925 an attempt was made to return to the two-party system of government, but the Progressives were still given support. The Prime Minister himself was defeated, together with several of his ministers, but owing to the support and co-operation of the Progressives he was enabled to retain control. After the War many new problems arose, and both the Conservatives and the Liberals declared their policy. An able speaker, Mr. King in his appeal to the electorate urged the adoption of a tariff for revenue, and suggested that the problem of taxation could be solved with the aid of an advisory board on taxation. He also stated his willingness to give the principle of public ownership of railroads a fair trial, though he was averse to either a privately or publicly owned railway monopoly. The Liberal party further advocated the reform of the Senate of Canada by fixing an age limit, and by abolishing the life tenure of office for senators. The object of this reform was to make the Senate more responsive to public opinion. Mr. King maintained that the principle of Canadian nationalism could best be developed within the British Empire, and that the bonds of Empire would be strengthened by reciprocal trade treaties. He stated that no attempt would be made to dictate to Great Britain how she should tax her people. The policy of the Liberal party as expressed by Mr. King may be summed up as "unity, moderation and progress." (A. G. D.)

KIPLING, RUDYARD (1865–), British man of letters (*see* 15.825).—The appearance of *Puck of Pook's Hill* in 1906 marked the last attempt of Kipling to essay any new kind or manner of writing. With one doubtful exception, all his later books can be referred to the existing categories. In 1909 appeared an unauthorised volume called *Abaft the Funnel*, into which an American publisher collected a number of unprinted sketches and stories belonging to the period 1888–90. Mr. Kipling issued an authorised edition in New York (1909), but it has never been published in England. The first authorised collection to follow *Actions and Reactions* (1909), was *Rewards and Fairies* (1910), a companion volume to *Puck of Pook's Hill*, and neither better nor worse than its predecessor. This pair of volumes tries to create for the young a semi-historical mythology of the English countryside.

The attempt was quite well worth making, and some of the stories and verses are good; but they are not told simply enough. Mr. Kipling's love of England is not of the kind that goes to the making of myth. In 1911 Mr. Kipling joined Mr. C. R. L. Fletcher in the production of a *History of England* for the young. His contribution took the form of 24 poems, some of which are happily stimulative to the historical imagination, though as read with the accompanying text, presenting to the young a rather limited view of national duty. The years from 1912–4 brought nothing but reprints and recensions, notably *Songs from Books* (1913), containing the verses and chapter headings from all the volumes except the *Jungle Books* and *Just So Stories*.

Mr. Kipling inevitably contributed to the literature of the War. For several newspapers he wrote poems and sets of articles, the most important of the latter being *The New Army in Training* (1915), *France at War* (1915), *The Fringes of the Fleet* (1915), *Tales of the Trade* (1916), and *Destroyers at Jutland* (1916). The last three were collected into a volume called *Sea Warfare* (1916). In 1917 appeared *A Diversity of Creatures*, a collection of stories and verses in the old manner, clever, but not attractive. Another volume of poems, *The Years Between* (1919), contained occasional verses written in war time, with some others of earlier date. The volume is vaguely accusatory and oracular, and contains as much of the publicist as of the poet. In the same year appeared the pamphlet *The Graves of the Fallen*, describing the work of the Imperial War Graves Commission. *Letters of Travel* (1920) reprinted some 24 articles ranging in date from 1892 to 1914, and showed how little the author had changed in style and matter over a long period. The one work by Mr. Kipling that lay outside his usual range was *The Irish Guards in the Great War* (1923), a lengthy and competent compilation, including some original matter in the old familiar manner. *Land and Sea Tales for Scouts and Guides* (1923) intended for the instruction or inspiration of the young, is unworthy of the author and the purpose. Mr. Kipling received many honours from universities at home and abroad, and in 1922 was elected Rector of St. Andrews. The rectorial address, which was published as *Independence* (1923), attracted much attention.

Mr. Kipling is, like Macaulay, a writer who remained to the end what he was at the beginning. Some of his writings are better than others, but none of them are older or younger than others. His earliest work conveys a sense of full experience; his latest has no other sign to post-maturity than a growing acerbity and tendency to scold. His immense efficiency was never of the kind in which genuine growth or development is possible; but such as it was it remained undecayed. Mr. Kipling's prose is clear, firm, tense and terse and the shaping of his best stories is admirable. He possessed (as Shakespeare possessed) the journalist's ability to use with apparent mastery the "cant" of many trades and callings: but this gift, though engaging, is artistically unimportant. Mr. Kipling often wrote as a publicist; but it is as a creative writer that he must be judged. Regarded merely as a political teacher he would have to take a low place. No large or consistent or even practical body of doctrine can be drawn from his vague accusations and rhetorical warnings, and, indeed, none need be looked for. The creeds of poets are more important

to themselves than to their readers. Mr. Kipling did his best work for Empire, not by thinking or writing imperially, but by revealing India artistically.

Mr. Kipling always worked in the spirit of a good craftsman. Though immediately popular as a writer, he never sought personal publicity, and never consciously wrote down to the groundlings, even of politics. His general style indicates a long study of the Bible and his metres show that the influence of Swinburne was strong and enduring upon him. Admiration of the Biblical prophets, however, produced in both writers a tendency to the large, cloudy, oracular utterance that appears more profound than it is. But in all essentials, Mr. Kipling is an original and underived writer. He noticeably added to the public stock of quotations and to the repertory of poems known to everybody. Few writers have found such a large body of sincere admirers in so many regions, ranks and callings of British people.

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KIRGHIZ OR QIRGHIZ REPUBLIC, an autonomous Socialist Soviet Republic of the R.S.F.S.R. The capital is Orenburg. (*See* SIBERIA.)

KIRK, SIR JOHN (1832–1922), British explorer (*see* 15.829), died Jan. 15 1922.

KITCHEN EQUIPMENT: *see* HOUSEHOLD APPLIANCES.

KITCHENER, HORATIO HERBERT KITCHENER, EARL (1850–1916), British field-marshal (*see* 15.838).—Kitchener was promoted field-marshal just before he left India in 1909, and the Order of St. Patrick was conferred on him on his arrival in England in 1910; but between India and England had occurred a visit to Australasia, where he had been invited to examine the military arrangements, and where the very thorough suggestions which he made for their improvement were acted on with a promptitude which bore full fruit in 1914.

Except for his command of the troops at the coronation of King George, Kitchener was now for the first time for nearly 40 years to enjoy some months of leisure; but the failure of the Government to employ him aroused unfavourable comment, which was only silenced when in the late summer of 1911 he accepted the post of British agent and consul-general in Egypt. The next three years were perhaps the happiest of his life; he was in familiar circumstances though he had many changes to note, since he had handed over the Sirdarieh to Sir Francis Wingate.

On the day he landed at Alexandria, Italy was presenting an ultimatum to Turkey, and there is no doubt that Kitchener's presence and his prestige were mainly responsible for the safe passage of Egypt through the critical period of the Tripoli and Balkan wars, and that no one but himself would have been able to prevent collisions between the Greek and Italian colonists and the natives. His idea was to keep the country busy with the contemplation of its own affairs, and he initiated a policy of economic reform the effects of which were to be enduring. His programme comprised such items as village savings banks, the five Feddan law, the opening of cotton markets all over the country, cantonal courts, the promotion of the Department for Agriculture to a ministry, school buildings, sanitation and press supervision, and the heightening of the Aswan dam—all of absorbing interest to him, all receiving his assiduous care. Lord Cromer's great service in Egypt had been rewarded by an earldom while he was still at the Agency, and the Prime Minister advised the King that no lesser title should adorn his successor during his tenure of the office. The *London Gazette* of June 1914 announced that the sovereign had been pleased to confer on Viscount Kitchener the honour of an earldom, and the telegram announcing his new dignity reached him just as he was starting for England on his annual leave.

At the War Office.—Kitchener had intended that leave to last until Sept., but on July 31 all heads of missions were ordered to repair to their posts, and on Aug. 3 Kitchener was actually on board the Channel boat when a message arrived from the Prime Minister requiring him to stay in England. Three days later he took over the seals of the War Office, to find, in his own words, "There is no army." The meaning of that trenchant observation was that for the titanic task the country had undertaken the British miniature Expeditionary Force, however gallant, was manifestly inadequate. Kitchener instantly laid his plans for an army of 70 divisions, coolly calculating that its maximum strength would be reached during the third year of the War, just when the enemy would be undergoing a sensible diminution of his resources in man-power. His scheme, of course, ran clean contrary to all accepted ideas: it had always been held that in time of war, though armies could be expanded, they could not be created, and to imagine otherwise seemed as surprising to our friends as to our enemies. The French general staff gracefully remarked that men had called new armies into being and men had utilised and maintained existing armies, but that for Lord Kitchener it was reserved to perform the two feats simultaneously. The Germans derided the Kitchener plan as impracticable.

In the early days of 1916 Kitchener could tell the Cabinet that 67 divisions were afoot and three in the mould; he was met by a representation that we must choose between a diminution of our forces and a reduction of our monetary advances to our Allies. He declined the dilemma. He did not think that England could present either of these conclusions to her Allies without proof positive that expenditure could not be reduced nor national income increased, that her administration was free from extravagance, that her taxable capacity was fully exploited and that all parts of the Empire were pulling their weight. The conflict of opinion was sharp and short, with the upshot that the 70 infantry divisions were assured of their existence, and the way was prepared for the Kitchener armies to take their part in the battle of the Somme which he knew was planned for the coming summer. "I have no fear," he said, "about winning the War; I fear very much we may not make a good peace." If he did not live to take his place at Versailles, at least as regards the creation and placing in the field of the great force which was to hold high England's honour he could review a finished work, for his last division to go overseas took ship the very day on which he himself set out on the journey from which he was not to return.

Kitchener's vision or intuition served him to protest, though vainly, against the concentration of the original B.E.F. so far forward as Maubeuge; his rapid and accurate grasp of a situation caused him to hurry to France after the retreat from Mons to insist, in the name of the Government, on the British Army remaining in the Allied line; and enabled him in 1915 to pronounce that the evacuation of the Gallipoli peninsula could be effected with infinitely less loss than had been gloomily predicted. Apart from these occasions he did little to interfere with the actual conduct of operations in the field. He knew and sympathised with the commanders, gave full consideration to their views, and did all that lay within human power to provide them with what was necessary for the performance of the duties assigned to them: moreover, he gave them his entire trust and his unswerving support; what this means to a commander perhaps only those with the experience of a commander can realise, and Kitchener himself had tasted of that experience.

Of the great difficulties which beset the Secretary for War, perhaps the greatest and the most discussed was that of providing guns and ammunition for a constantly and rapidly increasing army. The real root of the trouble was that the nation had plunged into Armageddon without armaments; there was not only a lamentable lack of munitions, but a total absence of all machinery for producing them. With barely means to keep the original expeditionary force on its feet, Kitchener had to provide

for a long and far-flung struggle with a powerful enemy who for 40 years had devoted himself to preparation. A friend who in the early weeks of the War noted in him signs of strain asked him if he were sleeping well. "I shall never have a good night's rest," he answered, "until I have 2,000,000 rifles and their ammunition, and that cannot be yet." The output of arms and ammunition—when one remembers that a start was made from zero and that at the battle of Neuve Chapelle more stuff was fired than in the whole South African campaign—reached an amazing total in the first nine months of the War, and no finer provision of material was made from end to end of it. It was alleged at one time that the great production of ammunition in the autumn of 1915 was due to the energy of the newly born Ministry of Munitions, and a confident claim was made on behalf of this department to the increased supply of high explosive shells. Before the end of the War Kitchener's work was challenged in some quarters on this point; the answer furnished by the dossier of the master-general of ordnance presented a defence of the War Office, whence, as a matter of fact, came the first proposal of high explosive for use in France.

To be precise, the Ministry of Munitions was set up during the first week of June 1915. It was not until the end of Oct. 1915 that a single component of ammunition worth speaking of was delivered from the Ministry of Munitions' factories or orders, and not until April 1916 that the first complete round, made and filled under the orders and arrangements of the Ministry, was delivered to the army authorities. In other words, the army, for a period of more than 18 months, was furnished with continually increasing supplies under the former arrangements.

With the change of the Government in 1915, when the Prime Minister and the War Secretary alone retained their offices, an unhappy attempt was made from G.H.Q. in France to inflame public opinion against the man to whom a few weeks earlier the Commander-in-Chief had written, "Thank God you are there, and I mean it." The attempt failed to shake the rock of public confidence on which Kitchener stood, right up to and even beyond, his last hour: messages of goodwill poured in to him from camps at home and overseas, and from every class and community and corner of England; a month later he received, on his way to and from the Guildhall, one of the greatest ovations of his life—and the Order of the Garter. If Kitchener did not travel quite easily on political lines, his close personal touch with England's Allies was not the least of his contributions to the War, and his early and constant friendship with France gave him, so to speak, a flying start in gaining the best relationships with her public servants.

Russia's rôle was to him a matter of vital importance if the War was to be brought even within his own three year's limit; but in the autumn of 1915 he said to Joffre at Chantilly, "You are calculating on Russia remaining till the end of the War; I am making my calculations on her being out within six months." He had not been afraid to commit himself to serious responsibilities as to arming and equipping the almost weaponless Russian hosts, but even so it is as difficult to account for, as it is impossible to deny, the almost uncanny influence which his name exercised throughout the great eastern empire. He was thus able to criticise Russian methods with a freedom and to press his advice—more especially at the critical moment when Italy was hanging back—with an insistence that would have been tolerated at the hands of no other foreigner.

Proposed Visit to Russia.—Early in May 1916 the Tsar urged that Kitchener should visit Russia, promising that his counsel would be taken to the full even if that counsel included certain transfers of control into British hands. The consent of the British sovereign was obtained, and it was decided that Kitchener should start from Scapa Flow on June 5 for Archangel. He was asked to examine thoroughly the whole Russian situation: he was given a free hand to make arrangements and conditions which he thought advisable; he was to use all the influence which he had already acquired with the Tsar and the Russian military authorities to set the Russian military house in order, and he was asked to come back to England with all speed.

On the afternoon of the appointed day, Kitchener, having paid a visit to Lord Jellicoe on his flagship, embarked on the "Hampshire," which was directed to proceed on what, with the prevailing wind—as reported—would be the lee side of the Orkneys and Shetlands. The arrangements made for the voyage of the cruiser have been, and perhaps always will be, open to question. It is at least certain that an unswept channel was chosen for her passage and that, under stress of weather, the destroyers who formed her titular escort turned about, leaving the vessel, with her priceless freight, to steam to her doom. A faithful steward had suddenly to give an account of his stewardship. The same electrical impulse which the next morning proclaimed Kitchener's death to the world induced an emotional current so intense as to lack precedent or parallel. For a moment it seemed as if a hush had fallen as universal as it was profound, and when the hush was broken there was exposed in full the sway which Kitchener had established over the hearts and minds of all sorts and conditions of men, and that the one man in England who had taken the least pains to win popularity was the hero of many peoples.

A week later the sovereign and his consort passed through the throngs in and around St. Paul's Cathedral to a simple service of hymn and prayer; simultaneously, at two-mile intervals from the sea to the Somme, British soldiers bade a *vale* to the great soldier; while in all parts of the world where two or three Englishmen were gathered together the name of a great Englishman was commemorated. The Queen-Mother at once placed herself at the head of a movement to secure a permanent and practical memorial, and in answer to her appeal there poured in from every point of the Empire—from men, women and children of all colours, classes and creeds—a stream of money, gathering in volume until it reached the astonishing sum of over £700,000. On Dec. 10 1925 a memorial chapter in St. Paul's Cathedral was dedicated to Earl Kitchener and all who fell in 1914–8.

(G. Ar.)

KLEIN, FELIX (1849–), German mathematician, was born at Düsseldorf April 25 1849, and after studying at the universities of Bonn, Göttingen and Berlin was appointed professor of mathematics at the University of Erlangen. He later took up similar professorships at the Munich Technical College and at the universities of Leipzig and Göttingen (1886), and finally became at the latter university director of the school of mathematical physics. Klein, who became a member of the Prussian Academy of Sciences, specialised in the practical application of mathematics and mechanics, and in conjunction with A. Sommerfield worked on the problem of gyratory motion. He took special interest in educational questions, and his well-known treatise on the teaching of mathematics in Germany appeared in 1909. Among Klein's other works should be mentioned *Vorlesungen über das Ikosaeder und die Auflösungen der Gleichungen vom fünften Grad* (1884) and *Vorträge über ausgewählte Fragen der Elementargeometrie* (1895).

KLINGER, MAX (1857–1920), German painter, etcher and sculptor (*see* 15.847), died July 4 1920 at Grossjena near Naumburg.

KLUCK, ALEXANDER VON (1846–), Prussian general, was born May 20 1846 at Münster, Westphalia. He took part in the Austro-Prussian War of 1866 and the Franco-Prussian War of 1870, and was twice wounded at the battle of Colombey-Neuilly. In 1906 he was promoted to the rank of general of infantry, and at the outbreak of the World War was inspector-general of the VIII. Army Inspection. He was placed in chief command of I. Army of the West, which he led in the battles of Maubeuge and St. Quentin and the advance upon the Marne. (*See* Frontiers, Battles of the.) At the battle of the Marne, the faulty disposition of the German forces in the line of battle and the success of the Allied offensive compelled Von Kluck to withdraw his army to the Aisne positions. (*See* Marne, First Battle of the.) In March 1915 he was wounded while visiting the front trenches, and was placed on the retired list in Oct. 1916. He gave his account of the earlier operations in *Der Marsch auf Paris und die Marne-Schlacht* (1920).

KNIGHT, DANIEL RIDGWAY (1845–1924), American artist (*see* 15.851), died in Paris March 9 1924. Of his paintings, "Hailing the Ferry" is in the Pennsylvania Academy, Philadelphia, and "The Shepherdess" in the Brooklyn Institute Museum.

KNIGHTHOOD AND CHIVALRY (*see* 15.851).—The following changes have taken place among the orders of knighthood and chivalry since 1910. While many orders have disappeared, several have been instituted since that date.

Austria-Hungary.—The World War, closed the history of the Orders belonging to the Dual Empire.

British Empire.—As was inevitable, the huge number of people engaged in the World War made it necessary that appointments to all the British Orders should be made on a greatly increased scale, while two additional Orders were instituted. A change in the method of wearing the badge of the Third Class (Companion) of some British Orders was made. Where it used to be worn medal-fashion on the left breast, it is now hung round the neck.

Order of the British Empire.—This was instituted in June 1917, to reward War services in all capacities, military and civil. In 1918 a Military Division of the Order was created. The essential features of the latest statute of the Order, published on Dec. 29 1922, are as follows:—

There are five classes of the Order, which (like the Order of the Bath) is divided into military and civil divisions. Each class can be conferred upon men and women equally.

Highest Class—Knights Grand Cross and Dames Grand Cross (G.B.E.).

Second Class—Knights Commander and Dames Commander (K.B.E. and D.B.E.).

Third Class—Commanders (C.B.E.).

Fourth Class—Officers (O.B.E.).

Fifth Class—Members (M.B.E.).

The two highest classes of the Order wear a star, which is of silver, of two designs. In the centre is a golden medallion showing a representation of Britannia seated, surrounded by a circlet of crimson enamel bearing the motto of the Order, "For God and the Empire."

The members of the first class wear the larger star on the left breast, and the badge of the Order (*see* below) is also worn on the sash, which, in the case of men, is 3¾ in. wide, in the case of women, 2¼ in. wide, and crosses the breast from the right shoulder to the left hip, the badge resting on the hip. A collar has been instituted for this class.

The members of the second class wear the smaller star on the left breast, with the badge suspended, in the case of men, by a ribbon 1¾ in. wide passing round the neck, and in the case of women, from a bow of ribbon of the same width, placed on the left side, above the star. The third class wear the badge, in the case of men, from a ribbon of the same width as the second class round the neck, and, in the case of women, from a bow on the left side. The fourth and fifth classes wear the badge on the left breast, from a ribbon 1½ in. wide, medal-fashion in the case of men, from a bow in the case of women.

The badge is a cross patonce, bearing in the centre the medallion and circlet as in the star. An imperial crown in gold surmounts the cross. For the first three classes the cross is enamelled in pearl grey, bordered with gold, while the circlet is of red enamel with the motto in gold. The commander's badge is smaller than that for the other two classes. The badge of the fourth class is entirely silver gilt, while that of the lowest class is entirely silver. The ribbon of the Order is purple for the civil division, and purple with a narrow red central stripe for the military division.

There are also two medals belonging to the Order: The gallantry medal, which is rare, and is only awarded for conspicuous bravery, where the recipient knew, when he performed the deed of gallantry, that his life was in danger, and the meritorious service medal, given for meritorious service.

Companion of Honour.—This order was instituted in June 1917, at the same time as the Order of the British Empire. It may be conferred upon either men or women who have rendered conspicuous national service, and for whom the distinction is deemed the most appropriate form of recognition, constituting, as it does, an honour dissociated either from acceptance of title or classification of merit, for it confers no title or precedence, simply the initials "C.H." after the recipient's name.

It consists of the Sovereign and 50 members, and there is only one class.

The insignia consists of a badge, worn by men suspended from the ribbon of the Order which is passed round the neck, and by women suspended from a bow of ribbon placed upon the left shoulder.

The badge is oval, and consists of a blue circlet ensigned with the imperial crown in enamelled colours and bearing in letters of gold the motto of the Order, "*In Action Faithful and in Honour Clear.*" In the centre is an oblong plaque, with thereon, on the dexter a representation of a mounted knight in armour, and on the sinister an oak tree, from the boughs of which hangs a shield charged with the Royal Arms. The ribbon is 1½ in. wide, of carmine silk with an interlaced border of gold wire.

The Order ranks next to, and immediately after, the first class of the Order of the British Empire.

Estonia.—This country has established the *Liberty Cross.*

Finland.—The chief Finnish Order is the *White Rose of Finland.*

Germany.—Officially, the old Orders of the German Empire have ceased to exist, but they are still worn in many cases.

Greece.—In addition to the *Order of the Redeemer* (*see* 15.865), the *Order of George I.* was instituted in 1912, and has six classes—collar, grand cross, grand commander, officer, knight and companion. There are also two medals of the Order, silver and bronze. The ribbon is red.

Owing to the establishment of the Greek Republic, it is possible that some changes may be made with regard to these two Orders.

Latvia.—Latvia has instituted the *Order of the Three Stars.*

Persia.—It is not improbable that the new Shah may alter the present chief Persian Order, the *Timsal-I-Humayun* (the Shah's portrait), but the *Lion and the Sun* may still be continued.

Poland.—Since the restitution of Poland's freedom, the old Polish *Order of the White Eagle* has been re-instituted.

This is the premier Polish Order, only awarded for most exceptional services. There is only one class. The ribbon is light blue.

The origin of the *Order of Polonia Restituta* needs no explanation. There are five classes—grand cordon, grand officer, commander, officer and chevalier. The insignia is worn after the fashion of that of the French Legion of Honour. The badge is a white cross with the Eagle of Poland thereon, and the ribbon is of the Polish national colours, red, with white edges.

Russia.—All the Russian Orders of Chivalry have been discontinued, though they still continue to be worn by adherents of the monarchy who have refused to acknowledge the present régime.

Egypt.—In the days before the World War, services rendered to the Egyptian Govt. were recognised by the award of the Turkish Orders of the Osmanieh and Medjidieh (*see* 15.867), but the change in the administration of the country made it inevitable that these would disappear, and that the King of Egypt would institute new Orders. There are now six of these:—

Order of Mohammed Ali, instituted in 1915 in memory of the founder of the present dynasty. The premier Egyptian Order and rare. Three classes—collar, grand cordon and commander. Star and Badge similar in design, consisting of a sun of which the rays are alternately gold and silver; upon this is a six-pointed green star, each point terminating in a golden lotus flower. In the centre is a green enamelled disc, with the Arabic inscription "Mohammed Ali" surrounded with an inscription to the effect that "Clemency, Justice and Generosity are the strength of a Reign." The ribbon is of watered green silk with a white line close to each edge. Two medals, gold and silver, belong to the Order. They bear on the obverse the Arabic inscription, "Honour to Bravery."

Order of Ismail, instituted 1922 in memory of the father of King Fuad. Second Egyptian Order. For eminent services rendered to Egypt. Four classes grand cordon, grand officer, commander and officer. The Badge is a five-pointed azure-blue enamelled star, having in the centre a round plaque with the Arabic inscription "Ismail" surmounted by a wreath of laurel with red knots. Star is similar, but has silver rays between the angles. The ribbon is dark blue with a stripe of red towards each edge.

Order of the Nile, instituted in 1915, for useful service rendered to Egypt. Five classes—grand cordon, grand officer, commander, officer and chevalier. The badge and star are of practically the same design, and consist of a star of 10 rays, alternately gold and silver, thereon a white enamel five-pointed star surmounted by the crown of Egypt. In its centre is a golden disc with an Arabic inscription in blue, "What benefits does Egypt owe to the Nile, the source of her prosperity and happiness." The crown in the badge is placed between the two top rays. The ribbon is of watered blue silk, with a golden-yellow stripe at each edge. The officer has a rosette on his ribbon.

Order of Al Kamal, instituted in 1915, is for ladies only. Four classes—"Decoration of Al Kamal," first, second and third classes. The decoration is in brilliants, and is reserved for the Queen of Egypt and princesses of royal blood. The insignia is a star enriched

with precious stones, worn on the left breast, and a cordon of light blue watered silk with golden edges, which, passing over the right shoulder, suspends a jewelled badge resting on the left side. The insignia of the first class (grand cordon) is similar in appearance and is worn after the same fashion, but it is not jewelled. The second and third classes wear a badge on the left breast, attached to the ribbon of the Order which is tied on in a bow, the second class having a rosette thereon. The star is gold, charged with ten ornamental flowers, and bearing in the centre the inscription "Al Kamal," surrounded by the words "Charity," "Duty," "Devotion," "Nobility," and "Pity." The badge is a star, of which the 10 rays are formed by the same flowers as on the star, surmounted by the Crown, and bearing the inscription "Al Kamal" in the middle.

Order of Agriculture, established 1915, is a reward for services rendered to agriculture. There are two classes—commander and chevalier. The insignia of the commander is a badge, attached to the ribbon of the Order, worn round the neck, while that of the chevalier is a similar badge worn medal-wise on the left breast. The badge is a five-rayed star, enamelled white, with leaves and pods of the cotton plant enamelled in colour. In the centre in green Arabic characters is the inscription, "Decoration of Agriculture," and above this, between the top rays a cartouche inscribed in Arabic, "He who sows, reaps." Above all is the Royal Crown in gold. The ribbon is watered silk, striped with green and golden-yellow.

Order of the Military Star of King Fuad.—This dates from 1919, and is conferred on natives and foreign officers of the Egyptian Army. It is a white enamel five-pointed star, suspended from a bar. The obverse is bordered with gold, each arm having a golden fillet in the centre. The centre is enamelled in red and blue (the colours of the Royal House of Egypt), and bears a garland of laurel surmounted by the Royal Crown which surrounds two crossed sabres of oriental type. The reverse bears the inscription in Arabic, "The Military Star of King Fuad." The ribbon has five equal stripes of blue, chamois, black, chamois and blue. Bars may be awarded for additional services. (A. V. W.-H.)

KNOWLEDGE, THEORY OF.—Theory of knowledge is a product of doubt. When we have asked ourselves seriously whether we really know anything at all, we are naturally led into an examination of knowing, in the hope of being able to distinguish trustworthy beliefs from such as are untrustworthy. Thus Kant, the founder of modern theory of knowledge, represents a natural reaction against Hume's scepticism. Few philosophers nowadays would assign to this subject quite such a fundamental importance as it had in Kant's "critical" system; nevertheless it remains an essential part of philosophy. It is perhaps unwise to begin with a definition of the subject, since, as elsewhere in philosophical discussions, definitions are controversial, and will necessarily differ for different schools; but we may at least say that the subject is concerned with the general conditions of knowledge, in so far as they throw light upon truth and falsehood.

It will be convenient to divide our discussion into three stages, concerning respectively (1) the definition of knowledge, (2) data, (3) methods of inference. It should be said, however, that in distinguishing between data and inferences we are already taking sides on a debatable question, since some philosophers hold that this distinction is illusory, all knowledge being (according to them) partly immediate and partly derivative.

I. THE DEFINITION OF KNOWLEDGE

The question how knowledge should be defined is perhaps the most important and difficult of the three with which we shall deal. This may seem surprising: at first sight it might be thought that knowledge might be defined as belief which is in agreement with the facts. The trouble is that no one knows what a belief is, no one knows what a fact is, and no one knows what sort of agreement between them would make a belief true. Let us begin with belief.

Belief.—Traditionally, a "belief" is a state of mind of a certain sort. But the behaviourists deny that there are states of mind, or at least that they can be known; they therefore avoid the word "belief," and, if they used it, would mean by it a characteristic of bodily behaviour. There are cases in which this usage would be quite in accordance with common sense. Suppose you set out to visit a friend whom you have often visited before, but on arriving at your destination you find that he has moved, you would say "I thought he was still living at his old house." Yet it is highly probable that you did not think about it at all, but merely pursued the usual route from habit. A "thought" or "belief" may, therefore, in the view of common sense, be shown by behaviour, without any corresponding "mental" occurrence. And even if you use a form of words such as is supposed to express belief, you are still engaged in bodily behaviour, provided you pronounce the words out loud or to yourself. Shall we say, in such cases, that you have a belief? Or is something further required?

It must be admitted that behaviour is practically the same whether you have an explicit belief or not. People who are out of doors when a shower of rain comes on put up their umbrellas, if they have them; some say to themselves "it has begun to rain," others act without explicit thought, but the result is exactly the same in both cases. In very hot weather, both human beings and animals go out of the sun into the shade, if they can; human beings may have an explicit "belief" that the shade is pleasanter, but animals equally seek the shade. It would seem, therefore, that belief, if it is not a mere characteristic of behaviour, is causally unimportant. And the distinction of truth and error exists where there is behaviour without explicit belief, just as much as where explicit belief is present; this is shown by the illustration of going to where your friend used to live. Therefore, if theory of knowledge is to be concerned with distinguishing truth from error, we shall have to include the cases in which there is no explicit belief, and say that a belief may be merely implicit in behaviour. When old Mother Hubbard went to the cupboard, she "believed" that there was a bone there, even if she had no state of mind which could be called cognitive in the sense of introspective psychology.

Words.—In order to bring this view into harmony with the facts of human behaviour, it is of course necessary to take account of the influence of words. The beast that desires shade on a hot day is attracted by the sight of darkness; the man can pronounce the word "shade," and ask where it is to be found. According to the behaviourists, it is the use of words and their efficacy in producing conditional responses that constitutes "thinking."[1] It is unnecessary for our purposes to inquire whether this view gives the whole truth about the matter. What it is important to realise is that verbal behaviour has the characteristics which lead us to regard it as pre-eminently a mark of "belief," even when the words are repeated as a mere bodily habit. Just as the habit of going to a certain house when you wish to see your friend may be said to show that you "believe" he lives in that house, so the habit of saying "two and two are four," even when merely verbal, must be held to constitute "belief" in this arithmetical proposition. Verbal habits are, of course, not infallible evidences of belief. We may say every Sunday that we are miserable sinners, while really thinking very well of ourselves. Nevertheless, speaking broadly, verbal habits crystallise our beliefs, and afford the most convenient way of making them explicit. To say more for words is to fall into that superstitious reverence for them which has been the bane of philosophy throughout its history.

Belief and Behaviour.—We are thus driven to the view that, if a belief is to be something causally important, it must be defined as a characteristic of behaviour. This view is also forced upon us by the consideration of truth and falsehood, for behaviour may be mistaken in just the way attributable to a false belief, even when no explicit belief is present—for example, when a man continues to hold up his umbrella after the rain has stopped without definitely entertaining the opinion that it is still raining. Belief in this wider sense may be attributed to animals—for example, to a dog who runs to the dining-room when he hears the gong. And when an animal behaves to a reflection in a looking-glass as if it were "real," we should naturally say that he "believes" there is another animal there; this form of words is permitted by our definition.

It remains, however, to say what characteristics of behaviour can be described as beliefs. Both human beings and animals act so as to achieve certain results, *e.g.*, getting food. Sometimes they succeed, sometimes they fail; when they succeed, their

[1] See J. B. Watson, *Behaviorism* (1925).

relevant beliefs are "true," but when they fail, at least one is false. There will usually be several beliefs involved in a given piece of behaviour, and variations of environment will be necessary to disentangle the causal characteristics which constitute the various beliefs. This analysis is effected by language, but would be very difficult if applied to dumb animals. A sentence may be taken as a law of behaviour in any environment containing certain characteristics; it will be "true" if the behaviour leads to results satisfactory to the person concerned, and otherwise it will be "false." Such, at least, is the pragmatist definition of truth and falsehood.

Truth in Logic.—There is also, however, a more logical method of discussing this question. In logic, we take for granted that a word has a "meaning"; what we signify by this can, I think, only be explained in behaviouristic terms, but when once we have acquired a vocabulary of words which have "meaning," we can proceed in a formal manner without needing to remember what "meaning" is. Given the laws of syntax in the language we are using, we can construct propositions by putting together the words of the language, and these propositions have meanings which result from those of the separate words and are no longer arbitrary. If we know that certain of these propositions are true, we can infer that certain others are true, and that yet others are false; sometimes this can be inferred with certainty, sometimes with greater or less probability. In all this logical manipulation, it is unnecessary to remember what constitutes meaning and what constitutes truth or falsehood. It is in this formal region that most philosophy has lived; and within this region a great deal can be said that is both true and important, without the need of any fundamental doctrine about meaning. It even seems possible to define "truth" in terms of "meaning" and "fact," as opposed to the pragmatic definition which we gave a moment ago. If so, there will be two valid definitions of "truth," though of course both will apply to the same propositions.

The purely formal definition of "truth" may be illustrated by a simple case. The word "Plato" means a certain man; the word "Socrates" means a certain other man; the word "love" means a certain relation. This being given, the meaning of the complex symbol "Plato loves Socrates" is fixed; we say that this complex symbol is "true" if there is a certain fact in the world, namely, the fact that Plato loves Socrates, and in the contrary case the complex symbol is false. I do not think this account is false, but, like everything purely formal, it does not probe very deep.

Uncertainty and Vagueness.—In defining knowledge, there are two further matters to be taken into consideration, namely, the degree of certainty and the degree of precision. All knowledge is more or less uncertain and more or less vague. These are, in a sense, opposing characters: vague knowledge has more likelihood of truth than precise knowledge, but is less useful. One of the aims of science is to increase precision without diminishing certainty. But we cannot confine the word "knowledge" to what has the highest degree of both these qualities; we must include some propositions that are rather vague and some that are only rather probable. It is important, however, to indicate vagueness and uncertainty where they are present, and, if possible, to estimate their degree. Where this can be done precisely, it becomes "probable error" and "probability." But in most cases precision in this respect is impossible.

II. THE DATA

In advanced scientific knowledge, the distinction between what is a datum and what is inferred is clear in fact, though sometimes difficult in theory. In astronomy, for instance, the data are mainly certain black and white patterns on photographic plates. These are called photographs of this or that part of the heavens, but of course much inference is involved in using them to give knowledge about stars or planets. Broadly speaking, quite different methods and a quite different type of skill are required for the observations which provide the data in a quantitative science, and for the deductions by which the data are shown to support this or that theory. There would be no reason to expect Einstein to be particularly good at photographing the stars near the sun during an eclipse. But although the distinction is practically obvious in such cases, it is far less so when we come to less exact knowledge. It may be said that the separation into data and inferences belongs to a well-developed stage of knowledge, and is absent in its beginnings.

Animal Inference.—But just as we found it necessary to admit that knowledge may be only a characteristic of behaviour, so we shall have to say about inference. What a logician recognises as inference is a refined operation, belonging to a high degree of intellectual development; but there is another kind of inference which is practised even by animals. We must consider this primitive form of inference before we can become clear as to what we mean by "data."

When a dog hears the gong and immediately goes into the dining-room, he is obviously, in a sense, practising inference. That is to say, his response is appropriate, not to the noise of the gong in itself, but to that of which the noise is a sign: his reaction is essentially similar to our reactions to words. An animal has the characteristic that, when two stimuli have been experienced together, one tends to call out the response which only the other could formerly call out. If the stimuli (or one of them) are emotionally powerful, one joint experience may be enough; if not, many joint experiences may be required. This characteristic is totally absent in machines. Suppose, for instance, that you went every day for a year to a certain automatic machine, and lit a match in front of it at the same moment at which you inserted a penny; it would not, at the end, have any tendency to give up its chocolate on the mere sight of a burning match. That is to say, machines do not display inference even in the form in which it is a mere characteristic of behaviour. Explicit inference, such as human beings practise, is a rationalising of the behaviour which we share with the animals. Having experienced A and B together frequently, we now react to A as we originally reacted to B. To make this seem rational, we say that A is a "sign" of B, and that B must really be present though out of sight. This is the principle of induction, upon which almost all science is based. And a great deal of philosophy is an attempt to make the principle seem reasonable.

Whenever, owing to past experience, we react to A in the manner in which we originally reacted to B, we may say that A is a "datum" and B is "inferred." In this sense, animals practise inference. It is clear, also, that much inference of this sort is fallacious: the conjunction of A and B in past experience may have been accidental. What is less clear is that there is any way of refining this type of inference which will make it valid. That, however, is a question which we shall consider later. What I want to consider now is the nature of those elements in our experiences which, to a reflective analysis, appear as "data" in the above-defined sense.

Mental and Physical Data.—Traditionally, there are two sorts of data, one physical, derived from the senses, the other mental, derived from introspection. It seems highly questionable whether this distinction can be validly made among data; it seems rather to belong to what is inferred from them. Suppose, for the sake of definiteness, that you are looking at a white triangle drawn on a black-board. You can make the two judgments: "There is a triangle there," and "I see a triangle." These are different propositions, but neither expresses a bare datum; the bare datum seems to be the same in both propositions. To illustrate the difference of the propositions: you might say "There is a triangle there," if you had seen it a moment ago but now had your eyes shut, and in this case you would not say "I see a triangle"; on the other hand, you might see a black dot which you knew to be due to indigestion or fatigue, and in this case you would not say "There is a black dot there." In the first of these cases, you have a clear case of inference, not of a datum.

In the second case, you refuse to infer a public object, open to the observation of others. This shows that "I see a triangle" comes nearer to being a datum than "There is a triangle there." But the words "I" and "see" both involve inferences, and

cannot be included in any form of words which aims at expressing a bare datum. The word "I" derives its meaning, partly, from memory and expectation, since I do not exist only at one moment. And the word "see" is a causal word, suggesting dependence upon the eyes; this involves experience, since a new-born baby does not know that what it sees depends upon its eyes. However, we can eliminate this dependence upon experience, since obviously all seen objects have a common quality, not belonging to auditory or tactual or any other objects. Let us call this quality that of being "visual." Then we can say: "There is a visual triangle." This is about as near as we can get in words to the datum for *both* propositions: "There is a triangle there," and "I see a triangle." The difference between the propositions results from different inferences: in the first, to the public world of physics, involving perceptions of others; in the second, to the whole of my experience, in which the visual triangle is an element. The difference between the physical and the mental, therefore, would seem to belong to inferences and constructions, not to data.

It would thus seem that data, in the sense in which we are using the word, consist of brief events, rousing in us various reactions, some of which may be called "inferences," or may at least be said to show the presence of inference. The two-fold organisation of these events, on the one hand as constituents of the public world of physics, on the other hand as parts of a personal experience, belongs to what is inferred, not to what is given. For theory of knowledge, the question of the validity of inference is vital. Unfortunately, nothing very satisfactory can be said about it, and the most careful discussions have been the most sceptical. However, let us examine the matter without prejudice.

III. METHODS OF INFERENCE

It is customary to distinguish two kinds of inference, Deduction and Induction. Deduction is obviously of great *practical* importance, since it embraces the whole of mathematics. But it may be questioned whether it is, in any strict sense, a form of inference at all. A pure deduction consists merely of saying the same thing in another way. Application to a particular case may have importance, because we bring in the experience that there is such a case—for example, when we infer that Socrates is mortal because all men are mortal. But in this case we have brought in a new piece of experience, not involved in the abstract deductive schema. In pure deduction, we deal with x and y, not with empirically given objects such as Socrates and Plato. However this may be, pure deduction does not raise the problems which are of most importance for theory of knowledge, and we may therefore pass it by.

Induction.—The important forms of inference for theory of knowledge are those in which we infer the existence of something having certain characteristics from the existence of something having certain other characteristics. For example: you read in the newspaper that a certain eminent man is dead, and you infer that he is dead. Sometimes, of course, the inference is mistaken. I have read accounts of my own death in newspapers, but I abstained from inferring that I was a ghost. In general, however, such inferences are essential to the conduct of life. Imagine the life of a sceptic who doubted the accuracy of the telephone book, or, when he received a letter, considered seriously the possibility that the black marks might have been made accidentally by an inky fly crawling over the paper. We have to accept merely probable knowledge in daily life, and theory of knowledge must help us to decide when it really *is* probable, and not mere animal prejudice.

Probability.—Far the most adequate discussion of the type of inference we are considering is obtained in J. M. Keynes's *Treatise on Probability* (1921). So superior is his work to that of his predecessors that it renders consideration of them unnecessary. Mr. Keynes considers induction and analogy together, and regards the latter as the basis of the former. The bare essence of an inference by analogy is as follows: We have found a number of instances in which two characteristics are combined, and no instances in which they are not combined; we find a new instance in which we know that one of the characteristics is present, but do not know whether the other is present or absent; we argue by analogy that *probably* the other characteristic is also present. The degree of probability which we infer will vary according to various circumstances. It is undeniable that we do make such inferences, and that neither science nor daily life would be possible without them. The question for the logician is as to their validity. Are they valid always, never or sometimes? And in the last case, can we decide when they are valid?

Limitation of Variety.—Mr. Keynes considers that mere increase in the number of instances in which two qualities are found together does not do much to strengthen the probability of their being found together in other instances. The important point, according to him, is that in the known cases the instances should have as few other qualities in common as possible. But even then a further assumption is required, which is called the principle of limitation of variety. This assumption is stated as follows (p. 256): "That the objects in the field, over which our generalisations extend, do not have an infinite number of independent qualities; that, in other words, their characteristics, however numerous, cohere together in groups of invariable connection, which are finite in number." It is not necessary to regard this assumption as *certain;* it is enough if there is some finite probability in its favour.[1]

It is not easy to find any arguments for or against an *a priori* finite probability in favour of the limitation of variety. It should be observed, however, that a "finite" probability, in Mr. Keynes's terminology, means a probability greater than some numerically measurable probability, *e.g.*, the probability of a penny coming 'heads' a million times running. When this is realised, the assumption certainly seems plausible. The strongest argument on the side of scepticism is that both men and animals are constantly led to beliefs (in the behaviouristic sense), which are caused by what may be called invalid inductions; this happens whenever some accidental collocation has produced an association not in accordance with any objective law. Dr. Watson caused an infant to be terrified of white rats by beating a gong behind its head at the moment of showing it a white rat (*Behaviorism*, p. 126). On the whole, however, accidental collocations will usually tend to be different for different people, and therefore the inductions in which men are agreed have a good chance of being valid. Scientific inductive or analogical inferences may, in the best cases, be assumed to have a high degree of probability, if the above principle of limitation of variety is true or finitely probable. This result is not so definite as we could wish, but it is at least preferable to Hume's complete scepticism. And it is not obtained, like Kant's answer to Hume, by a philosophy *ad hoc;* it proceeds on the ordinary lines of scientific method.

Grades of Certainty.—Theory of knowledge, as we have seen, is a subject which is partly logical, partly psychological; the connection between these parts is not very close. The logical part may, perhaps, come to be mainly an organisation of what passes for knowledge according to differing grades of certainty: some portions of our beliefs involve more dubious assumptions than are involved in other parts. Logic and mathematics on the one hand, and the facts of perception on the other, have the highest grade of certainty; where memory comes in, the certainty is lessened; where unobserved matter comes in, the certainty is further lessened; beyond all these stages comes what a cautious man of science would admit to be doubtful. The attempt to increase scientific certainty by means of some special philosophy seems hopeless, since, in view of the disagreement of philosophers, philosophical propositions must count as among the most doubtful of those to which serious students give an unqualified assent. For this reason, we have confined ourselves

[1] The argument which leads to this conclusion is long and technical. It has been criticised by Jean Nicod, *Le Problème logique de l'Induction* (Paris, 1924), whose contentions are rebutted by Mr. R. B. Braithwaite in *Mind* (Oct. 1925). The outcome is to justify Mr. Keynes in the main, though not in every detail.

to discussions which do not assume any definite position on philosophical as opposed to scientific questions.

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KNOX, PHILANDER CHASE (1853–1921) (*see* 15.882d), American politician, was born at Brownsville, Pa., May 6 1853. He graduated from Mount Union College, Alliance, O., in 1872 and was admitted to the Bar in 1875. The following year he was appointed assistant U.S. Attorney for the western district of Pennsylvania. In 1877 he opened an office in Pittsburgh and soon developed a lucrative practice. In 1901 he was appointed attorney-general by President McKinley and was retained by President Roosevelt. While he was attorney-general many important suits were instituted, notably those against the "Beef Trust" and the Northern Securities Company. He resigned in 1904, having been appointed to fill the unexpired term of Matthew S. Quay, deceased, as Senator for Pennsylvania, and was re-elected to serve 1905–11. In 1909 he resigned to enter the cabinet of President Taft as Secretary of State, holding that office for four years. He was again returned to the Senate for 1917–23. In 1920 he offered a resolution declaring that war with Germany was at an end, which was adopted by both Senate and House, but was vetoed by President Wilson. A similar joint resolution of Congress was approved by President Harding July 2 1921, and a formal treaty of peace with Germany signed Aug. 25. He died in Washington, D.C., Oct. 12 1921.

KNUTSFORD, SYDNEY GEORGE HOLLAND, 2ND VISCOUNT (1855–), eldest son of the first Viscount Knutsford, was born on March 19 1855. He was educated at Wellington and at Trinity Hall, Cambridge, where he secured honours in law and distinguished himself in athletics. He was called to the bar in 1879, and in 1883 married Lady Mary Ashburnham, daughter of the 4th Earl of Ashburnham. He succeeded to the title on the death of his father in 1914. He became a director of the Underground Electric Railways Co. and other important companies, and was associated with a number of philanthropic enterprises. He was appointed chairman of the London Hospital, and his proposal that certain city churches should be demolished in order to provide funds for the sustentation of hospitals, though it attracted several supporters, embroiled him in controversy.

KOBE, Japan, with a population of 714,976 in 1921 (including 4,727 foreigners, largely Chinese), has increased in importance as a port as a result of the earthquake of 1923. A considerable part of the trade of Yokohama was diverted to it, and part of this transference will probably be permanent, owing to the excellent railway facilities of Kobe. The foreign population has also increased. Large sums have been spent on port improvement and land reclamation, and work is still in progress. In 1922 there were four quays, with berths for 19 vessels, and 19 more berths were projected for the completion of the extension scheme. A large shipbuilding yard, the fourth, was opened in 1917. In 1910 the bed of the Minatogawa river was reclaimed; the upper part has been made into a park, with a city hall and large market. The tramways have been extended to Hyogo, which is now administratively a part of Kobe. The city stretches five miles between the hills and the river, and is extending rapidly towards Osaka, with which it is connected by electric railway; the hill of Rokko-Zan behind the city has become a favourite summer resort. Many Japanese have erected office buildings in the settlement, which is well laid out. The water supply, previously very inadequate, has been extended. Although the south and southwest parts of Japan are supposed to be immune from serious earthquakes, a shock in the neighbourhood of Kobe caused considerable damage and some loss of life in May 1925.

KODÁLY, ZOLTÁN (1882–), Hungarian composer, was born at Kecskemét, Hungary, Dec. 16 1882. He studied under Hans Koessler at the Budapest Academy of Music, where he became professor of composition in 1907. A leading exponent of the ultra-modern tendency in Hungarian music, he devoted himself enthusiastically to the collection and arrangement of Hungarian and Slovak folk-songs and his pioneer work in this connection was of great importance; for he and Bartók discovered a certain type of Hungarian national music, of a much greater purity and originality than the popular gipsy-music. This had a remarkable effect in transforming modern Hungarian music, and in opening up a new perspective. In his arrangement of folk-songs, Kodály successfully penetrated their inner meaning, and preserved their poetic spirit. His musical criticisms have appeared in Hungarian, American, French and Italian papers. His works include *Johannes Hary*, a musical comedy; *Psalm LV.*, for chorus and orchestra; two string quartets; a trio for strings; sonatas, piano solos, songs, etc.

KOKOSCHKA, OSKAR (1886–), German poet and painter, was born at Pöchlarn, Austria, March 1 1886. He was an expressionist, and produced a number of semi-dramatic works, written in whimsical vein, in which the problems of life were treated in a somewhat loose and vague manner. *Mörder, Hoffnung der Frauen* (1907), *Der brennende Dornbusch* (1911), *Hiob* (1917) and *Orpheus und Eurydike* (1918) were first published in the *Sturm* and afterwards appeared in collected form under the title of *Vier Dramen* (1919). *Mörder, Hoffnung der Frauen* and *Hiob* were performed for the first time in Dresden in 1919 and *Der brennende Dornbusch* was produced in Berlin under Kokoschka's direction by the "Junge Deutschland." In his staging of this piece Kokoschka revealed much original talent. His verse is, for the most part, complementary to the accompanying pictures. His poetical works include *Die träumenden Knaben* (Vienna, 1908; Leipzig, 1917); *Der weisse Tiertöter* (1920); *Der gefesselte Kolumbus* (1921); and among his more notable pictures and drawings are "Auswanderer" and "Der irrende Ritter." See Paul Westheim, *O. Kokoschka* (1919).

KOLÁČEK, FRANTIŠEK (1851–1913), Czech physicist, studied in Prague under E. Mach and in Vienna under Stefan. In 1882 he was appointed lecturer at the Brno (Brünn) Polytechnic, and in 1891 became professor of mathematical physics at the Charles University in Prague. His numerous publications (mostly in Czech and German) dealing with electromagnetic and optical theory and hydrodynamics include: "Dispersionserklaerung nach der elektromagnetischen Lichttheorie" (*Ann. der Physik* 1887, 1888), which gives the first explanation of dispersion on the basis of Maxwell's electromagnetic theory; "Theorie der Doppelbrechung" (*ibid.*, 1892); *Theorie des Kerr'schen Reflexion Phaenomens* (Prague, 1895); "Ueber Magnetostriktion" (*Phys. Zeitschr.*, vol. 6, p. 143, 1905), and "Zur Theorie der elektromagnetischen Gleichungen in bewegten Medien" (*Ann. der Physik.*, vol. 23, p. 698, 1907), which derives electromagnetic equations for moving media independently of the electron theory, and arrives at Lorentz equations which are related to a system of co-ordinates connected with the observer, thus satisfying the relativity criterion; also the excellent textbooks *Hydrodynamika* (Prague, 1899), and *Elektřina a Magnetism* (Prague, 1904). Koláček died in Dec. 1913.

KOLCHAK, ALEXANDER VASILIEVICH (1875–1920), Russian admiral, was born in 1875 and entered the Russian Navy in 1888. He served in the Russo-Japanese War of 1904–5 and at the beginning of the World War was in command of a destroyer in the Baltic. In the summer of 1916 Kolchak was appointed commander of the Black Sea Fleet, with the rank of rear-admiral. After the revolution in 1917 he took an active part in the fighting against the Bolshevists in Siberia. On Nov. 18 1918, by a decision of the Russian Govt. at Omsk, Admiral Kolchak assumed the title of Supreme Ruler of Russia. During the first half of 1919 the anti-Bolshevist army under his command met with considerable success but in the summer the army disintegrated, there were risings in the rear, and Omsk, the capital of the Siberian Govt., was captured on Nov. 15 1919. The Government was then transferred to Irkutsk, but after the creation of a new socialist administration at Irkutsk, Kolchak was asked to resign, and on Jan. 4 1920 he signed a ukase transferring his powers to Gen.

Denikin. Later he fell into the hands of the Bolshevists and was shot at Irkutsk on Feb. 7 1920.

KOMURA, JUTARO, MARQUESS (1855–1911), Japanese diplomat and statesman (*see* 15.892), was foreign minister in the second Katsura administration (1908–11) and died at Hayama Nov. 24 1911.

KOORT, JAN (1883–), Estonian sculptor, was born Nov. 7 1883 in the Tartu (Dorpat) district. He received his artistic training in the Baron Stieglitz Art School at St. Petersburg (Leningrad) and from 1905–8 studied at the École des Beaux-Arts in Paris under Prof. Mercier. For the purpose of completing his training he worked in the private studios in Paris of Adler, R. Collin and Lucas. He was represented in the exhibitions of the Paris spring and autumn salons in 1908 and in the Tartue exhibition, 1909. After a short stay in his own country, Koort again went to Paris in 1910 where he remained until 1915. In 1910 he exhibited in the Helsingfors art exhibition. In 1915 he went to Moscow, where his best work was produced, and in 1915 and 1916 took part in the exhibitions known under the name of "Mir Iskusstwa." The Tretjakow Gallery in Moscow acquired his granite "Frauenkopf" and the portrait of his wife executed in black granite is in the Moscow Gallery. Koort, who worked in granite, marble and wood, produced various decorative works in memory of those who fell in the Estonian War of Independence. His great talents are most forcibly revealed in a number of finely executed character heads.

KORAN: *see* ARABIC LITERATURE.

KÖRBER, ERNST VON (1850–1919), Austrian statesman, was born at Trieste Nov. 6 1850. He began his career as an official in the Austrian state service, and when the Emperor Francis Joseph was compelled to rely on cabinets of officials in view of the obstruction in Parliament, Körber became minister of trade under Gautsch in 1897, of the interior under Clary in 1899 and Prime Minister in 1900. He was the first man other than an aristocrat to hold this post since Schmerling. Körber attempted to solve the nationalist question by honest negotiation and compromise, but his efforts first to bring Germany and the Czechs in Bohemia to an agreement, and later to solve the language problem by dividing Bohemia into a German, a Czech and a mixed district, broke down. He succeeded in restoring confidence between the Germans and the Crown, but the Czechs renewed their obstruction and Körber was forced to rule, as his predecessors had done, with the help of para. 14 of the Austrian constitution (which allowed a Government to pass any measure on its joint responsibility, with "provisional validity," should it prove impossible to pass the measure through Parliament in the ordinary way). Körber employed this expedient on no fewer than 33 occasions. He evolved the Great Austrian canal scheme, the only example of constructive legislation on a large scale in Austria of modern times, which was voted but never carried into action. He was also able to introduce a better spirit into industrial disputes, winning the confidence of masters and men alike.

Körber resigned office in Dec. 1904, when the obstruction of the Hungarian party of independence made it impossible to carry through the periodical compromise with Hungary. He returned to politics as common finance minister in Feb. 1915 and became prime minister for the second time in Oct. 1916 after the murder of Count Stürgkh. His old confidence, however, was gone. He resigned in Dec. 1916 after a fresh dispute concerning the Hungarian compromise and died in Baden, disregarded and embittered, March 5 1919.

KOREA or CHOSEN.—On Aug. 22 1910 Korea (*see* 15.908) became an integral part of the Japanese Empire, under its ancient name of Chosen, formerly in use for over five centuries and now officially restored. With this event a new era dawned for what was formerly the "Hermit Kingdom." The ordered and systematic progress, already inaugurated by Japan in 1906, advanced steadily.

The peninsula of Chosen, with its outlying islands, has an area of 86,000 square miles. It is thus about as large as the mainland of Japan, or about two-thirds of the size of the British Isles. The population on Oct. 1 1920 was 17,264,119, including about 337,000 Japanese and about 23,000 foreigners. The density was only about 208 per sq. m., compared with 376 in Japan and about 374 in Great Britain. On Oct. 1 1924 the population was estimated at 18,677,800. The climate is dry and bracing, without intense variations of cold and heat, and, in contrast to Japan, there is an absence of hurricanes and practically no visitation of earthquakes. The country is mountainous, especially in the north, but there are extensive plains, well watered with good rivers, on the south and west, where are situated the excellent harbours of Fusan, Mokpo, Chemulpho and Chinnampo. The mineral wealth of the country is concentrated in the north, while agriculture is the predominant characteristic of the level and fertile southwest. Chosen's geographical position affords her easy access to the markets of China, Manchuria and Siberia, and a railway line now connects her with northern Asia and thus to the heart of Europe.

I. POLITICAL HISTORY

Subsequently to the annexation, the functions of the Japanese residency-general and of the Korean Govt. were merged in those of a governor-general, the first to be appointed being Gen. Terauchi, with Mr. I. Yamagata, son of Prince Yamagata, as administrative superintendent. In Oct. 1916 Gen. Terauchi vacated his post to become Premier of Japan, and was succeeded by Gen. Count Hasegawa, Mr. Yamagata continuing in office. An important reform effected in this period was the unification of the police and the gendarmerie service, by which a better control of the outlying districts was obtained where hitherto the peace and security of the inhabitants had been frequently disturbed by bands of robbers and marauders.

But widespread disturbances took place in March 1919. The Koreans desired to achieve at one step that measure of "self-determination" which President Wilson's utterances appeared to them to justify. The disturbances, however, were quickly subdued, and the Japanese Govt. hastened forward reform measures which had already been contemplated. The heads of the administration resigned, and Baron (later Viscount) Makoto Saito was appointed governor-general and Dr. R. Midzuno administrative superintendent. The reforms introduced were: (1) the extension to civil officials of eligibility to the post of governor-general, hitherto only open to a military officer of the rank of general; (2) the governor-general, formerly only directly responsible to the Throne, to be amenable to the Prime Minister of Japan; (3) the governor-general to be relieved, even when a military officer, of the right to the military command, which should be exercised only by the commander of the army; (4) the substitution of a police force for the mixed system of gendarmerie and police. The Premier, Mr. Hara, also issued a statement that the Government were desirous of further eliminating, as time went on, all differences between Japan proper and Chosen in matters of education, industry and the civil services. A system of provincial and municipal administration, similar to that in Japan, would also gradually be evolved.

Peace was thus established, although various agitators and malcontents who had fled either to Shanghai or to Manchuria from time to time made abortive attempts to stir up discontent. Episodes which occurred in the autumn of 1920 in the Chientao district, when a Japanese consulate was burned and attacks were made on peaceful Japanese and other civilians, were subsequently found to have been engineered by Korean agitators.

II. FINANCIAL AND ECONOMIC HISTORY

Finance.—After the Russo-Japanese War, 1904–5, Japan turned her attention more actively to the reform of Chosen fiscal affairs. Detailed regulations regarding revenue and expenditure were promulgated in June 1906, the system of public tenders was introduced, and a bureau of audit was established. The Seoul branch of a Japanese joint-stock bank was authorised to act as the central treasury of the Chosen Govt., and the post-offices were also entrusted with Treasury business. In Sept. 1906 regulations with regard to the collection of taxes were issued and assessors appointed, all being made directly responsible to the Minister of Finance.

A law of 1901, not then put into force, by which the coinage system was to be made analogous to that of Japan, became operative in June 1905, and it was further provided that the standard money of

Japan, or bank notes, should become the standard money of Chosen. Thus Chosen became a gold country.

In consequence of the steady expansion of financial and economic affairs, the Bank of Korea (renamed the Bank of Chosen in 1911) was established as a central bank in Oct. 1909, and took over the duties previously attended to by the First Bank, Ltd. The Bank of Chosen, which has an authorised capital of 40,000,000 yen and a paid-up capital of 25,000,000 yen, acts as cashier to the Treasury and handles loan business, and, in addition, is authorised to issue bank notes and to engage in ordinary banking and trust business, such as the discounting of drafts and other commercial papers. Also, subject to the approval of the Governor-General of Chosen, it may make advances to public corporations without security and represent other banks. Being the principal medium of exchange in Chosen, the volume of the note issue has steadily expanded with the development of economic affairs in the peninsula. Since Dec. 1917 the notes have been allowed unlimited circulation in the Kwantung territory and the South Manchuria Railway Co.'s leased districts. At the same time the notes were made to replace the gold notes formerly issued in Manchuria by the Yokohama Specie Bank, this further swelling the volume of circulation bank notes issued by the Korean banks.

In March 1906, during the protectorate régime of Japan, the Agricultural and Industrial Bank Regulation was enacted with the object of giving relief to the straitened money market in the provinces by the creation of a number of agricultural and industrial banks. The Government extended them help, such as by subscribing to the capital, making loans free of interest and so forth. By the end of 1917 six head offices and 41 branches had been established in various parts of the peninsula. In time they were adjudged inadequate for the rapidly growing industrial and economic requirements, and this resulted in the promulgation in June 1918 of the Chosen Industrial Bank Law, in virtue of which a central bank bearing this title was established in Oct. of the same year by amalgamating the agricultural and industrial banks then existing.

At the end of 1923 there existed in Chosen 18 banks with 58 branches or agencies in addition to their head offices, 17 branch offices and agencies of banks which had their head offices in Japan proper, and at the end of June 1924 as many as 499 local credit associations with a total membership of 357,000 persons.

The country's ordinary revenue rose from 44,764,559 yen in 1916–7 to 102,383,844 in 1924–5; while the extraordinary revenue rose from 23,437,548 yen in 1916–7 to 38,439,857 yen in 1924–5. The total expenditure, which in 1916–7 was 57,562,710 yen, was 140,823,701 yen in 1924–5.

Foreign Trade.—The external trade of Chosen rapidly increased with the development of her agriculture and industry. Exports, valued at 5,616,608 yen in 1912 (in addition to exports to Japan itself of 15,369,009 yen), increased to 20,403,305 yen in 1923 (with 241,262,427 yen to Japan); and imports, 26,359,434 yen in 1912 (plus 40,756,013 yen from Japan), rose to 98,338,377 yen in 1923 (plus 167,452,350 yen from Japan).

During the same period the ratio of trade with Japan to that with foreign countries may be seen from the following table:—

	Trade with Japan (including Taiwan and Karafuto)	Trade with foreign countries
	%	%
1912	67	33
1914	72	28
1916	75	25
1918	81	19
1920	70	30
1921	79	21
1922	76	24
1923	77	23

In 1924 the trade with foreign countries amounted to: imports, 97,882,000 yen, exports 22,495,000 yen.

Government Enterprises.—In 1908 a special Government office was established to control and foster the cultivation of the medicinal plant ginseng. The area under cultivation increased to 1,724 ac., the annual value of the medicinal ginseng raised being 2,000,000 yen.

In 1907 the Government commenced operations for the natural evaporation of salt, a product hitherto obtained by the artificial boiling process, and the manufacture was developed as a Government enterprise. By 1918 saltpans covering an area of 2,528 ac. were in operation, but, as the quantity of salt produced was still insufficient for home consumption, in 1920 the Government began laying out an additional 6,370 ac., the work to be completed in seven years. The salt produced in 1923 amounted to 67,000,000 kin (88,600,000 lb.).

The production and manufacture of tobacco has been greatly fostered by the Government. The area under cultivation increased from 33,261 ac. in 1915 to 42,525 ac. in 1919, the total value having risen from 4,878,127 yen to 14,501,169 yen in the same period. In 1923, however, the area had decreased to 19,885 ac., and the total value for the year was 22,217,642 yen.

Agriculture and Industry.—Rice is the staple agricultural product, followed by barley, Italian millet, soy beans, wheat and red beans, in addition to which there are also such special products as cotton, tobacco, hemp and ginseng. The cultivation of fruit-trees has produced very good results, and the area of their cultivation is gradually extending, fruit-farming having received considerable impetus through the establishment of model agricultural farms. The Government undertook the reorganisation of sericulture in 1906, and the industry is now being carried on everywhere. Both fruit-farming and sericulture are engaged in as subsidiary industries by the agricultural class. The breeding of cattle, horses, goats and pigs is carried on nearly everywhere in the peninsula, though not as an independent enterprise. The cattle are well known for their great size and good quality, and a large number of them are exported annually to Japan proper and Asiatic Russia.

At the time of annexation a large part of the forests and plains of Chosen was in a state of utter desolation, but since the year 1907 afforestation has progressed uninterruptedly, with Government assistance, many private forestry enterprises having also sprung up in various localities. The total area of the forests of Chosen is believed to be about 13,500,000 acres.

The principal native industrial products are: textile fabrics, paper, pottery, metal ware, manufactured tobacco, brewed drinks and leather, but as these works are mostly carried on as subsidiary house industries, the production is insufficient to meet the demand, and even common articles of daily use have in many cases to be imported. With the steady development of manufacturing industries and the rapid strides with which agriculture, mining and other primary industries have grown, Chosen has begun to attract wide attention as a promising field of enterprise, especially in spinning, filature, the manufacture of pulp, cement, beet-sugar, matches, milling and iron founding.

In 1922 there were 53 agricultural companies with a total paid-up capital of 23,988,000 yen, 178 industrial with 27,390,000 yen, 261 commercial with 22,994,000 yen, 79 transportation with 27,694,000 yen and 188 others with 116,883,000 yen, making a total of 759 companies with a capital of 218,950,000 yen.

Mining.—A mining law enacted after the annexation, and made operative on April 1 1916, prohibited foreigners from acquiring mining rights in Chosen unless as a legal Japanese corporation, although the rights existing and already granted to foreigners by the former Korean Govt. were strictly respected. The principal mineral products, in addition to gold, are silver, zinc, copper, lead, iron, tungsten ore, graphite, coal (especially anthracite), quartz sand and kaolin. A number of Japanese mine-owners have recently commenced operations in the peninsula, and mining enterprise shows a steady expansion. The total annual yield of all the mines in the country was as follows:—

1910	6,067,952 yen	1918	30,838,074 yen
1912	6,815,121 yen	1920	24,204,688 yen
1914	8,522,418 yen	1922	14,503,781 yen
1916	14,078,188 yen	1923	17,326,894 yen

Fisheries.—The advance in the fisheries was mainly due to the provisions of the Fishery Law of 1911 under which new fishing associations have been formed, havens for the fishing fleet provided, and proper investigations conducted into the suitability of gear and the movements and location of fish. As a result, the fishing population increased from 93,400 with 16,709 boats in 1910, to 346,349 with 53,118 boats in 1918, the total value of the catch having risen from 7,871,910 yen to 32,863,402 yen in the same period. The total catch in 1923 reached the value of 51,700,000 yen.

Communications.—Some 3,850 m. of road construction and repair were undertaken at Government expense, and the cost of another 1,000 m. was shared between the Government and the local authorities, the total outlay being about 25,000,000 yen. The first railway line in Chosen, between Seoul and Chemulpho, was completed by a Japanese syndicate in 1900 and opened to traffic in Oct. of that year, whilst the same syndicate undertook the construction of the Seoul-Fusan railway (274 m.), which was

completed and opened to traffic in Jan. 1905. The trunk line Seoul-Wiju (309 m.), which traverses the peninsula lengthwise, was built by the Japanese Army and completed in 1906. Branch lines were added from time to time, so that by the time Chosen became part of the empire some 759 m. of railway were in operation. By 1923–4 this figure had been increased to 1,189 miles.

Posts, etc.—Since 1910–11 the expansion of the postal, telegraph and telephone services in Chosen has been normal, the number of post-offices having increased from 447 in 1910–1 to 618 in 1922–3, the postal packets from 100,265,041 to 347,779,584 and the parcels from 1,589,722 to 4,565,571. The length of telegraph lines increased in the same period from 3,389 m. to 5,087 m.; the length of wires from 7,740 m. to 19,635 m.; and the number of messages from 7,127,235 to 9,850,157. The length of telephone lines increased from 314 m. to 4,447 m.; the wires from 10,121 m. to 45,704 m.; and the messages from 21,260,918 to 72,328,480.

A great increase both in the number of depositors and the amount of their savings was a feature of the Post-Office Savings Bank in Chosen; in 1911–2 there were 223,599 depositors (4,365,996 yen), and in 1922–3 there were 1,590,470 depositors (19,875,093 yen).

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KORNILOV, LAVR GEORGIEVICH (1870–1918), Russian soldier was born July 18 1870 in Ust-Kamenogorodsk, Siberia, his father being a Cossack officer. He entered the army, and was in 1892 commissioned and posted to the Turkistan artillery brigade. He devoted himself to service in Turkistan, whence he undertook journeys into Afghanistan, Chinese Turkistan, Persia and Baluchistan. He saw service as a staff officer in the Russo-Japanese War of 1904–5, and subsequently spent four years (1907–11) as Russian military attaché in Peking. In Galicia, Kornilov commanded an infantry division. He himself was captured and sent to the fortress of Laka, in Hungary, but he managed to escape, reaching Russia in the autumn of 1916. He was at once appointed commander of the XX. Army Corps. At the beginning of March 1917, with the outbreak of the Russian Revolution, Kornilov was appointed to command the troops of the military district of Petrograd.

He found the troops, in such a demoralised state that he asked to be relieved and sent to the front, and at the beginning of May he was made commander of the VIII. Army. Appointed by Kerensky supreme commander-in-chief, Kornilov presented his programme enforcing discipline in the army. The programme was, however, rejected, and this was the beginning of a split between Kerensky and Kornilov and the struggle between them ending in the outbreak of Sept. 8–12; Kerensky gained an apparent victory, and Kornilov was interned in Bikhov. On his release after the November revolution, Kornilov assisted Gen. Alexeyev in forming the Volunteer Army in which he took a command. On March 31 1918 he was killed in the Caucasus by the bursting of a shell.

KOSSUTH, FRANCIS (1841–1914), Hungarian statesman (*see* 15.916), died in Budapest May 25 1914.

KÖVESLIGETHY, RADÓ DE (1862–), Hungarian astronomer, was born at Verona, Italy, Sept. 1 1862. Educated at Pozsony and the University of Vienna, he became assistant to H. C. Vogel at Potsdam Observatory and later astronomer at the Ó-Gyalla Observatory. While still a student he evolved from Greenwich observations of velocities in the line of sight a first approximation of solar velocity. He constructed further for the Kis Kartal Observatory a handy and powerful spectrophotometer based on the principle of extinction by polarisation. After a year's collaboration at the Central Institute of Meteorology and Terrestrial Magnetism at Budapest he became assistant to Baron Eötvös. In 1897 he was appointed extraordinary, and in 1904 ordinary professor of cosmography and geophysics at the University of Budapest. In 1905 he became general secretary of the International Seismological Association, a position he held till the dissolution of the Association in 1916. In 1905 he founded the Seismological Institute of Budapest. After the great earthquake of Messina he investigated the conditions under which a rational prevision of earthquakes would be possible (*Sur l'hystérisis sismique*, 1912).

KOVNO or KAUNAS (*see* 15.921), with a population of 92,446 in 1923, became the capital of Lithuania in place of Vilna (Wilno) when that town was included in Poland. Kovno has changed greatly since the World War. Previously a quiet, somewhat poor town, with no water supply, gas or modern drainage, it has now electricity and other services and a number of new buildings, including large shops and theatres. Its improvement is largely due to the fact that the taxes of Lithuania are now spent in the country, since it gained its independence. A Lithuanian university, called the Gedimine University in honour of a medieval prince, was opened in 1922. Kovno is the industrial centre of the country, nearly one-fifth of the industrial establishments in existence in 1921 being in the city. Kovno was thought to be a first-class fortress, but was reduced in a few days by German forces during the World War. Two churches were wrecked, mills razed and much damage done. Great efforts to Germanise the town were made during the occupation. The independence of Lithuania was ratified by the Constituent Assembly at Kovno in May 1920.

KRASSIN, LEONID BROISSODICH (1870–), Russian politician, was born in Kurgan, Tobolsk, the son of a civil servant. He was expelled from the St. Petersburg Technical Institute in 1891 for taking part in a political demonstration on the occasion of the funeral of Shelgunov. He was arrested in 1894, 1907 and 1908 and banished for three years to Nijni Novgorod. He combined continuous revolutionary activity with great success in the engineering profession, taking important part in many large works in Russia and holding eventually a responsible post in the company of Siemens and Schuckert. After the Nov. Revolution, 1917, he organised the supply of munitions to the Red Army during the civil war and became People's Commissar for Trade and Industry. In 1920 he was president of the Soviet delegation that concluded the trade agreement with England. In 1922 he was a member of the Soviet delegation to Genoa. In London he concluded an agreement with Mr. Urquhart concerning concessions in Siberia, but this agreement was not ratified in Russia, owing to the personal intervention of Lenin. When the Commissariats of Internal and Foreign Trade were united, Krassin became assistant commissar. He was for some time Soviet diplomatic representative in Paris and was appointed to London at the end of 1925.

KRAUS, KARL (1874–), Austrian critic and poet, was born April 28 1874 at Jičin, Czechoslovakia. He attended the university of Vienna and attracted notice by two brochures, *Die demolierte Literatur* and *Eine Kron für Zion*, and by his periodical, *Die Fackel*. This review, of which he became editor in 1899, was at first largely, and later entirely, written by him. It began its career by violent attacks upon abuses in literary, theatrical, social and political circles in Vienna, and especially upon the newspaper Press. Gradually it became the mouthpiece of a pitiless and scathing critic and, though the satirist's point of view changed in the course of time, the middle classes and the liberal Press always remained the chief objects of Kraus's attack. His satire was most acute in his collected essays, *Sittlichkeit und Kriminalität* (1902) and his volume of anti-war poetry *Die letzen Tage der Menschheit* (1918) was compared with that of Juvenal and Swift. Kraus has great pathos at his command, but his lyrical talent, as shown in *Worte in Versen* (1918), is cramped by his mordant wit. Nevertheless his influence upon the younger generation in Austria and Germany was very considerable. As a lecturer upon his own and upon foreign

works, he achieved great success both in his own country and abroad. He must also be reckoned, with Lichtenberg, Novalis and Nietzsche, among the German masters of aphorism. Kraus's other works include *Sprüche und Widersprüche* (1909); *Pro domo et mundo* (1912); *Nachts* (1919).

See L. Liegler, *Karl Kraus und sein Werk* (1920); B. Viertel, *Karl Kraus* (1921).

KREHBIEL, HENRY EDWARD (1854–1923), American writer and critic, was born at Ann Arbor, Mich., March 10 1854. He studied law at Cincinnati 1872–4, but drifted into journalism, devoting himself more particularly to musical criticism. He was on the staff of the Cincinnati *Gazette*, 1874–80, then editor of the New York *Musical Review*, and finally musical critic for the New York *Tribune* till his death, which occurred in New York City, March 20 1923. He was one of the most influential musical critics of his time, and in addition to lecturing on musical topics, wrote a number of popular books. Among these are *Studies in Wagnerian Drama* (1891); *How to Listen to Music* (1896); *Music and Manners in the Classical Period* (1898); *The Pianoforte and Its Music* (1911); *Afro-American Folk Songs* (1914); also works explaining grand opera plots, motives and music. He was the American editor of the 2nd ed. of Grove's *Dictionary of Music and Musicians* (1904–10), edited Thayer's *Life of Ludwig van Beethoven*, 3 vol. (1921) and translated a number of foreign musical works.

KREISLER, FRITZ (1875–), Austrian violinist, was born at Vienna Feb. 2 1875. At the age of seven he was admitted to the Vienna Conservatoire and in 1887 won the Grand Prix on graduation from the Paris Conservatoire, where he studied under Massenet and Delibes. In 1889 he made a successful tour of the United States, but then abandoned music for some years, studying medicine and serving in the Austrian Army as an officer in a Uhlan regiment. His reappearance on the concert stage in Berlin, March 1899, was followed by a wonderful tour of the United States and Great Britain in 1900–1, and he later visited the chief musical centres of the world. On the outbreak of the World War in 1914 he rejoined his former regiment, but was wounded and discharged from service, thereafter resuming his musical career. He published his war experiences, *Four Weeks in the Trenches*, in 1915. He has also written numerous arrangements of music for the violin and piano, and his operetta, *Apple Blossoms*, was produced in New York in 1919.

KRILOFF, ALEXEI NIKOLAIEVICH (1863–), Russian mathematician and naval architect, was born Aug. 3 1863 in Alātyr, Simbirsk province, and educated in the naval school and naval academy at St. Petersburg (Leningrad). In 1881 he joined the navy. In 1896 and 1898 he read before the Institution of Naval Architects in London two remarkable papers on the oscillation of a ship on waves and was awarded the gold medal of the Institution. From 1900 to 1908 he was superintendent of the experimental tank at St. Petersburg; and from 1908 to 1910 director of naval construction. In 1890 he became professor at the naval academy and in 1916 member of the Russian Academy of Sciences. He devised for the Russian Navy a series of special high-grade optical instruments, and published many scientific papers and textbooks, among which the most original are: *On Approximative Calculations* (1906) and *On Differential Equations of Mathematical Physics* (1912). He was also interested in theoretical astronomy and translated into Russian Isaac Newton's *Principia* with a valuable commentary, published by the naval academy in 1916.

KROGH, SCHACK AUGUST STEENBERG (1874–), Danish physiologist, was born at Grenaa and took his doctor's degree in 1903 by a thesis on the respiration of frogs. In 1916 he became professor of animal physiology at the University of Copenhagen. Krogh made important discoveries by his experiments in connection with respiration, and in 1906 was awarded a prize by the Vienna Academy of Science for the investigations which he carried out and described in a treatise, *Mechanism of Gas Exchange in Lungs*. In 1920 he was awarded the Nobel Prize for medicine for his discovery of the capillary regulation of the conveyance of blood to the muscles. He afterwards continued his investigations of the capillaries and the blood, in which he discovered an element which influences the contraction of the capillaries. (*See* PHYSIOLOGY.)

Among his publications are: *The Respiratory Exchange in Animals and Man* (1916) and *The Anatomy and Physiology of Capillaries* (1922); and articles in *The Journal of Physiology*.

KROHG, CHRISTIAN (1852–1925), Norwegian painter and author, was born at Christiania (Oslo) Aug. 13 1852. After graduating in law, he went to Germany to study painting. During the following 30 odd years he lived alternately at Christiania and in Paris, until in 1909 he was appointed professor and director at the newly founded academy of painters and sculptors, Christiania. Krohg was the pioneer of the art of open-air painting in Norway which had its heyday in the first half of the 'eighties. He specialised in depicting the sea and the life of the pilots, which he rendered with a wonderful vigour and originality of incident and colouring. His deep interest in the social problems of his age is shown in his "Struggle for Existence" (1890) in the Oslo National Gallery. Krohg, besides being an excellent portrait painter, also possessed literary and journalistic talent. A selection of his literary works in four volumes appeared in 1920–1. He died on Oct. 16 1925.

KROPOTKIN, PETER ALEXEIVICH, PRINCE (1842–1921), Russian author (*see* 15.928), returned to Russia in June 1917, and died near Moscow, after a long illness, Feb. 8 1921.

KU KLUX KLAN (*see* 15.942).—On Thanksgiving night in 1915 William Joseph Simmons, preacher, travelling salesman and experienced promoter of fraternal orders, gathered some friends on Stone Mountain, near Atlanta, Ga., before a "fiery cross" and administered the oath of the "Invisible Empire, Knights of the Ku Klux Klan." A state charter gave corporate rights to his organisation. As Imperial Wizard, Simmons could hold office for life and have final authority unless opposed by two-thirds of the Imperial Kloncilium, council of supreme officers and delegates from other states.

Activities of Simmons.—Thus legally established, Simmons called upon the world to witness that his was a "high-class, mystic, social, patriotic, benevolent association" devoted to the sacred duty of protecting womanhood, to the idea of the "Fatherhood of God, Brotherhood of Man," to the principle of "white supremacy"—in short, to "real patriotism" and "pure Americanism." Simmons capitalised the mask of secrecy and roaming by night that had made so effective the old Klan. In the next four years, his order won some 5,000 adherents, mostly in the southern states. They displayed the patriotism of Klansmen on the "home front," against alien enemies, idlers, draft-dodgers, strikers in war industries and immoral women. Nevertheless, the tradition of the old Klan lost vitality. Simmons met financial difficulties. The order would have languished had not new impetus been given.

Growth of the Organisation.—On June 7 1920, Simmons contracted with E. Y. Clarke to increase the membership. As Imperial Kleagle, he was to receive $8 of the $10 admission fee, and $2 for every member added to a local Klan within six months after its organisation. He agreed to pay all expenses of the central office and $75 a week to Simmons. When Clarke's system was perfected, $4 of the original fee went to the local Kleagle, $1 to the King Kleagle or state sales-manager, $0.50 to the Grand Goblin, or head of the local Klan. The remaining $4.50 went to Atlanta. Other revenues accumulated from the sale of regalia by the subsidiary Gate City Manufacturing Company. When Congress made an investigation in Oct. 1921, it found that the Klan had funds enough to purchase an Imperial Palace and to take over control of Lanier University. The Invisible Empire then had a membership little short of 100,000. Expert salesmanship alone, however, did not account for the rapid growth of the Klan. It was not checked by the revelations before the Congressional Committee nor by the devastating attacks of such newspapers as *The New York World*. The control slipped from the grasp of Simmons and Clarke into the hands of Klansmen from the state of Texas and soon the order spread rapidly through the United States.

The Appeal of the Klan.—The appeal of the Klan came to a people suffering from the hysteria of the World War. Those who had enjoyed power in citizens' committees which forced the purchase of Liberty Bonds, intimidated German sympathisers and hounded slackers, saw in the Klan a continued outlet for their patriotism. Those who were outraged by immorality flaunted before inert police used the terror of the Klan to punish evil-doers. Those chafed by the deliberation of the courtroom and convinced that the guilty too often slipped through some loophole in the law, found the Klan a direct way to prevent the miscarriage of justice. Whether authorised or not, many acts of violence were perpetrated in the name of the Invisible Empire. But far more numerous were those who cherished the racial and religious prejudices of their ancestors. Kleagles had no difficulty in selling membership in a crusade for Protestant Christianity and native Americanism. In the south, where the negro is a social problem, purity of womanhood and white supremacy are stressed in the creed of Klansmen. On the Pacific coast, Japanese compete with native farmers and labourers. There the cry is against aliens. In the eastern states the Klan is most suspicious of Jews and Catholics. To the Klansman, the Knights of Columbus are in conspiracy against the Constitution to prostrate the American people before the Pope.

From religious hatred the Klan in every section of the United States draws vitality. It has gained its greatest strength in the south and west, among descendants of the first white stock of America, those English and Scotch-Irish pioneers, strong Protestants, who laid the foundations of American society. A secret order offered to such persons escape from the dullness of frontier life into romance with weird ritual, exalted titles and closer friendships. It was the same impetus that during the middle of the 19th century spread "Know Nothing" (*q.v.*) lodges over the land. Jealousy and hatred of the Irish-Catholic newcomers swept them on into politics. For much the same reasons, descendants of the pioneers have joined the Ku Klux Klan and concentrated its power at the polls.

In Jan. 1926 it was impossible to say whether the Klan was still growing, or whether, like its predecessor, the Know Nothing movement, it would prove only another temporary though meteoric organisation.

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KUN, BELA (1886–), Hungarian politician, was born near Györ, of middle class Jewish parentage. He passed his youth unnoticed, and he eventually entered the University of Kolozsvár, where he graduated in jurisprudence. He intended to become a lawyer, but soon tired of the profession and took up journalism and politics. His upbringing and ideas naturally led him to sympathise with the "under-dog" and he early became an extremely active member of the Socialist party. But his work as a party organiser and agitator did not go beyond the limits of his province, and the same may be said about his influence and popularity. Having entangled himself in the question of the mismanagement of the funds of a workmen's co-operative society, he fell into disgrace and was obliged to withdraw temporarily from public life. He therefore went to Budapest and some time after succeeded in getting a minor post on the socialist daily paper, *Nepszava*.

Soon after the outbreak of the World War he was appointed lieutenant-commander of an ammunition supply column on the Galician front. Captured by the Russians early in the War, he was in Russia at the time of the revolution. He immediately ranged himself on the side of the Bolsheviks and became an apostle of their gospel among the Hungarian prisoners of war. After the Armistice, he planned to return to his country in order to help to win her to Bolshevism. He was already known to, and appreciated by, Lenin. He was therefore furnished with a false passport, and, disguising himself as a Red Cross doctor, succeeded in crossing the frontier together with some of his companions in captivity, all anxious to upset the present order.

Although Lenin did not fail to supply Kun with money to aid him in his plans, more than money contributed to his success, namely the critical condition of Hungary at that time: unaccustomed to self-government, and flooded with crowds of ex-soldiers, embittered at finding no employment or means of livelihood and ready for the first opportunity to revolt. Kun's wild and revolutionary gazette, *Vörös Ujsag* (*Red News*) which he began to publish soon after his return to Budapest, therefore found numerous readers amongst all those who, for one reason or another, disliked the Karolyi Government. Kun soon found himself in conflict with the police and on one occasion shortly before his advent to power was badly injured and imprisoned. He had not yet recovered and was still in gaol when the Karolyi Cabinet as a protest against the harsh conditions of the victorious powers decided to hand over the government to the Bolsheviks, and placed Kun at their head.

Kun's programme was to "arm at once, and forcibly transfer every industry and all landed property without conservation into the hands of the proletariat." At first he collaborated with the Social democrats, but soon shouldered them aside, nationalised all banks, all concerns with over 20 employees, all landed property over 1,000 acres, every building other than workmen's dwellings. All jewellery, all private property above the minimum (*e.g.*, two suits, 4 shirts, 2 pairs of boots and 4 socks) was seized; servants abolished, bathrooms made public on Saturday nights; priests, with the insane, criminals and shopkeepers employing paid assistants were declared incapable of the active or passive suffrage. International loans of over 10,000 kronen were repudiated. All this entailed prodigious work and the creation of a new bureaucracy which was most unpopular. Moreover, the reforms were unsuccessful; in practise the former owners of estates and factories remained on as their managers, the only difference being that production deteriorated very rapidly and the State had to pay the wages and make up the deficit. Kun started to issue a new currency, which the peasants, already disappointed that the large estates had not been parcelled out, and fearful that their turn would come to be nationalised, refused to accept. They boycotted the towns; and as the blockade was still on, the urban population starved, while prices soared.

Kun planned to convert the peasants to communism by force of arms; but meanwhile there were foreign campaigns to wage. After a first failure with the "soldiers councils" system, Kun and Boehm organised a well-disciplined army, with which they attacked and defeated the Czech troops occupying Slovakia. Kun, who considered himself Lenin's advance guard in Central Europe, and held long daily conversations by wireless with his master, made tireless communist propaganda at home and in Vienna, and tried hard and not unsuccessfully to play off the Allied great and lesser Powers against each other. When, however, the Entente stopped the Hungarian advance in Slovakia, he could no longer appeal to nationalist feelings, and his position became desperate. The peasants were discontented, the counter-revolution was organising. Kun commenced a "Red terror" against his enemies in Hungary, and again attacked the Rumanians, but they easily drove his forces back, and he fled to Vienna on Aug. 1. Here he was interned in the local lunatic asylum, but after an attempt had been made to murder him by means of poisoned Easter eggs (which, being a Jew, he did not eat), he was allowed to go to Russia.

Kun was a man of medium size, rather plump. On his short neck was a square, massive, bold head. He resembled a small shop-keeper rather than a tribune or revolutionary leader. He was, however, the only man amongst the Hungarian Bolsheviks who possessed at the same time an aptitude for ruling a country and the exalted faith of an apostle. It was this idealism, his firm belief in the truth of Bolshevism which gave him this superiority. He was a cruel and violent man only when he thought it necessary for the triumph of his ideas. He was, however, impulsive and incredibly naïve, with an extremely limited knowledge of men. (G. R*.; C. A. M.)

KUPKA, FRANTISEK (1871–), Czech painter, was born at Dobruska in Bohemia. He studied at the Academy of Fine Arts in Prague, at Vienna and in Paris, where he took up his permanent residence. His inventive talent, strengthened by a close knowledge of contemporary society and coloured by his sceptical outlook, was manifested notably in satirical drawings and caricatures which appeared in such Parisian papers as *Cocorico*, *L'assiette au beurre* and *Le Canard Sauvage*. He became known principally through a series of drawings entitled "L'Argent" and through his admirable illustrations to the book *L'homme et la terre* by E. Reclus (1905). In 1908 Kupka provided the illustrations for a bibliophile edition of *The Fates* by C. M. R. Leconte de Lisle and three years later for the Lysistrata of Aristophanes. He later began to experiment in new directions and looked for a new form of artistic expression. He became an adherent of the tendency known as "Orphism," and produced large canvases in which the interest of the subject matter is subordinated to the rhythm of the colour scheme. His ironical powers of observation, his bold imagery and philosophical outlook make Kupka one of the most interesting and distinguished artistic figures of his time.

KURDISTAN (*see* 15.949), is an expression applied to the geographical area stretching north and south from Mount Ararat down to the river Diyālā, and east and west from Persia to the river Kara Su. It is now divided between Turkey, 'Iraq (under British mandate) and Persia, and has a Kurdish population of approximately 1,500,000 people.

Turkish Kurdistan consists of certain parts of the vilayets of Diarbekr, Bitlis, Hakkiari, Van, Erzerum and Adana, and is inhabited by some of the oldest tribes like the Millis, Haiderans, Ravandis, and the large group of tribes known under the generic appellation of Bohtan. 'Iraq comprises the core of Kurdistan proper: the cities of the ancient kingdom of Shehrizor, such as Erbil, Kirkuk, Sulaimaniya and the whole region of the two Zab rivers, as well as the ancient and famous tribes like the Babans, the Hamavends, Jaffs and the historic Bahdinan. Persian Kurdistan consists of the two *Valyats* (governments) of Luristan and Ardelan, and contains the Bakhtiaris, the Lurs, the Kalhoris, the Ardelanis and their numerous sub-divisions. Between the lakes of Urmia and Van are scattered the great tribes of Shikaks, Jallalis, the Hartoshis, the Mukris and others. This division of the Kurdish race under three sovereignties is likely to retard the growth of the Kurdish people into a homogeneous community, and may result in disastrous consequences for their future.

The Kurds before the War.—From an administrative point of view the Kurds of Persia since 1911 have undergone little change. The Young Turk revolution 1908, however, gave new opportunities to the masses of the Kurdish people. With the fall of 'Abdul Hamid were also suppressed the privileges of the so-called Kurdish Hamidiye Cavalry, which since 1890 had been a scourge indiscriminately for the peaceful Kurdish and Armenian peasants. The suppression of the Hamidian régime brought forward more constructive and enlightened elements of the Kurdish people, and several Kurdish deputies in the Turkish Chamber and the Senate took up the cause of their nationality. Kurdish newspapers and party clubs were established in Constantinople, Baghdād and Mōsul to cultivate a common language for the use of all Kurds. This nationalist movement was ably conducted by two great Kurdish leaders, Sheikh 'Abdul Kader, a senator (hanged in Aug. 1925 by the Turks) and Baban Zadé Ismail Hakki.

Concurrently with this ensued war between the Young Turks and several Kurdish tribal chiefs. The former met strong opposition in 1909–12 in their attempt to repress those Kurdish chiefs who were favoured by the fallen Sultan. The Young Turks waged regular war against Ibrahim Pasha of the Millis, the Sheikh Barzani near Mōsul, the Hamavends and the tribes of Dersim. In spite of this warfare in particular areas, the tribes and the settled people greatly benefited by the general prosperity which resulted from greater liberty allowed under the Young Turk régime. As a result of the Turkish defeat in the Balkans, Sheikh Said 'Ali, of Khizan (southeast of Bitlis) rebelled in 1913. But he was soon captured and hanged.

The Kurds in the War.—None of the Kurdish tribes had any interest in the World War; yet from the beginning they were involved both on the Caucasian and the Mesopotamian fronts. Most of their manhood was killed in the War, and whole tribes suffered terrible losses owing to forced retreats and the consequent evils.

Kurdistan in the Peace Treaties.—At the Peace conference in Paris in 1919, Sherif Pasha, a Kurd, presented the claims of the Kurdish race demanding independence from Turkey. In the Treaty of Sèvres, Kurdistan was defined as a narrow strip of territory lying between the southern frontier of Armenia and northern 'Iraq. The Treaty of Lausanne did not mention Kurdistan. It left the delimitations of the northern boundary of 'Iraq to a friendly agreement between Great Britain and Turkey; failing this, the dispute was to be solved by the Council of the League of Nations (*see* MOSUL).

While the Council of the League was discussing this essentially Kurdish problem, a Kurdish rebellion broke out in Turkey in Feb. 1925, having Ginj and other middle Taurus heights as its centre. A Sheikh Said, followed by some well-known tribal chiefs, had some initial successes. The Turks collected regular troops, and after some short and decisive assaults broke the Kurdish rebellion and captured the Kurdish ringleaders. It was noted at the time that the powerful tribes of Bohtan, of Sasun and of Armenia in general did not rise in any way. A Turkish court-martial was set up at Diarbekr, which condemned to death Sheikh Said, Dr. Fuad, and 46 other Kurdish Nationalist leaders. They were all executed in Aug. 1925. The Kurdish leaders died with the independence of Kurdistan on their lips. The president of the Turkish court-martial stated later that the Kurdish rebellion had a purely nationalist motive.

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KUROKI, ITEI, COUNT (1844–1923), Japanese general (*see* 15.952), was put on the reserve list in 1909 and died in Tokyo Feb. 4 1923.

KUROPATKIN, ALEXEI NIKOLAIEVICH (1848–1921), Russian general (*see* 15.952), died at the village of Shemshurino in the Pskov district on or about Feb. 10 1921.

KUT, SIEGE OF: *see* MESOPOTAMIA, OPERATIONS IN.

LABOR, DEPARTMENT OF (*see* 16.25).—The U.S. Department of Labor is the outgrowth of an agitation that began shortly after the Civil War, when Federal recognition of interests and rights of the great group of wage-earners was first sought. This agitation resulted in the creation of a Bureau of Labor in the Department of the Interior in 1884. In 1888 this bureau was enlarged and made an independent establishment of the Government, with its head reporting directly to the President. In 1903, under the administration of President Roosevelt, the Department of Commerce and Labor was created, and the Bureau of Labor was transferred to this new department. Continued demand that the wage-earners be represented in the President's Cabinet led to the law of 1913 creating the present Department of Labor and transferring to it the Bureau of Labor (now the Bureau of Labor Statistics), the Children's Bureau and the Bureau of Immigration and Naturalisation. By the terms of this organic law, " The purpose of the Department of Labor shall be to promote, foster and develop the welfare of the wage-earners of the United States, to improve their working conditions and to advance their opportunities for profitable employment." The law also gave the Secretary of Labor authority to conciliate industrial disputes submitted to him for settlement, and this conciliation service has become one of the major functions of the department.

At the end of the World War the Women's Bureau and the U.S. Employment Service were taken over as normal and necessary adjuncts to the department, and built up from skeleton organisations left from work in the War. Of the strictly war services only the Bureau of Industrial Housing and Transportation remains, to dispose of the vast amount of property which it acquired for the convenience of workers and for the acceleration of production during the War. The Department of Labor as constituted in 1926, therefore, includes the bureaux of immigration, naturalisation, labour statistics, conciliation, women and children, whose titles sufficiently indicate their scope. (J. J. D.)

LABORI, FERNAND (1860–1917), French lawyer, was born at Reims April 18 1860. Educated at Reims and Paris, he spent several years in England and Germany. He was called to the bar in 1884, and rapidly made a reputation as a brilliant lawyer and advocate, being counsel for the defence in most of the important political trials of the day during a period of nearly 30 years. It was his conduct of the Dreyfus case, however, which placed him at the top of his profession and earned him his unique reputation. He fought with unremitting energy for his client during both the first and second revisions of the trial, in 1898 and 1899, a task attended with considerable danger, as political passions were so strongly excited at the time that Labori was shot at and wounded at Rennes on the eve of his cross-examination of the witnesses for the prosecution. Dreyfus was not finally declared innocent until 1906, and Labori never once relaxed his efforts on behalf of the unfortunate officer. Other notable trials in which he was concerned were the prosecution of Émil Zola for libel (1898) which arose out of the Dreyfus case; the Humbert affair (1902); and the trial of Madame Caillaux for the murder of M. Calmette, editor of *Le Figaro* (1914), when he secured her acquittal. He died in Paris March 14 1917.

LABOUCHÈRE, HENRY DU PRÉ (1831–1912), British politician, was born in London Nov. 9 1831. He was educated at Eton, and, after spending a short time at Trinity College, Cambridge, entered the diplomatic service in 1854, becoming in 1863 second secretary to the British embassy at Constantinople. In 1864 he abandoned diplomacy for politics, and in 1866 was elected Liberal member for Windsor, but was unseated on petition. In 1867 he won a by-election for Middlesex, but failed to be re-elected in 1868. In 1880 he again entered the House of Commons as Radical member for Northampton, and this seat he retained until his retirement in 1906. He began his journalistic career with *The Daily News*, of which he became part proprietor just before the Franco-German War. In 1874 he became associated with Edmund Yates on *The World* (*see* 28.908); but three years later he started *Truth* which had a remarkable record in the exposure of shams and organised impostures, especially frauds on the charitable. Labouchère was a strenuous advocate of the abolition of the House of Lords (*see* 20.845, 846); at the time of the Parnell Commission he had much to do with the unmasking of Pigott; and he was a member of the inquiry into the Jameson Raid, his hostility to Mr. Chamberlain being as pronounced as against Lord Rosebery when the latter became leader of the Liberal party. After 1903 he lived mainly in Italy, at a villa near Florence, where he died Jan. 15 1912. See A. L. Thorold, *Life of Henry Labouchère* (1913).

LABOUR: *see* HOURS OF LABOUR; INTERNATIONAL LABOUR ORGANISATION; INDUSTRIAL RELATIONS; STRIKES; etc.

LABOUR, MINISTRY OF.—This department of the British Govt. was set up in 1916 to deal with the increasing amount of administrative work caused by the extended activities of the state. It took over certain duties from the Board of Trade and also the administration of the national health insurance scheme, hitherto under the Treasury. The Ministry looks after most matters affecting the welfare of the wage-earners, including unemployment insurance, although the inspection of factories and workshops remains under the Home Office. It is also the authority for dealing with industrial disputes. The Minister of Labour is the head of the department: his chief assistants are the parliamentary secretary, like himself a politician, and the permanent secretary, who is a civil servant. The head offices of the Ministry are at Montagu House, Whitehall, S.W.1. Some of the self-governing states of the British Empire have a public department charged with similar duties, and known as the Ministry of Labour.

LABOUR PARTY (*see* 16.28).—The year 1910 found the Labour party in Great Britain marking time. In Parliament it was hampered by the conflict between the two Houses; within itself the Osborne decision (1908), that trade unions could not legitimately subscribe money to political objects, had created financial difficulties which had not been got over. In the election of Jan. 1910 it ran 98 candidates, returned 40 and suffered a net loss of five seats; in the Dec. election, of the same year, owing to financial stringency, it ran only 56 candidates, but returned 42. At the beginning of the year it polled a total of 505,690 votes; at the end 370,802. From 1911 till the outbreak of the World War in 1914 the parliamentary embarrassments of the party continued. Pledged to Home Rule for Ireland, the provisions of the Parliament Act compelled it to keep the Liberal Govt. in office. and deprived it of complete freedom of action.

Industrially, the position was not good. The history of the Labour movement is marked by decided swings backwards and forwards, between a trust in industrial and in political action. Between 1906 and 1910, the swing was towards politics; between 1911 and the outbreak of the World War it was towards industrial, or, as it is called, direct action. Trade union membership was on the increase; industry, especially railways and coal-mining, was disturbed; the Osborne judgment drove active trade unionists on to the left as the political road seemed to be barred; trade-union action, as regards this Labour demand and that, gave swift and decisive results that justified the impatient mood of the time, whilst political action seemed to be impotent and slow.

Rise of the Syndicalists.—Moreover, in France and America the new school of syndicalists had arisen. Its doctrines were laid down in the former country by G. Sorel in his *Reflections sur la Violence* (1912), and elaborated in a series of books and pamphlets written by members of the *Confédération Général du Travail;* in the latter country De Leon, as a disciple of Marx, preached a similar doctrine, and the Industrial Workers of the

World, a rival to the American Federation of Labor, was founded to enforce it. The influence of these doctrines was felt in Great Britain. Several new socialist societies were started from splits in the existing ones, like the Socialist party of Great Britain and the Socialist Labour party, and though their membership never reached more than 100 or 200, their virulent and virile criticisms had some effect in spreading discontent amongst sections of the Labour party. This was reflected in the literature of the time, which consisted largely in defences of the parliamentary position and of political as against direct action. Looking back upon those years, one really finds the beginnings of what later on has become known as Bolshevism. Upon this philosophy of the inevitable revolution the Russian Social Democratic party split (1903) into the two schools which were to make history by the two revolutions of March and Nov. 1917.

Repeal of the Osborne Judgment.—At last, in 1913, the parliamentary party succeeded in getting the Osborne judgment repealed by the Trade Union Political Levy Act. To make this possible the annual conference of 1911 had decided to abolish the pledge imposed upon all Labour members to act with the party and to be independent of other parties. This political success was an effective weapon against the syndicalists and revolutionary trade unionists, and in the year preceding the outbreak of war, the pendulum had begun to swing back towards a belief in political action, and syndicalism had evidently gone beyond its zenith. In addition to the Trade Union Act, the party in Parliament had directed its attention (1911) to electoral reform, the women's suffrage agitation then being in evidence, a minimum wage, the feeding of necessitous school children, and the government proposals for national health insurance. On the question of national insurance, the party was much divided, and in the report which the parliamentary members made to the annual conference the action of the recalcitrant minority was reported in terms of censure. In that year (1911) payment of members was begun and a fund from which the party had made allowances to its members to meet some of their expenses was terminated. The year 1912 was one of industrial trouble and was marked by the passage of the Coal Mines (Minimum Wage) Act to end a coal strike—a historical departure from which much in both government and trade union policy dates.

The Party before the War.—The question of discipline within the party distracted its attention and reduced its efficiency, and the annual report for this year drew attention to the grave effect that the action of certain members was having upon party fortunes. Nevertheless, by-elections showed a steady strengthening of the grip of the party in the country, the first approaches to a political understanding with the co-operators were made, and *The Daily Citizen*, the first Labour newspaper, appeared. Meanwhile, the party had settled down to face seriously the question of organisation, and 1912 and 1913 show a great improvement in that respect. The first disappointment with parliamentary methods was still vocal, but was working itself out. The state of the country, owing to the Ulster agitation, was overshadowing everything else. Civil war seemed to be imminent and preparations for it were being made. Obviously a general election had first of all to be held so as to get a vote of confidence for the Government's Home Rule policy. Overtures were being made to ascertain how the party would stand in the conflict, and offers made to its leaders to join the Government; but another cloud was hurrying up to blacken the whole sky. The annual conference records are blank between Feb. 1914 and Jan. 1916. The World War had come.

Labour in the War.—The party hesitated. It had steadily opposed Sir Edward Grey's European policy, and it associated itself at first with the neutrality committee. On Aug. 2 1914 it resolved to oppose Britain's entry into the War, but on Aug. 6, by a majority, it decided to make no statement when the first war credits were to be voted. Some of its leaders, including Mr. Ramsay MacDonald, its chairman, resigned, and thenceforth the activities of the party were those of the nation. Throughout the War, however, it never ceased to discuss the best form of peace. It joined in an international conference of the socialist parties of the Allied countries in Feb. 1915, and issued a declaration of war aims; in May 1915 by a majority it joined the Coalition Govt.; in Jan. 1916 it was instructed by a special national conference to oppose conscription, and the Labour ministers resigned, but withdrew their resignation pending the annual conference which was about to meet. This condemned conscription, but refused by a narrow majority to ask for the repeal of the Act that had just been passed. The ministers remained. When in Dec. 1916 the new Coalition was formed, the party, by a majority, agreed to remain in it with added representation.

Meanwhile, the party was pursuing its discussion of peace terms, and in May 1917 decided to be represented at the abortive Stockholm Conference, to which delegates from the enemy states had been invited. This led to Mr. Henderson's severance from the Cabinet in August. The party was returning to its independence. At the annual conference held at Nottingham in Jan. 1918 a war-aims programme was agreed upon, in furtherance of a forward movement, and a new constitution making the enrolment of individual members possible was considered. Hitherto, the party had been a federation of socialist societies and trade unions; now, it proposed to form local labour parties in the constituencies, consisting of individual members as well as delegates from affiliated bodies. It also took a stand against Bolshevism and in favour of constitutional democracy. At a special national conference held in London in June, the declaration of the policy and principles of the party known as the new social order was launched, the truce had been broken in the Salford by-election won by Labour (Nov. 2 1917), and in Nov. 1918 the party withdrew its ministers from the Govt., and once more stood independent.

Labour in Office.—After the election that followed in Dec., the party strength was only 57, though its poll was increased to 2,244,945. A capital levy was advocated in 1920, and by 1922 the question of unemployment again came to the front. By-elections were encouraging and by the end of the Parliament the Labour party numbered 75 members. The election of Nov. 1922 brought up the number to 142 and Labour became the official opposition. Its vote in the country had increased to 4,236,733. In Dec. 1923 another election was held, and 191 Labour members were elected and the party vote increased to 4,348,379. The Govt., though in a minority, decided to meet Parliament. When it did so, in Jan. 1924, it was defeated by 328 votes to 256 and thereupon the first Labour Govt. in this country was formed with Mr. Ramsay MacDonald as Prime Minister. The Govt. could rely upon the support of less than one-third of the House of Commons and legislation was difficult. It directed its attention to unemployment, housing and to the preparation of national schemes for internal development. It had also to face a dangerous development in the Irish boundary problem and take legislative action to enable it to set up the Irish Boundary Commission.

Its foreign policy was devised to secure international co-operation and to pacify Europe, and it was successful in settling outstanding reparation difficulties at the London Conference (Aug. 1924) and was responsible for the protocol which was drafted at the Assembly of the League of Nations that year. It was also bent upon creating good diplomatic relations with Russia, for both economic and political reasons, and negotiated two treaties which were not ratified by its successor. The Govt. was defeated (Oct. 8) on its handling of a Communist prosecution, but really fell on its Russian policy. When the election came next month, the eleventh-hour publication of a letter, known as the Zinovieff letter, had considerable effect on the results, and, though the party vote increased to 5,551,549, its members fell to 151. The Govt. at once resigned and the party became the official Opposition. (J. R. M.)

LABRADOR (*see* 16.28).—By the end of 1925 considerable progress had been made by the agents of Canada and Newfoundland with the proposed case for submission to the Privy Council for its decision as to the boundary between the areas claimed

by the two Dominions. Newfoundland claimed broadly, that her jurisdiction should embrace the whole watershed draining into the Atlantic, while Canada contended that a strip of seaboard a mile deep from high water is all Newfoundland should have. The territory in dispute contains the famous "Grand Falls" of Labrador, one of the greatest waterfalls in the world, besides several minor cascades capable of producing vast hydro-electric energy, while in the river valleys are large areas of forest growth capable of being converted into pulp and paper, so that the potential value of the region is very great. The population of Newfoundland Labrador at the census of 1921 was 3,774: this showed roughly a 10% decrease since 1911, mainly among the Esquimaux population in the Northern section, who were decimated by the epidemic of influenza in the winter of 1918–9. These natives do not exceed 1,000 in all, a decline of about one-half in some 35 years.

Lumbering, which in the period 1900–10 was undertaken in Hamilton Inlet, virtually ceased, largely because of difficulties arising out of the boundary dispute. The missionaries in the north, the Hudson Bay and Revillon Fur Companies further south and Newfoundland traders all over the region conduct its limited commerce. The Grenfell Mission pursues its humane activities among both transient fisherfolk and permanent settlers, and the Churches in Newfoundland, both Protestant and Catholic, maintain missionaries there in the summer, with one or two residing permanently. The hinterland is unpeopled save by some wandering tribes of Indians, who number only a few hundreds altogether, and are slowly dying out. Industrial conditions continue unchanged and the annual value of fish, furs and other articles exported from the coast to foreign markets averages about $500,000. Codfish to the value of about $1,000,000 a year is taken on the coast, brought to Newfoundland to be cured, and figures in the exports from that country.

BIBLIOGRAPHY.—W. T. Grenfell, *Vikings of Today* (1898); W. T. Grenfell, *Labrador* (1922); W. G. Gosling, *Labrador, its Discovery, Exploration and Development* (1910). (P. T. M.)

LACROSSE (*see* 16.54).—Lacrosse still has its stronghold in Canada, where it is looked upon as the national game. The number of amateur clubs to-day in the Dominion is approximately 1,465, as against 950 in pre-War days, but the professional game is practically dead, only three or four clubs having survived. Ontario is perhaps the chief centre, but Quebec, Manitoba, Saskatchewan, Alberta and British Columbia are all strong supporters. In the United States lacrosse is advancing more rapidly than in any other part of the world. The country has over one hundred teams, including many of the large universities and colleges, and the United States Military and Naval academies, whilst in California and elsewhere the game has taken a strong hold in the women's colleges. In Australia lacrosse is making headway, especially round Melbourne, Sydney and Perth.

The Game in England.—In England the game was increasing in popularity up to the outbreak of the World War, when all the clubs were depleted and disbanded. Players in the north of England, chiefly grouped round Manchester and Yorkshire, have always been far more numerous and generally more expert than in the south, where the game is centred round London and Bristol. It is also played at Oxford and Cambridge. In Ireland there has been no serious attempt to revive the game, which once had a good following round Belfast. In 1912 teams from Manchester and London played exhibition matches in Brussels and Ostend, and in 1913 similar teams visited Paris and Stockholm. Preliminary plans were on foot for a visit of a representative English team to tour Canada in 1914, but the World War put an end to the plan. Lacrosse, as played by ladies, has made great strides since the War, and ladies' clubs are numerous. It is largely played in girls' schools all over the country. The laws have been modified to suit the requirements of ladies, and inter-county and territorial matches are annual events. (C. O. L.)

LADD, GEORGE TRUMBULL (1842–1921), American philosopher (*see* 16.59), died at New Haven, Conn., Aug. 8 1921.

LAERMANS, EUGÈNE (1864–), Belgian painter, was born at Molenbeek St. Jean (Brabant) Oct. 22 1864. Deaf and dumb from birth, but gifted with a keen intelligence, he developed his talent in almost total isolation. He devoted himself to painting scenes of humble life, and might be considered a modern Pierre Brueghel the Elder. He has adopted, in place of the passive objectivity or dark humour of the old masters, a liberal sympathy similar to that found in the works of Charles Degroux or Constantin Meunier, but which Laermans has interpreted in a different manner, with feeling and power inspired by the injustice and inherent misery of an ill-organised social state. Denied the usual channels of expression, he expresses, through the medium of form and colour, his pessimistic view of life. This pessimism is not only illustrated by his choice of subject but also by the design and colour schemes which lend individuality to his work. Notwithstanding the rare harmonies of colour found in the work of M. Laermans which show him to be a master of technique as well as a painter, the artistic value would appear subservient to its moral significance. This artist, already deaf and dumb, was further unfortunate in the loss of his sight. His works may be seen in the Luxembourg, Paris, and at Venice, Brussels, Antwerp, Ghent, Liége and other places. (P. L.)

LA FOLLETTE, ROBERT MARION (1855–1925), American politician, was born on a farm in Primrose township, Dane co., Wis., June 14 1855. He graduated from the University of Wisconsin in 1879, studied law there for one term, and was admitted to the bar in 1880. He began immediately to practise in Madison and served as district attorney for Dane co. for two terms (1880–4). From 1885 to 1891 he was a representative in Congress, and, as a member of the Ways and Means Committee, helped to draft the McKinley Tariff bill. On being defeated for Congress in 1891 he returned to practise in Madison. In 1896 he was a delegate to the Republican National Convention. He was elected governor of Wisconsin in 1901 and was re-elected in 1903 and 1905. It was largely due to him that state laws were passed for taxing railways according to valuation (1903), for nominating all candidates for public office by direct vote of the people (1904) and for regulating the railways in the state through a state commission (1905). He resigned the governorship in 1905 on being elected to the U. S. Senate, and was reelected for three succeeding terms.

Mr. La Follette was an unsuccessful candidate for the presidential nomination at the Republican National Convention in 1908. In 1915 he was sponsor in the Senate for the Seamen's bill providing for better working conditions and increase of life-saving equipment on board ship. He favoured, in 1916, an embargo on the shipment of arms from America, but supported armed intervention in Mexico. After America's entrance into the World War he was a pronounced pacificist. The Republican National Convention held at Cleveland, O., in June 1924 rejected a platform presented on behalf of Senator La Follette by the Wisconsin delegation, and he received only 34 votes on being placed in nomination for President. Accordingly a Convention for Progressive Political Action was convened at Cleveland on July 4, at which, following a letter from La Follette denouncing both the Republican and Democratic parties, he was endorsed as a presidential candidate. He selected the name "Progressive" for his party, and his platform included advocacy of public ownership of water power and railways, strict public control of all national resources, a recognition of agriculture as the basic industry of the country and abrogation of the power of the Supreme Court to nullify legislation. During the election campaign the American Federation of Labour agreed to support him. In the ensuing election he was beaten by both Republican and Democratic candidates, his electoral vote being 34, as against 382 for Coolidge and 136 for Davis, the popular vote being 4,686,681 for La Follette, 15,748,356 for Coolidge and 8,617,454, for Davis. His own state, Wisconsin, was the only one to give him a majority. He died at Washington, D.C., June 18 1925.

His son ROBERT M. LA FOLLETTE, who was born in Madison, Wis., Feb. 6 1895, was elected by a large plurality Sept. 29 1925, to fill the unexpired term of his father's senatorship. He stood as a supporter of his father's platform of 1924.

LAGERLÖF, SELMA (1858–), Swedish author, was born Nov. 20 1858 at Mårbacke in Vermland where she grew up in a province rich in local tradition, and became a teacher in Landskrona. In a literary competition in a weekly paper she won the highest prize for some chapters of her first work *Gösta Berlings Saga* (Eng. tr. 1898), which was published in two volumes in 1891 and attracted great attention. The book is a collection of stories of Vermland life in the year 1830, related with vivid imagination and lyric style. In 1894 she published *Osynliga Länkar* (Invisible Links) and from 1895 onwards was able to devote herself entirely to writing. After visiting Italy for the purpose of extending her studies, she published in 1897 *Antikrists Mirakler* (Eng. tr. 1898) depicting life in Sicily. In 1899 appeared *Drottningar i Kungahälla* (Eng. tr. 1917), historical legends, as well as *En Herrgårdssägen* (Eng. tr., *The Legend of the Manor*, 1922). After a journey to Palestine and the East in 1900 she published *Jerusalem*, 2 vol. (1901–2, Eng. tr. 1903), describing a religious movement in the Swedish province of Dalarne, which led to an emigration to Palestine. She also wrote *Kristuslegender* (1904); *Nils Holgerssons underbara resa*, 2 vol. (1906–7, Eng. tr. 1908), a book for children; *Liljecronas Hern* (1911, Eng. tr. 1913); *Korkarlen* (1912); *Dunungen* (1914), a dramatised novel; *Kejseren af Portugalien* (1914, Eng. tr. 1916); *Troll och Manniskor* (*Demons and Men*), 2 vol. (1915, 1921) and *Charlotte Löfvensköld* (1925). In 1909 she won the Nobel Prize for literature, and in 1914 was elected the first woman member of the Swedish Academy. Most of her books have been translated into English and many other languages.

See J. Mortensen, *Literary Biography* (1908); André Bellesort, *La Suède* (1910); also works with title *Selma Lagerlöf* by O. I. Levertin (1904); M. Jepson (1913); M. Kristensen (1917).

LAGOS (*see* 16.74), the principal port and capital of the British colony and protectorate of Nigeria, West Africa. The population, including Iddo and Apapa, is 99,690 natives and about 1,000 whites (1921). The town is built on an island in a large lagoon and is reached from the Bight of Benin over a shifting sand bar. Moles protect the entrance to the harbour and vessels drawing 23 ft. can enter it. Lagos is linked to Iddo Island, on which the terminus of the railway to Kano is situated, by Carter bridge, and Iddo in its turn is joined to the mainland by Denton bridge. The customs wharf at Lagos is 1,183 ft. long and vessels of 22 ft. draught can lie alongside. At Iddo is a wharf 860 ft. long, draught 18 feet. At Apapa, on the mainland, facing Lagos town, a wharf 1,800 ft. long, under construction in 1924, was designed to take vessels drawing 26 ft., to which depth the bar was being dredged. There are several smaller wharfs and floating docks. By the draining of swamps much has been done to improve sanitary conditions. The town has fine public and commercial buildings and ample water and electric light supplies. Some 25% of the inhabitants are Christians and 53% Moslems. Lagos has been since 1919 the seat of an Anglican bishopric. In April 1925 the Prince of Wales laid the foundation stone of the cathedral. The port takes all the trade of Nigeria served by the railway to Kano (over 700 m. long) and has a considerable canoe-borne trade with the neighbouring regions. The former colony of Lagos is now part of Nigeria. See *The Nigerian Handbook* (Lagos, 1925).

LAGUERRE, JEAN HENRI GEORGES (1858–1912), French lawyer and politician (*see* 16.79), died June 17 1912.

LAHORE, India (*see* 16.81), the capital of the Punjab, India, and a centre for agricultural produce, is of little importance industrially, except for the works of the North-Western Railway. The population was 281,781 in 1921. The Dyal Singh College, undenominational and affiliated to Calcutta University, was founded in 1910, and the Sanatan Dharma College in 1916. Western towers were added to the Cathedral Church of the Resurrection in 1913. An iron bridge over the Ravi was opened in 1915. In 1824 the old fort was taken over by the police, and a new fort built by the military.

LAIDONER, JOHAN (1884–), Estonian soldier, was born in the Viljandi district. He completed his military studies at the Vilna military school and the Nikolai military academy in St. Petersburg (Leningrad). On the outbreak of the World War, he was a staff officer on the Caucasian front, and in 1915 became divisional chief of the staff of the Russian Western Front. In 1917 he was promoted lieutenant-colonel in command of the Caucasian Grenadier Division and then chief of staff to the 62nd Division. On the formation of the Estonian National Army he was appointed to command the first Estonian Division. During the period of German occupation (1918) he negotiated with Soviet Russia concerning the prevention of the annexation of Estonia by Germany. He also organised from St. Petersburg the transport of the Estonian Army, via Archangel and Murmansk, to the Allied front. At the beginning of the Estonian War of Independence, (1918–9), Laidoner was appointed commander-in-chief of the Estonian Army; at the same time he became by arrangement leader of the Russian Northern Army until the latter reached Russian territory, when Yudenich took over the leadership. He conducted the operations with both military skill and political ability. On the conclusion of the War he left the army and entered politics, being elected representative of the Agrarian party in the first and second Riigikogu. He became president of the commission for foreign affairs and state defence of the Riigikogu, and Estonian delegate to the League of Nations. In 1925 he presided over the League of Nations Commission appointed to inquire into the Mosul frontier dispute between Great Britain and Turkey. (*See* ESTONIA.)

LAISANT, CHARLES ANNE (1841–1920), French politician (*see* 16.84), died at Asnières, near Paris, May 5 1920.

LAMMASCH, HEINRICH (1853–1920), Austrian jurist, was born at Seitenstetten, Lower Austria, May 21 1853. He was appointed professor at the University of Vienna in 1889, became eminent as a teacher of criminal and international law and his publications on these subjects deeply influenced their practice. Four times a member of the International Court of Arbitration at the Hague, being president three times, he helped to settle, among other cases, the dispute between Great Britain and America on the fishery rights off the North Coast of America in 1910. He was, perhaps, the most prominent Austrian pacifist during the World War and, as such, while incurring bitter hostility in the Austrian Herrenhaus, to which he had belonged since 1899, he inspired confidence elsewhere, and was chosen to preside over the final ministry which liquidated the central administration of the older Austria (Oct. 26–Nov. 13 1918). He published in 1919 *Der Völkerbund* and *Europas elfte Stunde*. Lammasch died at Salzburg Jan. 6 1920.

LAMONT, THOMAS WILLIAM (1870–), American banker, was born at Claverack, N.Y., Sept. 30 1870. He was educated at Phillips Academy, Exeter, N.H., and at Harvard where he graduated in 1892. He was for two years with the New York *Tribune*, and then for some time actively engaged in business. From 1903 to 1909 he was with the Bankers Trust Co. in New York, as secretary and treasurer and, after 1905, as vice-president. In 1909 he was elected vice-president of the First National Bank of New York City, serving for two years. On Jan. 1 1911 he entered the firm of J. P. Morgan and Co. He was active in raising additional endowment for the Harvard School of Business Administration. He took part in floating the British, French and Russian loans in America during the World War and from 1918–22 he was proprietor of the New York *Evening Post*. In 1919 he was financial and economic advisor of the American delegation to the Peace Conference in Paris. He was U.S. delegate on the international consortium for assisting Chinese industries and railways, and visited China as the representative of the American group. In 1921 he became chairman of the American committee for the China Famine Fund, and was chairman of the international committee of bankers which handled the question of the Mexican foreign debt.

LANCIANI, RODOLFO AMADEO (1846–), Italian archaeologist, was born in Rome Jan. 1 1846. He was educated in that city and in 1872 became secretary of the archaeological commission. In 1878 he was appointed director of excavations and professor of ancient topography in the University of Rome. Lanciani devoted his life to the study of the antiquities of an-

cient Rome, while by no means neglecting those of the Middle Ages; and in both fields he came to be recognised as a leading authority. He made important discoveries in the House of the Vestals, the Basilica Julia, the imperial palace on the Palatine, the baths of Caracalla, the temple of Jupiter Capitolinus, Ostia, Trajan's harbour at Porto and Hadrian's villa below Tivoli. He also worked with the minister, Guido Baccelli, to create the Passeggiata Archeologica, arranged the collections in the Antiquarium and organised the classical side of the Rome exhibition of 1911. In 1911 he was created a senator.

He wrote a great number of works on archaeological subjects in Italian and English of which the most important are: *Ancient Rome in the Light of Recent Discoveries* (1888); *Pagan and Christian Rome* (1892); *The Ruins and Excavations of Ancient Rome* (1897); *Destruction of Ancient Rome* (1899); *New Tales of Old Rome* (1901); *Storia degli Scavi e Musei di Roma* (1902); *Wanderings in the Campagna* (1909); *Ancient and Modern Rome* (1925).

LAND LAWS: *see* PROPERTY, LAW OF.

LAND TENURE (*see* 16.155).—There are in the course of recent history two outstanding and epoch-making events each of which was of great moment in bringing about far-reaching changes in existing conditions of rural tenure: the French and the Russian revolutions. The one has already receded into historic perspective, the second is an actual fact of to-day. The former broke up the feudal land system and did away with the obligations attaching to property in land, with the result that agricultural development became involved in a capitalist economy; the Russian revolution, while abolishing private property in land, swept away the capitalist agrarian conditions which had grown up during the 19th century. The land was nationalised, and the state gave the full use of the land to all who were prepared to cultivate it with their own labour.

Just as the ideas of the French revolution influenced the whole of European agrarian legislation, so the influence of the Russian revolution was felt throughout eastern Europe—that is, in the countries on the borders of Russia, all of which are agricultural countries in the fullest sense. Thus agrarian reform was undertaken by a whole series of states; and, speaking generally, the more closely the states followed the Russian agrarian revolution, the more radical were their reforms, both in principle and in practice. Estonia and Latvia came nearest in this respect, while the model was least closely followed by Finland, Austria and Germany. Between these two groups there lies a whole gamut of variously devised agrarian reforms. The objects of all reform schemes were: by means of a transformation of the existing conditions of land tenure to create a peasantry which is socially and economically sound; and to retain in the country the numbers of peasants who would otherwise emigrate, and thereby to identify them more and more closely with the homeland itself. In the realisation of these aims the War acted as an accelerating and releasing force.

I. THE JURIDICAL BASES OF LAND REFORMS

The juridical bases for the accomplishment of the agrarian reforms are to be found in the agrarian laws of different states.

If the land hunger of the population is to be satisfied—whether by the formation of new holdings, or by the apportionment of additional land to small peasant holdings already existing, or even by assignment of parcels of land to the land workers—a land fund of corresponding extent is obviously a first essential. This was usually achieved by devoting the state lands and the public land to the purpose, and, in varying degrees, by the expropriation of the large estates.

Russia.—A complete expropriation of rural land ownership in favour of the state, acting on behalf of the peasant, has been carried through only in Russia. The first so-called Land Decree of Nov. 8 1917 ordered the expropriation, without exception, of all the landed property of the large landowners, of all lands formerly the appanage of the Crown, and of monastic and Church lands. In the agrarian legislation of subsequent years this fundamental principle was retained (*see* RUSSIA). Some 40,000,000 desiatines in all (not including Siberia) were thus transferred from private large landowners to the peasantry as a whole. A similar solution by expropriation was originally enacted in Estonia by the law of Oct. 10 1919. On May 15 1925, however, the Assembly amended this enactment by permitting 50 hectares of land to be restored in usufruct to the original owners. In all an area of 2,147,100 desiatines—97% of the area held in large estates—was expropriated in Estonia.

Latvia and Lithuania.—Partial expropriation was carried out in certain countries. In Latvia, by the law of Sept. 24 1920, the state land fund was formed of the state domains and forests, and to a limited extent by the expropriation of large estates. On an average 50 hectares of land was restored to the original owners. After the expropriation the total state property in land amounted to 3,700,000 hectares. In Lithuania the law of Feb. 15 1922 enacted that state lands be appropriated, and that landed property belonging to the former Russian Nobles' and Peasants' Agricultural Banks, ecclesiastical lands and lands of private owners, in excess of 80 hectares in any case, be expropriated. Owners of not more than 150 hectares farming their own lands were expropriated only after the division of the large estates.

Balkan Countries.—In Rumania the law of Dec. 14 1918, later somewhat modified for the newly acquired territories, contemplated the entire expropriation of crown lands, the estates of charitable societies, of absentees and foreigners and the establishment of a land fund of 2,000,000 hectares by partial expropriation of the private large landowners of over 100 hectares, the size of the expropriation shares increasing as the areas to be expropriated became larger.

In Bulgaria, according to the law of May 10 1921, the state land fund is formed, *inter alia*, by expropriation of private estates, leaving, however, 30 hectares to the owner when he works the land himself. In the case of non-cultivation by the owner four hectares only are restored to the owner, or 10 hectares for the whole family; under the extending law of July 21 1924 a family with more than five members is allowed five hectares per member.

In Yugoslavia the decree of Feb. 25 1919 orders that the entire landed property, including entails and estates with from 56 to 280 hectares of cultivable ground, be expropriated, providing about 1,100,000, hectares for distribution. In the autumn of 1925 a new legislative project was laid before the Skupshtina, which was intended finally to settle the question of the expropriation of the large estates. In Greece the agrarian laws of 1920–2 provide for an expropriation of properties of over 100 hectares. According to a recommendation of the Ministry of Agriculture dated Feb. 11 1925, land is to be restored, district by district, to the extent of from 300 to 500 hectares. Cultivation is compulsory on pain of fresh liability to expropriation. The process of obtaining land in Austria may be ranked as expropriation rather on formal grounds than in actual fact, since the expropriation does not press at all harshly and is not to any perceptible extent prejudicial to the tenure of large property. The object of the resettlement laws of 1919 and 1921 was the resumption of cultivation of farms which the large holders, more particularly the owners of forest land, had devoted to purposes of sport or luxury. In such cases land which had been farmed land at any period since 1870 may be expropriated on the demand of a qualified applicant.

Czechoslovakia.—The agrarian legislation of Czechoslovakia followed a middle course. In Czechoslovakia, by a law of April 16 1919, the State Land Office is empowered in the first instance to impose certain restrictions on the property rights of large land-owners; by the law of April 8 1920 the state must give at least six months' notice of expropriation to persons farming such land. Any area is regarded as a large estate on which there are more than 150 hectares of agricultural land, or which itself exceeds 250 hectares.

Poland.—In Poland, where the state merely regulates the conditions of tenure without forming a proper state land fund, the land reserve according to the Seim decree of July 10 1919, and the agrarian law of July 15 1920, is made up of the following categories of land: the state lands, the property of the former ruling dynasties, of the former Russian Peasants' Bank

and of the former Prussian land settlement commission, mortmain lands, and also land acquired by forced sale of private properties which are more than 180 hectares in extent. In the industrial and urban districts this limit may be reduced to 60 hectares, and in the west and east regions of Poland may be extended to 400 hectares.

Under a law dated Dec. 28 1925 these limits may be exceeded, by agreement between the Ministry of Agrarian Reform and the Ministry of Agriculture, in the cases of large farms which have a special importance in the economy of the country, such as farms with sugar factories, distilleries, etc., or farms giving employment to many workers, on condition, however, that the aggregate area in the whole country of the farms to which this provision is applied shall not exceed 500,000 hectares. In any case, before a forced sale the owner is given 30 days in which to effect a voluntary sale of his parcel to the state. The area proposed for the land reserve is estimated at about 5,000,000 to 6,000,000 hectares.

Hungary.—In Hungary the state has recourse to expropriation only when the required parcels of land are not to be obtained either by purchase in the open market or on the basis of a legal right of pre-emption by the state, at the time of the alienation of parcels. However, there may be expropriated, *inter alia*, property to the extent of 100 cadastral *joch* (1 *joch*=0·575 hectare), which was bought during the War; such large estates as have changed hands in the way of sale since July 28 1864 and in particular so much of each estate as still to allow the remaining portion to be brought under systematic cultivation. The area coming under the reform schemes is estimated at over 7,000,000 hectares. For home colonisation in Finland there are available in the first place, under the law of Nov. 25 1922 (Lex Kallio), the state lands and the lands of public bodies, communities, churches, share companies, etc.; after these the property of private owners is purchased in the open market, and only when that does not suffice, is the expropriation of estates of over 200 hectares (in the north of over 400 hectares) carried out.

Generally speaking the percentage taken of the large property corresponds to the number of complete hundreds of hectares included in it; thus in the case of 200 hectares at least 2% is expropriated, and as a maximum 50% in the case of 5,000 hectares and over. The lands illegally acquired by the timber companies were expropriated before any other lands.

Germany.—Finally, in Germany, under the National Settlement Law of Aug. 11 1919, state lands, heath and waste land are already set aside for the provision of land for settlement and in addition land acquired by the state right of pre-emption on the occasion of large sales of private parcels of land. Only after this is recourse had to the expropriation of a part of the large estates. The Land Supply Unions (*Landlieferungsverbände*), the members of which are large landowners possessing over 100 hectares, are obliged to assign for settlement purposes at least one-third of the total area of the large estates in the district, or to reduce the cultivable area of the large estates to 10% of the total agricultural area in the district. In this way over 2,000,000 hectares of large landed property are to be expropriated in Prussia in the coming years.

The methods of acquiring land are thus very various—complete or partial expropriation with notice in advance, pre-emption by the state on the occasion of alienation of property, purchase in the open market—and each method is in its turn significant of the spirit in which the land reforms were undertaken.

Compensation for Expropriation.—Very striking differences are also found in assessing compensation for the expropriated estates, varying from the expropriation without compensation in Russia to the payment of the full value of the land which obtains in Germany. Latvia, following the precedent of Russia, decided not to give any compensation to the expropriated owners of large estates. In Estonia the question was still under discussion in 1926. In Lithuania compensation is reckoned on the basis of the average prices of the years 1910–4. Owners who possess not more than 200 hectares receive the average market prices at the time of the surrender of the land for areas under 150 hectares. Pre-War prices are also paid in Czechoslovakia with a corresponding reduction of the price in the case of estates of more than 1,000 hectares. In Rumania 40 years' rental is given for arable land and 20 years' rental for meadow land on expropriation; in no case, however, may the sum paid in compensation exceed the selling price of the year 1913. Compensation in Greece amounts to nearly 1·3 times the selling price. In Poland, as also in Bulgaria according to the law of 1924, half of the average local market price is fixed as the estimate of the compensation. In Yugoslavia, pending the final settlement of the question of compensation, a rent is paid to the expropriated owners up to the amount of the former net return. Payment of the average market price for the expropriated parcels has been established in Hungary, Finland and Austria, as in Germany.

Division of the Land Fund Among the Applicants.—In the distribution of the expropriated lands the principle of priority for ex-service men and their families runs through the whole agrarian legislation of the post-War period. In the states of western Europe measures were also taken for encouraging the settlement of ex-soldiers on the land, and legislation was passed with this object. In particular in England, according to a report of the Ministry of Agriculture ("Land Settlement in England and Wales, 1919 to 1924," London, 1925, p. 139) 16,461 ex-service men were, up to Dec. 31 1924, settled permanently, of whom 14,061 occupied 213,343 ac. of land. Much has been accomplished in this direction in France, Italy, Belgium and other countries.

The size of the peasant holdings newly brought into being is either determined according to an economic principle, or is fixed numerically. The former is the case in Russia, where the measure for land division is applied, sometimes in accordance with the farming system predominant in the different districts, sometimes according to the "work norm," *i.e.*, according to the sum of the work capacity of the family, or according to the "requirement norm," *i.e.*, according to the number of persons in the family. In Estonia, Bulgaria, Yugoslavia and in Finland, the size of the peasant holding is usually determined according to the "work norm," though sometimes also reaching the maximum numerical limit. In Germany the holdings must, according to the law, be of sufficient size to maintain a family. In the other states the average size of the holding is numerically fixed; thus in Latvia it is 22 hectares, in Lithuania from 8 to 20 hectares, in Poland not more than 15 hectares, in Czechoslovakia 6 to 10 or 15 hectares, in Rumania not more than 7 *joch*, in Hungary, 15 cadastral *joch*, and in Greece an average of 10 hectares.

Form of Management of the Farm Undertakings.—The most prevalent form of management of the new type of holdings in all the states is individual. In Russia 3% of the total area of the expropriated land was reserved for collectivist enterprises, 11% for the Soviet estates and 86% for individual holdings. The collectivist holdings have scarcely been able to maintain themselves, and since 1921 their number has fallen off. This seems the more remarkable, as a similar form of ownership was earlier familiar to the Russian peasant in the institution of the *mir*, although this juridical form was imposed on the peasants at the time of the freeing of the peasants in 1861 not on theoretical or socialistic grounds but rather for technical and fiscal reasons. Peasant enterprises managed co-operatively in very various forms are instituted under the agrarian reforms in Estonia, Latvia, in Czechoslovakia, Rumania, Hungary, Bulgaria and Greece. In the latter states the parcels expropriated by the Government are handed over to co-operative societies, which in their turn undertake the distribution of land to their members.

Legal Protection of New Peasant Holdings.—With a view to preventing any reversion, as the result of alienation, division, etc., to the former conditions of the apportionment of agricultural land, special measures have been included in the agrarian legislation of all countries, limiting the liberty of the peasants to dispose of the new holdings. In Russia, for instance, the land can be neither sold nor mortgaged nor given in free gift. It may not even be divided among the members of a family, unless the division leaves economic units of production. In Latvia a minimum limit of 10 hectares, and in Lithuania of 8 hectares, is fixed

for the land parcels to be divided in the future. In Poland no parcelling of the newly formed holdings may take place, so long as they are burdened with a mortgage in respect of the unpaid balance of the purchase price, and in no case before the lapse of 25 years from their formation. Peasant holdings in Rumania may only be sold, divided, etc., after the lapse of 5 years from the definite conveyance of ownership. According to the extending law of March 1925, the state has the right of pre-emption in the case of alienation of peasant holdings, etc.

In retrospect it may be stated that in all the land reforms undertaken the endeavour is to modify the conditions of rural tenure within the limits of the existing land property rights. The principle of private property in the land as such is, as perhaps is clear from the expropriation legislation, not merely protected, but even placed upon a much wider basis and riveted more firmly into the general consciousness. In Russia alone not only are the conditions of land tenure reformed, but land tenure itself is subjected to a reform in the socialistic sense by a breaking down of the existing land rights. In the agrarian legislation of Estonia and Latvia some echoes of the theories of Henry George may be noted, and the land reforms in Finland, Austria and Germany rather bear the character of home colonisation.

II. THE RESULTS OF LAND REFORM

If the War, as has been said, acted as an accelerating force in the initiation of agrarian reforms, the period of their execution was very unfavourable from the economic standpoint. In the confusion prevailing in the whole after-War economy, the absence of capital and the depreciation of the currencies, and in view of the special interstate trade relations of the Central European countries, which tend towards an extreme protectionist policy and prevent any speedy re-establishment of the national economic policy in each case, the progress of the land reforms has been beset with difficulties. The distance in time from the introduction of the reforms is still too small to make it possible to pass a final judgment on the economic results of these important changes in land tenure. The results achieved cannot of course be looked upon exclusively as the consequence of the land reforms—*post hoc, ergo propter hoc*—but rather are regarded as the outcome of the whole development of agriculture in the separate countries. But the parallelism in the course of the two phenomena may be noted—the transformation of the conditions of tenure of agricultural land and the simultaneous increase in agricultural production.

Russia.—Virtually the whole of the large landed property was divided into nearly 20,000,000 peasant holdings. The first years of the revolution, during the period of militant communism, witnessed the gradual shrinkage of the area in cereal cultivation. Since the introduction of the new economic policy in 1921, and the publication of the Agrarian Code in 1922, cereal production has steadily increased, and, according to the data published by the International Institute of Agriculture at Rome in Dec. 1925, reached in 1925 the total of 180,000,000 quintals, as compared with an average of 205,000,000 quintals for the years 1909–13. The cereal export has also increased since 1922, and according to the original estimates of the Russian Central Statistical Office, in the commercial season 1925–6 to nearly 600,000,000 *poods, i.e.*, the equivalent of the pre-War annual grain export. In reality, the exports have been considerably lower than was anticipated, owing, amongst other reasons, to the deficiency in the country of industrial products serving either for the farms or for the household consumption of the peasants. The result of this deficiency is that the peasant withholds his grain from the market, and it cannot, therefore, be exported. However, as was remarked in the issue of Jan. 1926 of the *Bulletin de renseignement de l'Office commercial pour la Russie et les pays limitrophes*, published by the French Ministry of Commerce and Industry, "all the evidence confirms that the peasants had their barns well filled."

Baltic States

Estonia.—In Estonia the process of land reform is nearly accomplished. Of the 1,060,400 desiatines of land under cultivation belonging to the large landowners, 431,900 desiatines were already previously rented to small holders. The agricultural land thus available for the purpose of the land reform was 628,500 desiatines. According to official data 30,766 new farms have been established in the years 1919–24, and bover a total extent of 598,837 desiatines.[1] The number of families who have profited by the land reform is of course, higher than the number of newly established farms, as a larger parcel of land was often assigned to two or more families. Under the new conditions of the distribution of land the production of flax for seed rose from 78,971 quintals in 1921 to 131,700 quintals in 1925 (as compared with 164,126 in 1909–13), and the production of flax as fibre from 67,202 to 148,100 (as compared with 169,171 in 1909–13). The export of linseed was 12,768 quintals in 1921 and 28,240 in 1924, and of flax fibre 52,280 and 104,328 quintals in the corresponding years. In both cases in the course of three years there is thus a 100% rise. The export of butter has also advanced, amounting to a value of about 2,000,000 marks in 1925 (or over 20% of the total exports), as compared with 1,000,000 marks in the previous year.[2]

Latvia.—In Latvia before the land reforms the estates of the nobles in Livonia embraced 463,449 hectares (32·3% of privately owned rural land), and in Courland, 533,689 hectares (30%). In 1924 more than half, viz., 61% of the agricultural and forest land, had passed under state control, and approximately 50,000 new holdings had been established on such land.[3] The area cultivated in flax in Latvia showed an even more rapid increase than in Estonia: from 30,499 hectares in 1921 it rose to nearly 78,100 hectares in 1925, as compared with an average of 69,619 hectares in the years 1909–13. In absolute figures, the export of flax, as seed, rose from 48,547 quintals in 1921 to 176,122 quintals in 1924, and the export of flax as fibre rose in the same period from 62,758 quintals to 204,458 quintals. In both cases accordingly the export has more than trebled.

Lithuania.—In Lithuania 36% of the agricultural area belonged before the War to the large landowners, almost all of whom possessed more than 2,000 hectares. There were 110,000 small holdings, belonging to 28% of the agricultural population, which contained on an average less than three hectares. Half a million persons, or from 15 to 20% of the agricultural population, were landless.[4] In the course of the land reform about 1,360,000 hectares, including 400,000 hectares of agricultural land and 960,000 hectares of forest, passed into the land reserve for the formation of small holdings. In this connection also a rapid increase in the production per area is to be noted. The flax growing area increased from 51,200 hectares in 1922 to about 81,000 hectares in 1925, as compared with the average area under cultivation of 55,167 hectares in the years 1909 to 1913, and the production rose in the same period from 281,500 quintals of linseed to nearly 486,600 quintals and from 205,000 to 421,500 quintals of fibre. A fair export trade is developing and amounts to nearly half the total production in flax.

Finland.—In Finland, where in 1910 out of the total area of 32,997,217 hectares not less than 91·4% was forest, moorland, etc., while the cultivated land only accounted for 5·7%, and the meadow land for only 2·9%, the forest wealth is naturally the determining element for the national economy. Of the total rural population of 2,820,000 persons (84·2% of the whole population of Finland), only 40·6% are owners or tenant farmers and 59·4% are agricultural workers of different kinds, who draw no assured subsistence from the land.[5] A systematic scheme of land settlement has been in progress since the beginning of the century. Up to Sept. 30 1925, by means of grants from the land colonisation fund, 437,319 hectares were settled, 11,845 new farms established, 4,078 small holdings enlarged and 6,000 sites for farm workers' dwellings granted.[6] The object of post-War legislation has been to facilitate the transition of the tenancies into free ownership, as also the wider employment of land for settlement purposes; 43,343 small holdings were established between Oct. 25 1918, and March 1 1925. The wheat production of Finland has risen from 157,538 quintals in 1921 to 202,900 quintals in 1925, and the export of butter from 64,652 quintals in 1921 to 131,910 in 1925; in 1913, 126,400.

Central European States

Poland.—Out of 1,000,400 peasant families in Galicia there were 813,000 who did not make an adequate living out of the land, while 1,220,000 peasant inhabitants of Russian Poland owned no land at all. Up to Jan. 1 1923, 271,197 hectares of land were available for land reform purposes, and 18,018 new farms were established, 27,256 were enlarged, 3,199 workers' homesteads were erected and 360 special farms instituted.[7] An Agrarian Reform bill was passed in Dec. 1925, which provided for the distribution of 20,000 hectares a year among peasant farmers over a period of ten years, the maximum areas tenable being 60 hectares in industrial areas, 300 acres in the border provinces, and 175 in other areas. Compensation to the owners was at the present value, from 25 to 50 per cent being paid in cash, and the remainder in bonds.

[1] Estonie Rigi statistika Reskburo: *Asumaa Majapidamised Eestis 1919–24* (Tallinn, 1924).

[2] *Revaler Bote*, No. 290, Dec. 19 1925.

[3] Bokalders, in *Neue Freie Presse* (Vienna, Jan. 31 1925).

[4] *Board of Trade Jour.*, No. 1211 (London, Feb. 12 1920).

[5] Dr. Oesten Elfving, "Die Bodenfrage in Finnland," *Archive für innere Kolonisation*, Parts 9–11 (Berlin, June–Aug. 1921).

[6] *Revue Sociale*, published by the Ministry of Social Affairs of Finland, No. 12, p. 889 (Helsingfors, 1925).

[7] Ludkiewicz Zdzislav, "La question agraire en Pologne," *Revue d'Économie Politique* (Paris, Dec. 1923).

Czechoslovakia.—In Czechoslovakia the land reform was practically complete in 1926. Before the War the great estates of over 500 hectares in extent absorbed altogether one-third of the total agricultural land. The land available for agrarian reform has been 1,229,688 hectares of arable and meadow land. Of this one-third remains in the hands of the large landowners, 80,000 hectares is left with the former tenants under the form of tenancy, and 820,000 hectares are being apportioned into small and very small holdings. The number of farms of 2–5 hectares in extent has doubled, and that of farms of from 5 to 10 hectares has quadrupled, and the number of peasant farms of over 10 hectares has increased to a remarkable extent.[1] The production of sugar-beet advanced from 40,716,551 quintals in 1921 to 84,083,300 quintals in 1925. The export of sugar returned in 1921 as 376,328 metric tons, amounted in 1924 to 1,015,155 tons. The republic holds the first place among European sugar-exporting countries and the third on the international sugar market.[2]

Hungary.—In Hungary before the land reform large estates of over 1,000 *joch* amounted to 35·88% of the agricultural area, the medium-sized estates of 100–1,000 *joch* to 16·62%, and the small holdings under 100 *joch* to 47·5%.[3] The very small holdings up to 3 hectares formed 53·6% of the total number of holdings and only 5·8% of the agricultural area; holdings larger than 575 hectares formed 0·2% of the total number of holdings, but nearly one-third of the entire agricultural area. Before Jan. 1925, 597,094 *joch* had been assigned to the peasants, and 127,471 sites allotted for houses. The production of wheat has risen from 8,052,950 quintals in 1921 to 18,385,000 quintals in 1925. The wheat exports have also increased very considerably, having in fact advanced from 176,949 quintals in 1921 to 1,803,918 quintals in 1924. A great impetus has been given to the cultivation of vines, but owing to tariff difficulties the export of wine is at present very much reduced.

Austria.—In Austria only 156 peasant holdings, covering 2,824 hectares, had been settled up to June 30 1924, in accordance with the Resettlement law.[4]

Germany.—In Germany 1,468,915 hectares of large landed property in Prussia ought, according to the Land Settlement law, to have been made available for home colonisation in the years 1919–22, whereas the area actually so available was only 95,576 hectares. What form will be taken, under stable economic conditions, by this home colonisation, as it was envisaged by the originator of the scheme, Prof. Max Sering, and how far the cry of the land-hungry population is really stilled,[5] only the future can determine.

Balkan States

Rumania.—In Rumania nearly half of the total agricultural area belonged before the War to the large landowners, though their number was scarcely more than ½% of the total number of all the agriculturists. At the beginning of 1925, 5,713,598 hectares of land, or 30% of the whole agricultural area, were expropriated under the land reform and assigned to the applicants for land. In consequence of this the small holdings now amount in Old Rumania to 80·94% of the cultivable area and in Transylvania to 49·34%.[6] The production of wheat had fallen off in Rumania, as compared with the pre-War production, but it again shows a very marked upward tendency. The area under wheat increased from 2,488,335 hectares in 1921 to 3,300,900 hectares in 1925, and the production from 21,381,484 quintals to 28,946,700 in the corresponding years. The wheat export has also recovered to some extent: it rose from 756,903 quintals in 1921 to 1,216,150 in 1924, and the wheat flour export from 194,223 to 1,165,270 quintals. Expansion of the cereals export was, however, made impossible on account of the increased duty, partly imposed on political and financial grounds, partly with a view to ensuring low prices for bread in Rumania, but this duty was eventually reduced. Quite apart from this, it has been necessary to import a considerable volume of cereals into Transylvania from the parts of Rumania where the supply was abundant.

Yugoslavia.—In Yugoslavia the conditions of rural land tenure varied very much according to the provinces. Generally speaking, every peasant in Old Serbia had his piece of land, and there was little scope for land reform. In those provinces, however, which were previously under Turkish rule, mediaeval feudal conditions still prevailed in the country districts: in Bosnia and Hercegovina, the *Kmet* régime, in Macedonia and a part of Montenegro the *Tchiftchius* system. The agrarian reform completely did away with this régime, and the former *Kmets* became small proprietors. In the former Austrian provinces such as Croatia, Slavonia, etc., more than half of the agricultural land was in the hands of the large landowners. Up to the end of 1923 in the whole of Yugoslavia 501,966 *joch* of cultivable land were divided among 185,905 families.[7] Wheat growing has made satisfactory progress, the yield rising from 14,100,300 quintals in 1921 to 22,403,100 in 1925, while the wheat export advanced from 470,729 quintals in 1921 to 1,772,764 in 1924.

Bulgaria.—In Bulgaria it is hardly possible to speak of a predominance of large ownership. The principal object of the land reform was to secure a better distribution of land between the medium sized and small farms, and up to the end of 1923, 1,885 hectares of land had been assigned to 780 persons. The cultivation of tobacco, which takes an important place in the agriculture of Bulgaria, has shown remarkable progress. In 1924 the production amounted to 436,975 quintals as compared with 129,848 quintals in 1914. In 1924 there was an export of 31,735,000 kg. of tobacco of the value of 1,828,109,000 leva.[8] In 1925 for various reasons the production of tobacco fell off to a perceptible extent.

Greece.—In Greece 832 large estates were expropriated up to 1923, and 7,500 small farmers were presented on an average with 13·5 hectares each. The peasants grow for the most part commercial crops, such as currants and wine-grapes, the export of which has noticeably increased.

Western European Countries

In western Europe even less than in Germany or Austria is it possible to speak of agrarian reform in the sense in which it has occurred in the countries of eastern Europe. The conditions of tenure of agricultural land have undergone slow though continuous modification without any remarkable alteration having come about in the traditional agrarian system of the separate countries. In England, the classic instance of a country of large estates and large and medium sized tenancies, the number of occupying owners has almost doubled. In 1910 there were 55,433 such owners, holding 3,329,015 ac., while the total number had in 1924 become 94,236 holding 6,574,074 ac., or nearly one-quarter of the total area of England and Wales, 29,739,000 acres.[9] Thus there has come about in this country what the Hon. Edward Wood (Lord Irwin) called (Dec. 9 1924) "a silent revolution." Indeed, in view of the fact that the rôle of the large landowner as the provider of credit for agriculture is disappearing, while at the same time this function devolves more and more upon the state, he added "... and so you may well find yourselves in the course of the next 30 or 40 years within measurable distance of something like nationalisation by a side wind." This would imply the virtual realisation of the land reform programme as proposed by Lloyd George—the taking over of the land by the state, which then assigns it to tenants in hereditary usufruct.

Italy.—In Italy there were in 1912 4,931,000 agricultural holdings, including 3,275,000 of less than one hectare each, 614,000 of from one to two hectares, and 450,000 of two to four hectares. At the same time in some provinces the extent of the latifundia was very considerable for example, in Caltanisetta, out of the whole area of 322,865 hectares, 134,807 were latifundia, or 41·7%; in the province of Palermo the percentage was 35·0, and in the provinces of Sicily taken as a whole nearly one-third.[10] A bill of the transformation of the latifundia for purposes of home colonisation was passed by the Chamber of Deputies on Aug. 19 1922, but was thrown out by the Senate at the end of the same year.

Denmark.—The agrarian policy is directed increasingly towards the promotion of rural small ownership. The object of the so-called old Small Holdings Act of 1899 was mainly the settlement of land workers. The land was procured for this purpose on the open market with the help of state loans. From 1900 to 1924, 11,451 small holdings were formed in this way, the state assistance amounting to about 100,000,000 crowns.[11] (*See* Denmark: Agriculture).

The intention of the framers of the new Small Holdings Act of Oct. 1919 was to establish peasant holdings as economically independent units, the Govt. supplying land on favourable terms to applicants by purchase of church lands, of entailed lands, etc. The average size of the holdings is now fixed at 7½ hectares, as compared with 3½ before the War. In accordance with this law in the years 1920–24, 2,251 new holdings were formed covering 15,874 hectares, and 3,040 hectares were allotted for 1,258 very small holdings. In all 14,960 peasant holdings have been formed since 1900. At the present time the question is being asked whether the obtaining of land for small holdings would not be greatly facilitated by expropriation of land in the case of property which exceeds a given extent.

III. CONCLUSION

The changed conditions of tenure of agricultural land are to be traced back almost entirely to social causes, and land reform is thus rather a problem of the more equal division of property

[1] Venkop, No. 214 (Prague, dept. 13, 1925).
[2] *Gazette de Prague*, No. 86 (Oct. 28 1925).
[3] Gustave Gratz, *La situation économique de la Hongrie*, p. 9 (Budapest, 1925).
[4] *Der Oesterreichische Volkswirt* (Vienna, April 4 1925).
[5] *Deutsche Landwirtschaftliche Presse*, No. 15 (Berlin, April 11 1925).
[6] Constantinescu Mititu, *L'évolution de la propriété rurale et la réforme agraire en Roumanie* (Bucharest, 1925).
[7] *Revue économique et financière de Belgrade* (Dec. 1923).
[8] *La Bulgarie*, No. 718 (Sofia, Nov. 25 1925).
[9] Orwin and Peel, *The Tenure of Agricultural Land*, pp. 20–22 (Cambridge, 1925).
[10] G. Lorenzoni, "Latifundia in Sicily and their possible Transformation," *International Review of Agricultural Economics*, No. 3 (1923).
[11] "Conservation and Formation of Small Holdings in Denmark," *International Review of Agricultural Economics*, No. 1 (1926).

than one of increase of production from landed property. None the less the land reforms are already of proved economic value, although the peasant holdings that are their outcome are still in the first stage of adaptation to the new conditions. The advance of agricultural production is determined, not merely by the greater or less area of the peasant farms, but in a marked degree also by the psychological attitude of the peasant to his land, his joy in production and will to work. It is this imponderable factor, defying measurement, but, when multiplied a million fold, yielding in due time great results, that is the true achievement of the agrarian reforms. The lessons of the War come to this, that a sound distribution of ownership, together with a large peasant class, tends to conditions of agricultural progress and forms the essential presupposition of social peace. (*See* also FARM ORGANISATION.)

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LANE, FRANKLIN KNIGHT (1864–1921), American public official, was born near Charlottetown, P.E.I., Canada, July 15 1864. He graduated from the University of California in 1886. He began his career as a newspaper reporter, studied law and was admitted to the bar in 1889. He practised in San Francisco, drafted a charter for that city and soon afterwards, in 1897, was elected city attorney, to which office he was twice re-elected. In 1902 he was the unsuccessful Democratic candidate for governor of California, and the following year failed in his election for the U.S. Senate. In 1905 he was appointed by President Roosevelt a member of the Interstate Commerce Commission and was retained by President Taft, serving for eight years, part of the time as chairman. In 1913 he entered the Cabinet of President Wilson as Secretary of the Interior. During his term of office the wealth of Alaska was made more accessible by the construction of a Government railway. Dams were built in several western states for conserving the water supply in dry regions. To the Indians he gave special attention, maintaining that perpetual tutelage was wrong. He advocated development of national resources without waste as being reasonable conservation. He was an earnest advocate of reclamation of land. In 1916 he was a member of the American-Mexican Joint High Commission, and the following year became a member of the Council of National Defense. In 1920 he resigned his post as Secretary of the Interior. He was treasurer of the European Relief Council. He died at Rochester, Minn., May 18 1921. He was the author of *The American Spirit* addresses delivered in War time (1918). See also A. W. Lane and L. H. Wall, *The Letters of Franklin K. Lane, Personal and Political* (1923).

LANE, SIR HUGH PERCY (1875–1915), Irish art collector, was born in Co. Cork Nov. 9 1875, the son of the Rev. J. W. Lane. He entered the firm of Colnaghi & Co. in 1893 and rapidly made a name as a connoisseur of extraordinary perception. In 1898 he began dealing on his own account. He took a prominent part in the revival of an interest in art in Ireland, especially in establishing a gallery of modern art in Dublin. A fine collection was ultimately made, and housed in Harcourt Street, Dublin, where it was opened in 1906. He was knighted in 1909. Lane offered a number of old masters to the city of Dublin but, owing to the attitude of the Dublin corporation, his gift did not take effect. He acted as adviser on the formation of the Johannesburg Municipal Gallery of Modern Art (1909), and brought together the Cape Town National Gallery collection of 17th century Dutch pictures (1912). He was in 1914 appointed director of the National Gallery of Ireland. He was drowned in the sinking of the "Lusitania," May 7 1915.

See Lady Gregory, *Hugh Lane's Life and Achievements: with some account of the Dublin Galleries* (1920).

LANESSAN, JEAN MARIE ANTOINE DE (1843–1919), French statesman and naturalist (*see* 16.169), retired from politics in 1914. Among his latest works were *La crise de la République* (1914); and *L'histoire de l'entente cordiale Anglo-Française* (1916). He died at Écouen, Seine-et-Oise, Nov. 8 1919.

LANG, ANDREW (1844–1912), British writer (*see* 16.171), died at Banchory, Aberdeenshire, July 20 1912.

LANG, COSMO GORDON (1864–), Anglican divine, was born in Aberdeen Oct. 31 1864, the son of John Marshall Lang, sometime moderator of the Church of Scotland. Educated at Glasgow University and Balliol College, Oxford, he graduated in 1886 and two years later was elected a fellow of All Souls. In 1890 he was ordained and was appointed curate of the parish church of Leeds. From 1893 to 1896 he was fellow and dean of divinity of Magdalen College, Oxford, and from 1894–96 vicar of the University church of St. Mary's. In 1896 he became vicar of Portsea, and in 1901 suffragan bishop of Stepney, London, and canon of St. Paul's Cathedral. In 1908 he was appointed archbishop of York. His eloquence and clear common sense made him an influential member of the House of Lords, and in 1909 he was appointed a member of the royal commission on divorce.

His published works include *The Miracles of Jesus as Marks of the Way of Life* (1901); *Thoughts on some of the Parables of Jesus* (1906); *The Opportunity of the Church of England* (1905).

LANGLOIS, HIPPOLYTE (1839–1912), French general (*see* 16.177), died in Paris Feb. 12 1912.

LANGMUIR, IRVING (1881–), American chemist, was born in Brooklyn, N.Y., Jan. 31 1881. He studied at the Columbia school of mines, proceeding in 1903 to the University of Göttingen. He was instructor in chemistry at Stevens Institute, Hoboken, N.J., from 1906 to 1909, since which time he has engaged in physico-chemical research for the General Electric Co., Schenectady, New York. He invented the gas-filled tungsten lamp and the condensation pump for producing high vacua; his inventions in the field of electric discharges are largely responsible for the modern vacuum tube used in radio. In 1911 he discovered the atomic form of elementary hydrogen, and subsequently developed a process for welding metals by flames of atomic hydrogen. In 1917–8 he was engaged at the Naval Experimental Station, Nahant, Mass., developing devices for submarine detection. For his work in the field of molecular physics he received in 1918 the Hughes Medal of the Royal Society, London.

LANGUAGES: *see* FOREIGN LANGUAGES; PHONETICS.

LANKESTER, SIR EDWIN RAY (1847–), British biologist, was born in London May 15 1847, and was educated at St. Paul's School, Downing College, Cambridge, and Christ Church, Oxford. In 1872 he was elected to a fellowship at Exeter College, Oxford. During 1874–90 he was professor of zoology and comparative anatomy at University College, London, and from 1891–8 Linacre professor of comparative anatomy at Oxford. From 1898 to 1907 he was director of the natural history department of the British Museum, and from 1898–1900 he held the Fullerian professorship of physiology and comparative anatomy at the Royal Institution, London. He did valuable research work on the comparative structure of animals, both living and extinct. To the general public he became known owing to his successful presentation of scientific subjects in a popular form. He was elected F.R.S. in 1875, and was awarded the Royal Medal in 1885 and the Copley Medal in 1913. In 1884 he founded the Marine Biological Association, becoming its president in 1892. He was awarded K.C.B. in 1907. His numerous publications include *Comparative Longevity* (1871); *Degeneration* (1880); and the several editions of *Science from an Easy Chair* (1908, 1910, 1912); *Diversions of a Naturalist* (1915); *Science and Education* (1919); *Secrets of Earth and Sea* (1920); and *Great and Small Things* (1923). He was for many years editor of *The Quarterly Journal of Microscopical Science.*

LANREZAC, CHARLES LOUIS (1852–1925), French soldier, was born at Pointe-à-Pitre, Guadeloupe, July 31 1852. While at the École de Guerre, the new French doctrine of strategy and tactics was being established under the influence of Maillard, Langlois and Bonnal. To this doctrine Lanrezac himself contributed in his study *La manoeuvre de Lützen.* He became colonel in 1902, general of brigade in 1906, and general of division in 1911. In 1912 he commanded the XI. Corps, and on April 10 1914 succeeded Galliéni as a member of the Conseil Supérieur de la Guerre and commander-designate of the V. Army. His theories as summarised in the article *Stratégie* of the *Dictionnaire militaire* were not in accordance with the modern theory of an incessant and universal offensive, of which plan 17 was an example. This plan assumed that the V. Army would attack east of the Meuse towards Neufchâteau. Lanrezac pointed out in his report of July 31 1914 that if the extreme German right crossed the Meuse north of Givet the V. Army at Neufchâteau would be turned. Neither he nor Joffre anticipated the magnitude of the German attack, though he feared an enemy attack between Namur and Givet aimed at Chimay and the sources of the Oise and the direct road to Paris. He therefore sought and obtained permission on Aug. 12 to place the I. Corps (left) in the Dinant region, and to make preliminary arrangements for moving the rest of his army towards the northwest. On Aug. 15 the Germans having endeavoured to cross the Meuse at Dinant, General Joffre ordered the transfer of the army on the left bank.

On Aug. 21 Lanrezac asked Joffre whether he should attack the following day, but was then violently attacked by Von Bülow's army, and the battle of Charleroi began. The arrival of the III. German Army forced the I. French Corps to fall back on the Meuse, while the III. Corps had to yield. On the evening of the 23rd Lanrezac was obliged to order a retreat, which lasted from Aug. 24 to Sept. 5. On Aug. 27 orders were given to renew the offensive at Saint-Quentin in order to assist the British. This order provoked a violent disagreement between Joffre and Lanrezac. Nevertheless Lanrezac renewed his offensive on the 29th and at the battle of Guise, won a brilliant tactical success. But the retreat continued, and on Sept. 3 Gen. Lanrezac was relieved of his command. In 1917 he was offered the post of Major General of the armies by M. Painlevé, but he refused and suggested Gen. Pétain. "He is one of my own children," he said, "and I can answer for him." On July 3 1917 he was made grand officer of the Legion of Honour and on Aug. 29 1924 he was given the grand cross of the same order. He died on Jan. 18 1925.

See Lanrezac, *Le plan de campagne français et le premier mois de la guerre* (1920); Jules Isaac, *Joffre et Lanrezac* (1022); F. Engerand, *Lanrezac* (1926). (H. Bi.*)

LANSBURY, GEORGE (1859–), British politician, was born on Feb. 21 1859 in Suffolk. Working in a timber business, in London, he became a member and trustee of the National Union of General Workers. He abandoned his early Liberalism to found the Church Socialist League and to join the Independent Labour party. In 1909, as a member of the Royal Commission on the Poor Laws, he signed the Minority Report, and started an active campaign for its adoption. Elected M.P. for Bow in 1910, he supported the militants in the women's suffrage movement, and in 1912 resigned his seat to test opinion on the subject, but was defeated; he recaptured it, however, in 1922. In 1913 he became editor of *The Daily Herald,* which he carried on as a weekly during the War period. From 1920, on its revival as a daily, he was again editor, becoming general manager in 1922. In 1925 he resigned this post and founded *Lansbury's Weekly,* a journal friendly to communism. He visited India and Russia, publishing his book, *What I Saw in Russia,* in 1920. He was elected a borough councillor in 1901 and was mayor of Poplar from 1919–20 but he refused a post in the Labour Govt. (1924) and criticised its policy in many respects.

LANSDOWNE, HENRY CHARLES KEITH PETTY FITZMAURICE, 5TH MARQUESS OF (1845–), British statesman (*see* 16.184), had, during his tenure of office as Foreign Secretary (1900–5), definitely set his mark on British foreign policy at a critical period of history. In 1900 Great Britain felt all the disadvantages of isolation. Lord Salisbury's system of a general reliance on Germany and the Triple Alliance (Germany, Austria and Italy) had become no longer possible, in view of the open expression of German ill-will during the Boer War, and of the German resolve to build a fleet sufficiently large to constitute a serious challenge to the British Navy. On the other hand, Great Britain had nearly come to blows with France over Fashoda (Kodok), and her historical friction with Russia continued. Her isolation was especially marked in the Far East. Germany, Russia and France had forced Japan, after her Chinese War, to relinquish her conquest of the Liaotung peninsula. England had refused to join the other European Powers in their action, but had simply stood on one side. Subsequently Russia had over-run Manchuria and seized Port Arthur; France had effected a favourable revision of her frontier in the Mekong valley, and Germany had seized Kiaochow. It is Lord Lansdowne's main title to fame that he rescued Great Britain from this position of peril, procured her an ally in the rising maritime Power of the Pacific, Japan, and in Europe established her on terms of friendship and mutual understanding with France, by clearing away all the sources of bickering between Paris and London.

When the Duke of Devonshire resigned from Mr. Balfour's Government in 1903, Lord Lansdowne became the Conservative leader in the House of Lords, and though the fall of the Ministry in Nov. 1905 transferred him to the Opposition bench he remained the leader of the majority of that House till Dec. 1916. His polished and courteous manner, his thorough acquaintance, both with his work and with the idiosyncrasies of the peers, his cool temper and the sweet reasonableness of his expositions of policy speedily rendered his leadership most acceptable to his followers, in spite of the drawback, from the point of view of the Tory majority among them, that he was himself an old Whig. He rendered consistently patriotic support to the development by Sir Edward Grey of the foreign policy for which he himself had been responsible. In domestic politics he endeavoured, as far as possible, to limit points of difference with the Commons; but the measures of the Liberal Ministry almost inevitably brought about a conflict, which came to a head over Mr. Lloyd George's budget of 1909. In advising the Lords to reject it—as they did—he claimed that it was not an ordinary budget, but emphatically one which ought to be referred to the electorate to decide. Next year, however, he accepted the result of the general election of Jan. 1910, as making it obligatory on the peers to pass the Finance bill.

After the second general election of 1910 on the point of the Lords' veto, Lord Lansdowne brought forward in 1911, as an alternative to the Parliament Bill, a scheme for reconstructing

the Upper House, which however was dropped after a second reading. When the Parliament Bill itself came up to the House of Lords, he moved and carried, by 253 to 40, an amendment providing for a submission to a popular vote of bills affecting the constitution or otherwise of great gravity. From that amendment he and his friends would not, he said, recede so long as they were "free agents." Ministers immediately announced that they would not accept the amendment, and that the King had consented to create, if necessary, sufficient peers to ensure the passage of the bill in its original form. Lord Lansdowne held that, after this threat of coercion, the peers had ceased to be free agents, and he therefore advised them to desist from further resistance. In this advice he was supported by Mr. Balfour; but a vehement opposition developed in the Conservative party, headed by the ex-Lord Chancellor, Lord Halsbury, and these "Diehards" were supported by such a large body of opinion that the bill was only carried eventually by 17 votes.

This episode gave a shock to Lord Lansdowne's authority both in the House and in the Conservative party, but he remained leader and co-operated cordially with Mr. Bonar Law after Mr. Balfour's resignation. He fought the Irish Home Rule Bill and the Welsh Disestablishment Bill strenuously on their successive appearances in the House of Lords, and procured their rejection by large majorities. But he was always ready for an agreement by consent over the Irish question, to avoid the "irremediable misfortune," the "overwhelming catastrophe," of civil war. The World War reduced all these issues to minor significance, and Lord Lansdowne associated himself with Mr. Bonar Law in tendering at once the support of the Opposition to the Government in rallying to the assistance of France and Russia. In 1915 he joined Mr. Asquith's Coalition Ministry without portfolio; and took the lead in pressing the military service bills on the House of Lords. At the close of that Ministry he retired from office, the leadership of the House and of the Conservative majority passing to Lord Curzon. In his retirement he got somewhat out of touch with public opinion, and published in *The Daily Telegraph*, in Nov. 1917, a letter in which, to the general surprise, he advocated a negotiated peace instead of the policy of Thorough, on which the Ministry and the Empire were set. His ideas received hardly any support save from the small pacifist section. In subsequent years he suffered much from ill-health, and so took little or no active part in politics.

Lord Lansdowne's great and various services to his country were rewarded with the K.G., G.C.S.I., G.C.M.G. and G.C.I.E. He was a trustee of the National Gallery and chairman of the British Royal Red Cross Society 1915–20; he received honorary degrees from Oxford, Cambridge, McGill and Leeds. His elder son, Lieut.-Col. the Earl of Kerry, D.S.O., married Elizabeth Caroline, only daughter of Sir E. S. Hope. His younger son, Lord Charles Mercer Nairne, was killed in action in France in 1914. Of his two daughters the elder married the 9th Duke of Devonshire and the younger the 6th Marquess of Waterford and, after his death, Lord Osborne de Vere Beauclerk. (G. E. B.)

LANSING, ROBERT (1864–), American diplomatist, was born at Watertown, N.Y., Oct. 17 1864. He graduated from Amherst in 1886, was admitted to the bar in 1889, and for the next 18 years practised at Watertown. In 1892 he was associate counsel for the United States on the Bering Sea Commission, and later was American counsel or agent before several important arbitral tribunals or mixed commissions, including the Alaskan Boundary Tribunal (1903), the Hague Tribunal for the arbitration of the North Atlantic fisheries (1910) and the Anglo-American commission (1911) for settling outstanding claims between Great Britain and the United States. In 1914 he was appointed counsellor of the Department of State. When W. J. Bryan resigned (June 8 1915), Mr. Lansing was appointed Secretary of State *ad interim*. He was definitely appointed Secretary of State on June 23 1915. In his attempts to uphold American rights he was called upon to direct notes to all the countries at war. In reply to a note addressed by England to neutrals, asking that all belligerent submarines be excluded from neutral waters, he said that the nature of each submarine must govern the decision. He thus drew an important distinction between the "Deutschland," which had peacefully brought a cargo to America, and the U53, which had raided several ships off the New England coast, Oct. 7 1916. In 1917 he notified President Carranza, of Mexico, that the United States would not adopt his proposed Pan-American plan of stopping the shipment of food and munitions to all the European belligerents. In Nov. 1917 he signed an agreement with Japan (the Lansing-Ishii agreement) which, while recognising Japan's special interests in China, provided for a continuance of the "open door" policy for commerce.

Lansing was a member of the American commission to negotiate peace at Paris, 1918–9, and, together with Viscount Cecil and Col. House, prepared a draft of the League of Nations in Jan. 1919. On Feb. 13 1920 he resigned as Secretary of State on being reprimanded by the President for having called together the heads of the executive departments of the Government. Such meetings of the Cabinet had, however, frequently been called before during the President's illness, naturally by the Secretrary of State as ranking member. In Aug. 1920 he opened a law office in Washington. He was the author of *The Peace Negotiations* (1921); and *The Big Four and Others* (1921).

LAPWORTH, CHARLES (1842–1920), British geologist (*see* 16.208), died at Birmingham March 13 1920.

LARDNER, RING W. (1885–), American author and humorist, was born at Niles, Mich., March 6 1885. He received his education at the Niles High School and the Armour Institute of Technology, Chicago. He was a reporter on the South Bend (Ind.) *Times*, 1905–7, after which he spent four years in Chicago, contributing to the sporting columns of various newspapers there. He was editor of *The Sporting News*, St. Louis, 1910–1, and sporting writer for the Chicago *Tribune* 1913–9, after which date he was connected with the Bell syndicate. His humour is based in part on its racy use of vernacular and the language of illiteracy. He wrote a number of books, among which are *Bib Ballads* (1915); *You Know Me, Al* (1916); *Gullible's Travels* (1917); *Treat 'em Rough* (1918); *The Real Dope* (1919); *How to Write Short Stories* (1924); and *The Love Nest* (1926).

LARMOR, SIR JOSEPH (1857–), British mathematician, was born at Magheragall in Ireland on July 11 1857, and was educated at the Royal Belfast Academical Institution, Queen's College, Belfast, and St. John's College, Cambridge. From 1880–5 he held the post of professor of mathematics in the Queen's University, Ireland, and from 1885–1903 he was lecturer in mathematics in the University of Cambridge, subsequently becoming Lucasian Professor there. He carried out much valuable research work in mathematics and mathematical physics, displaying a particular interest in the problems of electrodynamics and thermodynamics, and in the electrical properties of ether and matter. He was intimately connected for many years with the Royal Society, of which he became a fellow in 1892, serving on the council and acting as secretary from 1901–12. He received the Royal Medal in 1915, and the Copley Medal in 1921. In addition to these he was the recipient of many British and foreign honours and awards, including in 1914 the de Morgan Medal of the London Mathematical Society of which he was at that time President. He was knighted in 1901, and from 1911–22 was Unionist member of Parliament for Cambridge University. His writings include *Ether and Matter* (1900), and numerous memoirs on mathematics and physics.

LASCELLES, HENRY GEORGE CHARLES, VISCOUNT (1882–), eldest son of Henry Ulick Lascelles, 5th Earl of Harewood, was born Sept. 9 1882. He was educated at Eton and entered the Army as a lieutenant in the Grenadier Guards. For a time he exchanged military for diplomatic service, becoming an honorary attaché to the Embassy in Rome 1905–7, and A.D.C. to the governor-general of Canada (Earl Grey) 1907–11. He served in France during the World War, being three times wounded, and winning the D.S.O. with bar, as well as the Croix de Guerre. In 1922 (Feb. 28) he married Princess Mary, only daughter of King George V., and he was the same year created a Knight of the Garter. Through his grandmother, Elizabeth Joanna,

daughter of the 1st Marquess of Clanricarde, he inherited the property, though not the titles, of his great-uncle, the second and last marquess, who died April 12 1916.

LATIN LITERATURE (*see* 16.257).—During the period from 1911 to 1926 the progress of Latin scholarship ran on well-marked lines. The closing decades of the 19th century witnessed a great revival of classical study, parallel, if not due, to the great discoveries in natural science. It was realised that the doctrines which were current, in almost every branch of the study of antiquity, needed to be re-examined; and that the evidence available was far more extensive than previous generations of scholars had been willing or able to contemplate.

Hence came a great addition to the original sources of information accessible. Newly discovered inscriptions, papyri, monuments of stone and bronze and ancient remains of every kind; manuscripts and the products of ancient and medieval scholarship were newly read or newly analysed, and so made available for wholly new study, often in monumental publications like the *Corpus Inscriptionum Latinarum*, which, despite its 15 volumes, is still not yet complete. This new stream of research, strictly scientific in character, still continues with hardly any diminution; and students of Latin literature have learnt to give heed to the methods and the fruits of these studies.

Study of the Great Writers.—But the special feature of the years since 1910 has been a reassertion of the older and larger objects of classical study, namely, the interpretation and appreciation of the greatest authors, not in a spirit of opposition to the new research, but in alliance with it, and on the strength of its results. Thus, for example, in 1896 Theodor Mommsen was content to determine the date of an inscription, then newly discovered on the island of Philae in the Nile, and to show that it was probably one of the monuments set up or permitted to be set up in his own honour by Cornelius Gallus during his governorship of Egypt in 26 B.C.; and hence that it was one of the causes of the anger of Augustus and of the fall and suicide of Gallus—all good history, but, so far as Mommsen took it, with no particular literary bearing.

But Mommsen's results have since[1] been combined with what we have now learnt about the poet-soldier Gallus from a deeper study of Virgil's *Eclogues*, and with what the ancient commentators record about the curious ending—or want of ending—of Book IV. of the *Georgics*, so as to make clear how it was that Virgil came to mutilate what was probably the most perfect poem he ever wrote; and to suggest also how innocent his bosom-friend Gallus, despite his Gascon vanity, had been of the graver charges laid against him. In this way a fact of Virgil's experience, which must have contributed profoundly to shape his general outlook, appears in clearer light, and the standing riddle of the Aristaeus-Proteus-Orpheus-digression has found its final solution; the whole patchwork is nothing but a half-hearted attempt to replace the *Praise of Gallus* (and of Egypt) by piecing together three epyllia, of the poet's own earlier work, short narrative poems in the Alexandrine style.

Of similar interest is the discovery by Prof. G. E. K. Braunholtz, in the course of studies of the ancient place-names of North Italy and of the family-names of the same area recorded on inscriptions, of new evidence which places Virgil's farm near Calvisano, 30 Roman m. northwest of Mantua, not at the traditional site two m. to the southeast in the marshes of Pietole. This has elucidated the story of his expulsion from his farm in 41 B.C., and thrown much light on all the *Eclogues* whose scene is laid in North Italy—that is, as has been now pointed out, all those with odd numbers.

New and more searching methods of manuscript study have also added much to our knowledge of Latin authors. The Oxford series of texts with critical notes, though they vary a good deal in the fullness of their record, have at least made it difficult for an editor of any ancient book to frame his text or comment without regard to the evidence of the different manuscripts and the judgment of competent scholars upon their worth; just as no future editor of Juvenal can dispense with Prof. A. E. Housman's text (1905), or of the *Culex* (now attributed to Virgil by a clear and marked preponderance of expert opinion) without the same scholar's *Apparatus Criticus;* or of the *Metamorphoses* of Ovid without the critical edition by H. Magnus. Dr. J. P. Postgate's *Tibullus* and *Phaedrus*, and Profs. R. S. Conway and C. F. Walters' Livy I.–V. and VI.–X., Prof. H. W. Garrod's Statius (*Thebaid* and *Achilleid*)—all five volumes in the Oxford series—have offered similar service towards the better understanding of these authors.

Further, the more profound analysis of the history of manuscripts due to such scholars as L. Traube, A. C. Clark and E. K. Rand, besides the editors just mentioned, has revealed the frequency, not to say regularity, of certain causes of corruption—especially the loss of whole lines, or groups of lines, in uncial codices, and has thus imposed a certain check on haphazard emendation, and given new guidance for our procedure (or non-procedure) in difficult cases. One result is that the formula with which the most brilliant critical scholar of the 19th century, J. N. Madvig, was wont to cut the worst knots—"Livius scribere debuit" (so and so)—has disappeared from the work of self-respecting scholars. We have learnt so much more of the possibilities of error in tradition that we are humbler in framing judgments on the writings of great authors in the form in which the centuries have left them.

These illustrations will suffice to show the way in which new knowledge in epigraphy, in the study of place names and in textual criticism has deepened the study of ancient literature. It would be easy to increase their number by others drawn from comparative grammar, comparative religion, glossography and the many recent developments of archaeology. A typical example of the application of several different lines of inquiry to a literary purpose is W. Warde Fowler's exposition[2] of the *Carmen Saeculare* of Horace and its performance on June 3 17 B.C., which combines the results of his own studies of Roman ritual with the evidence of recent excavation on the Palatine and of the inscription of Augustus (discovered in 1890) recording the celebration and containing the words *Carmen composuit Q. Horatius Flaccus.*

To such indications of growing knowledge perhaps it may be serviceable, so far as the judgment of an individual scholar may be trusted in such a matter, to suggest a few parts of the field of Latin study which seem to have been comparatively neglected in the period under review. Chief among these is certainly the text of *Horace*, where the number of MSS. is very large, and our knowledge of them, both in quantity and quality, lamentably small. Next, the metre and language of *Plautus;* for, despite the work recorded below, no commentator seems yet to have realised the far-reaching effects of the Sonnenschein-Wallstedt[3] discovery of the lawfulness of a spondee, even one whose first syllable bears the word-accent, in the fourth foot of an Iambic Senarius, provided that accent and ictus coincide in the fifth and sixth feet; *e.g.*, in Trinummus, 410,

"Quam si tu obicias formicis papaverem,"

the fourth foot *mícis* is a spondee with the first syllable accented, but is legalised by the coincidence of word-accent and verse-ictus in the quadrisyllable (*papáverem*); a similar solution applies to the corresponding difficulty in Trochaics.

Catullus, Tibullus and Statius, though frequently edited in whole or part, have not yet been adequately handled in the light of our present knowledge, though on Statius much valuable work has been recently done. For a commentary on the *Natural History of Pliny*, that discursive encyclopaedia of ancient learning, the student is often obliged to go far back into the 19th century, or farther still, for even the most obvious kind of help.

Besides actual commentaries, this period has produced a wealth of critical studies, directed to determining as precisely as possible, in the light of all the evidence yet available, what were the actual thoughts and motives of the greatest authors viewed in relation to the history of their times, rather than to

[1] *See* below under D (*New Studies of a Great Inheritance*, c. V.).

[2] *See* below, *Roman Essays and Interpretations*, p. 3.

[3] Emil Wallstedt, *Studia Plautina*, Lund Univ. Arskrift, 1909. Afd. 1 (esp. p. 89 ff.). E. A. Sonnenschein, *Accent and Quality in Plautine Verse*, Class. Rev. 20, p. 156 (1906).

appraising their merit in the abstract—a vain ambition, responsible for much writing of a type fashionable in the 19th century, which now seems superficial. Contrast, for example, Conington's introduction to his edition of Virgil with that of S.G. Owen to Ovid's *Tristia* (Book 2); or with the series of volumes initiated by Warde Fowler, devoted at first to the interpretation of the *Aeneid*, book by book, and later to other Virgilian topics; such a series could hardly have been projected or published in any earlier epoch of scholarship.

Linked with this interpretative effort has been a desire, manifest alike in Britain, America, France, Italy, Germany, Holland and Scandinavia, to arrive at a clearer conception of the personality of the different authors, a desire more manifest than in any period since the New Learning of the 16th century. Indeed, in this and other ways the enterprising spirit of scholarship in the last quarter of a century has proved itself akin to that of the times of Thomas More, Spenser and Ben Jonson. Another is the multitude of translations of Latin authors begun in this period and still being poured out in many different series, affording no less clear evidence of quickened popular interest in classical study than did, in their own great way, the famous renderings of the Elizabethan era, North's *Plutarch* and Holland's *Livy*, to name no others; and in yet another feature, the abundance of what may be called propagandist literature which has grown up around Latin studies, the work of the 20th century shows a striking tendency to parallel, if not to imitate, the warm-hearted pleading of Roger Ascham or Sir Philip Sidney.

It is well to add that one of the features of the period has been the new organisation of the classical periodicals published in Great Britain; others have been newly established in the United States, Italy, Germany and Sweden. *The Classical Quarterly* had been separated, as an organ of research, from *The Classical Review* in 1906; but in 1910 both became the property of the Classical Assn., a body whose influence has done much to evoke and to guide the active work just described. In 1910 also a concordat was made between that association and the Society for promoting Hellenic Studies and the then newly formed Society for promoting Roman Studies respectively, by which the province of *The Classical Quarterly* was declared to be Greek and Latin language and literature (including texts, manuscripts and Indo-European Philology) approached by all methods save those mainly dependent on architectural remains or other archaeological evidence; whereas all study largely concerned with these was reserved for *The Journal of Hellenic Studies* and *The Journal of Roman Studies* in their proper spheres. This agreement has been happily carried out.

Further, when *The Journal of Philology*, long maintained by the support of the Cambridge Philological Society, was allowed to lapse (in 1920), that support was transferred to *The Classical Quarterly*. The *Review* and the *Quarterly*, with *The Year's Work in Classical Studies*, established by the Classical Assn. in 1906, are managed for it by the Classical Journals Board, on which the philological societies of Oxford and Cambridge are represented. All the Classical periodicals of Great Britain are therefore now conducted on a definite scheme which precludes overlapping. In America, beside the old-established *American Journal of Philology* and *Classical Philology* (a quarterly established in 1907), *The Classical Journal* (appearing in nine months of the year), which was founded in 1905, had by 1916 become the organ of the three powerful associations which now represent Classical studies in nearly the whole area of the United States.

In Italy the *Rivista Indo-Greco-Italica* began in 1916; in Germany *Glotta* (*Zeitschrift für Griech. u. Lat. Sprache*) at Göttingen in 1911; *Die Antike* (at Berlin) in 1923; and *Gnomon* at Berlin in 1924. In Sweden there was founded in 1925 *Litteris, an International Critical Review of the Humanities*, edited by Scandinavian scholars with associates in Germany, Denmark, England and France.

To this brief survey of the general tendencies of Latin scholarship may be added for practical purposes a brief list of the chief contributions to its different branches which have appeared in the period under review. The list is necessarily incomplete, but care has been taken to make it as representative as possible. It is largely based on surveys by Prof. J. F. Dobson and Mr. A. D. Nock in *The Year's Work*, where fuller information will be found.

The following list excludes (*a*) all publications dealing with a portion only of some large work, and (*b*) all new editions of books published before 1911, save a few in either class of exceptional importance.

A. Critical Texts of Latin Authors; and Textual Studies.

1. Five excellent Series, two begun in this period, all continue: (*a*) in the Oxford Bibliotheca Classica, *Livy 1–5* (1914) and *6–10* (1919); R. S. Conway and C. F. Walters jointly (*21–25* in the press); Ovid, *Tristia, Halieutica, Fragmenta*, S. G. Owen (1915); Phaedrus, J. P. Postgate (1919); Statius, *Silvae* (2nd ed., 1918), J. S. Phillimore; *Thebaid* and *Achilleid* (1911), H. W. Garrod; *Tibullus*, J. P. Postgate (1914).

(*b*) In Teubner's texts (many re-edited): *e.g.*, *Apicius*, C. Giarratano and F. Vollmer (1922); *Cato* (1923), G. Goetz; *Livy 41–45* and *Fragments* (1912); W. Heraeus; *Martianus Capella*, A. Dick (1925).

(*c*) In the Corpus Paravianum (Turin): *e.g.*, *Caesar, Bellum Civile* (1916), D. Bassi; *Catullus* (1916) and *Cicero, De Republica* (1916), both by C. Pascal; *Justin* (1921), M. Galdi.

(*d*) In the Collection Budé (Paris): *e.g.*, *Lucretius*, A. Ernout; *Ovid, Ars Amatoria*, H. Bornecque; *Seneca, Consolationes*, R. Waltz.

(*e*) In Hans Lietzmann's *Kleine Texte* (Bonn): *e.g.*, *Cicero Pro Milone*, with Asconius and the Schol. Bobiensia (1911), P. Wessner; *Vitae Virgilianae* (1911), E. Diehl.

2. Single works: *Ovid, Metamorphoses* (Berlin, 1914), H. Magnus. *See* also under B.

3. *Textual Studies: Apuleius*, D. S. Robertson, *Class. Quarterly* (18), 1924. *Ibis*, A. E. Housman, *Journal of Philology*, 35 (1920), p. 287. *Livy;* R. S. Conway, C. F. Walters, J. F. Dobson, A. Kyd, Florence Whitehead, *Class. Quarterly*, 4–2 (1910–8), W. B. Anderson, in *Class. Quarterly*, from 5 (1911) to 11 (1917). *Martial* and *Persius;* A. E. Housman, *Class. Quarterly*, 13 (1919) and 7 (1913); *Thebaid;* E. H. Alton, *Class. Quarterly*, 17 (1923), p. 175. *Thebaid 2*: W. B Anderson, *Class. Quarterly*, 18 (1924), p. 203. *Virgil: Culex*, E. H. Alton, Hermathena, 14 (1920), p. 68 (based on A. E. Housman's "Apparatus Criticus to the Culex," *Camb. Phil. Soc. Trans.*, 7, 1908).

B. Editions with Commentary:

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4. Chronology: *The Chronicle of S. Jerome* (2 vol., London, 1923), J. K. Fotheringham. (R. S. C.)

LATVIA.—A Baltic state and a member of the League of Nations. The Republic of Latvia, lying east and south of the Gulf of Riga, was proclaimed on Nov. 18 1918. It embraces the provinces of Vidzeme, Kurzeme, Zemgale and Latgale, covering an area of 24,400 sq. m., with a population of approximately 2,000,000 inhabitants, mostly Lutherans, divided, according to the census of 1925, in the following proportions: Letts 75·93%, Russians 10·28%, Jews 4·5%, Germans 3·4%, Poles 2·5% and other nationalities 3·39%. The principal towns with their populations are Riga, 337,699; Libau (Liepaja), 60,762; Dvinsk (Daugavpils), 40,640; Mitau (Telgava), 28,325; and Windau (Ventspils), 16,384.

I. CONSTITUTION

The Constitution law, passed on Feb. 15 1922, came into force on Nov. 7, on the election of the first Latvian Parliament (Saeima) composed of one Chamber. The supreme executive power is vested in the electorate, which is composed of authenticated citizens of either sex who have attained the age of 21 years.

No lists are made of the electors, and consequently the voters are not bound to wards. The elections are effected by general, equal, direct voting, on the basis of proportional representation. The electorate is entitled (*a*) to elect 100 members of Parliament (Saeima); (*b*) at the instance of the president of the republic to decide, by means of a referendum, upon the dissolution of the Saeima, and thus indirectly on the president's resignation; (*c*) to submit to the Saeima amendments of the constitution or other proposed legislation on the demand of not less than one-tenth of the electorate; and finally, to demand a referendum for the adoption or rejection of bills and legislative resolutions. This right may be exercised in three ways: (1) by the obligatory referendum for proposed amendments to the constitution; (2) by the permissive referendum, in case on his own initiative or on the motion of at least one-third of the members of the Saeima, the president postpones for two months the promulgation of a law passed by the Saeima, and if not less than one-tenth of the electorate demand a referendum; (3) a legislative proposal brought forward by the nation is also put to the public vote if not accepted by the Saeima without alterations in the text.

The Saeima is elected for a term of three years, and its authority expires on the convocation of the new Saeima. The elections take place on the first Saturday and Sunday in Oct., and the new House assembles on the first Tuesday in November. The minority of the Saeima (not less than one-third) may demand the establishment of an inquiry commission and the shelving of a law passed by the Saeima for two months pending a referendum. The president of the republic is elected by the Saeima for a term of three years, with the possibility of being returned for a further period of three years, but his tenure must not exceed six consecutive years. The president has the power of initiating legislation, of granting amnesty rights, he is the chief of the armed forces of the state, and is vested with a suspensive veto right, though he may dissolve the Saeima only after a referendum. He may not be under 40 years of age.

The Cabinet of ministers is the executive organ. The responsibility of the Ministers to the Saeima is formulated in Article 59 of the constitution. The Prime Minister and the members of his Cabinet require the confidence of and are responsible to the Saeima for their official actions. The whole Cabinet must resign if the Saeima passes a vote of censure against the Prime Minister. If a vote of no confidence is passed on one of the ministers, he must resign, and the Prime Minister appoints another person in his stead. By the Cabinet law of April 1 1925, a vote of confidence of the Saeima is required before the Cabinet or a new minister may take up office. The Cabinet has the right in certain cases to proclaim martial law, and to issue emergency regulations. Resort was had to these powers on different occasions in the early days of the republic. The constitution secures freedom of action for the courts of law. The State Control law of Aug. 2 1923, based on paragraph 88 of the constitution provides Latvia with a completely independent and active State Control Department. The constitution of the Latvian Republic does not contain the usual legal guarantees for the citizens, but the right of assembly and the freedom of the Press are guaranteed by special laws which were passed by the first Latvian Parliament. The cultural autonomy of the national minorities has been legalised by the National Council.

II. POLITICAL HISTORY

Latvia's geographical location contributes to its political importance. This constant factor has always influenced the

historical development of the country. Thus an important part is played by Latvia in connection with the problem of the *dominium maris Baltici* in the history of north-eastern Europe. The solution of this problem one way or the other has always affected the political position of the peoples on the Baltic seacoast. In the 9th century the Vikings crossed the Baltic to Russia, in the 12th the Germans proceeded from Bremen and Lübeck to colonise the Baltic coast, establishing a staple market at Wisby (Gothland). By then, the already politically organised Latvian tribes (Kurs, Semgallians, Seli, Talavians, Latgalians), moving seawards, had reached the mouth of the river Dvina and the seacoast, and assimilated the inhabitants of the coast, the Livs (of Finnish origin). The Latvian tribes, however, had not yet crystallised into an organised united state, and, while the Scandinavians were distracted by internal disturbances, the Germans gained a footing in Livonia.

After fighting until about 1450, an episcopal state was founded in conjunction with the Livonian Order, as the precursor of the Federal State of Livonia founded about the middle of the 15th century, and embracing Estonia and Latvia of to-day. The problem of the Baltic Sea was again acute towards the middle of the 16th century, when Moscow turned to the Baltic coast after having destroyed the trade of Novgorod (a Hanseatic creation) and annexed the Ruthenian duchies bordering on Latvia. Then it was that the Hanseatic structure of all the Baltic began to fall, while Germany was in the throes of the reformation movement and Sweden evinced a desire to establish itself beyond the Baltic Sea. Having made a union with Lithuania, Poland too, showed a tendency to expand in the same direction. These conflicting efforts led to a partition of Livonia, and so Estonia became Swedish, Livonia Polish, Pilten in North Courland and the isle of Oesel Danish, while Courland was converted into a duchy under Polish suzerainty, and later became an important state under Duke Jacob, a godson of James I. of England.

Simultaneously with the expansion of Sweden's power, Livonia and Riga were occupied at the beginning of the 18th century, whereby the Swedes contributed largely to the cultural progress of these parts by founding schools, establishing legal and clerical order, protecting the peasantry and translating the Bible. Latgalia alone was left under Polish rule. By then an united Latvian people had evolved out of the separate tribes, though the estate owners were not Latvians. This continued until the beginning of the 18th century, when, in alliance with Poland, Russia undermined Sweden's power and under the Treaty of Nystad, 1721, occupied South Finland, Estonia and Livonia, afterwards turning on Poland and destroying her.

The whole of Latvian territory was united under Russian rule after the partitions of Poland (1772–95). The reforms introduced by the Swedes were rescinded, and the estates which were formerly held in fee became the hereditary possession of the nobility. The position of the peasants grew worse, and repeated revolts ensued. Only in 1807 a law was passed in St. Petersburg giving the peasants hereditary possession of the land cultivated by them on their own behalf. But after Napoleon's downfall, this law was modified to the effect that the landlords retained possession of the land, which the peasants could acquire by purchase only. The landed proprietors, mostly German Balts, also recovered all their feudal privileges, as game and fishing rights, and patrimonial rights. They also enjoyed the sole right to establish industrial enterprises.

This state of affairs lasted till the beginning of the 20th century, and only shortly before the World War was the idea of a limited self-government with the participation of the more important small landowners conceived. During the 19th century the co-operative movement, loan-banks, etc., enabled the growth of a larger and more independent class of Latvian small farmers; the landless proletariat went to the towns and evolved in a revolutionary direction. A Latvian educated class came into being; a Latvian daily press and theatre were founded. A nationalist and revolutionary movement began to grow. The national leaders, A. Kronvalds, K. Valdemars, J. Kalnins, F. Grosvalds and others, received much valuable assistance from some liberal German clergymen. In the Latvian revolution of 1904–5, the first declaration of Latvian independence was made. Russia had to reinstate herself by armed force. She put the revolution down with much bloodshed. There was practically no improvement in the position of the peasants, as not even the Russian conception of self-government (the Zemstvo) was extended to this region (*see* also LITHUANIANS AND LETTS, 16.789).

The War Period.—At the outbreak of the World War, the full force of the attack fell on Latvia and the other frontier regions. In the year 1915 Tsar Nicholas II. permitted the organisation of a national Latvian Army, which subsequently proved to be the foundation of Latvia's political independence. Nevertheless the Latvian nation was subjected to great suffering in consequence of compulsory evacuation to Russia.

After the Russian revolution in 1917 the Latvian Refugees Committee developed into a powerful organisation, and deputed its representatives J. Chakste and Z. A. Meierovics to Stockholm and from thence to Paris, where they took part in the peace negotiations. On Nov. 30 1917, shortly after the Bolshevist revolution, the Latvian National Council, under the leadership of V. Zamuels, was formed in Walk, Riga having been under German occupation since September. The National Council issued an exhortation to the people to make practical use of the right of self-determination proclaimed by President Wilson. The delegations sent to Paris and London were vested with full powers by the National Council in Walk. The Brest-Litovsk Treaty of 1918 was most emphatically rejected by the Latvian National Council. Solemn protest was raised against the dismemberment of the Latvian nation by the then leaders of Germany's eastern policy, which purported to create a Duchy of Courland in personal union with the Kingdom of Prussia, and to make of Livland, Estonia and the adjacent islands a Baltic state under German suzerainty. Latgale was to be ceded to Russia in order to lend another direction to Polish irredentism. Germany's Baltic policy was really introduced by the agrarian regulation of Field-Marshal Hindenburg of July 17 1918 for the colonisation of Courland. A colonisation union, after the German pattern, was formed in Courland, at the disposal of which one-third of the landed property of the Baltic nobility was voluntarily placed. The Hindenburg agrarian order nullified Baltic private rights in respect of land agreements for a period of 30 years, but made no provision for Latvian peasants.

The Allied victory in the autumn of 1918 frustrated these plans. The Democratic Bloc led by K. Ulmanis was formed in Riga, and pursued the aims of the National Council in Walk. After the collapse of German power in the Baltic, the Democratic Bloc gained a firmer footing and by Nov. 18 1918 the members of the Refugees' Committee in Petrograd and those of the Walk National Council had arrived in Riga. The All-Latvian National Council was composed of representatives of the peasantry, of the workmen, making together two-thirds, while the last third was made up of the representatives of Latvian merchants and manufacturers, house-owners and national minorities, of whom the representatives of the liberal Balts were particularly active.

Independence.—The *de facto* recognition of the Latvian National Council by Great Britain on Nov. 11, and shortly afterwards by other Powers, led to the solemn proclamation of the Latvian Republic on Nov. 18 1918. A provisional government was formed under K. Ulmanis pending the convocation of a Constituent Assembly. J. Chakste, a barrister and former Latvian deputy in the Russian Duma, was elected president of the National Council, then president of the Constituent Assembly and eventually by the Parliaments of 1922 and 1925, president of the republic.

The Provisional Govt. was practically penniless, and lacked military power. The Latvian regular troops, left in the lurch by the Russians, had retreated before the advancing Germans from the Dvina front to Russia, where their sense of discipline was exploited by successive governments. Only after the conclusion of the Latvo-Russian peace treaty in 1920 were they able to return home. The work of national organisation was

interrupted by Bolshevist invasion until May 22 1919. The Provisional Govt. and the National Council retired, under Bolshevist pressure, to Libau, where they held their ground with the help of troops mobilised in Courland. A Latvian Army was formed, commanded first by Col. Kolpaks, and after his death by Col. (General) Balodis. The German-Baltic Landeswehr also joined the anti-Bolshevist front. Libau was then the seat of the German occupation administration under Gen. von der Goltz. The social democrat Winnig functioned as representative of the German Government. Amidst these chaotic conditions the German "Putsch" of April 16 1919 was foiled in the attempt to overthrow the Cabinet of K. Ulmanis.

The loyal forces, with the Baltic Landeswehr, advanced against the Bolsheviks, liberated Riga on May 22 1919 and pursued the enemy to the Russian frontier. Similar operations were conducted in North Livland by the North Latvian Army under Col. Semitan, with whom the Estonians sided against the Bolsheviks. After the failure of the second adventure of the German Balts near Wenden, the Provisional Govt. headed by K. Ulmanis returned to the capital on July 7 1919 and resumed the work of organising the state, despite the obstacles presented by a continuous state of war. The complete repulse of the Bolshevists would have been effected much sooner had Riga not been attacked on Oct. 8 1919 by the "Bermondt-Avalov" troops, composed of Russians and Germans in disguise, instigated by the Baltic nobility. This invasion from the direction of Lithuania and Courland was liquidated by the end of Nov. 1919 with the help of British and French naval artillery. Latgale was liberated from the Bolshevists in Jan. 1920 by combined Polish-Latvian action; all Latvian territory was now free. With Germany, which had assumed the protection of the Bermondt troops, an agreement was made on July 15 1920 for the resumption of normal relations. Peace was concluded with Russia on Aug. 11 1920.

Meanwhile the Latvian Constituent Assembly had met on May 1 1920 and elected Mr. J. Chakste to the presidency. The Constituent Assembly, summoned by general vote, passed the Agrarian law of Sept. 16 1920, which liquidated the system of big landed properties, and placed the expropriated land at the disposal of a special land fund. The landlords were left in possession of a certain portion of their estates, not larger than 50 hectares, with live stock and inventory. The law limits the area of the new farms to 22 hectares. In this way the number of small farms was increased to over 200,000 and the state was placed on a firm social basis (*see* FINANCIAL AND ECONOMIC HISTORY, below). Many other important laws were passed, *e.g.*, the Free Port Law of May 20 1920.

Political Parties.—The first Latvian Parliament, which met on Nov. 7 1922, consisted of 62 non-Socialist and 38 Socialist members. In the second Parliament, elected in Oct. 1925, there were 63 non-Socialists, and only 37 Social Democrats, four of whom belong to the Revisionist branch. Communism is weak in Latvia, and is legally banned. The non-Socialist deputies are divided among several parties. Many non-Socialists are returned by the peasantry. In the second Parliament, for instance, the Farmers Bloc, including representatives of the so-called Young Farmers, was 27 strong. The townspeople elected representatives of the middle classes, besides the Social Democrat deputies. There is also a conservative representation originating from the parishes. The number of parties is partly due to the system of proportional representation, which entitles every 100 electors to add to the list of candidates. Moreover the minorities form national groups in Parliament. In the second Parliament there were 5 Germans, 5 Russians, 2 Poles, 4 Jews.

The Social Democrats adhere to the Second International, and stand for the promotion of industry, protective labour legislation, and the international neutralisation of Latvia. The Farmers' Union stand for development of agriculture, for protective duties, amelioration credits, restoration of the devastated regions, in general for intensifying agriculture, and for efficient means of defence, civil order, property rights and, politically, for a union of the Baltic States. The Democratic Centre share radical democratic views based however, on the sovereignty of the state. The groups of the Right, for example, the National Christians, are strongly clerical. Another section represents trade and industry. The different Latgallian parties present a variety of local demands, though they side with the corresponding Lettish parties in questions of general State policy. In ecclesiastical matters certain groups of the Left demand the separation of the Church from the state and the cessation of the state subsidy to the Church. The racial minorities make special demands, the Jews asking for extensive modifications in the law regarding citizenship, while others watch the interests of the landowners dispossessed under the Agrarian Reform laws.

Foreign Relations.—In the sphere of foreign policy the idea of a Baltic States Union is predominant. The so-called "small" programme seeks a union with Estonia and Lithuania—a lesser group advocating a Baltic Union embracing Finland and Poland. Towards proposals for a four-state-union excluding Poland, Finland maintains an attitude of reserve. In accordance with the Latvo-Estonian Treaty of Nov. 1 1923 negotiations were undertaken for a Customs Union between these two states. Latvia also entered into a defensive alliance with Estonia. No passports or visas are required for nationals crossing the Latvo-Estonian frontier. Negotiations with Poland led only to the conclusion of a consular convention. With Finland, as with the Scandinavian states, a treaty of commerce has been concluded, together with an arbitration agreement which was signed by the representatives of Latvia, Estonia, Finland and Poland at the conference of the Baltic states in Helsingfors in 1924. Latvia has also entered into a number of trade agreements and legal protection treaties with the European Powers, in particular a Treaty of Commerce and Navigation with Great Britain on July 22 1923, a trade convention with France on Oct. 29 1924, as well as trade agreements with Switzerland, Czechoslovakia, Turkey, Hungary, Austria, Japan, Belgium, Italy and the United States. In its trade agreements Latvia makes provision for the so-called Baltic and Russian clause, reserving the possibility of closer economic contact with the Baltic states and the development of transit traffic with Russia, which was facilitated by the technical agreements concluded in Aug. 1924. Relations with Russia are good and becoming more and more normal.

Latvia joined the Permanent Court of International Justice at The Hague, and couples the conclusion of trade agreements with the signature of legal protection and arbitration conventions. Negotiations for an economic treaty were begun with Lithuania on May 19 1924. With Germany an agreement was reached in principle regarding an arbitration convention and mutual settlement of claims.

As Latvia was recognised *de jure* by the Great Powers on Jan. 26 1921, and admitted to the League of Nations on Sept. 22 of the same year, diplomatic relations are maintained with the corresponding states. A concordat was signed with the Holy See on May 30 1922.

III. ADMINISTRATION, EDUCATION, ETC.

There are some 6,000 state officials. Teachers, judges, foresters, railwaymen, the agents and employees of government enterprises and monopolies are paid by the state. The Latvian Army is directed by experienced staff officers and graduates of the Riga Officers' School, who complete their military education in France and in Poland. Apart from the regular army there is a territorial voluntary defence force, divided into regiments and companies after the model of the Finnish Defence Corps. The Latvian Defence Corps include cavalry and cyclist companies. Military games and rifle clubs are also popular. The young people receive military training, and the Boy Scout movement is well developed in Latvia.

The whole country is divided into 19 administrative districts and 3 prefectures: Riga, Libau, Daugavpils. Extensive autonomy is granted to the towns and parishes. The smallest units of rural self-government are the rural communes, of which there are about 510 in all. Markets are held in 80 towns and villages, 37 of these having town councils.

Justice.—The administration of justice is entrusted to the justices of the peace, four district courts, the Court of Appeals and the Senate. The judges cannot be dismissed from office. The old local Baltic provincial law is still in force; and in Latgale the Russian law in part, pending codification. As the constitution provides only for a single legislative Chamber, the Saeima, the functions of a second Chamber are to some extent fulfilled by various committees in the different departments, as, for example, the financial council attached to the Ministry of Finance, the Agricultural Council to the Ministry of Agriculture, special committees for music, theatres, etc., attached to the Ministry of Education, and so forth. Civil interests are protected by numerous recognised associations, as chambers of commerce, guilds, etc.

Vital Statistics.—The bulk of the population of Latvia are engaged in agriculture, only 35% of the population being urban. 41,172 births and 28,399 deaths were registered in 1924.

Co-operation.—The co-operative system is widespread and both consumers' and agricultural societies are largely developed. The system of social clubs and unions is extensively adopted in rural districts, and is generously supported by the so-called Culture Fund created by levying a 3% tax on railway tickets. It has thus been possible to establish public libraries, co-operative houses, etc., in the country. Education is further promoted by an itinerant theatre, several provincial theatres, and an opera house in Libau ranking second to the National Opera House in Riga.

Education and Culture.—School attendance is compulsory in Latvia. In addition to the public elementary schools there are secondary schools, commercial colleges, several language institutes, and other advanced and specialised educational institutions. Illiterates form only 8·5% of the population, and for every 100,000 of the population there are 300 university students. The study of German or English is compulsory in the middle schools, German holding the first place; French and Russian are optional. Due encouragement is also given to the elementary and middle schools of the national minorities in the form of state grants to German, Russian, Jewish and Polish schools.

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IV. FINANCIAL AND ECONOMIC HISTORY

Latvia lost nearly 40% of her population in the World War, mainly by emigration in consequence of the German invasion. Hardly 300,000 have returned out of the refugee population of 1915–7. The greater part of the missing, near 650,000, perished. Almost all the industries and the industrial population were evacuated to Russia; 10,000 farms were utterly destroyed. Machinery and equipment of industries employing over 100,000 factory hands were sent to Russia in 20,000 railway trucks. Of these the Bolshevists have restored barely 200 trucks under the Peace Treaty of Aug. 13 1920. In Courland the population and cultivated areas at the time of the German occupation, 1915 to 1918, had diminished to one-third. Over half of the farms were destroyed or stood empty.

Production—Cultivated Areas.

	1909–13 hectares	1920 hectares	1924 hectares
Rye	351,000	196,000	266,000
Wheat	33,000	16,000	43,000
Barley	191,000	124,000	179,000
Oats	306,000	216,000	334,000
Mixed grain	..	46,000	77,000
Peas	23,000	20,000	39,000
Potatoes	80,000	49,000	75,000
Flax	70,000	30,000	60,000

The total cultivated area was thus in 1924, except for mixed grain, 996,000 hectares, *i.e.*, 5·2% less than in 1909–13.

The harvests were:—

	1909–13 metric tons	1920 metric tons	1924 metric tons
Rye	325,000	119,000	199,000
Wheat	38,000	11,000	43,000
Barley	173,000	66,000	162,000
Oats	279,000	113,000	271,000
Mixed grain	..	29,000	76,000
Peas	18,000	13,000	35,000
Potatoes	639,000	375,000	676,000
Flax fibre	30,000	10,000	25,000
Flax seed	25,000	10,000	26,000

The grain harvest, apart from mixed grain, reached 833,000 metric tons in 1909–13, in 1920 only 322,000, in 1924 only 710,000. Only the potato harvest reached its pre-War figure, the linseed crop was the same, the flax fibre one-sixth less. Four-fifths of the flax fibre harvest is exported.

Finances.—When the Latvian Republic was formed on Nov. 18 1918, the country was greatly impoverished owing to the requisitioning of corn, cattle, horses, etc., by the German armies of occupation, though part of the supplies which could not be carried away were sold back to the peasants on the evacuation of the troops. In April 1919, a new paper currency, the Latvian rouble, was issued by the Govt., which continued for a considerable period to finance its requirements by this means, with the result that the exchange in terms of sterling rose from 215·5 roubles on Jan. 1 1920, to 2,000–2,400 roubles in May 1921. After the demobilisation of the army in the autumn of 1920, the fresh issues of currency were mainly for production purposes, and flax, hides and linseed were purchased by this means from the peasants. The sale of the stocks thus acquired brought in 2,000,000,000 paper roubles to the state and enabled the Finance Minister in office in March 1921, Ringold Kalning, to raise the value of the rouble to 1,140 to the pound sterling, at which point it was stabilised. The currency was backed by gold to the value of 15,000,000 gold francs and by foreign balances amounting to 7,730,000 gold francs. The lat (=gold franc) was fixed at a value of 50 paper roubles, and the 2,270,000,000 paper roubles in circulation were thus covered to the extent of about 50% in gold. In 1923 the Bank of Latvia was founded and provided by the state with a capital of 10,000,000 lats.

The total foreign debt amounted to 39,360,000 lats in the middle of 1922, of which one-third had been paid off by the middle of 1925. At the end of 1925 there remains a debt of 5,500,000 dollars to the United States for famine relief in the summer of 1919, and of about £1,350,000 newly regulated debt to England for War deliveries. The finances in the last three years have been very soundly handled; not only has the foreign debt been considerably reduced, but loans to the value of 30,000,000 lats were made from current revenue. The Budget of 1925–6 provides for further loans amounting to 35,000,000 lats from current revenue for agricultural purposes and for the construction of railways. The actual revenue for 1924–5 amounted to 215,680,000 lats and expenditure to 214,000,000. The Budget for 1925–6 balances at 160,000,000 lats (excluding railway receipts and the expenses of the spirits monopoly).

Trade.—Latvia's trade balance has been adverse since 1920. The official figures showed the following results:—

Calendar year	Imports (In millions of gold lats)	Exports (In millions of gold lats)
1920	97·0	62·3
1921	73·4	28·9
1922	107·4	102·0
1923	211·9	162·0
1924	256·4	170·6

But an inquiry undertaken by the Latvian "Ekonomists" in 1925 No. 22 showed that the import figures were 10% too high.

Taking into consideration the circumstance that the 221,000 refugees who had returned since the middle of 1920 had brought back at least 33,000,000 lats, that moreover the Letts who had emigrated to America had remitted at least 33,000,000 to Latvia, that goods in transit to Soviet Russia brought in 18,000,000, that unregistered exports amounted to about 40,000,000, etc., the "Ekonomists" reckoned that the balance of payments to Jan. 1 1925, in reality showed a surplus of 3,000,000 lats in favour of Latvia. The present writer considers, after comparing the figures of the Latvian exports and those of English statistics of imports, that the Latvian export figures are about 10% too low, so that in reality a surplus of about 55,000,000 lats would result in the Latvian balance sheet from 1920 to Jan. 1 1925. In the year 1925, the imports, according to official statistics, amounted to 280,000,000, the exports to 179,600,000 lats.

By reducing the import figure by 10%, and raising the export figure by 10%, the adverse balance is reduced from 70,000,000 to 41,000,000 lats. But unsold imported goods valued at 70,000,000 are said to be in Latvian warehouses. Meanwhile the adverse balance has created such anxiety, that Parliament decided in 1926 to increase the existing high customs duties of 20% to 100%.

Latvia's chief exports are timber amounting to about 60,000,000 lats, about four-fifths of which goes to England, and flax export amounting to about 20,000 tons, valued at 50,000,000 lats. In the calendar year (1925) the butter export was estimated to be 7,150,000 kilogrammes, valued at 30,300,000 lats.

The chief imports are textiles, 50,000,000 lats, machines 24,000,000, foodstuffs 70,000,000. In 1924 110,000 tons of rye and wheat were imported, 20,000 tons of sugar, 4,000,000 lats worth of tobacco. The imports of tea and coffee are small, also of fruits, on account of the high customs duties.

Agrarian Reform.—Under the agrarian laws, 499 private estates were appropriated in Courland with an area of 1,124,000 hectares; in Livonia 1,300,000 hectares; in Latgale about 750,000 hectares. But from this area must be deducted the old peasant properties, also forest and uncultivable land. In reality there remained for division among the newly established peasant properties in Livonia and Courland only an area of 832,000 hectares of agricultural land, *i.e.*, arable, meadow and grazing land, in Latgale rather more than 250,000 hectares. Up to June 15 1925, 82,761 new farms were established, enclosing 100,000 hectares of forest land. The newly founded peasant properties consisted of 15 to 17 hectares, the largest to 22 hectares. But included in the above-mentioned 82,761 new farms are about one-third garden and artisans' holdings with an area of about 2 to 3 hectares. A further 20,000 small holdings are to be established. The state has retained about 1,500,000 hectares of forest and about 500,000 hectares of uncultivable land, chiefly peat moor; the former landowning nobility have only retained 50 hectares of land each.

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LAUE, MAX VON (1879–), German physicist, was born Oct. 9 1879 at Pfaffendorf near Coblenz. He attended the universities of Strasbourg, Göttingen and Munich, and became an assistant in the University of Berlin, and later in Munich, being subsequently called to the University of Zürich as professor. From here he went to the newly formed University of Frankfurt (on the Main), finally proceeding to Berlin University as a director of the Institute for Theoretical Physics. He specialised in theoretical physics, and is regarded as one of the most zealous champions of modern theories, and especially of Einstein's theory of relativity. He also devoted his attention to the quantum theory, to the Compton-effect (alteration of the frequency of Röntgen rays), to Bohr's atomic model, to the "Einstein-Bohr equation" and the disintegration of atoms. In 1914 he was awarded the Nobel prize for physics. Besides his work for scientific publications, he also writes for the daily Press.

Since 1910 he has published the following books: *Ueber e. Versuch z. Optik d. bewegten Körper* (1911); *Die Beugungserscheinungen an vielen unregelmässig verteilten Teilchen* (1915); *Ueber d. Möglichkeit neuer Versuche an Glühelektroden* (1919); *Die Relativitätstheorie* (1919); *Ueber d. Auffindung d. Röntgen-strahlinterferenzen* (1920); *Das physikalische Weltbild* (1921); *Die Bedeutung d. Nullkegels in d. allgemeinen Relativitätstheorie* (1922); *Die Lösungen d. Feldgleichungen d. Schwere v. Schwarzschild* (1923); *Zur Theorie d. v. glühenden Metallen ausgesandten positiven Ionen und Elektronen* (1924); and with Dr. W. Gordon, *Ein Verfahren z. Bestimmung d. Wärmeleitfähigkeit bei Glühtemperaturen* (1922).

LAUNDRY WORK (*see* 16.282).—Modern laundry work in its commercial aspect requires an elaborate mechanical plant very different from the crude appliances which were the first outgrowth of domestic processes of treading, pounding or rubbing. Its success owes much also to chemistry, by which suitable soaps, bleaches and solvents have been evolved.

Machinery.—The washing-machine consists of a horizontal outer drum in which revolves the inner cylindrical cage which holds the clothes. This cage is divided into compartments of various sizes, thereby offering a chance for sorting the clothes and so reducing, or almost eliminating, the need of marking garments. Within each compartment, wash bags, "nets," are frequently used to hold fabrics of the same kind, thereby safeguarding delicate garments. The machine is equipped with hot and cold water and high-pressure steam, the latter serving as a heating as well as a sterilising medium. With the rotation of the cage, which is reversed by automatic gearing every few revolutions, the clothes are rubbed or pounded, producing a displacement of dirt through the soap and water which are forced through the fabric. The operations of soaking, washing, bleaching (when needed), sterilising, rinsing, blueing and even starching, are done in the machine without removal of the garments and often without inspection during the process. Sterilising was formerly accomplished through boiling (212° F.), a process which, due to its tendency to weaken the fabric, has been replaced by keeping the garments at about 180° F. for a time sufficient to effect the result. Stains insoluble by soap and water require special chemical cleansing (*see* DRY CLEANING).

The process of drying, formerly accomplished by twisting by hand or pressing between hard rubber revolving wringers, is effected industrially by machines which in recent years, have been adapted for use in the home (*see* HOUSEHOLD APPLIANCES). The extractor consists of a metal basket revolving in a closed outer drum. There are two types, the "under-driven" and the "over-driven." The latter is used for the heavy-type work like the wet-wash or bundle work. The basket makes 1,000 to 1,400 revolutions a minute, the water being expelled by centrifugal force until the desired degree of dryness is attained. The drying is completed by means of box dryers, which, in their more improved form, consist of a heated revolving cage, called a tumbler, within which hot air is agitated by means of suction fans and blowers. This device prevents the yellowing and scorching of fabrics through excessive heat and eliminates the adherence of lint to the clothes. A softer finish also is imparted by this means to woollen garments and the time required for finishing is greatly reduced.

Ironing.—Having been washed, starched and dried, the garments are then transferred to the ironer. The earlier form of ironer was the box mangle, by which clothes were calendered as in paper or textile manufacturing. This mangle, sometimes known as the "flat-work ironer," has been replaced in more up-to-date laundries by gas and steam-heated revolving rolls, which press against concave beds of polished metal or overfelted rolls, as a flat iron is used on a padded ironing table. Ironers may be operated by hand, gas, gasolene, electricity or steam. While it was formerly customary for laundries to charge for work by the piece, a "rough dry" service has been widely offered, in which the cost is based on weight, none of the work being ironed. Another service is "float iron," in which everything is pressed by the "flat-work ironer," the cost being considerably less than for work finished by hand.

Statistics.—The annual volume of business done by laundries in the United States in 1923–5 was between $300,000,000 and $500,000,000. The production of laundry machinery in 1923 was valued at $19,000,000, an increase of 46% over the corresponding figure for 1921. In the same period the output of home washing-machines increased 69%, standing at $57,000,000 in 1923. These increases reflect several economic and social factors, the more important being an increase in wealth and the scarcity of domestic help, both of which have operated to transfer laundering from the home to central plants. The same factors have led to the installation of numerous electric washers and ironers in the home. The popularity of light, delicate fabrics in women's garments together with the lavish use of colour have placed an added burden on laundries, making necessary the services of textile experts. The interests of the industry are furthered by laboratories, research bureaux and professional schools financed by the trade. Trade papers, courses in technical schools, cooperation among operators, and other factors have done much to improve the status and efficiency of the industry.

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LAURIER, SIR WILFRID (1841–1919), Canadian statesman (*see* 16.286), was defeated at the general election in 1911, but remained leader of the Opposition until his death. Previous to the dissolution of Parliament in 1911, he had begun negotiations for reciprocity with the United States which was vigorously opposed in the Dominion House of Commons, and was, in a manner, responsible for the fall of his party. The Banking Act introduced by the Conservative party was much on the same lines as that outlined by Sir Wilfrid during the last years of his administration. In the prolonged naval debate in 1913 Sir Wilfrid urged the maintenance of a purely Canadian Navy. At the outbreak of the World War in 1914 he eloquently defended Great Britain's cause and supported the urgent measures that were adopted for the maintenance of the Canadian troops. He was however strongly opposed to conscription on the ground that it was a departure from the enactments of the Military Service Act, and a still wider departure from the principles of constitutional government. When Sir Robert Borden was invited to attend continuous meetings of the War Cabinet in London, Sir Wilfrid expressed his desire to facilitate public business in Canada in order to make the absence of the Premier possible. He declined, however, to enter the Cabinet in the Coalition Government. In 1918 Sir Wilfrid took part in the debate on hereditary titles and honours in Canada and was pronounced in his utterances against them. He died in Ottawa Feb. 17 1919.

LAUSANNE, CONFERENCE OF:—The Conference of Lausanne, between the Turkish Govt. established at Angora, and the gov-

ernments of the four principal Allied Powers (Great Britain, France, Italy, Japan), Greece, Bulgaria and Yugoslavia, with the United States represented by an observer, lasted, with a break in the middle, from Nov. 20 1922 to July 24 1923, and resulted in the signatures of no less than 17 diplomatic instruments.

The most important of these were:—

1. The Treaty of Peace itself (July 24 1923).
2. Convention respecting the régime of the Straits (July 24 1923).
3. Convention respecting the Thracian frontiers (July 24 1923), under which neutralised and demilitarised zones were established.
4. Convention respecting conditions of residence and business and jurisdiction in Turkey (July 24 1923), to replace the capitulations.
5. Commercial convention (July 24 1923).
6. Convention respecting the exchange of Greek and Turkish populations and protocol (Jan. 30 1923).
7. Greco-Turkish agreement on the restitution of interned civilians and the exchange of prisoners of war (Jan. 30 1923).
8. Declaration relating to the administration of justice (July 24 1923) to replace the capitulations (No. 11).
9. A protocol relating to the evacuation of the Turkish territory occupied by the British, French and Italian forces, and declaration (July 24 1923) (No. 14).
10. Protocol relating to the Karagach territory, and to the islands Imbros and Tenedos (July 24 1923) (No. 15).
11. Protocol relating to treaties regarding the protection of minorities in Greece, and regarding Thrace, which had been concluded on Aug. 10 1920 between Greece and the principal Allied Powers (July 24 1923) (No. 16). (*See* DARDANELLES; DEDEAGAACH; MOSUL; TURKEY.)

Conditions before the Conference.—The Lausanne Conference took place under conditions quite different from those which had prevailed during the Peace Conference of Paris, and the resulting diplomatic instruments therefore bore a different stamp from the four European peace treaties and the instruments subsidiary to them. At the time of the Paris Conference the Powers just defeated in the War of 1914–8 had been temporarily impotent, and the victorious Powers had agreed among themselves as to what the terms of peace should be. The draft treaties embodying inter-Allied agreements had simply been submitted to the defeated Powers for their observations, which the victors had then accepted or rejected at their discretion, after which the vanquished parties had been compelled to sign the instruments by *force majeure*. At the conference of San Remo (*q.v.*) a peace treaty between the Allies and Turkey had been drawn up by the same procedure, and after the representatives of the Ottoman Govt. of Constantinople had submitted their observations, and these observations had been rejected, they were compelled, at Sèvres, on Aug. 10 1920, to sign the terms presented to them. By this time, however, the Constantinople Govt. had ceased to exercise any authority in Turkey outside the narrow areas under the military occupation of the principal Allied Powers. The greater part of the country was under the effective control of a new national government seated at Angora; and this Govt. was carrying on a war against the Greeks (who had landed at Smyrna on May 16 1919, at the invitation of Great Britain, France and the United States).

The Angora Govt. repudiated the Treaty of Sèvres, and continued to fight for the terms laid down in the Turkish National Pact of Jan. 28 1920. In Sept. 1922 the Greco-Turkish War in Anatolia was brought to a decision by the complete victory of the Turkish Nationalist forces, who drove the Greeks into the sea, and came into direct contact with the British forces in the zone of the Straits. On Sept. 23 1922 the principal Allied Powers invited the Angora Govt. to a peace conference on two bases: (1) the restoration of Turkish sovereignty over Constantinople and Thrace up to the line of the river Maritsa; (2) the exclusion, pending the final settlement of Turkish military forces from Thrace, and respect by the Turks for certain zones adjoining the Straits which the Allied authorities had declared neutral during the Greco-Turkish conflict. On Sept. 23 the Angora Govt. accepted this invitation, and proposed a preliminary armistice conference, which met at Mudania on Oct. 3 and resulted in the signature of an armistice convention on the 11th.

Results of the Conference.—Thus the Turkish delegates came to Lausanne as victors in their recent local war with the Greeks, and on an equal footing with the principal Allied Powers, by whom they had been defeated four years earlier in the War of 1914–8. Indeed, during the whole period of the Lausanne conference, the Turks were less unwilling to resume hostilities than were the principal Allied Powers, who had long ago demobilised the greater part of their forces in the East under pressure from their taxpayers, and who could now no longer call upon the Greeks to fight their battles for them. This complete reversal of the situation reflected itself in the contrast between the terms of the Treaty of Lausanne and the Treaty of Sèvres, as well as in the method by which the Lausanne conference was conducted. This conference was noteworthy as the first meeting between ex-allies and ex-enemies in the World War, in which peace was negotiated and not dictated. In this respect it anticipated the London reparations conference of 1924 and the Locarno security conference of 1925.

The Turkish Gains.—In brief, the Turks secured at Lausanne practically everything which they had demanded in their national pact. In respect of territorial boundaries, the former Arab provinces of Asiatic Turkey, which had been detached from Turkey as a result of the World War and had been mandated to France and Britain under the supervision of the League of Nations, were not restored, but otherwise Turkey recovered everything which she had possessed in 1914, particularly Smyrna, Constantinople and Eastern Thrace. Even as regarded the Arab territories, she obtained some concessions, since the Lausanne Treaty confirmed the rectification of the northern frontier of Syria in Turkey's favour, which had been made by the so-called "Franklin-Bouillon" Agreement of Oct. 20 1921, while the destiny of the Mosul province was referred, by agreement between Turkey and Great Britain, to the League of Nations. In regard to the Dardanelles and the Bosporus, the settlement made at Lausanne has been described elsewhere (*see* DARDANELLES). The special spheres of influence in Anatolia which had been assigned to France and Italy by a tripartite agreement of Aug. 10 1920, between these two Powers and Great Britain, were tacitly dropped, and there was no further question of giving autonomy to Northern Kurdistan or of ceding Turkish territory to the Armenian Republic of Erivan, which had now been included in the dominions of Turkey's ally, the Union of Socialist Soviet Republics.

Again, no restrictions were imposed on the Turkish naval and military forces, and no control was asserted by the Allies over Turkish finance, though certain financial questions, such as the rate of exchange at which the pre-War creditors of Turkey were to receive payments, remained contentious. The capitulations under which foreign residents in Turkey had lived since the 16th century were swept away, and the only special safeguard left to foreigners was the institution of legal councillors, without executive power, who were to be nationals of ex-neutral states. As for such minorities as remained in Turkey after the great exodus of Christians from Anatolia and Eastern Thrace which accompanied the Greek débâcle of 1922, it was settled at Lausanne that they should receive all, and only, the guarantees which had been secured to minorities in Europe in the special minority treaties or minority clauses in the peace treaties signed after the World War. Meanwhile, on Jan. 30 1923, the Greek and Turkish delegations had signed a separate convention providing for the compulsory interchange of minorities left on the wrong side of the new frontier, with a special exemption in favour of Christians domiciled in the city of Constantinople, and of Moslems domiciled in Western Thrace.

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LAVERAN, CHARLES LOUIS ALPHONSE (1845–1922), French physician, was born in Paris June 18 1845 and was educated at the Strasbourg faculty of medicine. In 1874 he joined the staff of the Val-de-Grâce military school of medicine, and four years later was sent to Algeria. He remained there until 1883 and in

1884 was appointed professor of military hygiene and clinical medicine at Val-de-Grâce. In 1894 he relinquished these posts and took up work at Lille and Nantes. He was in 1895 elected a member of the French Academy of Science. His chief contribution to medical science was his discovery of the *hématozoaire*, a parasite that causes malarial fever. He was the author of important studies of sleeping sickness and of the rôle played by mosquitoes in epidemics. Laveran, who retired from active practice in 1897 and received the Nobel Prize for medicine in 1907, died in Paris May 18 1922.

His works include *Traité des maladies et des épidémies des armées* (1875); *Du Paludisme et son hématozoaire* (1891); *La prophylaxie du Paludisme* (1903); with Félix Mesnil, *Trypanosomes et trypanosomiases* (1912).

LAW, ANDREW BONAR (1858–1923), British statesman, was born in New Brunswick, Canada, Sept. 16 1858, the son of a Presbyterian minister, the Rev. James Law, by his marriage with Eliza, daughter of William Kidston of Glasgow. A Scot on both sides, he came to Scotland when still a boy and finished his education at Glasgow High School. He entered at once into commercial life in Glasgow, and became a member of a kinsman's firm, William Kidston and Sons, iron merchants, subsequently joining William Jacks & Co., also iron merchants. After acquiring a sufficient competence in business, he went into Parliament in 1900 as Conservative member for the Blackfriars division of Glasgow.

His commercial experience had led him to the conclusion that free trade, in the Cobdenite sense, was no longer beneficial for Great Britain. A speech which he made on April 22 1902, in favour of Hicks-Beach's corn duty, having favourably impressed the House, he was promptly appointed parliamentary secretary to the board of trade in the Conservative Government. When Mr. Chamberlain started his tariff reform movement in 1903, he found a warm supporter in Mr. Law, who wished to see more raw material imported and fewer manufactured goods, who resented "dumping," and who held the true field of commercial expansion to be within the Empire and therefore advocated preferential duties. Mr. Law shared in the general rout of the Conservatives in Jan. 1906, and had another electoral mishap in Dec. 1910; but in each case came back to the House shortly at a by-election, and took his full share in the Opposition attack on Mr. Lloyd George's 1909 budget and on the Parliament Bill. He kept aloof from the "Die-hard" movement, and warmly defended his leader, Mr. Balfour, from the reproaches cast upon him. This loyal attitude, no doubt, was one of the reasons, and his strong Tariff Reform programme was another, which recommended him to his party as Mr. Balfour's successor in the leadership when the claims of Mr. (afterwards Sir) Austen Chamberlain and Mr. (afterwards Lord) Long appeared to divide the Conservatives pretty evenly. Both the rivals stood aside, and on Nov. 13 1911 Mr. Law was unanimously elected leader in the Commons, Lord Lansdowne continuing to lead the party in the Lords.

As Opposition leader, Mr. Law was very trenchant in his criticism of the Government, and put up a strong fight against the ministerial bills introduced to take advantage of the Parliament Act, his principal concern being the Home Rule Bill, and the situation created in Ireland by its introduction. At Easter 1912 he went to Belfast, and, at a great demonstration presided over by Sir E. Carson, encouraged the Ulstermen to trust to themselves; and at a large Unionist gathering at Blenheim on July 27 he said that the Ulster people would submit to no ascendancy, and that he could imagine no lengths of resistance to which they might go in which he would not be ready to support them, and in which they would not be supported by the overwhelming majority of the British people. Meanwhile, he had to deal with differences inside his own party as to the extent to which the Tariff Reform policy should be carried. A considerable section, especially strong in Lancashire, were definitely against any duties on food; and the assurances which Mr. Law gave in a speech at Ashton-under-Lyne on Dec 16 1912 did not convince them that there was no possibility of food taxes being imposed without reference to the people. As the party dreaded a split, Mr. Law and Lord Lansdowne, in response to a general appeal, gave on Jan 14 1913 a formal promise that food duties should not be imposed without the approval of the electors at a subsequent general election. The imminent danger of the Ulster problem, on which Mr. Law had insisted for two years, brought ministers in 1914 to express a readiness for compromise; but no settlement, satisfactory to the Opposition, had been formed when the World War supervened.

Directly the crisis became acute Mr. Law wrote, on Sunday Aug. 2, on behalf of Lord Lansdowne and their colleagues, tendering to Mr. Asquith the unhesitating support of the Opposition in any measures necessary to support France and Russia; and when hostilities began he aided the national cause and promoted recruiting by speeches at the Guildhall, London, and in Belfast and elsewhere. Even when criticism of the management of the War began legitimately to spring up in the early months of 1915, he used his influence to repress or moderate its expression in Parliament. He promptly accepted Mr. Asquith's proposal in 1915 to assist in forming a Coalition Govt. and brought seven of his colleagues into the Cabinet, accepting himself the Colonial Secretaryship. He took charge in the House of Commons of the first military service bill in Jan. 1916 and got it through all its stages with little difficulty. He promoted the economic conference in Paris in June 1916 and, as principal representative of his country, was largely influential in carrying through the co-operative and protective resolutions then adopted. He was a member of the War Committee of the Cabinet, but, like Mr. Lloyd George, he was far from satisfied with its organisation and powers. It was natural therefore that he should be one of the four persons, besides Mr. Lloyd George, to whom that statesman, forcing the issue on Dec 1 1916, asked Mr. Asquith to confide the absolute conduct of the War. In the confused crisis which followed, the Premiership was offered to Mr. Law; but he recognised that Mr. Lloyd George was the Prime Minister whom the nation demanded, and to a Ministry formed under him, the Conservative leader brought the full cooperation of his party.

In this second coalition, Mr. Law, whose followers supplied the main body of the ministerial supporters, was partner rather than second-in-command of his chief. Besides Chancellor of the Exchequer and member of the War Cabinet, he became leader of the House of Commons, so as to enable the Prime Minister to devote the whole of his energies to the prosecution of the War. The House was at first disposed to resent this arrangement; but before long its respect and indeed affection were won by its new leader's business habits, his courtesy, his readiness to yield in non-essentials coupled with firmness in essentials, his exceptional clearness of head and of expression, and his extraordinary capacity for impromptu reply, without taking a note, at the close of a long debate on an intricate subject involving perhaps complicated figures.

It was his duty, as Chancellor of the Exchequer, to find the money to meet the gigantic cost of the War, and this was done principally by means of two great loans and by numerous increases of taxation. The first loan was launched in Jan. 1917, and its basis was the issue of a 5% Government Stock at 95, while there was also a 4% tax-compounded loan issued at par. This brought in £1,000,312,950 from 5,289,000 subscribers. The second loan, launched in Oct. of the same year, was in form of National War Bonds, combining the advantages of short-term securities such as Exchequer bonds, and three sorts of longer-dated securities for 7 and 10 years, interest being, as before, 5% or 4% tax-compounded. The amount was unlimited; all the securities were for continuous sale till further notice, so that there might be a steady and persistent flow of money loaned to the State. This novel device was most successful. Down to Jan. 11 1919, £1,446,625,613 of these bonds had been sold, and nearly £50,000,000 small post-office bonds in addition.

Mr. Law's first budget, that of 1917, only raised the excess profits tax from 60 to 80%, and increased the taxes on entertainments, tobacco and dogs. But in his second budget, in 1918,

he imposed additional taxation calculated to bring in £114,000,000. Income tax was raised from 5s. to 6s.; farmers' tax was doubled; supertax was increased; the stamp on cheques became 2d.; beer and spirit duties were doubled and tobacco and match and sugar duties raised; letters were to be 1½d. and postcards 1d. It must have been with peculiar gratification that Mr. Law announced in April 1917 that the Imperial War Cabinet had accepted the principle of imperial preference. Throughout the War he opposed a firm front both to pacifists and to pessimists, and never doubted that there could be no peace "until the Germans are beaten and know that they are beaten."

As the general election of 1918 approached he responded heartily to Mr. Lloyd George's proposal that the Coalition should be continued to forward after-War reconstruction, and he joined with him in issuing the letters, or certificates, nicknamed "coupons," accepting coalition candidates. The Coalition obtained an immense majority, and among the Coalitionists Mr. Law's special followers, the Unionists, had a considerable predominance. When the Ministry was reconstituted in Jan. 1919 the arrangement by which Mr. Law led the House was continued, as the Prime Minister would be much away at the Peace Conference; but he was relieved of the Exchequer, and took the sinecure office of Privy Seal. He was one of the British peace plenipotentiaries, though his duties at Westminster seldom permitted him to go to Paris; and he appended his signature to the Treaty of Versailles. During 1919 and 1920 he had a strenuous time, dealing with after-War disorders and projects, and in particular with the passing of the Home Rule Act of 1920, constituting two subordinate Governments and Parliaments in Ireland.

Mr. Law's incessant labours during and after the War undermined his health, which suddenly broke down in March 1921; and, on the advice of his medical advisers, he resigned office at once, and went away to rest in the south of France. His retirement was felt in Parliament as a personal loss, and there was corresponding satisfaction when he returned in the autumn greatly (but not, as it turned out, permanently) restored, and took part in recommending the Irish Treaty to the House of Commons. During the first half, and more, of 1922 he only spoke occasionally, but he watched carefully the increasing reluctance of the Conservative party to support Mr. Lloyd George and the Coalition; a reluctance which had indeed resulted in the formation of a large group of independent "Die-hards" under Lord Salisbury's leadership. When the question was brought to an issue at the Carlton Club meeting on Oct. 19, the decisive factor was Mr. Law's declaration that the only method of preserving the unity of the party was to come out of the Coalition and to appeal to the country as an independent body. Mr. Lloyd George at once resigned, and Mr. Law, after being unanimously elected to his old post of party leader, formed a purely Conservative Government, which did not include the most prominent Conservative Coalitionists. His action was endorsed by the country at the general election in Nov., when the Conservatives returned 344 strong, a majority of 74 over all other parties put together. He at once reduced the inflated Cabinet secretariat, and restored the Foreign Office to its former position in the official hierarchy; and he carried through Parliament the bill to establish the Irish Free State Constitution.

Though he proclaimed the policy of his Government to be one of tranquillity and stability, he found himself in the winter deeply involved in political troubles. Unemployment was rampant, with Labour unrest and housing problems threatening; a European Conference at Lausanne proved impotent in face of the obstinacy of Nationalist Turkey; and M. Poincaré, the French Premier, insisted, in spite of Mr. Law's personal intervention at Paris, on despatching a French military expedition to the Ruhr to exact reparations from Germany. Mr. Baldwin, his Chancellor of the Exchequer, did indeed succeed in concluding in January at Washington an arrangement to fund the British war debt to the United States; but the terms were so severe that the Prime Minister was at first reluctant to accept them. After such an anxious winter it is not surprising that in the spring his health once more gave way, and he resigned office on Whitsunday, May 20, after a Ministry which only lasted 209 days. He survived for five months, dying on Oct. 30 1923. He was buried in Westminster Abbey, with every sign of general and genuine mourning, the pallbearers including the Prince of Wales, and past, present and future holders of the office of Prime Minister. He married in 1891 Annie Pitcairn, daughter of Harrington Robley, of Glasgow, by whom he had a family; but he was left a widower in 1909. Two sons perished in the World War. (G. E. B.)

LAWN TENNIS (*see* 16.300).—The recent history of lawn tennis may conveniently be dated from the year 1911. In that year the late Anthony Wilding (killed on the Menin Road during the World War) was defending his title to the world championship he had won in 1910, and one of the Wimbledon championships was won by France for the first time when Max Decugis and André Gobert beat Wilding and Ritchie in the challenge round of the Men's Doubles. In that year, also, Mrs. Lambert Chambers defeated her challenger, Miss Boothby, herself an ex-champion, by 6–0, 6–0.

France might have advanced still further in 1912, but André Gobert always seemed to be fated to break down at Wimbledon. In those days the champion (in this case still A. F. Wilding) had to stand out while the rest of the players fought for the honour of meeting him. Gobert met A. W. Gore, and looked a certain winner until the English player managed to pass him two or three times at the net and broke up his brilliant attack. Gore, however, failed to beat Wilding, who was at this time approaching the zenith of his powers.

Wilding and McLoughlin.—The year 1913 can fairly be described as the first big "boom" year in lawn tennis, the reason being the presence of a great personality. This was a 24-year-old boy named Maurice McLoughlin, who had won the championship of America the year before. He was called the "American comet" and, with his merry eyes and his mop of red hair he instantly took the fancy of the great international crowd at Wimbledon. His service was tremendously fast, but swerved and broke as well, and like Tilden's and Patterson's of a later day, it frequently beat his opponent outright—a feat rarely accomplished in first-class tennis today. It swept him straight through the competition, past J. C. Parke and S. N. Doust, then at their best, with only one check when Roper Barrett took the match to five sets by sheer finesse. But Wilding to the surprise of everyone, instead of standing back to McLoughlin's service, stood up to it, and after a few failures, seemed to send it back harder the harder it came at him. It was a great battle, possibly one of the greatest Wilding ever fought. Roper Barrett and C. P. Dixon beat the crack German players Rahe and Kleinschroth for the Men's Doubles, while Mrs. Lambert Chambers, returning after a year's absence, once more won the Ladies' Singles quite easily. The prestige of British tennis was retrieved.

The year 1914 has been very rightly called "Brookes' year." Brookes had not been at Wimbledon since 1907 when he won his second championship, and there was a good deal of speculation as to whether in view of the improved standard of play he would be able to hold his own. On this occasion the international element was less prominent as the American champion, R. N. Williams, was not competing, but in any case, judging by form, it is doubtful if he could have beaten Brookes. The English players were largely what were coming to be termed "the old guard." Their skill was waning, and it was left to a German, Fritzhein, to give Brookes the most stubborn contest. It was touch and go all the way through the fifth and deciding set, but the old champion's steadiness and generalship pulled him through. Wilding won the doubles in company with Brookes, and, once again, Mrs. Lambert Chambers proved that she had no really dangerous rival among the women.

G. L. Patterson.—The years of the World War saw little championship lawn tennis, even in those countries which were not directly involved. In America R. N. Williams, W. M. Johnston and Maurice McLoughlin shared the highest honours,

but, even there, in 1917, there was no competition. But as soon as the War was over there was a vigorous revival and a real beginning of a world-wide competition. The year 1919 saw many newcomers with many new styles, but perhaps the most notable was the Australian, G. L. Patterson, one of the most forceful players ever seen on a tennis court. His style was not unlike that of Maurice McLoughlin, and his fastest service was almost untakable. He depended on it very largely, but, as was shown in the following season, he had weak points of which advantage could be taken once the fierceness of his first onslaught was checked. In the final he beat A. R. F. Kingscote, the English international. In 1919 Mlle. Lenglen beat Mrs. Lambert Chambers.

Tilden and the "All Court" Game.—In 1920 William T. Tilden, probably the greatest player the world has ever known, made his first appearance in this country, and defeated Patterson, the holder of the championship. He was the first American champion. There was a notable feature about Tilden's victory, and indeed about the play of all the Americans. For some time lawn tennis, although increasing in speed, had, in the opinion of many of the best judges, been declining in skill and finesse. There had for some time been a reign of the serving and volleying specialists, but Tilden and his compatriots brought back to England what is known as the all-court game. This tradition, which demands that a player shall be master of every shot, was first laid down by Renshaw, and Pim, Baddeley, the Dohertys and Wilding strengthened it. The ascendancy of the all-court game was completed by the victory of Williams and Garland in the Men's Doubles.

In 1921 lawn tennis became still more a cosmopolitan game and there was a large increase in the entries for the World Championship from European countries. The meeting was memorable for the contest between Tilden and a young South African, B. I. C. Norton. The brilliant promise which the latter had shown was naturally gratifying to British spectators, for there had been no British Singles Champions since 1909, only one British finalist in the All-comers since 1912, and no British lady champion since 1914. It was true that Lycett and that remarkably versatile sportsman Max Woosnam had won the Doubles Championship, but this was the only honour which the Empire held, save Lycett's further participation in the Mixed Doubles honour with Miss Ryan. Tilden, although ill, insisted on playing, and almost paid the penalty. The first set opened rather tamely, with Tilden leading, but suddenly Norton blazed out and took the set 6–4. He followed this up by winning the next set 6–2, and the defeat of the champion seemed inevitable. Then there came an inexplicable collapse. Norton lost the next two sets 6–1, 6–love. Nevertheless even then he was able to keep the issue in doubt to the last, and twice was within a stroke of victory and the world championship before he lost the final set, 7–5.

The New Wimbledon.—The New Wimbledon was opened in the following year (1922). The title "world's championships" was dropped, the meeting being now designated simply "the championships." The fact that there were no American entries in 1922 was erroneously attributed to this change. But if there were no Americans there were worthy challengers from Australia. Patterson, the ex-champion, J. O. Anderson and P. O'Hara Wood were a trio of Australia's best and figured in everything until the finish. Patterson, who had seen the wisdom of playing an all-round game, beat Lycett in the championship, but Lycett had his revenge when, in one of the greatest Men's Doubles matches ever fought, he and Anderson, after looking hopelessly beaten, snatched a glorious victory from Anderson's compatriots Patterson and P. O'Hara Wood. Miss Ryan and Mlle. Lenglen won the Doubles, for the fourth year in succession. The latter won the Ladies' Singles, her opponent in the final round being Mrs. Mallory.

An American Year.—America was supreme in 1923. Not only did she win the Davis Cup again, with comparative ease, but also, sending her players over to Wimbledon without the assistance of Tilden, won the championship with W. M. Johnston, while another American, F. T. Hunter, was Johnston's opponent in the final. There was also in Europe in 1923 an American player, Vincent Richards, barely 20 years of age, who certainly had all the promise of becoming as great a champion as his tutor, Tilden.

Winners of the Championships at Wimbledon, 1911–26

Year	Gentlemen's Singles	Ladies' Singles	Gentlemen's Doubles	Mixed Doubles	Ladies' Doubles
1911	A. F. Wilding	Lambert Chambers	M. Decugis and A. H. Gobert		
1912	A. F. Wilding	Larcombe	H. Roper Barrett and C. P. Dixon		
1913	A. F. Wilding	Lambert Chambers	H. Roper Barrett and C. P. Dixon	Hope Crisp and Mrs. Tuckey	McNair and Boothby
1914	N. E. Brookes	Lambert Chambers	N. E. Brookes and A. F. Wilding	J. C. Parke and Mrs. Larcombe	Ryan and A. M. Morton
1915–8		*No Competitions*			
1919	G. L. Patterson	S. Lenglen	R. V. Thomas and P. O'Hara Wood	R. Lycett and Miss Ryan	Lenglen and Ryan
1920	W. T. Tilden	S. Lenglen	R. N. Williams and C. S. Garland	G. L. Patterson and Mlle. Lenglen	Lenglen and Ryan
1921	W. T. Tilden	S. Lenglen	R. Lycett and M. Woosnam	R. Lycett and Miss Ryan	Lenglen and Ryan
1922	G. L. Patterson	S. Lenglen	R. Lycett and J. O. Anderson	P. O'Hara Wood and Mlle. Lenglen	Lenglen and Ryan
1923	W. M. Johnston	S. Lenglen	R. Lycett and L. A. Godfree	R. Lycett and Miss Ryan	Lenglen and Ryan
1924	J. Borotra	K. McKane	V. Richards and F. T. Hunter	J. B. Gilbert and Miss McKane	Wightman and H. Wills
1925	R. Lacoste	S. Lenglen	R. Lacoste and J. Borotra	J. Borotra and Mlle. Lenglen	Lenglen and Ryan
1926	J. Borotra	Mrs. L. A. Godfree	H. Cochet and Z. Brugnon	L. A. Godfree and Mrs. Godfree	

Borotra and Lacoste.—The fact that the Olympic games were taking place in Paris a fortnight after Wimbledon, contributed to make the international entry of 1924 one of the greatest in the history of the championship. For the first time the device of " seeding the draw, " as it is called, was adopted. Under the old system it was quite possible that, if, say, America's four best players had entered for the championship, their names might come out of the hat one after the other, in which case two would disappear in the first round and one more in the second. This luck of the draw imposed great hardships on players who might have travelled some 6,000 miles to try their luck, and it was decided, internationally, that overseas associations might nominate not more than four players in singles, or four pairs in doubles, as representative players, and that these players should be drawn in four separate quarters of the draw. Smaller numbers were treated proportionately and the result proved excellent. Of course it was still possible that the two best players of two different countries might meet in the first round but that in fact did not occur.

Washer, the hard-hitting Belgian international, disposed of Brookes in the fourth round, and then, in " the last eight " were left Lacoste (France), Washer (Belgium), Williams (America), Kingscote (England), Borotra (France), Richards (America), Raymond (South Africa) and Washbourn (Africa). For the first time two Frenchmen, Jean Borotra and Rene Lacoste, appeared in the final. Borotra's brilliance, on this occasion, triumphed over Lacoste's steadiness, although in the remarkable repetition of that final, for Borotra and Lacoste were to meet again for the title in 1925, the result was reversed in unmistakable fashion. America shared a similar honour in the Men's Doubles, Vincent Richards and F. T. Hunter winning over their fellow countrymen R. Williams and W. Washburn. Owing to illness, Mlle. Lenglen, who should have met the English champion, Miss K. McKane, in the semi-final, was obliged to retire. Miss McKane met Miss Helen Wills, the young player from America of whom much had been heard. After looking almost hopelessly beaten at one time, the English player pulled the game out of the fire and scored a brilliant victory. On the other hand, with the aid of Mrs. Wightman, Miss Wills carried off the Ladies' Doubles, beating Mrs. Covell and Miss McKane. Miss McKane finally held a doubles championship, for, with the English international J. B. Gilbert, she won the Mixed Doubles.

The year 1925 may be claimed as French. Lacoste met and beat Borotra, the champion, in the final, while Borotra and Mlle. Suzanne Lenglen won the Mixed from de Morpurgo and Miss Ryan. Mlle. Lenglen and Miss Ryan got back the title of Doubles Champions which they had held together for so long. French players also did well in 1926, although Mlle. Lenglen was obliged to withdraw. (S. L.)

LAWRENCE, DAVID HERBERT (1885–), British novelist, was born at Eastwood, Nottinghamshire, Sept. 11 1885, and educated at Nottingham High School and University College, Nottingham. With his first books, *The White Peacock* (1911), *The Trespasser* (1912) and *Sons and Lovers* (1913), it became evident that a writer of great force and originality was rising in the younger generation. A police prosecution of *The Rainbow* (1915) seemed for a time to check Lawrence's fertility, but he issued *Amores*, poems, and travel impressions, *Twilight in Italy*, in 1916, further poems, *Look! We have Come Through!* in 1917, and another novel, *The Lost Girl*, 1920. Hereafter Lawrence's outlook and style were being deeply influenced by a study of psychoanalytical doctrine and by travel in Italy, Sardinia, New Mexico and Australia: a new note is evident in *Women in Love* (1921), *Aaron's Rod* (1922), *Kangaroo* (1923), *The Ladybird* (1923), *England, My England!* (1924), *St. Mawr* (1925) and *The Plumed Serpent* (1926). Miscellaneous writings include *Sea and Sardinia* (1921), *Psychoanalysis and the Unconscious* (1921), *Fantasia of the Unconscious* (1922), *Studies in Classic American Literature* (1923), two plays, *The Widowing of Mrs. Holroyd* (1914) and *Touch and Go* (1920). He wrote also a historical study, *Movements in European History*, which was issued as by " Lawrence H. Davison " in 1921, and under his real name in 1925.

LAWRENCE, THOMAS EDWARD (1888–), British explorer and scholar, was born in Wales Aug. 15 1888, of a Leicestershire family one branch of which had moved to the neighbourhood of Dublin and thence to Oxford. The second of five brothers, he was educated at the Oxford High School and at Jesus College, Oxford, where, in 1910, he took a first class in modern history. In order to study Crusading architecture he made in that year a tour through Syria on foot; and the colloquial Arabic, which he then picked up, and his interest in and knowledge of archaeology, commended him to D. G. Hogarth, who was about to lead an expedition to Jerablus on the Euphrates and excavate the site of Carchemish for the British Museum. Thither Lawrence went in 1911, helped by a postgraduate endowment at Magdalen College; and at Carchemish he worked on and off till 1914, taking several opportunities to explore Syria and Mesopotamia in native company, and accepting for a few weeks an appointment under the Palestine Exploration Fund, which attached him to the Survey of North Sinai carried out by Col. Newcombe, R.E., for the War Office in the winter of 1913–4. Though naturally inclined to scholarship and letters, he showed singular practical ability and capacity for leadership, and a remarkable power of inspiring confidence in Arabs.

On the outbreak of the World War, Lawrence, being below standard height, obtained at first no more active service than a post in the geographical section of the War Office. But soon after Turkey had joined the Central Powers he was sent by Lord Kitchener to Egypt and attached to a rudimentary Military Intelligence Section. He was a moving spirit in the negotiations leading to an Arab revolt and in the organisation of the Arab Bureau which, as finally constituted early in 1916, acted as staff and intelligence office for the Arab campaigns. In the autumn Lawrence, feeling that stalemate would ensue if closer liaison between ourselves and the Arabs were not contrived, asked leave to go down to Jidda; and once there, was transferred definitely from military control to the Arab Bureau which was under the Foreign Office. Hearing good accounts of the Emir Faisal, he persuaded Sharif Hussain to let him go inland and visit the force which had been driven back from Medina. He soon won the confidence of Faisal, and induced him to reorganise his army and move North so as to threaten the communications of Medina by attacking the Hejaz Railway. When his chief was established at Wejh, and the army of another brother, 'Abdulla, had been brought to Wadi Ais to co-operate, Lawrence rode off into the interior to raise the northern tribes, and so extend the area to be held and defended by the Turks. He pushed right up to and beyond Ba'albek, *i.e.*, far behind the enemy lines in Syria, and on his return, having picked up a Huweitat force under the famous raider, Auda Abu Tayyi, he routed a Turkish battalion near Ma'an, and forced a passage to 'Aqaba which was occupied for Faisal in Aug. 1917. For this exploit he was promoted to field rank and given decorations, British and French, which, however, he would not accept.

Lawrence, now cordially helped by General Allenby, prompted the successive forward moves made by Faisal's force, after 'Aqaba had become its base, and himself organised and led a battle in Wadi el-Hesa, near Esh Shobek, in which the enemy suffered his worst defeat in the open. He turned his attention in particular to train-wrecking and had such success that Medina became virtually isolated, and a large reward was advertised for the capture of " El-Orens, destroyer of engines." Early in 1918 he made a desperate attempt to cut the Turkish Palestine army's railway communication with Damascus, and failed only by a hair's breadth. In that summer, in concert with Allenby, he induced Faisal to move up to Qasr Azraq and organise a new force to advance on Damascus. This duly moved up in the autumn side by side with Allenby's thrust and after breaking up the enemy's trans-Jordan army, entered Damascus some hours ahead of the British. Lawrence took charge of the city till Allenby could reach it, and suppressed attempts at reaction.

Called to the Peace Conference, Lawrence became one of its outstanding figures during the spring of 1919. His legendary fame as organiser and inspirer of guerilla tactics was enhanced by

the forcible part that he played when Faisal, whom he had accompanied on a British tour, came to Paris. But fight as Lawrence might against French plans for Syria, he could not prevail in that milieu, and at last, retiring to his tent, he sat down to write the narrative of his adventures. The first manuscript was subsequently lost; but he began again, and, after many recensions, it was announced that the book, under the title *The Seven Pillars of Wisdom*, would be issued in 1926. He was elected a Research Fellow of All Souls, Oxford, in 1919, and resided there for a year, but without much share in the college life. In 1921 Mr. Winston Churchill called him to the Colonial Office as Adviser on Arab affairs, in which capacity he had a large share in making Faisal King of 'Iraq. But, disgusted with the failure of the Allies to fulfil adequately what he considered their moral obligations to the Arabs, and remorseful for the part he himself had played in leading them on, Lawrence abruptly left Government service in 1922 and, abjuring all official rank and decorations and even his surname, enlisted as a mechanic in the Royal Air Force. Thence in 1923 unwelcome publicity drove him to hide in the Tank Corps, but, in 1925, he was re-transferred to the R.A.F., still as a mechanic, this being the only grade that he would accept. (D. G. H.)

LAWSON, VICTOR FREMONT (1850–1925), American editor and philanthropist, was born at Chicago, Ill., Sept. 9 1850, the son of Iver H. Lawson, a Norwegian immigrant, and educated at Phillips Academy, Andover, Massachusetts. He took charge of his father's interest in *The Daily Skandinavian*, and in July 1876 bought an interest in *The Chicago Daily News*, which had been organised six months before by Melville E. Stone as the first one-cent newspaper in the West. It was a four-page five-column daily. In 1881 Lawson and Stone started a morning edition called *The Chicago Record*, since discontinued. In 1888 Lawson bought Stone's interest, and remained sole proprietor until his death, Aug. 19 1925. His principal achievement was the development of *The Chicago Daily News* as a powerful newspaper with cultural influence; to this end he divorced politics and news; supported non-partisan organisations for investigating political candidates; maintained free public lectures; developed a wide-spread foreign news service, and established *The Daily News* fresh-air fund sanatorium for sick babies. His advocacy of a postal savings bank caused him to be called the father of the law establishing such a bank.

Lawson supported Stone in his development of the Associated Press, of which he was president from 1894 to 1900, and a director until his death. In 1923 the University of Michigan, and in 1924 Columbia University, gave him the degree of doctor of laws. He aided numerous colleges, hospitals, churches and schools; by the terms of his will his estate benefited, among many others, the Chicago Congregational Missionary and Extension Society, The Young Men's Christian Association of Chicago, The Chicago Theological Seminary (Congregational), the International Committee of the Young Men's Christian Association of New York City, Northland College, Berea College and the Northfield, Conn., schools. (H. H.*)

LAZAREV, PETR PETROVICH (1878–), Russian physicist, was born in Moscow April 1 1878. A doctor of medicine of Moscow University, he did research work in science at Strasbourg and in 1907 was appointed *Privatdozent* in physics and assistant to Prof. P. N. Lebedev at the University of Moscow. In 1912 he became professor at the technical college in Moscow, and in 1917 member of the Russian Academy of Sciences and director of the research institute of physics and biophysics in Moscow. Lazarev's early investigations were in photochemistry; he showed by experiment that the velocity of photochemical reactions is proportional to the absorbed energy and does not depend on the wave length of light. Another series of his investigations is in molecular physics. His main work is on the fundamental problem of biophysics—the stimulation of living matter. His ionic theory of stimulation explains the process of senses and of muscular contraction and forms the basis of his theory for the functions of the central nervous sytem. In 1918 Lazarev became head of the geophysical survey of the Kursk Magnetic and Gravimetric Anomaly. Some of his papers have been published in French (Comptes rendus de l'Académie, 1923–4) and in English (*Science, Lancaster, Pa.); Jour. of General Physiology* (Baltimore, 1924).

LEACOCK, STEPHEN BUTLER (1869–), Canadian author and economist, was born at Swanmoor, Hants., Dec. 30 1869 and went to Canada at the age of six. He graduated at the University of Toronto and became a master of modern languages at Upper Canada College, where he remained 1891–9. The next four years he spent in the graduate school of the University of Chicago, where he took the degree of Ph.D. In 1903 he was appointed to the staff of McGill University, Montreal, becoming professor of political economy in 1908, and subsequently head of his department. In 1907–8 he made a tour of the British Empire, lecturing on Imperial Organisation under the auspices of the Cecil Rhodes Trust. His serious work includes biographies of R. Baldwin and La Fontaine in the "Makers of Canada" series; *Elements of Political Science* (1906); and *The Unsolved Riddle of Social Justice* (1920). It was as the author of a number of delightful short stories, parodies and skits, however, that Prof. Leacock became most widely known to the general public. His humourous works include *Literary Lapses* (1910); *Nonsense Novels* (1911); *Sunshine Sketches of a Little Town* (1912); *Behind the Beyond* (1913); *Arcadian Adventures with the Idle Rich* (1914); *Moonbeams from the Larger Lunacy* (1915); *Further Foolishness* (1916); *Frenzied Fiction* (1918); *Winsome Winnie* (1920); *My Discovery of England* (1922); and *The Garden of Folly* (1924).

LEAD (*see* 16.314).—The principal lead producing countries in the world are now the United States, Spain, Germany, Australia, Mexico. Other important producers are India, Canada, Italy and Poland. Russia and China possess deposits of ore which, adequately worked, would yield a very large output, but at present their production is quite small. The United States has widely distributed deposits, and an output of at least four times that of any other country. The magnitude of her reserves, moreover, ensure her retaining this eminence for many years. The home market, however, consumes practically the whole of her production, the export being almost negligible.

Spain ranks second to the United States as a producer of ore, and, with Australia, is the largest exporter in the world. The principal German lead mines are in Upper Silesia, which, before the War, produced about half the ore smelted in the country, the balance being imported. Other deposits occur in Saxony, Nassau, Westphalia and the Black Forest. In Australia, the largest part of the output comes from Broken Hill, New South Wales. Before the War 50% of the production was shipped for smelting elsewhere, Germany being the principal buyer. Since the War, however, Australia has done her own smelting at Port Pirie (S.A.) and Cockle Creek (N.S.W.). Mexico has large quantities of lead ores, but disturbed conditions and inadequate communications militate against production in proportion to the country's resources. She has, nevertheless, a large output. The principal mines are situated in the northern and central states. The following table gives the production of lead ore of the countries mentioned in the years 1921, 1922 and 1923:—

Country	1921	1922	1923
	long tons	long tons	long tons
United States	370,081	426,458	487,135
Spain	133,677	117,484	125,465
Germany	36,500	39,400	27,500
Australia	83,878	151,929	171,857
Mexico	59,540	108,681	153,217
India	47,300	56,400	68,900
Canada	29,768	41,655	49,658
Italy	14,796	15,083	21,153
Poland	580	7,106	15,000
Russia[1]	1,500	2,000	2,000
China[1]	2,000	2,500	2,000

[1] Approximate.

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LEADER, BENJAMIN WILLIAMS (1831–1923), British painter (*see* 16.320), died at Burrow's Cross near Guildford, Surrey, March 22 1923.

LEAF, WALTER (1852–), British banker and scholar, was born at Norwood, London, Nov. 26 1852. Educated at Harrow and Trinity College, Cambridge, he graduated as senior classic in 1874, and in 1875 was made a fellow and in 1920 honorary fellow of his college. In 1877 he entered the firm of Leaf, Sons and Co., becoming in 1888 chairman of Leaf and Co. Ltd. Later he became chairman of the Westminster Bank. Leaf was one of the founders of the International Chamber of Commerce, of which he was elected president in 1925. In 1918–9 he was chairman of the committee of the London clearing banks, and from 1919 to 1921, president of the Institute of Bankers. His scholastic attainments were recognised in his presidency of the Hellenic Society and the Classical Association. Among his classical works are *The Iliad* (1886–8, 1900–2), with English notes and introduction; *Companion to the Iliad* (1892); *Troy, a Study in Homeric Geography* (1912); *Homer and History* (1915); *Little Poems from the Greek* (1922); and *Strabo on the Troad* (1923). In 1882 he collaborated with Andrew Lang and E. Myers in a translation into English prose of Homer's *Iliad*.

LEAGUE OF NATIONS.—The Covenant of the League of Nations, incorporated in the Treaty of Versailles and the other Treaties of Peace in 1919, was perhaps the most remarkable of all the direct results of the World War. For the text of this document *see* Covenant. (*See* also Europe; Security).

I. ORIGINS AND FOUNDATION

The League of Nations may be regarded as a necessary result of the development of human society in political organisations. It is not an abnormal achievement of human idealism—a great leap in advance beyond the achievements of the present age, outstripping the practical needs and requirements of the world. On the contrary, it is a practical method for achieving practical ends which are of importance to every citizen of every country. The demand for an international organisation to prevent war has often been made in the last four centuries. Fundamentally, this demand is that the relations of States shall be subjected to something analogous to the system of law and order to which men have subjected themselves within the smaller units in which they live. It is one example of the truth of the maxim of the Roman lawyers—*ubi societas ibi lex*. But the purpose and the content of the rules for the conduct of their relations—the *lex*—necessarily depend on the nature of the units of the society and on the nature of their relations.

When Grotius wrote his famous work on the Law of Nations, he was writing of a Society of States whose intercourse was disturbed by the continual outbreak of war. Indeed, Europe had been convulsed by the Thirty Years' War for a whole generation prior to the publication of his work. Thus it was natural and indeed inevitable that the rules which Grotius produced for the guidance of the Society of States, as he knew it, amounted to little more than a code of laws for the better conduct of war. He did, indeed, sketch the outlines of a law for the pacific relations of States, and, in the following century and a half, his successors developed to some extent what he had begun. But only after the Napoleonic wars was the first serious attempt made to establish an organised system of conducting international affairs with a view to the avoidance of war.

To Alexander of Russia's scheme of a holy alliance we need only briefly allude. Though admirable in intention, it was rejected as "sublime nonsense and mysticism" by Castlereagh, and it eventually degenerated into a mere prop of despotism supported by the empires of Central Europe and France. But the work of Castlereagh himself is worthy of closer attention. He tried to substitute for the chaotic political methods of the past a system of diplomacy by conference, confining his efforts, however, to the Great Powers, though he desired to make their attitude to the smaller Powers one of "influence rather than authority." He provided his "Conference of Ambassadors" with an organised plan of work and with a secretariat, and he supplemented it by occasional conferences of the principal statesmen of the Concert. His conference of ambassadors continued to sit in one form or another for almost six years, and he held four or five of his conferences of principal statesmen.

The European Concert.—Later in the 19th century, Castlereagh's work bore fruit in the European Concert, which proved on many occasions to be an effective instrument for the joint settlement of Balkan problems and for the maintenance of European peace. But at the time, and for the purpose for which he had created it, Castlereagh's system of diplomacy by conference almost completely failed. It did so because it never had in it the seeds of life. Its members differed fundamentally on all the greater issues of international politics—while some of them were independent and autocratic sovereigns, subject to no control, and without the pressure behind them of a general democratic will for peace. It could truly be said that international society was not ready for such schemes.

Since the Napoleonic wars, however, forces have been at work which have changed the economic condition of the world, knitting its many parts together, and making possible a permanent international political organisation. The first of these forces is the revolution in communications in the course of the last century, which has brought the most remote parts of the world nearer to each other than neighbouring towns were 100 years ago. The second of the forces—a result of the first—is the remarkable raising of the standards of civilisation through the co-operation of mankind in ever larger groups and in enterprises conceived and conducted on an ever greater scale. To-day, much of the world's commerce is international, and it has become evident that the interests of any one civilised country are indissolubly bound up with those of every other country, so much so that no sensible statesman will ever again base his policy on the principle that his country will gain by another country's loss.

Nor is this community of interests between peoples confined to their material well-being. It extends to every sort of scientific, political and moral activity in which men co-operate for the progress of their race. On the other hand, revolution in communications, rapidly destroying the factors of space and time, has rendered possible a development of warfare which has changed its whole character and rendered it universal and destructive in a sense never hitherto imagined. Indeed, it is not too much to assert that another World War would almost certainly throw mankind back into the dark ages. For these, among other reasons, some sort of international organisation for the conduct of the relations of States was, in 1919, essential, if the human race was not to abandon the hopes and the ideals for which it had striven during centuries of progress.

Essential Conditions of a League

With the reasons for the failure of the earlier scheme of a century before, and with the nature of modern national States in our minds, we can perhaps now proceed to lay down the essentials of a league of nations.

It may be taken as commonly accepted that the purposes and objects of a league are the following: first, the maintenance of peace; second, and as a corollary to the first, the solution of international disputes by methods of law, if and when the necessary law exists; when it does not, their solution by political methods, by public debate, by impartial investigation and by conciliation on the basis of the accepted canons of right and justice; third, the promotion of international co-operation

wherever necessary or useful, between States and between the citizens of different States. The promotion of such co-operation will imply the development of rules and the general acceptance of common machinery and common practice in ever wider spheres of international activity.

Further, a first principle which must be borne continually in mind is that the fundamental basis of all law, and the primary condition of all political organisation, is the consent of those who are to obey it. And an important and relevant corollary of this proposition is that the force, even the united force, of the greater or more powerful members of a society cannot in the long run coerce the will, or replace the consent, of the others. It is useless, therefore, to plan any organism which depends on the co-operation of the powerful States, but which will not also receive the willing acceptance and co-operation of the great body of other States.

An examination of the results of these limiting conditions, and of the lessons to be drawn from historical experience, and of the accepted objects which it is desirable that a league should achieve, will indicate the minimum of rules and of machinery which is essential.

Membership.—In the first place, then, there must be rules laying down the conditions of membership of the League. As the members of the League, in order to carry out the objects which they agree upon, must give reciprocal undertakings, they must have some guarantee that those with whom they associate themselves are willing and able to carry out what they promise. Next, it is essential that all the members should enter into agreements to meet in conference from time to time. Third, it will in practice be necessary that there should be some smaller organ than the full conference of all the members, which in the current business of the League, and when executive action is required, can act for and represent the whole. It is evident that the composition of such an executive organ will—in a society in which members are so unequal in size, population and power—involve most difficult problems of representation such as those that arose in 1926.

Secretariat.—A further consequence of any attempt to organise international affairs through regular conferences of all the members of the League, and through a smaller executive organ, is the necessity for a secretariat which shall be charged with the duty of preparing the work of the organs of the League, which shall act as a central exchange for information among members and shall organise the central and technical services. The secretariat would also have to keep the records of the League, supervise the execution of the League's decisions, and in general act as an organising agency for the promotion of international co-operation. It is, perhaps, theoretically possible that these duties should be fulfilled by means of national secretariats attached to the representatives who compose the full conference or the executive organ of the League; but there are great practical advantages in an international secretariat whose members are individually independent of national governments.

The above represents the minimum machinery that is essential to the effective working of any league. We must next consider the minimum mutual obligations which the members of the League must assume if it is to prove an effective instrument for the maintenance of peace.

Peaceful Settlement of Disputes.—It is evidently essential that every member must agree that it will not go to war with any other member without previously submitting the dispute to peaceful methods of settlement. Further, and as a corollary to this first undertaking, there must be a second one providing for common action against members who break this fundamental agreement. What the nature of this common action must be is a matter for discussion; but it must at the least provide for united and energetic moral pressure by the whole body of the League against the recalcitrant member. It may well be argued that in the world as it is to-day this united moral pressure should be supported in whatever way may be possible by united material pressure as well. What in any case is essential is to find some means of bringing home to every citizen of a member which breaks its League agreements the universal disapprobation of the other members. Thirdly, it is practically, if not theoretically, necessary to lay down in advance, some method, or methods, for the settlement of disputes by peaceful means.

Great elasticity may be left as to the nature of these methods, and as to the choice of method which the parties to a dispute may adopt. But the agreements of the League should include plans for settlement by conciliation, or arbitration or judicial verdict; and these plans should be based on the essential principles by which alone moral pressure can be brought to bear on individuals or on Governments—that is to say, on strictly impartial inquiry into the merits of disputes, and on full publicity for the contentions of the parties and for the proceedings by which settlement is attempted.

It is further essential that the agreements of the League should include the automatic abrogation by members of all treaties or undertakings which are not consistent with their obligations as members of the League. No general organisation, such as a league of nations, can operate or inspire confidence in its members if the undertakings to which they agree by their membership are overborne or superseded by other inconsistent agreements which they may enter into with individual States.

The organisation and the undertakings indicated seem to constitute the minimum that can serve as the basis of any effective international organisation for the prevention of war. Beyond this minimum, there are other things not absolutely essential but highly desirable. For example, judicial verdict implies a court of international law. It is true that such a court might be set up *ad hoc* for any dispute in which it is required, but it is far better that a permanent court should be established as part of the machinery of the League. Such a court, indeed, appears to be a necessity if we are to achieve the development of international law as an increasingly important factor in the relations between States.

Again, it is highly desirable, though it is not theoretically essential, that the agreements of the League should provide that any dispute, or any circumstances affecting the peace of the world, should be a matter of general concern to every member, so that any member may be within its right in demanding the consideration of any such matter by the organs of the League.

Interdependence of States had so far advanced during the course of the 19th century that this principle received some slight and tentative recognition in the conventions for the peaceful settlement of international disputes drawn up by the conferences at The Hague. But the principle needs full recognition and application if countries are to be prevented from drifting into armed conflicts which in these times will certainly involve the interests of their neighbours.

And lastly, it is desirable, though again not essential, that the League should be given the necessary powers to enable it to act as the co-ordinating agency for the international activities of its members in all the multifarious spheres hitherto governed by international bureaux, by general treaties and by other forms of official and unofficial co-operation.

The Essential Provisions of the Covenant

Impartial consideration of the Covenant will show that it embodies every one of the features which have been enumerated as the essentials of an effective league. It may further be said that where it goes beyond the essentials it does so in a way which was intended to make, and does make, for greater completeness and efficiency.

Membership.—Article 1 of the Covenant consists of the rules of membership. It stipulates that the original members of the League shall be the signatories to the Covenant and such other States named in the annex thereto as shall accede to it without reservation; and that any fully self-governing State, dominion or colony may become a member if its admission is agreed to by two-thirds of the members and provided that it shall give effective guarantees of its sincere intention to observe its international obligations and shall accept the regulations of the League in regard to its military forces. These rules constitute a statement of the principles concerning membership that are essential if the members of the League are to have confidence that their mutual undertakings will be carried out.

Representation.—With regard to agreements to meet in conference, Articles 2, 3 and 4 of the Covenant stipulate for the creation of an Assembly consisting of three representatives of each member of the League, and for a smaller Council consisting of representatives of four great Powers and of four smaller ones. The Covenant does not lay down the intervals at which these bodies shall meet: it merely stipulates that the Assembly shall meet at stated intervals and from time to time as occasion may require; and that the Council shall meet in the same way, and at least once a year. It leaves these questions to be dealt with in whatever rules of procedure the council and the assembly might respectively consider it wise to adopt.

The question of representation of the members at the assembly was one which naturally involved serious difficulties. It was solved by according to every member an equal right to send three representatives.

The question of representation on the Council was still more difficult. A definite preponderance of influence in international affairs had been accorded prior to the World War, to the Great Powers of the world. It was inevitable, and right, that the Great Powers who are members of the League should be given permanent representation on its principal executive organ. The representation of the smaller Powers—an exceedingly difficult matter—was dealt with by providing that the four non-permanent members of the Council shall be selected by the Assembly from time to time in its discretion.

Articles 6 and 7 provide for the necessary secretariat, and for the nomination of a secretary-general, who shall make all the appointments to the staff with the approval of the Council. These articles also provide that every position in the secretariat shall be open to women. So much for the institutional organisation of the League as it was established by the Covenant.

Disputes.—With regard to the agreements not to resort to war, which are included above, among the essentials, the Covenant embodies almost everything that any responsible authority had in 1919 advocated as practicable. By Article 12 the members agree that if there should arise between them any dispute likely to lead to a rupture, they will submit the matter either to arbitration or to inquiry by the council, and they agree that they will in no case resort to arms until three months after an award has been made by the arbitrators or a report has been made by the council. Article 12 thus not only embodies an agreement not to go to war without previous recourse to peaceful methods of settlement for disputes, but also lays down two alternative procedures by which, through the agency of the League, settlement can be effected. The first is ambiguously referred to as "arbitration," but it is evident from Articles 13 and 14 (the latter of which provides for the establishment of a permanent court) that the use of the word "arbitration" is a loose one, and that what is really intended is recourse to legal decision. These two articles, indeed, leave great elasticity, but their purpose was to secure the establishment of a permanent court of international law to which the parties should in the normal course take disputes of a legal nature.

There is, moreover, at the end of Article 14, a clause designed to increase the value of the permanent court. This clause provides that the court may give an advisory opinion upon any dispute or question referred to it by the Council or by the Assembly. Thus, if a litigant should bring to the League a dispute in which it believes the law to be on its side, it will be able to demand, even if the other party does not agree, that the Council shall secure on the juridical questions at issue an advisory opinion from the court; and the court, in rendering this opinion, will give the Council the elements for a decision which would have all the force of a legal verdict. Thus the Covenant included provisions which went far towards securing that all international disputes of a genuinely legal nature shall be determined by legal methods.

With regard to the other alternative method provided for the settlement of disputes, which members agree to by Article 12, that is to say, inquiry by the Council, Article 15 lays down in considerable detail the procedure which is to be adopted. It provides that any party to a dispute can oblige the League to take cognizance of it by giving notice to the secretary-general. The parties undertake to communicate to the secretary-general as promptly as possible statements of their case, with all the relevant facts and papers. The Council is then given discretion to endeavour to effect a settlement of the dispute, and it is provided that if its efforts are successful, a statement shall be made public giving such an account of the dispute and of the settlement arrived at as the council may deem proper. If the council fails to settle the dispute, it is to make a report setting forth the merits of the dispute and the recommendations which the Council thinks would be suitable for a settlement, and this report is to be published. A report may be made either unanimously or by a majority vote, and any individual member of the League which is represented on the Council has a right to make its own public statement concerning the dispute.

There is a further provision in Article 15 to the effect that if such a report is agreed to by the Council unanimously, with the exception of the representatives of one or more of the parties to the dispute, the members of the League—including the parties—agree that they will not go to war with any party to the dispute who complies with the provisions of the report. This is a most important additional limitation of the right of members to resort to arms. Article 15 also allows an appeal from the Council to the Assembly, provided it is made within 14 days after the submission of the dispute to the Council. If a dispute is so referred to the Assembly, the Assembly is to deal with the matter in the same way as the Council, and if its report is agreed to by all the members of the League represented on the Council, and by a majority of the other members of the League, exclusive in each case of the representatives of the parties to the dispute, it has the same force as a unanimous report agreed to by the Council, *i.e.*, the members of the League must not go to war with any of the parties to the dispute which accept it.

These Articles, then, provide two, or rather three, methods by which disputes can be settled by peaceful means through the agency of the League. The first provides for legal verdicts by the permanent court, when such verdicts are possible and useful; the second for arbitration by some special tribunal agreed to by the parties to a dispute; and the third, for settlement by the political agency of the Council or the Assembly, in accordance with procedure based on the principles of full publicity and strict impartiality. The authors of the Covenant believed that publicity would of itself ensure impartiality; that it was not conceivable that a council, acting as the representative of the whole body of the League and in circumstances of utmost publicity, should conduct its inquiries into a dispute in any way not consistent with the strictest fairness to all the parties concerned.

Sanctions.—Articles 12 to 15 also make provision for the next essential of a league—united pressure by all the members against any of their number which disregards its undertakings. In providing for a public report by the Council on the merits of a dispute and for the publication of its recommendations as to a settlement, the Covenant lays down a method which, in practice, must exert the strongest moral pressure on any state which in defiance of Article 12 is disposed to go to war.

But the Covenant goes beyond this, and provides in Article 16 that, if any member of the League in contravention of its agreements resorts to arms, such a member is *ipso facto* "deemed to have committed an act of war against all other members of the League," and the other members are obliged to prevent all financial, commercial or personal intercourse between the nationals of the Covenant-breaking State and the nationals of any other State. It was difficult in the disturbed condition of the world after the War to realise just what would be the effect of such a complete economic and financial boycott in times of normal peace. But it is not too much to say that no civilised State would, in 1914, have ventured to declare war had it been threatened by such a universal boycott as is stipulated by Article 16 of the Covenant.

It is sometimes held that in providing for such a universal boycott, the Covenant goes beyond the essentials of a league. It is sometimes even held that it goes beyond what is practicable and wise. But it must be remembered that Article 16 only comes into force if a State insists on going to war without waiting for any attempt at peaceful settlement, or where an agreed tribunal or a unanimous council have given a decision which has been accepted by the other party. In other cases ultimate resort to war is envisaged under the Covenant as legitimate, and the obligations of Article 16 would not come into force. Indeed against a genuinely recalcitrant member of the League, the Covenant goes even further. Article 16 lays down that in addition to the blockade which is an automatic obligation of all the members of the League, the council shall consider and shall *recommend* to the several Governments concerned, what military, naval or air forces members of the League shall severally contribute to the armed forces to be used to protect the Covenant. In other words, while leaving again the greatest possible elasticity, the Covenant foreshadows united military action, if it is necessary, against a Covenant-breaking State.

To turn to another matter, the Covenant provides by Article 20 for the abrogation of treaties, obligations and understandings which are inconsistent with its own terms, and thus meets in yet another particular, the essentials of a league.

Further Provisions of the Covenant

How far, and in what respects, does the Covenant go beyond these essentials?

Guarantees.—First, there are the much-discussed provisions of Article 10. This Article has been very generally misunderstood. Its effect is to guarantee the members of the League *against external aggression* which would impair their territorial integrity or political independence; but this guarantee is only to be enforced as the Council acting unanimously shall agree. In practice the protection against sudden and unjust attacks provided by Articles 12–16 will probably be much more useful, and, if executed, all that is required. Article 10 is really only a rather clumsy assertion that territorial or political changes shall not be made by aggressive war. Such changes, if required, must be made under Article 19, which enables the Assembly to reconsider treaties which have become obsolete or dangerous to peace.

Armaments.—Second, it may perhaps be said that, by the provisions of Article 8 on the subject of armaments, the Covenant introduces something which is extraneous to an agreement to preserve the peace. But the history of the 20th century has demonstrated that if you prepare for war you will have war; that increase of armaments in one country provokes increase of armaments in other countries, and that if rivalry in preparation for war continues, within a certain time war will break out. The authors of the Covenant believed that unless rivalry in armaments could be prevented, any league of nations, however it be constituted, would fail. They therefore thought an agreement not to engage in unlimited competition in armaments absolutely necessary to the peace of the world. The Covenant deals with the matter in a way which is pre-eminently practical and sane. It recognises that the maintenance of peace requires the reduction of national armaments to the lowest point consistent with national safety, and directs the Council to formulate plans for such reduction for the consideration of the several members of the League. In other words, the members agree to co-operate in working out a general international plan embodying scales in accordance with which their armaments shall be limited or reduced.

Further, the members agree that they will, through the League, endeavour to take measures for abolishing the evil effects of the private manufacture of armaments and material of war, and they agree to exchange full information as to their armaments, their preparations for war and the condition of their industries which may be adapted to warlike purposes. Lastly, by Article 23 they agree that, subject to conventions to be arranged, the international traffic in arms, admittedly one of the minor contributing causes of war, shall be placed under the League's supervision.

These are only general principles. In themselves they would be of small value. But it was hoped by the authors of the Covenant that the action of the permanent machinery of the League would in time enable its members to give effect to the purpose of Article 8; and that thus great strides would be made towards the disarmament which everyone desires. In this respect, as in others, the authors of the Covenant were careful not to travel too fast; they laid foundations on which those who were to wield authority in the League could later build.

Secret Treaties.—By providing in Article 18 for the publication of all treaties, the Covenant again goes beyond essentials. Yet no reasonable man can doubt that, under the diplomatic system which prevailed before 1914, secret treaties of alliance, directly by their mere existence and indirectly through the mistrust which they created, were one of the serious causes of international conflict.

Mandates.—Article 22 of the Covenant introduces a new principle into international affairs which is certainly extraneous to the central purpose of a league. The mandates system which it creates is a great experiment in the government by advanced peoples of backward territories and races. The main principles are simple. The Article is based on the proposition that backward peoples and territories are not for the future to be exploited for the exclusive benefit of those who govern them; that, on the contrary, their interests and well-being constitute a sacred trust of civilisation and that the way in which they are ruled is a matter of interest to the world at large. The Article therefore lays down that in the government of such territories the interests and progress of the inhabitants must be the guiding purpose of the administration. The methods by which their interests are to be protected and their development secured vary, of course, in every case with the nature of the territory and the character of the people concerned. But in every case the fundamental principles are the same; and to secure the observance of them the Covenant imposes on the mandatories a duty to make annual reports for submission to a permanent mandates commission; which is, in turn, to report to the Council. Here again the Covenant relies on publicity and public opinion as a guarantee that Article 22 will be faithfully carried into effect.

International Co-operation.—With regard to international co-operation, the Covenant in Articles 23 and 24 goes a great deal further than might be considered essential. It provides in general terms for the establishment of a labour organisation (which in fact has been elaborated separately by another agreement); for the equitable treatment of commerce; for the development of freedom of transit; for League supervision of the traffic in arms; for League action in matters of public health and for the general supervision by the League of all official, and also, if necessary or useful, of unofficial, international offices established for international purposes of general interest. The general effect of these provisions is to make the League what it is clearly desirable that it should be—a central organism through which international activities of every sort can be co-ordinated and, when useful, assisted by the council and the secretariat. There can be no doubt that the result of this must be to prevent waste of effort and promote efficiency in the conduct of international business of every kind.

Amendments.—In the last place the Covenant, by Article 20, provides a method by which it can itself be amended; and this, it may be held, is not an essential of a league. It is true that the Covenant might have been regarded as an ordinary international treaty, valid, as most treaties are now made, for a certain fixed period, at the end of which it might have been renewed or changed by the ordinary methods. But it was precisely because the authors of the Covenant did not regard it as an ordinary international treaty that they provided a special means for amendment; and there can be no doubt that, morally, Article 26 is of great significance, and that practically it may prove to be of great constitutional value. It still leaves it difficult to secure amendment of the terms of the Covenant. It can only be done if all the members of the council and the majority of the members of the assembly are agreed. But the fact that amendment is definitely envisaged is in itself important.

Generally, it may be said that when the Covenant goes beyond the essential features which are necessary to any effective league to preserve peace, it does so with one of two objects in view. Either it is with the purpose of giving real life to the machinery which it establishes: of bringing the international forces actually at work into effective co-operation, in order that members of the League may be brought closer together, and the League itself be strengthened and have the vitality that comes from continuous and varied work; or else it is with the purpose of removing those deep-seated causes which public opinion has recognised as having led to war. It is not by chance that the Covenant contains more or less elaborate provisions concerning armaments, the traffic in arms, annexation by conquest, the avoidance of unfair economic competition, imperial rivalry in the exploitation of backward countries, secret treaties and alliances. It is because these things have led to war in the past that the Covenant seeks to deal with them in a practical and effective way, to the end that war may be rendered less probable in the future.

It has already been said that the authors of the Covenant confined themselves to laying down the essentials of the organisation which they considered the League required and the general rather than the detailed obligations to which they thought that members of the League must agree. Elasticity is one of the chief "notes" of the whole machinery of the League. The Council and the Assembly are free to develop their own methods and

systems as they choose, to appoint committees and commissions at their discretion, and to draw up codes of procedure which they can themselves change; they are thus able to give to the general principles of the Covenant the free development which experience may dictate.

It is in pursuit of this same elasticity that in several cases the Council is charged to carry into execution plans which the authors of the Covenant felt to be essential, but which they were not themselves, for lack of time and for lack of expert technical advice, able immediately to prepare. Much valuable work has been done under these provisions.

Preparation and Enforcement

The Covenant was prepared by a special Commission of the Peace Conference of Paris, consisting of ten representatives of the Great Powers and nine representatives of the smaller Allied States. This commission, appointed on Jan. 20 1919, was a body of remarkable authority. Presided over by President Wilson, its members included Colonel House, General Smuts (later Prime Minister of South Africa), Lord Robert (Viscount) Cecil, M. Léon Bourgeois (former Prime Minister of France), M. Veniselos (Prime Minister of Greece), M. Pessoa (later President of Brazil), M. Vesnitch (later Prime Minister of Yugoslavia), M. Scialoja (later Foreign Minister of Italy), M. Hymans (Foreign Minister of Belgium) and others.

The first draft prepared by the commission, based on proposals put forward jointly by the British and American delegations, was laid before the Peace Conference at a public meeting on Feb. 14; it was thereafter amended in the light of criticisms made by the conference, by the Press and by the neutral Powers at a special meeting held for the purpose of hearing their views; and the final draft was adopted by the Plenary Conference at another public meeting on April 28. It was, on the insistence of President Wilson, inserted as Part I. of the Peace Treaties made with Germany, Austria, Hungary and Bulgaria. By this device the Allied Powers were prevented from making peace with their enemies without being members of the League.

With the entry into force of the Treaty of Versailles on Jan. 10 1920, the League of Nations came legally into existence. Prior to this date, preliminary organisation of its work had been carried on by the secretary-general under the authority of a committee of the Powers. When all the Allied Powers had ratified the Peace Treaties (except the U.S.A., Hejaz and Ecuador, who failed to do so) the members of the League numbered 29. To these were added during the course of 1920 the neutral Powers, 13 in all, who in accordance with Article I. of the Covenant acceded to it without reservation. By successive admissions of ex-enemy and other States, the number of members had by 1925 risen to 56.

See also Covenant; Disarmament; Sanctions and Guarantees; Treaties; Versailles, Treaty of, etc.

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II. THE WORK OF THE FIRST SIX YEARS

In order to understand what has determined the character, scope and varying efficacy of the League during the first six years of its existence, it is necessary to bear in mind both the general conditions under which, and the organisation through which, it has been working. It is only by realising these conditions that we shall understand why some of the main international problems have been dealt with by the League and some outside it; and why its success in those which it has undertaken has varied from case to case.

The first of the determining political conditions is that the process of settling the terms of peace, of resolving the immediate problems left by the World War, was only begun and not ended by the treaties of peace signed in 1919. For years afterwards peace was still being negotiated in every capital in Europe. One of the treaties, indeed, the Treaty of Sèvres, was never ratified. Renewed war between Greece and Turkey, rather the continuation, after an interval, of one section of the World War than the outbreak of a new one, was to precede the new Treaty of Lausanne of 1923. But even those treaties which were duly ratified left unsettled questions of the first political importance, in the forefront " reparation " and in the second rank a host of secondary, but still difficult and important, problems.

But the task of completing and executing the terms of settlement between recent combatants is very different from that of permanently preserving the peace of the world. The Covenant (*q.v.*), designed to create a permanent instrument, is naturally drafted as if the immediate war problems had been settled by the treaties of peace and as if, peace and normal conditions having been established, it was the task of the League to maintain them. The questions left unsettled directly concerned the late belligerents, not the world as a whole. Their settlement was essentially a corollary of the treaties and a part of the same work. It was natural, therefore, that they should be dealt with, not by the new world organisation, the League, but by conferences of the Allies or of the late belligerents similar in composition and in character to those which had negotiated the treaties.

Limiting Factors.—In the second place, the scope of the League's work has been limited by the fact that, while in essence a world organisation, it has not yet received the adhesion of all countries, and in particular three of the seven principal countries of the world have during the whole period now under review been outside its membership.

These conditions derive additional importance from the fundamental character of the League as an organisation. The League is not a super-state with either the right or the authority to impose its will on the sovereign States which compose it. It is essentially an organ for securing agreement between them, and its power of action is at any time limited by the extent of possible agreement. Except in a few special cases, of which the most important is that members undertake not to go to war to enforce a claim rejected by all the members on the Council except the disputants themselves, signature of the Covenant does not involve an obligation on any State to accept a decision of the League without its own consent.

For the great bulk of its work, therefore, the League requires unanimity. It can persuade, it can elicit a collective world opinion, both private and official, which it may use to aid its persuasion, but, except before the imminent threat of war, it cannot compel; and even in this case unanimity of the non-disputant members of the Council is required. It follows, therefore, that the power of the League varies with the policies and characters of the countries which compose it and of their relations between each other. How far this is from involving impotence, how great is the difference between the policy a country would pursue if left alone from that which it can be induced to follow under the persuasion of collective opinion, the following account will show. But however wide the range within which such persuasion can be effective, there is at any given moment a limit beyond which a country cannot be moved. And beyond such limits the League is, for the great bulk of its work, impotent. In dealing with its various problems the League has to deal with exactly the same forces and differences of policy and interest as if they were handled by other methods of negotiation; and the organs of the League, the Assembly, and the Council comprise, indeed consist of, representatives of interested governments themselves.

It follows that any serious divergencies of policy between members of the League, and especially its more important members, will be likely to enfeeble the League for its general work. And it is obvious that the obstinate differences on reparation and other questions touching Germany and on Near Eastern affairs, affecting as they did for some years the general relations of some of the principal countries on the council, necessarily limited the League's general power and progress.

These limiting factors have diminished in importance as the years have passed. Little by little, the specifically War problems have found a settlement, the transitional instruments of negotiation, supreme councils or allied conferences or the Conference of Ambassadors (*see* SAN REMO; SPA; PARIS; LONDON; CANNES; GENOA; LAUSANNE; and LOCARNO; also AMBASSADORS, CONFERENCE OF; SUPREME COUNCIL) have ended or retired to a secondary place; and the permanent organisation has come into the foreground. The number of member States has risen from the 42 of the first Assembly to 55, in 1925, and the improvement in international relations which, while largely developed at Geneva, found its expression at Locarno, has immensely added to the strength of the League to deal with such future troubles as may occur.

ORGANISATION OF THE LEAGUE

The principal organs of the League are the Assembly, meeting usually once a year and representing all States; the Council, meeting usually every third month and consisting of four permanent members (Great Britain, France, Italy and Japan—to which Germany will doubtless shortly be added)—and six non-permanent members elected by the Assembly; the permanent secretariat; a whole series of special organisations and committees (for finance and economics, transit, health, armaments, mandates, intellectual co-operation, opium, traffic in women, etc.); and, working independently of the Council and Assembly, the permanent court of international justice, and the international labour office.

The respective spheres of competence of the Assembly and the Council are not exactly defined in the Covenant. Each may deal with any matter within the League's competence or affecting the peace of the world. In practice, the size, composition and times of meeting of the two bodies determine their functions. The Assembly affords an opportunity for an annual review, by the responsible representatives of the Governments of the world, of the international situation. It largely creates the atmosphere and determines the general lines of policy for the ensuing year, and it is a convenient instrument for the concluding stages in the negotiations of conventions and general agreements of world interest. The Council, on the other hand, has become the League's executive organ. It deals with the host of special questions that arise for settlement throughout the year, and directs the multifarious permanent tasks of the League and the special organisations through which they are carried on.

These special organisations are in some respects the most interesting feature of the League as an administrative machine. They consist for the most part of permanent committees, composed of specialists and experts drawn either from the departments of the national governments or from private institutions. These experts work normally in their own countries, and they have the special knowledge of national forces and conditions, and possess the national influence, which no purely international officials can retain. But they meet periodically as members of a regular organisation. By this system, which follows closely the principles of the inter-Allied central organisation built up in the later years of the World War, the League obtains an executive instrument more expert, more effective and more economical than could possibly be obtained by the unaided service of its own whole-time officers. It binds together the national administrations of the world and forms them into an instrument of international work. More than this, it permeates with its own spirit those who in their own countries are carrying on national work which reacts on the interests of other countries.

In these six years some thousands of such persons, no small proportion of those who throughout the world are forming and executing the policy which determines international relations, have learnt, in regular co-operation with those of corresponding position in other countries, the international point of view. It is thus a system which, apart from its direct utility, effects a peaceful penetration of the League point of view into national systems. In this elaborate and elastic system the permanent secretariat is the uniting element—the "coupling." Its importance results from the immense range and variety of the organs which it serves, and from the fact that these organs consist of councils, commissions or committees meeting periodically, not in permanent session, and consisting of persons whose main work is elsewhere, in their respective countries.

POLITICAL DISPUTES

It is the task of the League to prevent political disputes causing war. It is most successful where it has been able, by patient work in improving international relations, to remove the causes of disputes before they arise. In this wider sense most of the work of the League has a political aspect. In its mandates and minorities work, for example, the League is continually trying to establish conditions which will diminish the risks of future conflict; and in such a piece of international co-operation as the reconstruction of Hungary, the existence of political differences constituted one of the main obstacles to success, and their settlements one of its main rewards. The definite political disputes threatening to disturb international relations and, in some cases, the peace of the world, which have been submitted to the League of Nations are treated in this work under the individual headings, but something must be said here to illustrate the methods by which the League discharges its primary responsibility of preserving the peace.

Aaland Islands.—The first of these disputes was between Sweden and Finland in 1920 over the Aaland Islands (*q.v.*). Neither country appealed to the League, but as the danger of conflict increased, Great Britain brought the matter to the Council under Article 11 of the Covenant. Both countries were invited to become members of the Council for the purpose, Sweden as a member State under the specific provision of Article 4, and Finland, not then a member, by special resolution in accordance with the general spirit of Article 17. Sweden urged the strong and persistent desire of the islanders themselves for union with Sweden, and her representative declared that "if Finland . . . failed to withdraw her troops a conflict was likely to arise." Finland claimed that her legal sovereignty was indisputable and that the Council was not competent because the matter was one which by international law was solely within the domestic jurisdiction of Finland. The Council, with the concurrence of both parties, appointed a commission of three international jurists to give an advisory opinion on this point (the court of justice not yet being established), and on the basis of its report declared itself competent. It then sent a committee of inquiry, consisting of a Belgian, a Swiss and an American, to investigate on the spot and propose a settlement. In conformity with the report of the committee and after hearing the views of the islanders, as well as the Finns and Swedes, the Council, in June 1921, decided that Finland's claims to sovereignty over the islands must be recognised but that the claim of Sweden and the islanders should be met by detailed guarantees ensuring neutralisation and a large measure of autonomy. This decision was followed by a conference of 10 Powers in Oct. to frame a convention providing for the neutralisation and demilitarisation of the whole archipelago. The convention was duly ratified and came into force in April 1922. No trouble has since arisen, and the settlement appears to be accepted as final and conclusive.

Vilna (Wilno).—The next dispute marked a failure in League action. The Treaty of Versailles left the eastern frontier of Poland to be fixed later by the Principal Allied Powers. No definite frontier was fixed, but a provisional line was drawn which left Vilna (*q.v.*) in the territory of Lithuania, a newly created State. A dispute arose between Poland and Lithuania over this line, and hostilities became imminent. The Council, in Sept. 1920, sent a military commission which prevented hostilities and provisionally arranged the disposition of the respective forces. But General Zeligowski, a senior Polish officer, crossed the line and entered Vilna with a considerable force. The Polish Government repudiated his action, but refused to send troops against him. The League's military commission arrested hostilities by establishing three neutral zones between the opposing forces, and the Council proceeded to deal with the territorial dispute. They first attempted a referendum and arranged to send a small international police force to maintain order during the plebiscite. But the inflammation of public opinion made it very unlikely that a fair expression of opinion could be maintained, and this plan failed. The Council next attempted conciliation by direct negotiations between the two Governments under the presidency of M. Hymans, the Belgian member of the council. A proposal made by M. Hymans himself that the Vilna territory should be an autonomous canton within the Lithuanian State was not accepted, and the effort at direct negotiation thus failed. The council then made a formal "recommendation" in accordance with Article 15; they adopted M. Hymans' report unanimously and with the assent of the full Assembly which discussed the proposal in Sept. 1922, called upon both countries to accept it. They refused, and the League did not enforce

the recommendation. Finally, early in 1923, the Conference of Ambassadors, acting on behalf of the principal Allies under Article 87 of the Treaty of Versailles, definitely fixed the eastern frontier of Poland in such a way as to include the district of Vilna within it. The *fait accompli* prevailed. The League had succeeded in averting hostilities which would otherwise have been inevitable, but it had failed to secure the adoption of its own solution on the substance of the dispute.

Upper Silesia.—The next dispute was equally difficult, and again resulted from the incompleteness of the terms of peace signed in 1919. The Treaty of Versailles provided that a frontier was to be drawn in German Upper Silesia (*q.v.*), dividing the district between Germany and Poland in accordance with the "wishes of the inhabitants" as indicated by a plebiscite and taking account of "geographical and economic conditions"—two conflicting criteria which pointed to very different conclusions. The plebiscite was held in March 1921, but neither the Plebiscite Commission, nor a committee of experts, nor the Governments composing the "supreme council" could agree as to the line to be drawn. A Polish insurrection broke out, and production in the rich mining and industrial area of the "triangle" was stopped. There was the greatest tension not only between Poland and Germany but between the Allies—France proposing a line based on the plebiscite, giving the bulk of the disputed area to Poland, and Great Britain proposing a line more in accordance with economic considerations, giving the bulk of it to Germany. Repeated and prolonged attempts to effect an agreement failed. There was rioting and, indeed, for some days, fighting between organised volunteers. Work was stopped and there was danger of a serious rupture between the Allies. Having failed to reach agreement through their normal organ, the Supreme Council, the Allies, in Aug., asked the League to propose a frontier in accordance with the treaty, binding themselves to accept any agreed recommendation. The Council met in special session on Aug. 29 and referred the problem for preliminary examination to a committee consisting of the representatives of Belgium, Brazil, China and Spain—states which had taken no part in the previous discussions.

This committee came to the conclusion that the only practicable solution was to be found in drawing such a frontier as would attribute to each country a number of inhabitants proportionate to the votes recorded in its favour, while arranging special guarantees against the dislocation of the economic life of the district for a period long enough to enable it to be adjusted to the new frontier. That is, instead of trying to determine a frontier on a compromise between the conflicting plebiscite and economic considerations, they proposed to take the plebiscite as the basis of the first and to meet the second by an appropriate economic convention. This solution was adopted by the council, and by the Allied Powers, who traced the frontier accordingly. A Germano-Polish convention, ensuring the continuity of the economic life of Upper Silesia for a period of 15 years, was subsequently drawn up in agreement by the two Powers negotiating under the presidency of a Swiss statesman appointed by the League.

This settlement was severely criticised both in Germany and Great Britain. It must, however, be remembered that the League had no authority to fix an ideal frontier line, but only to apply the treaty provisions. The whole case is an illustration of the difficulty already mentioned of the League, designed as an impartial instrument for the preservation of peace, being used to complete the terms of a peace settlement between recent combatants. But at last agreement was reached, a cause of dissension between the Allies was removed, work was resumed and rioting ceased.

Albania.—A further risk of hostilities occurred in 1921 through a delay in the definitive settlement of a frontier. Albania (*q.v.*) was admitted as a member of the League in 1920, but the frontier question was still under consideration by the Conference of Ambassadors. In April 1921 Albania called the attention of the League to encroachments on her territory by Serbia and Greece. The Council, unwilling to complicate the task of the Conference of Ambassadors by separate intervention, asked the Conference to hasten their decision and called on the three countries to abstain from any hostile action. The question being still unsettled in Sept., however, the League appointed a committee of three impartial persons from Luxembourg, Norway and Finland to report on the situation. Before its arrival in Nov., however, Yugoslav troops entered the Mirdita district of Northern Albania. There was heavy fighting, and the defeat of Albania was almost complete. The British Govt. at once demanded the summoning of a special meeting of the Council under Article 11 to consider the situation and if necessary to agree upon measures under the "sanctions" article, No. 16, of the Covenant. At the meeting of the Council on Nov. 18, the Serb-Croat-Slovene State agreed to evacuate its troops and to respect the frontier which had now been definitely fixed by the Conference of Ambassadors. The League Commission of Inquiry personally accompanied the departing troops, and on Dec. 10 were able to report that the evacuation had been successfully completed without untoward incidents. A serious threat of conflict had again been averted and has not since recurred.

Memel.—The Memel problem is another instance of a peace treaty question handed over to the League because the Allies, acting through their normal machinery, had been unable to settle it. There was a strong reason for invoking the services of the League in this case because it involved extremely complex technical questions of transit and port facilities, with which the League's technical organisation was particularly fitted to deal. Lithuania, having suffered from a *fait accompli*, pending the definite fixing of a frontier at Wilno, successfully tried a coup of her own at Memel in Jan. 1923. The Conference of Ambassadors fixed the frontier in a way which left Memel in Lithuania on condition of a large measure of autonomy to the German population and guarantees for the development of the port as an international outlet. But they failed to frame a convention acceptable to Lithuania to give effect to this condition. Active conflict being threatened, the Conference in Sept. asked the League to deal with the matter. The Council appointed an impartial commission, which made a thorough investigation of the local conditions, and in March 1924 presented a complete draft convention to the council. This convention (for the terms of which *see* MEMEL) was accepted by both parties and endorsed by the Allied governments.

The Corfu Dispute.—A much more important dispute, affecting a principal power, was brought before the League in the autumn of 1923. An Italian General and his staff, who were engaged as representatives of the Conference of Ambassadors in fixing the frontier between Albania and Greece, were murdered on Greek soil, by persons unknown, on Aug. 27 1923. The Italian Govt. demanded reparation and apologies of the Greek Govt., who accepted some of the conditions and refused others. The Italian naval authorities thereupon occupied the island of Corfu, loss of life occurring in the operation (*see* CORFU). Greece appealed to the League, but also stated her willingness to accept any decision of the Conference of Ambassadors. The position of the Conference, as a body whose decision both parties agreed to accept and as itself directly interested, made the formal competence of the Council doubtful. The Council therefore confined itself to discussing detailed suggestions for a settlement and forwarding them to the Conference of Ambassadors. The Conference adopted most of these suggestions, but with an important modification on the question of reparation. With regard to this it dispatched an Allied committee of inquiry and, on receipt of its report, which it withheld from publication, it awarded Italy the full amount of reparation which she had demanded. Corfu was then evacuated. The immediate question thus settled, the Council referred to a committee of jurists the question of legal principle which the case had raised with regard to the competence of the Council, the right of coercive action and the responsibility of a state for political crimes committed on its territory. Unanimous replies were received to these questions and were transmitted by the Council to the Assembly; and the legal position was thus more clearly established as regards similar incidents in the future.

The case was an extremely intricate one, and there has been much difference of opinion as to the action of the League. The League facilitated a quick settlement, the early evacuation of Corfu and the avoidance of hostilities; and the actual proposals which it made as to the details of settlement are not open to adverse criticism. But it did not secure the adoption of all these proposals. The action of the Conference of Ambassadors, in giving its award, while withholding the report on which it purported to base it, would have been impossible if the League had been in full control of the case. The factors which made effective League action difficult were partly the special and dual position of the Conference of Ambassadors in the question and partly, it must be recognised, the fact that one of the parties involved was a Great Power and that the general relations of the Powers were at the moment complicated by other questions of policy. The degree and limits of the League's action accurately reflect the extent to which it was possible to make a collective world opinion effective under the conditions created at the moment by the relations between the governments, and especially the Great Powers on the council. That this collective opinion had an important influence on the settlement is indisputable, and the expression of this opinion, made possible by the meeting of the Assembly, was indeed a revelation to all who witnessed it of what is bound to be henceforth a new force of the first importance in the political life of the world.

Mosul.—The Conference of Lausanne in 1923 found that its most difficult question in the settlement of the terms of peace with Turkey was the frontier line between Turkey and the British "mandate" territory of 'Iraq. Agreement having failed, the treaty provided that Turkey and Great Britain should attempt to reach agreement by friendly negotiations, and that, if these did not succeed within nine months, the question should be referred to the Council of the League. The negotiations failed, and in Aug. 1924 the question was accordingly brought before the Council, who appointed a commission of three (a Swede, a Hungarian and a Belgian) to investigate on the spot. The commission worked for eight months and then presented a report in which, after reviewing exhaustively all the factors of the case, they recommended unanimously that the best solution would be for the disputed district, including the town of Mosul, to be included in 'Iraq if the British mandate could be continued for 25 years, but that, if this were impossible, it would be better to assign it to Turkey. When the Council had this report before them in Sept. 1925, they were faced with the contention of Turkey that the Council's task under the Treaty of Lausanne was one of mediation, not arbitration, and that no decision could be binding unless Turkey herself had assented to it. The Council asked

an advisory opinion of the Permanent Court of International Justice, who replied that the Treaty had given arbitral powers and that the consent of the two parties was not required, though unanimity of the other members was necessary. With this opinion, the Council in Dec. decided, by a unanimous vote of all members other than the disputants, that the territory should be assigned to 'Iraq, subject to the prolongation of the British mandate and the assurance of full protection for the Kurdish population. The Turks refused to accept the court's opinion that an arbitral decision was binding, and withdrew from the Council at which the above decision was taken. The British Govt. undertook to ask for authority to accept the prolongation of the mandate for 25 years or until such earlier date as 'Iraq could be accepted as a member of the League, and announced their intention to attempt the renewal of negotiations with Turkey.

During this difficult period the Council took various measures to assist in the maintenance of the *status quo* without hostilities and to investigate complaints as to Turkish deportations of Christians and violations of the frontier. The mission of Gen. Laidoner on behalf of the League for this latter purpose is of special interest as being the first of its kind. (For the general settlement *see* MOSUL.)

The Greco-Bulgar Incident.—On Oct. 19 1925 shots were exchanged between two Greek and Bulgarian sentries occupying frontier posts separated by 40 yards on the frontiers northeast of Salonika. On Oct. 22 Greek troops, under orders from Athens, entered Bulgarian territory through the Struma valley and penetrated about 8 km. on a front of about 32 kilometres. Bulgaria telegraphed an appeal to Geneva asking the secretary general to convene a special meeting of the Council under the powers conferred on him by Article 11 of the Covenant. This appeal arrived on Friday morning, Oct. 23. The secretary general at once decided to convene the Council, and after telephonic conversation with M. Briand, the president for the time being, fixed it at the most quickly accessible place, Paris, and at the earliest date physically possible for members requiring to come from Stockholm, London and Rome, Monday, Oct. 26. At the same time it was arranged that a telegram should be sent to both governments in M. Briand's name, as president, calling on both sides to abstain from all hostilities. This telegram was also dispatched the same Friday morning. Preparations had been made for a Greek attack on the Bulgarian town of Petrich with a force of 1,000 men and three batteries at 6 A.M. on Saturday, Oct. 24; and the Bulgarian Commander had orders to resist. Briand's telegram, arriving in the two capitals on Friday, was immediately effective. Orders arrived from Athens just in time to stop the Greek attack on Petrich.

On Monday, the 26th, the Council met in Paris. The situation of immediate danger, viz., the presence of Greek troops in Bulgarian territory, was at once dealt with. Evacuation was demanded within a time-limit of 60 hours, and an assurance that the necessary orders had been given was asked within a time-limit of 24 hours. The same day orders were telegraphed to British, French and Italian military attachés to proceed from Belgrade and Athens to supervise the evacuation. The attachés received their instructions on Tuesday, proceeded immediately by special trains, and arrived on the scene of action about 2 P.M. on Wednesday, Oct. 28. There followed one of the most dramatic and significant scenes in history. The attachés at once summoned the two commanders and gave them detailed instructions in the name of the League of Nations as to the evacuation, prescribing the times at which the evacuating troops should move and the interval which was to elapse before Bulgarian troops might enter the abandoned territory. Within about 11 hours of the officers' arrival, and eight hours before the expiration of the time limit, the last Greek soldier left Bulgarian soil.

The Council proceeded to deal with the question of reparation and of safeguards against the recurrence of similar incidents. They appointed a commission, under the chairmanship of Sir Horace Rumbold, and including French and Italian generals and Dutch and Swedish civilian members. The commission reported to the council at Geneva at its meeting in the first week in December. Its findings (*see* BULGARIA) were approved by the Council and accepted by the two governments. The incident was closed and future security in the Balkans substantially increased.

The League in this case acted with promptitude and efficacy. The spirit expressed and developed at the recent Locarno conference, the relative weakness of the countries directly concerned and the fact that this was the kind of problem with which the League was designed to deal, and was not complicated by the difficulties of incompletely defined treaty provisions, all doubtless contributed to this result.

These eight cases have been chosen as best illustrating the character of the political problems with which the League was faced during the years 1920-5, and its method of working. Other disputes were brought before the League: between Hungary and Rumania about the expropriation of certain Hungarian nationals in Transylvania; between Hungary and Austria about the Burgenland; between Hungary and Czechoslovakia about a frontier delimitation; between Finland and Russia about Eastern Karelia; a frontier dispute (Jaworzina) between Poland and Czechoslovakia, and a dispute between France and Great Britain with regard to the nationality of persons born of British parents but resident at Tunis.

Two Comments.—In reviewing the League's action in these political disputes as a whole, two comments at once suggest themselves:—

1. The extent of the League's power to act effectively necessarily varies with the general international relations of the governments in and outside the League. After Locarno the Council deals promptly and decisively with the Greco-Bulgar trouble. With the Vilna incident, which occurred when the relations between the principal powers were difficult and complicated by many divergencies of policy in other questions, the action is slow, indecisive and unsuccessful.

2. The League, whose normal task is to preserve peace on the basis of treaties fully concluded, is placed in a difficult position when it is asked to complete the work of settling terms of peace. In the Upper Silesia, Memel, Vilna and 'Iraq cases this was a complicating factor. In such cases the treaties are either incomplete or ambiguous; they may be complicated by *obiter dicta* in the course of the negotiations; the League is held responsible by public opinion not only for a decision within the limits of its mandate but for the character of the mandate which it has had no power to vary; and by the very fact that it is continuing the work of making terms imposed by a victor its impartiality is compromised.

DISARMAMENT AND SECURITY

The reduction of armaments is the first of the specific tasks imposed by the Covenant. There is none on which the League has achieved so little direct and tangible result, for armaments remain, in the world as a whole, at a level not very substantially lower than in 1913, and no reduction is directly traceable to League action. But the indirect results have been of great importance. For it at once appeared that reduction of armaments required an increased sense of security; and the search for methods of obtaining this led to the growth of a belief in all-inclusive arbitration, the most notable and fruitful political development since the Covenant.

The first action of the League was to appoint a "temporary mixed commission" to prepare the way for armament reduction. This commission, consisting partly of politicians (though not representing their governments), partly of military and other technical experts, and partly of persons representing special classes of public interest (*e.g.*, working-class opinion), finally elaborated a draft treaty of mutual assistance. The basic principle was a combination of a general and special guarantees. Within the cadre of a general treaty, groups of states would enter into detailed arrangements to support each other if attacked, and as a condition of being entitled to this support they would agree to proportional disarmament. The proposal was criticised on the ground that the detailed plans for reciprocal military support contemplated would be unlikely in fact to lead to reduced armaments and, above all, that the authorised grouping of friendly states against prospective enemies was in conflict with the essential spirit of the League. At the 1924 Assembly, when it was clear that these objections would be fatal to the draft Treaty, the whole problem was reviewed on another basis. In a month the "Geneva Protocol" was elaborated and unanimously agreed for recommendation to the governments (*see* SECURITY).

This second scheme also failed to win acceptance, the new Conservative Govt. of Great Britain taking the lead in its rejection as the previous Labour Govt. had led the opposition to the earlier treaty. Great Britain was not prepared to accept the unlimited obligation of arbitration in her own disputes, or the responsibility of assisting the enforcement of such arbitration over an unrestricted range of other countries who might accept the obligation.

Apart from the objection of substance made to certain of the principles of these two schemes, it may be suggested that their rejection was in part due to the methods and procedure by which they were framed, which differed from the ordinary practice and traditions of the League. The temporary mixed commission included in one body diverse elements (statesmen, experts, etc.) who, under the ordinary League system, are separated into

clearly differentiated committees, each with its own competence and defined rôle. In fact, serious misunderstandings sometimes arose as to the extent to which a statesman connected with a government, but not on this matter representing it, might be taken to be reflecting its policy or a policy it might be induced to accept. Moreover, the commission for a technical body, which it was in principle, perhaps worked too long without the effective direction of a political authority like the Council. The Geneva Protocol, on the other hand, was dealt with too rapidly by the political body, the Assembly, the work of experts having to proceed simultaneously with the political discussions and not having preceded them, as is the normal League method. The consequence was that the Assembly was acting more as an advisory body recommending a scheme than a political authority of fully accredited representatives. For so important a project the work of political preparation had been inadequate.

When all is said, however, it is difficult to regret even the haste of the 1924 Assembly, for the demonstration which it gave of the genuine desire of a large part of Europe for all-inclusive arbitration, and the impetus it gave to the movement towards arbitration throughout the world, have been perhaps the most important factors in political history since 1919.

Certainly the preparation of these two schemes was essential to the Locarno agreements of 1925. By " preparation " of course is not meant merely the technical elaboration of the proposals. In international agreements, that is always the least part of the work. It is the preparation of the public opinion of the world, of the minds of ministers and their advisers, which is the important thing. The preparation, in this wider sense, at Geneva was the indispensable basis of the Locarno treaties. These treaties provide for all-inclusive arbitration, on very much the Protocol principle, but over a restricted though wide range of countries; and for mutual guarantees and support somewhat similar to those of the original treaty of mutual assistance. It is, however, of their essence that the main vital guarantee is " bilateral " and not based upon a grouping of Powers presumed to be friendly against others presumed to be unfriendly.

Traffic in Arms.—Apart from these efforts to deal with the fundamental problem involved in the reduction of armaments the League has worked at the two subsidiary and connected questions of the traffic in arms and their private manufacture.

A Draft Convention to regulate traffic in arms was drawn up at a conference of 44 states, including the United States, Germany and Turkey, in Geneva in June 1925. The object of this Convention is to establish a general system of supervision and publicity over the international trade in arms and munitions, and a special system for certain land areas and maritime zones. Governments alone are to have the right to export or import arms exclusively designed for war, and a licensing system is provided for. In general, it may be said that the Convention does not give any effective authority to control traffic by international action, but is likely to provide the publicity which is the first condition of either national or international restriction when that proves practicable. This international aspect of private manufacture of arms, is still (1926) under preliminary study.

The Saar, Danzig, Mandates, Minorities

In certain areas of the world the League, normally an instrument through which sovereign states settle their differences or co-operate in matters of international concern, has itself direct and special responsibilities for government and administration. In the Saar it has the full responsibility of a sovereign state, exercised through a permanent commission appointed by and responsible to the Council. The small free city of Danzig is under its special protection, and a resident High Commissioner of the League acts as arbitrator on disputes between the free city and Poland. Over the large area of the mandated territories separated from the German and Turkish Empires by the terms of peace, it is responsible for seeing that the mandatory powers govern and administer in accordance with the mandate and the provisions of the Covenant. And in a number of states it has duties with regard to the protection of minority populations.

The Saar Basin.—The Saar Basin (*q.v.*) is a mining district, with a predominant German population of some 700,000, which the Treaty of Versailles transferred from Germany to the trusteeship of the League for 15 years, after which its future fate is to be decided by a plebiscite. The treaty prescribes the form of government, through a governing commission, subject to the Council of the League only, the inhabitants having no rights of representative government outside purely local administration, though the Commission are required to consider the views of elected representatives before changing the laws or imposing new taxes. The treaty also transferred the property in the mines to France in compensation for the destruction of the mines in Northern France.

The Saar Govt. is thus, by treaty provision, not by League decision, purely autocratic and unrepresentative. With an overhanging plebiscite and situated between France and Germany, it was inevitable that its inhabitants should have developed an extremely sensitive political consciousness and that the district should have been a mirror reflecting the controversies of its two great neighbours. There has in fact been considerable political friction and tension, varying directly with the changing political relations of France and Germany.

The Council and the Commission have been criticised for some of the appointments on the Commission, for the introduction of the French franc as the sole legal tender, for questions affecting education, for certain administrative decrees designed to prevent disturbances during a strike in 1923, for the presence of French troops for the maintenance of order which the treaty contemplated would be undertaken by local gendarmerie, and in general for an undue regard for French interests. The inquiry made by the League in July 1923 showed that some of the charges were not without foundation. The Commission has now developed an elected advisory council, designed to give as full representation to the wishes of the inhabitants as is possible under the autocratic régime imposed by the treaty; the administrative measures complained of in 1923 were changed with the termination of the strike; French troops were gradually replaced by local gendarmerie, and the political tension generally relaxed with the improved relations of France and Germany.

The main grievances, substantial though they had often been, have in reality been complaints against the provisions of the treaty, against conditions which those provisions made practically inevitable. Entrusted with the execution of terms imposed by the victor, the League is at once compelled by those terms to action which bears the mark of its origin, and at the same time is criticised by the standards properly applicable to an international authority which is not only impartial but unfettered.

Danzig.—The free city of Danzig, a small wedge between East Prussia and the Polish Corridor, is important as the chief outlet to the sea for Polish trade. To act as a kind of court of first instance for the disputes bound to arise out of the intricate and nicely balanced provisions of the Danzig constitution (*see* Danzig) it was provided by the Treaty of Versailles that the League should appoint a resident high commissioner, a further appeal lying to the Council. There has been great tension and mutual suspicion throughout practically the whole six years between Danzig and Poland, such as sometimes almost to make negotiations between the two impossible. Under these conditions the Council has had to devote much time at nearly every meeting to disputes of which the one about Poland's right to have post-boxes under her own control within Danzig is typical and the best known. The economic life of the city has on the whole been satisfactory, the vessels entering the port and the exports rising considerably above the pre-War level. The demoralisation of the German mark caused great difficulties, however, and capital was urgently needed to adjust her port and other facilities to the new conditions. The League gave an expression of its special interest in the city by assisting her to introduce successfully a stable currency of her own and later to raise a municipal loan for development purposes.

Mandates.—The German colonies and the Arab provinces of the Turkish Empire, ceded as a result of the World War, were not transferred to other states in full sovereignty. Their administration was entrusted to different mandatory powers under the general supervision of the League. For the terms on which the mandates were given and the general supervision exercised by the League through the permanent mandates commission, *see* Mandates.

It is difficult to measure the extent to which this system of supervision does in fact modify colonial administration. No indication can of course be found by searching the League records for instances of censure and repentance. That is not the way in which the influence of a collective opinion operates, or can operate, without disruptive results on the conduct of Great Powers. That does not mean, however, that this influence is not profoundly effective. Mandatory powers and their administrators are keenly sensitive to the candid and informed criticism which is always forthcoming in the Commission's meetings, even if it finds little reflection in the public resolutions; and the desire to avoid risk of exposure to it is a factor in daily colonial administration comparable with the influence exercised by Parliament on Whitehall by the right to ask questions of the responsible minister.

Minorities.—The work of the League in the protection of minorities (*q.v.*) is one of the most important, and perhaps the most delicate

of all its current duties. Nine states are under treaty obligation, and five others have by declarations accepted a similar engagement, to observe in their administration certain principles designed to secure to racial and religious minorities within their territories protection of life and liberty, the free exercise of religious rights and the free use of their native tongue, with opportunities of education in it where it is the native tongue of a considerable proportion of the population. The minorities number in all some 30,000,000, and are so situated that no possible treaty provisions or frontiers could have given them rights of sovereign self-government without creating innumerable states or enclaves. They are free citizens of the states to which they belong, and the only ultimately satisfactory solution is that they should become indistinguishably incorporated in the general political life of the country. In the meantime the racial, religious and traditional feelings of enmity between them and those who form the majority of the population subject them to the dangers of differential majority government and administration.

The difficulties so caused constitute perhaps the greater part of the political troubles and political dangers of Europe. It is a problem of peculiar delicacy, for the minorities constitute a kind of state within the state, and interference with or even open criticism of the government on which the daily conditions of their life depend may always do more harm than good. For this reason complaints are only considered officially by the Council if they are put on the agenda by a member of the Council, who satisfies himself that they are sufficiently serious and well founded to justify this action; and the council itself deals directly with these questions, not entrusting them beforehand to any technical committee. The League's influence is exercised for the most part in the form of private representations and conversations which gain their authority from the fact that the sanction of a public discussion at the Council always remains as a possibility in the background.

Economic and Financial Reconstruction

The reconstruction work of the League shows, better than anything else, that the League is not confined to a limited range of special tasks, but is an instrument which the governments of the world can use for any form of international co-operation they wish to undertake. The Covenant imposes scarcely any specific economic or financial duties. It implies the preparation of economic sanctions; it contains the obligation to secure and maintain freedom of communications and transit and (in a vague and ambiguous phrase) equitable treatment for the commerce of all member states; but there is nothing which directly contemplates such tasks as that of the financial restoration of a country.

The League's work in this sphere began with the Brussels financial conference held under its auspices in Sept. 1920. Experts from 39 countries, named by the governments but not representing their policy, met to consider the methods by which stable finances and currencies could be restored. They drew up a series of unanimous resolutions which, elaborated as they were by the later Genoa Conference of 1922, have since served as a useful guide and support to countries attempting to restore their finances. More important, however, than the establishment of this general body of doctrine was the League's practical work in itself restoring the finances of two countries, Austria and Hungary, whose problem was beyond their own unaided resources.

Austria.—It is interesting to observe the mechanism of the League in dealing with the extraordinarily complex political and financial problem of the republic of Austria (*q.v.*). A sub-committee of the Council handled the political aspects of the question. The financial committee worked out a technical scheme of reconstruction; the economic committee considered what immediate economic measures would be useful; a legal committee worked side by side and prepared the formal instruments to embody the technical recommendations; and behind all the Assembly provided the motive force of the collective good will of the world towards an effort to save a member state from destruction. The composition of the financial committee, on which the heaviest burden fell, deserves special attention. It consisted of experts, partly drawn from national treasury departments and partly from private finance. They sat as experts and not as representatives of governments, and were thus able to recommend proposals involving government action, without waiting for the assent of the governments. At the same time, their position enabled them to estimate with special knowledge how far it was possible to induce the several governments to go.

The principles of the scheme proved of such importance in the future history of European recovery, and were so novel and untried at the time, that it is well to summarise them briefly. The immediate trouble with Austria was that her currency was rapidly falling to zero. This was due primarily to the fact that the revenue was insufficient for the public expenditure, and the government, having no other resources, was meeting the deficit by printing notes. The scheme therefore provided that the inflationary issue of notes should cease and, to assure this, that the right of note issue should be transferred from the government to an independent Bank of Issue, working on commercial principles. This of course did not solve the problem. Inflation resulted from the unbalanced budget. Austria was, therefore, required to undertake internal reforms which would bring the budget into equilibrium. As this would take some years, and it was essential to stop inflation at once, it was proposed to raise an external loan of some £27,000,000 which would be available to meet deficits during this period. As security for this loan Austria's assets, primarily her customs and tobacco receipts, were assigned and placed under control. At the time, however, there was an obvious danger that Austria herself would fall to pieces, in which case her customs and tobacco receipts might also disappear. They were, therefore, an insufficient basis on which to issue a loan. This difficulty was met by securing government guarantees of the loan, in different proportions, from Great Britain, France, Italy, Czechoslovakia, Sweden, Holland, Belgium and Denmark, two other countries, Spain and Switzerland, associating themselves with the loan in a somewhat different form. In addition, a political protocol was signed assuring Austria's political and economic independence. Lastly, there was to be a Commissioner-General responsible to the council in general control of the whole scheme, controlling the assigned revenues, holding the proceeds of the loan, and supervising the reform of the Austrian budget.

The scheme was therefore essentially one of *financial* reconstruction. It did not directly undertake the economic restoration of the country. Its contribution to economic development was to afford the indispensable basis of a sound currency.

This work is now practically completed. The currency was at once stabilised in 1922 and has remained absolutely stable ever since, the only currency in Europe remaining stable throughout the period. Taxation receipts covered ordinary expenditure during 1924–5 and a large part of the reconstruction loan has been available for increasing the capital resources of the country by productive investment. The control of the budget ceased on Dec. 31 1925, and it is anticipated that the office of the Commissioner-General will be terminated before the end of June 1926.

Hungary.—The results in Austria led, a year later, to a request for similar aid from Hungary, whose currency and finances reached the same position as Austria's, though more slowly. Here the problem was technically easier, as Hungary had a solid agricultural basis for her economic life and was more than self-sufficient in the primary necessities of food. But it was politically more difficult, for her neighbours, particularly Czechoslovakia, Serbia and Rumania, speculated anxiously as to the attitude of a restored and strengthened Hungary, and their relations with her were embittered by many unsettled disputes. The League could not act except at the unanimous wish of all the interested countries, who included Hungary's neighbours, and it looked as if this would prove an insuperable obstacle. Under the influence of the League, however, these disputes were settled—with an incidental advantage to the political situation of Central Europe extending far beyond the immediate results of the reconstruction scheme.

The scheme was identical in its main principles with the Austrian, but the loan was less than half the amount, it was issued without government guarantees and provision was made for a moderate reparation payment under technical conditions which afforded a valuable precedent for the German problem. The Hungarian crown was at once stabilised in relation to sterling and with sterling has now gone on to gold. The budget recovered its balance after the first few months. Control began on May 1 1925. The first subsequent financial year (July 1 1924 to June 30 1925) showed a surplus of 63,000,000 gold crowns and there was a further surplus in the first six months of the following financial year. The great bulk of the loan, therefore, not being required for its primary purpose of meeting budget deficits, will be devoted to productive investment. It is anticipated that the control will end with a declaration by the Council that the financial stability of Hungary is assured at about the same time as the Austrian, *i.e.*, in June 1926.

German Reparation.—Though the League had no direct responsibility for handling the German reparation problem, the experience gained in the Austrian and Hungarian schemes certainly contributed to its solution. The most important principles of the Dawes scheme had been anticipated, and for the most part tried in practice, in these earlier schemes. It is sufficient to mention the stabilisation of the currency, the foundation of an independent bank of issue, the provisions for the maintenance of budget equilibrium (with the important difference that no general budget control was necessary in Germany), the fixation of reparation payments not for all time but for a considerable period, the principles of the control of the assigned revenues and the "transfer" system.

Greek Refugee Settlement.—Reconstruction work of a somewhat different kind has been undertaken by the League in the settlement of Greek refugees (*see* Refugees) who to the number of nearly 1,500,000 or more than a fifth of the population of Greece, fled back to Greece as a result of the Greco-Turkish War, a task evidently beyond the unaided resources of Greece. With the aid of the League a loan of £10,000,000 was raised and employed to settle the refugees

in productive employment, mainly upon the land. The work, directed by a refugee settlement commission, consisted of an American chairman and a British vice-chairman, selected by the League, and two Greek members, chosen with the Council's approval by the Greek Government. The bulk of the refugees were housed, allotted land, and started on their new careers with a small initial capital and the necessary equipment.

Among other work carried on under the direction of the financial committee have been the introduction of a new and stable currency, later followed by a municipal loan, for Danzig; financial advice to Estonia and Albania; and a study, which is still continuing, of the problem of double taxation.

Trade and Commerce.—Meantime the economic committee has been working patiently at the task of securing more "equitable treatment" for commerce in the spirit of Article 23 of the Covenant, and in removing impediments to international trade. The most important achievement in this sphere was the conclusion in Oct. 1923, of a convention for the simplification of customs formalities. In addition, a convention has been arranged which has removed some of the obstacles to commercial arbitration. The committee have also considered the equitable treatment of foreigners (the recommendation of a code of principles to guide governments in their treatment of foreign enterprises established in their territories) and the suppression of fraudulent trade marks. They have embarked upon an attempt to secure the abolition of prohibitions of exports and imports.

A communications and transit committee, with numerous subcommittees, includes experts in land, sea and air transport, and is responsible to a periodical conference. The first important conference was held at Barcelona in 1921, when two conventions were approved laying down the general principles that transport originating in one state and crossing a second into a third, or transport making use of through international waterways (*see* INLAND WATER TRANSPORT), should enjoy complete liberty of transit with equal treatment for all flags and freedom from customs duties and vexatious dues. A second conference held at Geneva in Nov. 1923 dealt with international railway traffic, equality for shipping in maritime ports, the transmission of electric power across a third state and the development of hydraulic basins situated between two or more states. The maritime forts convention, drawn up at this conference, provides for equal treatment of all states in port dues and regulations, while the railway convention codifies existing railway practice as regards international traffic and aims at simplifying frontier formalities for passenger and goods traffic. All the conventions concluded at these conferences provide for machinery of compulsory arbitration similar to those contained in the clauses of the Peace Treaties of 1919 relating to communications and transport. In such cases the transit committee of the League acts as a mediatory body before a case goes for compulsory settlement to the international court of justice. The transit organisation has been instrumental in effecting considerable improvements in the passport system (particularly in the abolition of visas in many cases) and it has arranged a further passport conference to continue this work in 1926.

Among other questions studied are the reform of the calendar, commercial aerial law, wireless regulations, international motor drivers' licences, etc.

MISCELLANEOUS QUESTIONS

The League is also an instrument of positive co-operation in work of general benefit to the world. The short space here allotted to this must not be taken as an adequate measure of its relative importance in the general achievements of the League. For its health work the League has the assistance of a technical health committee, composed, like the financial, economic and transit committees, of experts. This health organisation has had the active co-operation of the United States, Germany and Russia, as well as the member states, and its activities have extended throughout Europe and the Eastern Mediterranean, tropical Africa and the Far East.

Public Health.—Its first important work was to assist Poland by means of an Epidemic Commission with the best western experience to prevent the spread of typhus through Poland to Europe. For this purpose it was necessary to attack the problem in Russia itself, and the Commission went to Russia, established effective co-operation and opened offices in Moscow and Kharkov. This was followed by a European conference at Warsaw in May 1922, attended by Soviet Russia, the Ukraine, Turkey, Germany and 24 other states. A draft convention was drawn up and has since become the basis of bi-lateral agreements between the nations adjoining Poland and Russia. Public health courses were arranged for health officers at Moscow, Kharkov and Warsaw. The Epidemic Commission next gave assistance to the Greek health authorities in dealing with the dangers of epidemic resulting from the sudden immigration of masses of Greek refugees in and after the Greco-Turkish war.

Apart from such emergency assistance, much has been done to secure an interchange of knowledge and experience between the public health organisations of the world, to promote their co-operation and to study the characteristics of special epidemic or endemic diseases and the methods of combating them. Various missions have visited the Eastern Mediterranean, the Far East, Greece and Albania, the Balkan States, Russia and Italy, Palestine and Syria and Persia. Scientific work is also being done with a view to the standardisation of sera and of certain drugs for the treatment of diphtheria, tetanus and dysentery.

An interesting experiment, which has been made possible on a large scale by the generosity of the Rockefeller Foundation, is the interchange of selected officers of health administrations. Officers of one country visit those of another, study their methods, participate for some weeks or months in practical work and then meet at Geneva to compare results. Lastly, the health organisation maintains an epidemiological intelligence service, publishing at regular intervals detailed information of the movement of epidemic disease throughout the world.

Drug Traffic.—Of what may be called the social questions handled by the League the control of noxious drugs, and particularly opium, has been the most difficult and important. The League took as its starting point the Opium Convention of 1912, which had been signed by most countries in the world. An advisory committee was appointed to prepare a plan to make the application of this convention more effective in practice. They took as their aim the restriction of the traffic to medicinal and scientific requirements, and started an investigation to discover the extent of these requirements. Finally, the U.S. Govt. sent a delegation to participate in the work of this committee, and in any conference which might follow, and to attend the 1924 Assembly which reviewed the progress of the previous year and a half. Two plenipotentiary conferences followed in the winter of 1924–5. The first of these dealt with the question of the gradual suppression of opium smoking in the Far East with a view for its ultimate abolition.

At this an agreement was reached under which the signatory states undertook (*a*) to strengthen the measures already provided for in the convention of 1912 and (*b*) to suppress entirely the consumption of prepared opium in their respective territories within 15 years from the date at which the poppy-growing countries should succeed in preventing the clandestine exportation of raw opium from constituting a serious obstacle to the restriction of consumption in the former territories. The second conference drew up a convention for the more effective restriction of the production or manufacture of narcotics and of the international trade in them. The latter is to be controlled in particular by a system of export authorisations and import certificates. A permanent central board is to be established which is to receive periodical estimates from the contracting parties of the quantities of narcotics they need and ask for explanations if they are such as to suggest a danger of illicit traffic. A further protocol engages the signatory states to take measures which shall completely prevent, within five years, the smuggling of opium out of their territories from constituting a serious obstacle to the suppression of the use of prepared opium in other countries.

The American delegation had brought a complete programme of their own, which they failed to get adopted. The chief difference was that they wanted a more definite undertaking than the other countries thought practicable for the restriction of the growth of the raw product and for the cessation within a term of years of the prepared opium. They ultimately withdrew from the conference, as did China.

White Slave Traffic.—Certain work has also been done by the League in connection with the traffic in women and the protection of children. A convention was drawn up by the 1921 Assembly strengthening in certain respects the provisions of two pre-War conventions dealing with traffic and has been signed by 33 states. The problem is also being studied by one of the two committees of the Commission for the protection and welfare of

children and young people, which includes representatives of voluntary organisations and makes annual recommendations to the Assembly. The study of child welfare is undertaken by the Child Welfare Committee of this Commission.

Apart from this general work the League took direct practical measures in 1921 to rescue, and where possible restore to their own people, women captured and removed from their homes during the military operations in the Near East, houses of refuge being established at Constantinople and Aleppo. Lastly, in 1923, the League arranged a conference at which a convention was drawn up to assist in the suppression of the international traffic in obscene publications.

Humanitarian Work.—Two important pieces of humanitarian work have been undertaken by the League through Dr. Nansen. In 1920 large numbers of war prisoners were still in Russia and adjacent countries awaiting the means of repatriation. With the aid of certain charitable societies Dr. Nansen organised a fleet of steamers under League charter in the Baltic and Black seas and 427,386 prisoners of 26 different nationalities were repatriated at the astonishingly low cost of less than £1 a head. Dr. Nansen also undertook somewhat similar work for the settlement of large numbers of Russian refugees. Their movements were assisted by the invention of a special system of identity certificates, as a substitute for passports, and considerable progress has been made in finding them employment.

Two other pieces of humanitarian work may be mentioned in conclusion, a convention drawn up at the 1925 Assembly for the suppression of slavery (*q.v.*) and restriction of forced labour, and the scheme prepared by Senator Ciraolo and now being worked out in collaboration with Red Cross organisations, for the provision of insurance against national calamities such as earthquakes. Among other tasks, the most novel departure has perhaps been the work of the committee on Intellectual Co-operation (*q.v.*) which has till recently been presided over by M. Bergson and has included among its members Prof. Einstein, Madame Curie and Prof. Gilbert Murray.

Under Article 24 of the Covenant some international bureaux established by convention must be, and others may be, brought under the League. Four such organisations have now been affiliated, viz.: relief bureau (for the repatriation of distressed persons), a hydrographic bureau (to secure co-ordination in hydrographic work), an office for the control of liquor traffic in Africa and a committee for air navigation. The League issues a handbook giving information about some 360 international organisations and a quarterly bulletin giving some account of their work.

Summary of Work

In these six years (1919–25), therefore, the League has averted hostilities in some half-dozen cases and probably prevented at least minor wars in several of them. It has made a substantial contribution to Europe's recovery by the guidance and influence of the Brussels Financial Conference; by the direct reconstruction of Austria and Hungary; by the model so afforded for the solution of the German problem and the self-restoration achieved in other countries; and by a series of transit and customs formalities Conventions and other measures designed to remove the impediments to international trade. It has repatriated some hundreds of thousands of refugees and established nearly 1,000,000 in productive employment in Greece. It has exercised a varying but increasing influence over the government of some 30,000,000 of minority populations entrusted to its guidance. It has supervised the mandatory administration of the former colonial Empire of Germany and Turkey. It has directly governed the district of the Saar and has assisted in the government of Danzig. It has worked at a number of social problems, the regulation of opium and other drugs, and the protection of women and children.

Apart from these tangible and visible results, it has penetrated and modified the policies of national governments through the regular contact, and co-operation in international work, of Foreign Ministers, quarterly and annually at meetings of the Council and Assembly, and of their advisers and technical assistants both at these meetings and at a series of technical conferences and discussions. Beginning with disarmament but extending to security, it has prepared the way for the great extension of comprehensive arbitration embodied in the Locarno agreements and doubtless destined to extend beyond them.

On the other hand, the League remained long impotent before the protracted conflicts which reflected the incompleteness of the conclusion of peace in 1919 both in diplomacy, as in the reparation question, and in actual hostilities, as between Greece and Turkey. In some of the disputes which it has handled, it has been indecisive or ineffective; in others, the nature of its action has apparently been determined as much by the relative strength of the disputants as by considerations of ideal justice. It has made no material progress in securing disarmament. Its work in removing the fundamental causes of war, and in particular those which spring from economic policy, has only begun.

Whether these results will be regarded as disappointing or as satisfactory will doubtless depend mainly on the standard by which they are judged. By comparison with the pre-War position and methods of negotiation there can be no doubt that they represent a very great achievement. No better illustration can perhaps be found than in two references to Lord Grey's book, *Twenty-five Years* (1926). Of the London Conference of Ambassadors of 1913, for example, he says in effect that it lasted eight months, discussed minor questions and settled nothing, but was well worth while because it gave the world a sense of confidence to think that there was some method of international contact during a period of tension.

In contrast with this, even the Assembly of 1925, the least spectacular of recent years, in three weeks dealt with a mass of useful work, of real if secondary importance, and the assurance of a regular method of international contact is now not temporary but permanent. Still more significant is the account which Viscount Grey gives of the conference of the Balkan Powers when they met, as it happened in London, after the first Balkan conflict of 1912. He believed that the policy they were discussing would mean both the resumption of war and a disastrous result, as indeed it did. But neither Great Britain nor any other Great Power was directly concerned. If his opinion were asked in unofficial conversations he gave it, informally, tentatively—and in fact without effect. Neither he nor anyone else felt able to intervene in a matter directly affecting only the negotiating States. The second disastrous war followed. In contrast with this the settlement of the recent Greco-Bulgar dispute of 1925 illustrates the recognition of the new principle that a war is the concern of the whole world.

If, however, our standard of judgment for the results of the six years is not the pre-War position but the ultimate ideals of the League, it is no less clear that the League's work is only in its infancy. The League is not yet universal in its composition. Its ability to deal with a first-class dispute between first-class Powers has fortunately not yet been tested. There is as yet no complete assurance that such a dispute would find the League united and effective. Nor has more than a beginning been made in removing the causes from which such disputes may arise. This, the ultimate object of the League, must in the nature of the case be a progressive, and indeed a permanent task. It means a complete, if gradual, revolution in the traditional and historic attitude of the nations of the world to each other and a transformation of many of their policies. In this work the League may lead, but it can never advance far beyond, the public opinion of the world. The scope is illimitable and the task unending.

Bibliography.—The main authorities are the League's own publications, which give complete information as to all its activities. In the first place the *Official Journal* contains the minutes of the Council with the documents presented to it; while the records of Assembly meetings are issued in special supplements. All Treaties registered under Article 18 of the Covenant are published in the *Treaty Series*. All reports of specially appointed League Commissions are at once published, as are also the periodical reports of permanent officers and authorities carrying on League work (such

as the Commissioners General in Austria and Hungary, the Greek Refugee Settlement Commission, the Saar Governing Commission, etc.). As these official records are very voluminous the League also publishes (*a*) an abbreviated *Monthly Summary*, giving a regular account of League activities and (*b*) a series of special pamphlets as to special tasks (health work; reconstruction of Austria; mandates, etc.) and a general summary "A Survey." In addition, the League issues technical publications on various subjects of world interest. Of these the most important are the *Economic Publications* (including a *Monthly Bulletin of Statistics*, which gives a synopsis of all main statistics indicative of economic development throughout the world, and annual publications on *Currency, Public Finance, Trade and Commerce*), a *Military Year Book* and a *Monthly Epidemiological Report*. These publications are issued in English and French through League agents (in England Messrs. Constable).

Books on the League work are numerous, especially with regard to special subjects (the Saar, Opium, etc.) and the general principles and conception of the League. Of those which summarise the general work of the League the following may be mentioned: Publications by the League of Nations Union (1920, etc.); Organisers of the League of Nations, *The League of Nations Starts* (1920); W. Schücking und H. Wehberg, *Die Satzung des Völkerbundes. Kommentiert* (1921); L.V.A. Bourgeois, *L'Oeuvre de la Société des Nations 1920–1923* (1923); P. Munch, *Les Origines et l'Oeuvre de la Société des Nations* (1923); R. Williams, *The League of Nations To-day* (1923); H. G. Alexander, *The Revival of Europe* (1924); M. Fanshawe, *Reconstruction*, a full summary to 1925, well documented (1925). League of Nations Information Section, *Pamphlets on the League of Nations*, its Covenant and its various activities; P. J. N. Baker, *The Geneva Protocol for the Pacific Settlement of International Disputes* (1925); Sir G. G. Butler, *A Handbook to the League of Nations, brought down to the end of the 5th Assembly*, with an explanation of the Protocol . . . with an introduction by the Right Hon. Viscount Cecil of Chelwood, 2nd ed. (1925). The publications of the World Peace Foundation include a number on the work of the League. Among these are *Handbook on the League of Nations, 1920–24*, and the *Yearbook of the League of Nations* (1925). (A. Sr.)

LEARNED SOCIETIES.—Incorporated by royal charter in 1902 "for the promotion of historical, philosophical and philological studies," the British Academy has since 1910 proved itself a potent force in the branches of learning which come within the scope of its activities.

The Proceedings of the British Academy, of which 10 vol. have been published, comprise "communications," together with special annual lectures endowed by private benefactors, or by public subscription. Other publications are *Supplemental Papers* (1911, etc.) and the annual *Schweich Lectures* on Biblical Archaeology, inaugurated in 1908.

The Fund—an anonymous endowment of £10,000—has also enabled the Academy to help forward the work of excavation in Bible lands. The series of *Social and Economic Records* under the direction of the late Sir Paul Vinogradoff, was started in 1908, with the support of a Government grant; five vol. have now been published. A renewed grant in aid of the Academy's work has furthered the continuation of this series. The publication, by the Clarendon Press, of the facsimiled *Old Testament of the Codex Sinaiticus* (1911–22) was made possible by an anonymous gift.

National Commemorations.—Since, in 1908, it organised the commemoration of the tercentenary of Milton's birth, the Academy has become the recognised co-ordinating body for the organisation of similar national commemorations, aided in this by the foundation of the annual Master Mind Lecture (one of a number of endowments, under the will of the late Henriette Hertz). The Academy's activities in furthering the Shakespeare tercentenary in 1916 were stimulated by the establishment, in 1911, of the annual Shakespeare Lecture (endowed by the late Mrs. Frida Mond). The annual Raleigh Lectures on History (founded by Sir Charles Wakefield, in 1919) the tercentenary of the death of Sir Walter Raleigh, were inaugurated by Lord Bryce, president of the Academy, with a survey of world history.

Among other endowments may be mentioned the Warton Lecture on English Poetry; the Philosophical Lecture; the Italian Lecture; the Lecture on Aspects of Art; the Lecture on English Philology and Literary History; the Cromer Prize for Greek Essay; the biennial Prize for English Studies. The Academy administers also the Rose Mary Crawshay prize fund for English literature, an annual prize of £100 awarded to a woman of any nationality for work on English literature.

Educational Work.—The Academy has provided a platform for dealing with educational needs. Thus, the School of Oriental Studies, now an integral part of the University of London, was largely the outcome of a scheme submitted to the Academy in 1904 by the late Professor Rhys Davids. The organisation of Imperial Studies, now recognised in London and in other British universities, was directly due to proposals made by Sir Sidney Low, in a paper read before the Academy in 1912. The English Place-Name Society, founded in 1921, to carry out the survey of English place-names, was inaugurated under the auspices of the British Academy in 1923, as the result of a statement submitted by Professor A. Mawer, now Director of the Society. The membership of the Society, drawn from all parts of the country, already numbers some 700. The foundation of the British School of Archaeology in Jerusalem in 1919 was brought about by the Academy, in conjunction with the Palestine Exploration Fund. Students are now being trained at the school to fill posts created by the formation of a Government Department of Antiquities. The compilation of a register of the archaeological sites of Palestine has been taken in hand. The Government Museum of Antiquities has been organised. The exploration of various sites in Palestine and, not least, the excavation of two palaeolithic caves in Galilee, and the discovery of the "Galilee" skull, are among the early achievements of the school, under the directorship of Professor J. Garstang. The establishment of the British School at Jerusalem, in which the late Professor Leonard King was primarily concerned as initiating the idea, must take an important place among the more recent efforts of the Academy. In all this archaeological work the Palestine Exploration Fund has been foremost and active, and among its recent excavations are those on the Hill of Ophel at Jerusalem, the results of which confirm the view as to the site of the City of David. Meanwhile remarkable discoveries have been made in the Near East (*see* ARCHAEOLOGY: *Western Asia*).

Among the enterprises promoted by the Academy is the *Encyclopaedia of Islam* (1908, etc.)—perhaps the most important project of the International Associations of Academies (which lapsed at the outbreak of the World War). The scheme was launched at the meeting of the Association held in London, 1904. The encyclopaedia is issued in English, French and German. Sir Thomas Arnold, nominated by the Academy, acts as English editor. The Government of India, through the Academy, contributes towards the publication of the English issue.

International Relations.—Internationally, the Academy is closely associated with the newly established Union Académique Internationale, in which body it represents Great Britain. The principal proposals of the *Union* in which the Academy is concerned are the following: (*a*) *Corpus vasorum* (1922, etc.); (*b*) *Catalogue of Alchemical MSS* (1926, etc.); (*c*) *Dictionary of Mediaeval Latin;* (*d*) *Forma Imperii Romani;* and (*e*) supplements to the *Corpora Inscriptionum graecarum et latinarum.*

Other Learned Societies.—The leading departmental societies, the Society of Antiquaries, the Royal Historical Society, the Royal Society of Literature, the Early English Text Society, the Selden and other societies have all continued, developed and renewed their activities, during the period under consideration. Among newer developments may be mentioned the remarkable progress of the less eclectic institutions, such as the English, classical, historical, geographical and modern languages associations, and the important part played by them in securing due recognition for humanistic studies, in the scheme of national education. The value of classical study is increasingly recognised and there is due appreciation of the danger likely to accrue were it submerged by newer studies. The organisation of co-operative research in studies appertaining to modern languages and literatures was advanced by the foundation, in 1916, of the Modern Humanities Research Association. Many agencies have promoted the recognition of English and its paramount position among modern studies—notably the English Association, and, in more specialised work, such societies as the Early Text Society, the Malone and the S.P.E. (Society of Pure English), of which Dr. Robert Bridges, is the founder and leading spirit.

The Shakespeare Association (incorporating the Shakespeare Day Committee), founded in close connection with the Shakespeare Tercentenary, 1916, has started a survey of Shakespeare in the various countries of the world, and has published a number of papers. The Bibliographical Society, founded in 1892, has since 1910, mainly owing to the activities of Professor A. W. Pollard, issued a number of important publications on English bibliography. In 1920 the society took over *The Library*, founded by the late Sir John MacAlister in 1888, and incorporated its *Transactions* with it, as a bibliographical quarterly. (I. G.)

Societies in the U.S.A.

A feature in the United States during the period 1910–26 has been a marked tendency towards decentralisation and specialism in constantly narrower groups or subjects. The number of societies has increased, with a corresponding increase in the number of individuals engaged in research work, but the professed scope of the large majority of these organisations is local, particularly in the fields of history, ethnology and geology. All the older societies continued to function, with little or no change in organisation or objective. The Smithsonian Institution maintained its pre-eminency, particularly in the fields of American ethnology and astrophysics. The American Oriental Society, founded in 1842 for the promotion of Oriental studies and the encouragement of research in Eastern languages and literature, continued to publish a journal which has appeared without a break since 1843, and extended its activities by including in its field of research the historical study of religion in its widest scope. The National Geographic Society, with possibly a larger membership (700,000) than any other society in the United States, was very active both in organising and financing explorations and in publication.

Of recent formations the Carnegie Institution of Washington, D.C., is the most important. It was endowed in 1902 by the late Andrew Carnegie with a sum of $22,300,000 to encourage in the broadest and most liberal manner investigation, research and discovery and the application of knowledge to the improvement of mankind. Organised in departments, including those of experimental evolution, embryology, botanical research, marine biology, meridian astrometry, eugenics and nutrition, it is working energetically along its selected lines of investigation. In addition to other work in terrestrial magnetism, researches are prosecuted in atmospheric electricity, magnetism in general and other allied topics. The Institution has physical laboratories at National Rock Creek Park, D.C., a nutrition laboratory at Boston, Mass., where studies of the metabolism of normal individuals and of diabetics and other researches connected with metabolism are conducted, and a desert laboratory for botanical research at Tucson, Arizona. In addition it maintains the Mount Wilson observatory at Pasadena, California.

LEATHER (*see* 16.330).—Several noteworthy advances nave been made since 1910 in the science and practice of leather manufacture.

I. IMPROVEMENTS IN MANUFACTURING METHODS

New Institutions.—A notable addition to the institutions engaged more particularly in the study of scientific problems of the leather industry is to be recorded. In 1924 the American Tanners' Council established a leather research department in the University of Cincinnati as a memorial to members of the industry who lost their lives in the World War. In the first place the department is to be devoted to research work, but eventually it will extend its activities to the training of chemists for the industry. A leather research institute has also been established at the Darmstadt Technische Hochschule.

New Bating Materials.—Probably the most notable change in the processes of light leather manufacture is to be found in the utilisation of artificial bating or puering materials in place of the natural materials formerly used. In manufacturing soft flexible leathers the skins were exposed, after removal of hair or wool, to a bate or puer made by fermenting the excreta of fowls or dogs. The researches of J. Turney Wood of Nottingham resulted in the production of a satisfactory substitute from the pancreas of animals, which contains enzymes capable of bringing about most of the desired changes in the skins. Under various proprietary names, and usually mixed with ammonium chloride, pancreatic preparations have superseded the old type of puer to a great extent. The artificial bates are free from the objectionable features inseparable from the use of fermented natural material, are more uniform in composition, and their action upon skins can be better controlled. For a few purposes tanners find that the artificial bate is not entirely satisfactory, but a large proportion of European and American tanneries no longer use the natural bates.

New Tanning Materials.—A great number of new vegetable tanning materials have been brought to the attention of tanners from time to time, but the staple materials now used are not very different from those employed in 1910. The use of mimosa bark as a source of tannin has certainly increased, and this material, grown largely in South Africa, is exported either as such or in the form of a solid concentrated extract of the bark. Several modern extract factories have been erected for this purpose at convenient points in South Africa, and the product competes with the solid quebracho wood extract of South America as a relatively low-priced and efficient tanning material.

The sulphite cellulose liquors, by-products of the paper industry, have found some application in the leather industry. Although not strictly tannins, when suitably treated they combine with hide substance, and have been successfully used in conjunction with ordinary tanning materials in the production of sole leather.

Synthetic Tanning Materials.—As a result of the researches of Dr. E. Stiasny, of the Leather Industries Dept. of Leeds University, synthetic tanning materials have been manufactured and used on a commercial scale, and were particularly useful when the regular supplies of tanning materials were interfered with during the War. In principle the preparation of synthetic tannin is simple. Phenolic bodies such as cresol are treated with sulphuric acid, and under carefully regulated conditions the product is condensed with formaldehyde and partly neutralised with an alkali. The first synthetic tannin of this type was named "Neradol" by Stiasny and manufactured by the Badische Anilin und Soda Fabrik. Various firms now produce similar materials in most European countries and in the United States. The synthetic tannins have many of the chemical properties of tannin, and are capable of converting skin into leather, but they appear to give more satisfactory results in practice when used in conjunction with other tanning materials. A great many modified processes of manufacture have been suggested from time to time, but there is some diversity of opinion amongst tanners as to the merits of synthetic tannins, and in their present form it is improbable that they will replace the natural tanning materials to any great extent.

The Chrome Process.—The chrome tanning process is now utilised in the manufacture of a large proportion of all boot upper leathers. It is estimated that in Great Britain about 80% of such leathers are now chrome-tanned, and this figure probably represents the approximate proportion used in other countries. Chrome-tanned sole leather is now manufactured in appreciable quantity, and as the early disadvantages associated with it have been overcome, a waterproof, non-slipping chrome sole, more durable than the vegetable tanned product, is now produced. It will probably be used in increasing quantity, although more costly to produce than the older type, and this fact may restrict its use.

Use of Pigments.—In the finishing of coloured leathers pigments are now used in increasing quantity, as a more uniformly coloured surface can be obtained than is possible in most cases with coal-tar colours alone. The leather is dyed with solutions of the latter in the ordinary way, and in the final stages of finishing very finely ground pigments suspended in suitable media are sprayed or swabbed over the leather surface. On the highest grade leathers this may be unnecessary, but the appearance of medium and low-grade skins is improved by the treatment.

Machinery.—The developments on the mechanical side of tannery equipment have been concerned chiefly with the improvement of existing types of machinery. Probably the most interesting to the British sole leather tanner is to be found in the perfection of the unhairing and fleshing machinery. Machines which remove hair and flesh from skins and sides (*i.e.*, half hides) have long been available and used in tanneries throughout the world, but the special difficulties connected with the manipulation of heavy whole hides were not met until the Turner Tanning Machinery Co., Ltd., developed the pneumatic roll unhairing and fleshing machine. British sole leather tanners who work whole hides, as distinct from sides, through the earlier processes in the tannery, found this machine particularly useful when manual labour was scarce in 1914–8, and have continued to use it successfully since then.

The Liming of Hides.—Two devices with the same object—the economisation of labour in the liming of hides—have been patented and found some application in sole leather tanneries. In both systems the hides are suspended in pits containing the depilating solution, and in one (Forsare) the liquor is agitated and circulated between the hides by blowing compressed air through perforated pipes fixed at the bottom of the pits. In the other system (Tilston, Melbourne) the liquor is distributed by means of a paddle which moves slowly along the bottom of the pit. The heavy manual labour involved in handling and setting the hides by the orthodox method, where hides are piled in a pit, is avoided, but both of the new systems require a larger pit space for dealing with a given number of hides than does the older method. In the period under review there has been a notable increase in the number of chemists employed in the leather industry, and there are few important tanneries which do not now employ one or more specially trained chemists on their staffs.

(D. McC.)

II. THE TRADE IN LEATHER

The main differences in the distribution of the industry since 1911 affect the position of Great Britain and the United States. Great Britain, with the exception of certain classes of leather, is becoming a bigger producer and much less dependent upon import supplies. Export from the United States has declined in quantity. The rest of the world remains approximately where it was, though there is a tendency to an increase in leather production in those agricultural countries where there is a substantial supply of hides which previously were exported, *e.g.*, South Africa.

World Production of Hides.—There has been a small increase in the world's annual supply of hides, though this increase has not been equal to the rate of increase in population within the same period. Every tanning country has a certain supply of hides of its own, but most of the big ones require to import from other countries. Dividing all countries into the two categories:—(*a*) "tanning countries" and (*b*) "hide exporting countries," there has been an increase in the aggregate in the number of cattle in the "tanning countries" of about 2% on a total of about 200,000,000 which is a rate of increase appreciably less than that of the population of those countries. On the other hand, there has been an increase of about 15% in the aggregate number of cattle in the "hide exporting countries" on a total of about 300,000,000. It is probable, however, that this is an overstatement of the real increase as in one or two countries the pre-War figures were defective.

The most important hide producing country from which heavy leather tanners draw their supplies is Argentina, in which country there has been a substantial increase in the number of cattle, the pre-War figure being 25,800,000 and the latest post-War figure being 37,000,000. In 1913 the export of frozen and chilled beef from the Argentina was only 4,119,000 quarters. In 1921 the figure had risen only to 4,750,000 quarters, but by 1924 the total was 9,547,000 quarters, falling slightly in 1925 to 8,921,000. One of the most significant features about this increase, of considerable interest to tanners in estimating future supplies of hides, is the fact that the increased export has been mainly to the continental countries of Europe. Before the World War Argentina exported practically no beef to those countries, but since the War Germany, Holland, Italy, Belgium and France have all imported beef from Argentina on a substantial scale. If this indicates a change in social habits in these countries leading to an increase in the consumption of meat, there is likely to be a further demand for cattle in South Africa and Australia, as well as in South American countries, which will react favourably upon supplies of hides for tanners.

Against this, however, must be set off the diminution in the supply of dry hides from many parts of the world. The hides from the meat works throughout the world are by-products of the meat and would come forward in undiminished numbers even if the price obtained for them was substantially less than at present. Dry hides, however, come from the outlying parts of the earth, and frequently the hide has to be carried some hundreds of miles by land before reaching the port. These hides are not forthcoming unless there is satisfactory return for the labour and costs involved, and a distinct relationship can be traced between the price and the supply of dry hides. During the period of high prices in 1919, for instance, some millions of hides were brought forth which would never have come forward but for the high prices ruling. Owing to the increase in transport and handling charges, the return to the original holder of the hide now is less than it was before the War, and the diminution in the supply is to be measured by some millions. The United States is now taking practically no dry hides, though the consumption in Great Britain is being maintained.

Tanning Materials.—The chief tanning material supplies before the War were quebracho extract from Argentina and chestnut extract from various European countries as well as the United States. A rapid increase is shown in the exportation of quebracho extract from Argentina and a decline, in comparison with the pre-War figures, in the export of logs, the figures being as follows:—

	Quebracho Logs	Quebracho Extract
	Tons	Tons
1913	383,964	79,684
1920	56,582	122,837
1921	30,857	120,100
1922	124,822	167,845
1923	113,639	208,586
1924	93,797	216,322
1925	116,940	274,245

Supplies of chestnut, however, are diminishing. In France in particular, exports have fallen very substantially, because the forests in past years have not been properly replanted. Imports of chestnut extract into Great Britain from France in 1913 were 35,800 tons, while the figure for 1925 was only 11,000 tons. In the United States also there is a reduction in the production of chestnut extract, due to the ravages of the chestnut blight.

Against this reduction, however, has to be set off the increased consumption of wattle bark as a tanning agent. The wattle tree, which was indigenous to Australia and was introduced into South Africa in the last decade of the past century, has made very rapid strides. The Australian industry has fallen to very small dimensions, but the exports of wattle bark from South Africa increased from 65,000 tons in 1913 to 121,000 tons in 1922, declining slightly since. In addition to these exports of bark from South Africa, substantial quantities are now converted into extract in South Africa and exported to tanners throughout the world in the form of a solid extract, somewhat similar in appearance to quebracho extract. The biggest tanning material company in the world has interested itself in the developments of the South African wattle industry.

Demand for Leather Goods.—On the leather side, there has been a substantial increase in the amount of leather made for the upholstery of motor cars. Although only a relatively small proportion of the cars manufactured in the world are upholstered in leather, the amount of leather required is substantial, and many firms who formerly produced leather for saddlery and harness work have turned over to this class of production.

A further change is the production of fancy leather for boot and shoe purposes, and the extensive use of coloured leathers has caused considerable difficulty to upper leather manufacturers, who find that their industry has become one subject to fashion. It is probable that the consumption of sole leather in the world has not increased, as there have been a substantial number of substitutes which have made a certain degree of headway. The competition of substitutes against leather for the soles of boots, however, is largely an economic one, and with the lower prices of hides which have now been reached, it is probable that the field for the substitute will be limited. In belting leather also, in certain countries, substitutes have made headway, though in the United States, where special propaganda in the interest of leather belting has been undertaken, the substitute has declined in importance. (E. C. Sn.)

LEBEDEV, PETR NIKOLAJEVICH (1866–1912), Russian physicist, a master of experimental research, was born on Feb. 24 (old style) 1866 in Moscow, son of a merchant. He was educated at a German secondary school and a technical college in Moscow, and in 1887 went to study physics under Kundt in Strasbourg. He took his doctor's degree in 1891 and published his first research on the Mossotti-Clausius theory of dielectrics. In the same year he was appointed assistant in physics at the University of Moscow and in 1892 professor. In 1895 he produced very short electric waves and published his work on the double refraction of electric rays. He also succeeded in proving, experimentally (1899), the existence of the extremely small pressure which light exercises on bodies. In 1901 appeared his classical work: *Experimental Research on Light Pressure* (published in 1913 in German in *Ostwald's Klassiker*). Finally in 1910 (*Annalen der Physik*, April) he succeeded in measuring this pressure, theoretically determined by Maxwell. In 1911 Lebedev had to leave the university for political reasons, and started, with his pupils, a private laboratory. His further work was mainly on the origin of the earth's magnetism, but death from heart failure on March 1 1912 stopped his ingenious experiments. He founded in Moscow the Lebedev Physical Society. In 1913 his *Collected Researches* were published in Russian under the auspices of this society. (A. Fo.)

LE CATEAU, BATTLE OF: *see* FRONTIERS, BATTLES OF THE.

LECOCQ, ALEXANDRE CHARLES (1832–1918), French musical composer (*see* 16.355), died in Paris Oct. 24 1918.

LEDGER: *see* BOOKKEEPING.

LEE, SIR SIDNEY (1859–1926), a British man of letters (*see* 16.363), died in London March 3 1926. He was knighted in 1911 and was president of the English Association in 1917. His lectures on *The French Renaissance in England* were published in 1910; and his later works include *Principles of Biography* (1911) and *Shakespeare and the Italian Renaissance* (1915). At the time of his death, he was engaged on the second volume of his official biography of *King Edward VII.*, the first volume of which had appeared a year previously.

LEE, VERNON (pen-name of Violet Paget) (1856–), British author, was born in France, of English parentage, on Oct. 14 1856. She lived almost entirely near Florence, and was a well-informed and acute student of Italian art, history and literature. Her *Studies of the Eighteenth Century in Italy* (1880) is typical of several books of essays; *Miss Brown* (1884); *Hauntings* (1890); *Vanitas* (1892); *Sister Benvenuta* (1906); and *Louis Norbert* (1914) are among her novels. *Satan the Waster*, a philosophic trilogy, was an ambitious dramatic satire on war and civilisation (1920), and among many other works may be mentioned *Gospels of Anarchy* (1908), essays on political subjects, *The Sentimental Traveller* (1908) and *The Tower of Mirrors* (1914), essays on the spirit of places, and *Proteus, or the Future of Intelligence* (1925).

LEEDS, England (*see* 16.368), had a population of 458,320 in 1921, and in 1925 it was stated to be nearly 500,000. Roundhay, Seacroft, Shadwell and part of Crossgates were included in the borough in 1912, Middleton in 1919, and part of Adel-cum-Eccup in 1925, making the total area 30,136 acres. In 1918 the parliamentary borough was redistributed in six divisions, each returning one member. The city museum was acquired by the corporation in 1921 from the Leeds Philosophic and Literary Society. Kirkstall Abbey House, an historic building near Kirkstall Abbey, was bought by the municipality in 1924, and the old Kirkstall bridge over the Aire was replaced by a new bridge in 1912. The corporation owns the fine mansion of Temple Newsam, with an estate of 935 ac., in the Hunslet rural district in the east of the city, where there is a fine collection of arms and art treasures. A farm in connection with the estate has been worked as a municipal dairy farm since 1922. At Middleton 316 ac. have been leased for a public park, and 427 ac. bought for a housing scheme.

In 1924 and 1925 respectively the corporation obtained parliamentary powers to enable them to carry out very extensive street improvements in the city. New office buildings, capable of accommodating a staff of 350, were acquired and equipped in 1925. Under the provisions of the Leeds Corporation Act 1924 the city was constituted one township under a separate board of guardians by the amalgamation of the former townships of Leeds, Armley and Bramley, Holbeck and Hunslet and the former parish of Osmondthorpe. The construction of a reservoir at Leighton, 46 m. distant, was completed in 1926. In 1926 the tercentenary of the granting of the city charter was celebrated.

LEEDS, UNIVERSITY OF (*see* 10.43).—In the period under review, the professorial staff has been strengthened by the institution of chairs in English language, philosophy, medieval history, applied mathematics, physical chemistry, agricultural chemistry, bacteriology, therapeutics and clinical surgery. New departments of Russian and Spanish languages and literatures and of geography have also been established. Provision has been made for the residence of both men and women students. The university now has a hall of residence with accommodation for 120 men and four halls for women with accommodation for about 175 students.

Temporary structures were erected to accommodate the influx of students after the War and private dwelling houses were adapted for various departmental purposes. Considerable additions have been made to the site, however, and the efforts of the university authorities are now being directed to the provision of a range of adequate and permanent buildings. The university council has set aside special funds to aid research in all departments. With the help of grants from the Government, special investigations have been undertaken in animal nutrition, flax-growing, etc. A staff of research chemists has been appointed in the coal gas and fuel industries department, where investigations are carried out in co-operation with the Institution of Gas Engineers and the National Benzole Association. An International Research Laboratory for the leather industries has been established by means of public subscriptions as a memorial to Professor H. R. Procter. Considerable developments have taken place in the department of pathology and bacteriology which works in close association with the Leeds General Infirmary and the Health Committee of the Corporation.

In the department of agriculture a large volume of advisory work is done in the county. More than 1,400 problems were dealt with in 1924, 750 of them involving personal visits. Research is in progress in all branches of agricultural science and organised courses of lectures, demonstrations, etc., are conducted in the three Ridings of Yorkshire. The Rawdon Baptist College, the York Diocesan Training College and the Leeds Central Technical College (printing department) have been affiliated to the university, recognition being given, for purposes of degree work, to certain courses of study at these institutions.

In co-operation with Armstrong College, Newcastle-upon-Tyne, the university, at the request of the North Eastern Railway Company, undertook the conduct of lectures and examinations in connection with the company's educational system—a scheme which has since been extended throughout the area of the London and North Eastern Railway Company's service. Striking developments have taken place in the extra-mural work of the university. Five tutorial classes were conducted in 1919: in 1925 there were thirty-eight. In addition to these regular, three-year courses, a considerable number of one-year

classes, introductory courses, single lectures and extension courses are given each year throughout the university's area. Public lectures are arranged in the university each session on literature, history, art, science, music, etc., while mid-day music recitals have become a regular feature of university life.

Between 1910 and 1914 the average number of students was 650. Between 1914 and 1919 the average fell to 540 but rose in the quinquennium 1919–24 to 1,329. There were 1,435 students in 1925. The appeal for a fund for new buildings produced £263,085 and £124,314 for the development of the university. Sir Edward Brotherton, Bart. gave £20,000 for bacteriological research. The Clothworkers' Company have made capital as well as annual grants amounting in all to £251,333. Sir James Roberts and Lord and Lady Cowdray have been generous benefactors.

LEE OF FAREHAM, ARTHUR HAMILTON LEE, 1ST VISCOUNT (1868–), British politician, was born at Bridport, Dorsetshire, Nov. 8 1868. Educated at Cheltenham and Woolwich, he entered the Royal Artillery in 1888, retiring with the rank of brevet-major in 1900. From 1893 until 1900 he was professor of strategy and tactics at the Royal Military College in Canada, during which period he organised the military survey of the Canadian frontier. He was British military attaché with the United States army during the Spanish-American War in 1898, and in the following year was military attaché to the British Embassy at Washington. In 1900 he entered the House of Commons as Conservative member for the Fareham division of Hampshire, which he represented for 18 years. He was Civil Lord of the Admiralty from Oct. 1903 until the resignation of the Balfour ministry in 1905. In 1912 he carried through Parliament an Act aimed at the white slave traffic. On the outbreak of the World War he rejoined the army, and served as a colonel on the staff. In 1915–6 he was personal military secretary to the Secretary for War (Mr. Lloyd George) and in 1917–8 director general of food supplies. He was made K.B.E. in 1916, G.B.E. in 1918, in which year he was created baron; and was sworn of the privy council in 1919. He joined Mr. Lloyd George's administration in 1919, first as Minister of Agriculture and then as First Lord of the Admiralty (Feb. 1921–Nov. 1922). In 1922 he was made a viscount. He was a member of the Imperial Cabinet in 1921, a delegate to the Washington Conference, Nov. 1921–Feb. 1922; and in 1923–4 chairman of the royal commission on the public services of India, for which he was created G.C.S.I. in 1925. In 1921 he presented to the nation, as a residence for the prime minister for the time being, the house and estate of Chequers on which subject he writes in this Encyclopædia.

LEFROY, HAROLD MAXWELL (1877–1925), British entomologist, was born at Crondall, Hampshire, Jan. 20 1877, and was educated at Marlborough and King's College, Cambridge, where he graduated in 1898. He early specialised in entomology and became in 1899 entomologist to the Imperial Department of Agriculture for the West Indies, a position which he held until his appointment in 1903 as imperial entomologist for India. In 1912 he was appointed to the newly created chair of entomology at the Imperial College of Science and Technology, South Kensington, and in 1913 he became honorary curator of the insect house of the Zoological Gardens, London. He devoted himself particularly to the study of the life history of insects of economic importance in the field, and as imperial silk specialist for India in 1915 and 1916 he did much valuable work for the silk and cotton industries. During the World War as temporary lieut.-colonel in Mesopotamia he conducted sanitary measures against flies, and in 1917 served as an expert on the royal commission on wheat supplies, dealing effectively with the problem of beetles in wheat. He subsequently devised means of combating the depredations of the death watch beetle in old buildings. He died in London on Oct. 14 1925, poisoned by the fumes of a gas with which he was experimenting for insect destruction.

His publications include *Indian Insect Pests* (1906); *Indian Insect Life* (1909); *A Manual of Entomology* (1923); and articles in *The West Indian Bulletin*, the *Agricultural Journal of India*, and many official papers.

LEGAL EDUCATION (*see* 9.603).—The purpose of this article is to indicate the main tendencies of legal education in England and Wales since 1910, and to trace the general development of legal education in the United States from the beginnings to the present day.

I. ENGLAND AND WALES

The most noteworthy feature of the period under review has been the greatly increased interest which law has received at the hands of those interested in education generally. Two principal tendencies have been revealed—first, an increasing demand for scientific legal education for both branches of the legal profession; and, second, the serious consideration by educational bodies of the advisability of including elementary instruction in law in the curriculum of the ordinary schools.

Systematic legal education is now provided by the older and the newer universities, the Council of Legal Education, the Law Society and the approved law schools set up by the Law Society under the provisions of the Solicitors Act 1922. There are faculties or departments of law at the Universities of Oxford, Cambridge, London, Birmingham, Durham (Armstrong College), Leeds, Liverpool, Manchester, Sheffield and Bristol; and departments of law at the following university colleges: Aberystwyth, Exeter, Nottingham, Leicester, Southampton, Bangor, Swansea and Cardiff. In some cases these faculties and departments provide qualifying courses for degrees in other faculties. Thus, at the university of London, the degree examinations for B.Sc. (Economics) include industrial law, and for bachelor of commerce (B.Com.) commercial law, contract, banking and insurance.

Professional Law Schools.—A degree in law, however, is not in England a professional qualification. Before he can practise, the student must pass in the case of a barrister the examinations of the Council of Legal Education, and in the case of a solicitor the Law Society's examinations. The instruction provided by the Council of Legal Education for such Bar students as care to take advantage of it constitutes a complete curriculum in law. The organisation is in the hands of a director of studies and a body of readers of high standing. Lectures are given in the Inns of Court lecture rooms. The Law Society from the year 1903 onwards has held a school of law at the Law Society, Chancery Lane, where lectures and classes under the control of a principal and director of legal studies and a body of readers, lecturers and tutors have been given to increasing numbers of students both for the intermediate examination and the final examination of the Law Society, and in lesser numbers for the degree in law at London University.

From 1903 until the passing of the Solicitors Act of 1922 attendance at a law school was entirely voluntary, and a matter of personal choice for each individual articled clerk. By the Act of 1922, however, subject to certain exceptions, every articled clerk, before presenting himself for his final examination at the end of his period of articles, must have attended substantially for 12 months at an approved law school. To meet this requirement law schools had to be organised in the principal provincial towns.

The contribution of the law schools at Oxford and Cambridge to the cause of legal education is noteworthy. These universities supply practically the whole of the teaching staff engaged on this branch of educational activity as well as the bulk of the research students. Nor are these activities confined to the academic field. At Cambridge there are few colleges that do not possess their law clubs affiliated to the University Law Society; these bodies meet frequently for discussion and debate, and at intervals hold moots. This practice of mooting, which has also been revived in its ancient home, the Inns of Court, is a valuable addition to the practical side of legal education.

Law and General Education.—Apart from the study of law as a professional education, it may be said that educational establishments generally have come to allow a greater importance to the knowledge of law as part of the equipment of every citizen. Considerable attention and prominence has been given to the

matter by distinguished judges and others, and lectures have been given in which the idea has been formulated. It has not yet been found practicable, however, to introduce elementary law into the average school curriculum, and it may be doubted whether such a suggestion is likely to be carried into effect in the near future. Clearly, only those who are approaching the conclusion of their school life would be able to profit by such instruction, and it is notorious that sixth-form students already have a very full curriculum. (E. L. B.*)

II. THE UNITED STATES

American legal education begins in 1784 (or perhaps 1782), when Judge Tapping Reeve of Litchfield, Conn., set up the first school for the teaching of the common law.

Early History.—There had been no legal profession in the colonies until the 18th century. Before the revolution a certain number of lawyers had received their training in England, in the Inns of Court. But a system of courts, manned by lawyers and requiring a trained profession to practise before them, was not called for by the economic conditions of the colonies until toward the middle of that century; nor were the executive and legislative justice, characteristic of the colonial polity, wholly superseded by judicial justice until after the revolution. Legal education was at a low ebb in 18th-century England. The universities had never taught the law of the land. The medieval system of the Inns of Court had decayed, and the system that now obtains had not been set up. Hence there were no good models at hand after the revolution, and American legal education had to develop its own methods. So far as the models were English, they were, first, the purely apprentice training of the lower branch of the profession in England (for in general the United States took the attorney or solicitor for its type, rather than the barrister), and, second, the academic lectures on the law of the land which began with Blackstone's lectures as Vinerian professor at Oxford. This example was followed eagerly in America. Wythe's lectures at William and Mary (1779), Wilson's at the College of Philadelphia, now the University of Pennsylvania (1790), Kent's at Columbia (1793) and Parker's at Harvard (1815) were of this type. They were not instruction in law to prospective lawyers so much as lectures to young gentlemen as part of their general cultural training. Later this plan of academic lectures upon law was grafted upon the apprentice training which was the first type of legal education in America.

After the revolution, students ceased to go from America to the Inns of Court. Then education for the Bar became distinctly American. Beginning from this point, three stages of development may be distinguished. These stages correspond to three periods in American legal history. The method of each stage is a response to the needs of the period in which it grew up.

Apprentice Training.—First, there is a stage of apprentice training, either in the office of a practising lawyer or in a law school organised as an expanded law office and applying office methods of instruction. This sort of training sufficed for the needs of the time immediately after the revolution. The development of judicial justice administered in courts by trained judges called for practitioners who knew the art of the lawyer's craft. When the United States took over English law as the law of its several commonwealths, in the first instance it took over English legal procedure. Except for land law, at the time of the revolution the greater part of English law was expressed in terms of procedure. Thus there was need of lawyers who knew how to bring a lawsuit and how to conduct it through the courts. Apprentice training was adapted to this need. Judge Reeve's law school grew out of the practice of taking a number of students into a country law office where the press of business did not interfere with instruction. Just because it grew out of such a law office, the exact date of establishment of the school at Litchfield cannot be fixed.

The law schools of the period were modelled on that institution. In effect, they were but expanded law offices in which preceptors who were practising lawyers carried on the teaching side of the law office as their chief activity. Such was the Harvard law school, the oldest of the existing law schools in the United States, in its first stage (1817–29).

At this time there was little differentiation of local law. But the whole tendency of the apprentice training was to dwell upon the local and temporary rather than the universal and enduring elements in the body of legal materials, and this unfortunate feature served to develop and entrench many provincialisms in the law of the several states, since, until, much later, the bulk of the profession was apprentice trained. In general the first stage prevailed until Joseph Story began to teach law at Harvard (1829). Also in many parts of the country the simpler needs of a rural or even pioneer society required nothing more than an apprentice-trained profession, so that the method of that stage has persisted in many localities into the present.

College Teaching.—A second stage begins with the appointment of Story as Dane professor at Harvard, and extends until the epoch-making work of Langdell after 1870. There was nothing in the way of a rule-of-thumb apprentice training, which, under 19th-century conditions, could be done better in a law school than in a law office. But with the growth of the law something more than a rule-of-thumb training in practice was required, and the second stage of legal education was a response. From Story to Langdell the law schools continually increased in influence. The accepted mode of training came to be study in a law school in which law was taught by lectures and from text-books with the teaching apparatus of the old-time college.

The era of expansion that followed the adoption of the constitution called for creative juristic activity and creative legislation. Study of substantive law was called for. It was necessary to investigate each item of the common law of England with reference to its applicability to the conditions in the New World. The traditional materials of 17th-century English law had to be reshaped so as to make of them a common law for America. A mere apprentice training could not meet these demands. Text-books had to be written to guide the courts in the new departments of law, which were formative on every hand. These text-books came from the law schools and soon gained the upper hand as the bases of instruction, even where the whole spirit of instruction remained that of the first stage. The best examples of the second stage are the teaching of Story and Greenleaf, and later of Parsons, Washburn and Parker at Harvard, the teaching of Dwight at Columbia, and the teaching of Cooley and his colleagues at Michigan.

Scientific Study of Jurisprudence.—In a third stage there is scientific study of the legal system of English-speaking countries on the basis of the sources. An analytical and a historical method, as methods of a general science of law, are applied to the sources, and thus system is put into each branch and department of the law. By the time of the Civil War the formative period of American law and legal institutions was substantially at an end. With few exceptions, the great text-books that had guided the courts speak from before the Civil War. In the last quarter of the 19th century, law books tend more and more to be mere indexes to the decisions: they cease to be creative. The need of the time had come to be in another direction. Now there was need of systematising the law which had developed in the period of growth. In response to this demand, within less than a decade after the end of the Civil War, Langdell, who was appointed to Story's chair at Harvard in 1870, had inaugurated the method of study from adjudicated cases which has come to prevail in the majority of American law schools of high grade.

This method seeks, through analytical and historical study of the sources, to give a grasp of the traditional art of deciding cases on the basis of reported judicial experience. It teaches the traditional art of developing grounds of decision from the authoritative legal materials. This is the enduring element in Anglo-American law. Conditions in many localities, in which requirements for admission to the Bar are low, and candidates have insufficient preliminary training to enable them to study the sources directly, have led to persistence of the method of lectures and text-book instruction in schools in which the teachers are actively engaged in practice, and hence the spirit is that of

apprentice training. In such schools local law and procedure are chiefly stressed. Probably 60% of those who come to the Bar to-day are trained in such schools. (R. Po.*)

LEGIEN, CARL (1861–1920), German labour leader, was born Dec. 1 1861 at Marienburg (West Prussia). A turner by profession, he entered the trade union movement in Hamburg. In 1887 he became president of the turner's association, and in 1890 member of the general commission of the German trade unions. He was president of this commission from Jan. 1 1891 until the general German trade union association was founded in 1919, when he became its president, which he remained until his death. The leading organiser of the German trade union movement, in 1901 he founded the International Trade Union League, being its first secretary from 1903–19. During the World War he prepared the way for the legal recognition of the trade unions, which was granted in Jan. 1918. Together with Leipart, who succeeded to his post after his death, he formed the Arbeitsgemeinschaft (community of labour) at the end of 1918—an institution destined to set on foot the reconstruction of German economic conditions after the War by co-operation between the employers federations and the trade unions, the latter enjoying equal rights. His last great achievement was putting down the Kapp Putsch in March 1920. He died in Berlin Dec. 26 1920. Legien wrote many works on trade union questions, including *Die deutsche Gewerkschaftsbewegung* (1911).

LEGOUIS, ÉMILE (1861–), French scholar, was born at Honfleur on Oct. 31 1861. Educated at Honfleur and in Paris, after teaching for a year at the Collège d'Avranches, he was made *agrégé d'anglais* in 1885. He was next appointed lecturer at Lyons; and after passing his doctorate in 1896, he became professor at Lyons. In 1904 Legouis was appointed special lecturer in English at the Sorbonne. He is the author of many important critical works on English literature.

Among his publications are *Le Général Michel Beaupuy*, with G. Bussière (1891); *La jeunesse de Wordsworth; Étude sur "Le Prélude,"* crowned by the Académie française (1896); *Shakespeare* (1899); *Morceaux choisis de la littérature anglaise*, with M. Beljame (1905); *Chaucer* (1910); *Edmund Spenser* (1923); and with L. Cazamian, *Histoire de la littérature anglaise* (1924). He also collaborated in the translation of Chaucer's *Canterbury Tales*, crowned by the Académie française, 1908.

LEGROS, ALPHONSE (*see* 16.380) (1837–1911), Anglo-French artist, died in London Dec. 8 1911.

LEHÁR, FRANZ (1870–), Hungarian operetta composer, was born at Komárom, Hungary, April 30 1870. After studying at Vienna and Prague, he became a conductor. His opera *Kukuska*, afterwards called *Tatiana*, was performed in 1896, and since then he has written about 30 operettas. The popularity of his music is due to the charm of its melodies; and especially to the orchestration of his waltz themes, which, with their sensuous grace, are typical of 20th century light opera. His most famous musical comedies are *The Merry Widow* (1905) and *The Count of Luxemburg* (1909). He also wrote *The Man with the Three Wives; Gipsy Love; Eva; Alone at Last; The Blue Mazur; Frasquita;* and *Paganini* (1925).

LEHMBRUCK, WILHELM (1881–1919), German sculptor, was born Jan. 4 1881 at Meiderich near Duisburg, the son of a miner. He received his artistic training at the Düsseldorf Academy, lived from 1910 to 1914 in Paris, where he gained recognition for his art, and afterwards resided in Zürich and Berlin. Lehmbruck was a sculptor of great sensibility, and his art, especially in the last phase, is moving in its spirituality and tenderness. His best known works are: "Weibliche Figur," in Duisburg; "Weiblicher Torso," at The Hague; "Frau Lehmbruck," at Essen; "Knieende" at Mannheim; "Grosse Sinnende"; "Grosse Rückblickende"; "Sterbender Krieger"; "Sitzender Jüngling"; "Emporsteigender Jüngling", and a portrait of Fritz von Unruh in Frankfurt. He also produced numerous etchings of high merit. He died by his own hand in Berlin March 25 1919. See Paul Westheim: *W. Lehmbruck* (1919).

LEICESTER, England (*see* 16.393), with a population of 234,143 in 1921, and an area of 8,582 ac., was created a city in 1919, and has grown rapidly, particularly to the south. At Aylestone a town to accommodate 7,000 to 8,000 people is being built (1926) by the municipality on a site of 206 acres. A scheme has been approved by Parliament, and is now being carried out, for the reconstruction of old, and the construction of new streets in the centre of the city, affecting between 700 and 800 buildings. The erection of a garden city at Braumstone is also contemplated. A measure creating a diocese of Leicester has received the royal assent after passing through the National Church Assembly and Parliament. It will include the whole of Leicestershire, and St. Martin's Church, constituted a collegiate church in 1922, will be the cathedral. The Harvey Lane Baptist Chapel was destroyed by fire in 1921 and replaced by the memorial hall—completed in 1924. The Church of St. Augustine's, Newfoundpool, was finished in 1912, and that of St. James the Greater in 1914. Another new parish was created in 1924, when the Church of the Holy Apostles was consecrated.

De Montfort Hall, built by the corporation, was opened in 1913. In 1921 a University College was founded, the site and buildings in Victoria Road being the gift of Mr. T. Fielding Johnson. An extensive addition to the colleges of art and technology has been decided upon and to this end certain adjoining properties were purchased in 1924. A new central electricity station was opened in 1922, and an extension begun in the following year. Leicester is a partner with Sheffield, Nottingham and Derby in the Derwent Valley Water undertaking. The first part of the scheme, which includes 35 m. of aqueduct from Derwent Valley to the Ambergate Reservoir, was finished in 1912.

LEIPZIG, Germany (*see* 16.399), the fourth city of Germany and a large industrial centre, had a population of 636,485 in 1919, including Mockau and Schönefeld, incorporated in 1915; Eschocker-Windorf, Leutsch, Paunsdorf and Wahren, incorporated in 1922, added a further 32,105 persons to the population. The famous fair has been resumed, and is held yearly in September. The university is one of the largest in Germany. The termina station, through which most of the traffic between Prussia and Saxony passes, was completed in 1915; it contains 26 tracks and covers an area of 172,000 feet. After the Revolution there were serious demonstrations against the Government in the city, and in April 1919 a Soviet republic was set up, but was put down by government troops in the following month.

LELAND STANFORD JUNIOR UNIVERSITY (STANFORD UNIVERSITY) (*see* 16.406).—The work of the university has in recent years been so reorganised that the first two years constitute a so-called lower division with certain specified requirements, including biology, a course in citizenship, etc. The major department system now becomes operative at the beginning of the junior year, and degrees are granted upon the recommendation of the departments. Stanford sold most of its large ranch properties in 1919, and in 1925 had about $28,000,000 in investment securities. Its educational plant on the campus, together with the Stanford Medical School, Lane and Stanford Hospitals, Stanford School for Nurses and Lane Medical Library—all in San Francisco—and the Hopkins Marine Station on Monterey Bay, were valued in all at $11,000,000. The medical school owed its origin to the fact that the director of the Cooper Medical College in 1910 turned over that institution and the associated Lane Hospital to Stanford.

In addition to the schools of law, medicine, and education and the graduate school, there have been organised schools in biology and social science, also in 1925 engineering and a graduate school of business, and in 1926 a school of letters and a school in physical science. In 1921 the Food Research Institute of Stanford University was organised with the help of the Carnegie Corp. of New York to make a study of the production, distribution and consumption of food. New dormitories for men and women have been recently constructed, so that 1,000 men and 250 women live in university buildings. There is a housing scheme by which practically all of the faculty and most of the students live on the campus. Volumes in the library numbered 377,904 in 1924, of which 57,722 were in the Lane Medical Library and 27,067 in the Law Library. Herbert Hoover, a

graduate of Stanford, presented to the university the Hoover War Library, comprising approximately 47,500 volumes and numerous documents covering the history of the World War.

In 1924–5 the students numbered 3,312, of whom 500 were women and 591 graduates. Limitation in funds and equipment resulted in restrictions in the body to something over 2,500. There is now a tuition fee of $75 per quarter, and a tuition note system enables students to postpone payment until three or more years after graduation. Military training is not required, but there is a field artillery unit of the Reserve Officers' Training Corps, and an ordnance unit was established in 1925. During the World War, Stanford was represented by 3,000 of its members, graduates and undergraduates. A students' army training corps unit was organised in the War period. Dr. Rav Lyman Wilbur became president Jan. 1 1916. (R. L. W.)

LEMAÎTRE, FRANÇOIS ÉLIE JULES (1853–1915), French critic and dramatist (*see* 16.408), died in Paris Jan. 21 1915.

LEMBERG, BATTLES OF.—Lemberg (Polish, Lwów), the capital town of Galicia, was twice during the World War the centre of a series of battles. The first series constituted the opening campaign between Russia and Austro-Hungary in Aug. and Sept. 1914; it resulted in the defeat of the Austrians and the occupation by the Russians of the whole of Eastern Galicia. The second series was fought some 10 months later during the great Russian retreat which was started by Mackensen's offen sive on the Dunajec in May 1915. It gave Austria re-possession of Lemberg and of practically the whole of Eastern Galicia.

I. THE BATTLES OF 1914

The main concentration of the Austro-Hungarian forces for action against Russia at the opening of war in Aug. 1914 was made in Central and Eastern Galicia. In the general plan of the Central Powers the rôle of the Austro-Hungarian Army was to engage the main Russian forces till the German Army had overwhelmed France and was free to transfer its principal weight to the Eastern theatre.

Alternative Policies.—Two main alternatives were open to the Austrians, to await attack or themselves to take the offensive. If the former course were chosen, the line of the river San, between the Carpathians and the Vistula, was indicated as the strongest available position. On this they might well hope by an active defence to hold up the maximum Russian effort for some time and to win local successes by counter-attack. But defence entailed not only the abandonment of Eastern Galicia but also the surrender of the passes over the Eastern Carpathians and the opening of a road into Hungary. This might have serious political consequences. Moreover, in the years preceding the War, the military opinion of almost every country in Europe had proclaimed insistently that offensive action was the solution of all major difficulties in war. Certainly Conrad von Hötzendorf, the Chief of the Austrian General Staff, optimistic by temperament, was not the man to adopt a defensive attitude willingly. He determined to attack, though the advantages hoped for from a speedier mobilisation were not secured owing to errors made during the preliminary deployment against Serbia.

The chosen line of attack was northwards against one flank of the Polish salient; probably Conrad hoped that a German offensive might eventually be made from East Prussia against the other flank of the salient. The problem of supply was not easy, since the terrain between the Vistula and Bug rivers, where the advance was to be made, had been left, at the instance of the Russian General Staff, without good communications in anticipation of the Austrian plan. It was indeed the obvious direction of any invasion of Russia from Galicia, since an advance eastwards would leave the lines of communication exposed, while to the northeast lay the trackless marshes of the Pripet.

The Rival Forces.—The Austrian main forces were divided into four armies, of which two, the I. (Dankl) and IV. (Auffenberg), were to carry out the offensive, directed on Chełm (Kholm) and Lublin respectively; the II. (Bohn-Ermolli) and III. (Brudermann) were to be deployed east of Lemberg to hold off the Russian armies advancing from the Kiev district. The II. Army had, however, been originally dispatched to the Serbian frontier, and was at first represented by one corps only, the XII. (Kövess). North of the Vistula, Kummer's group of Austrian Landsturm and Woyrsch's corps of German Landwehr were to advance on Sandomierz and Dęblin (Iwangorod) respectively, to protect the left flank of the I. Army and to foster a Polish rising in favour of Austria.

The Russians also deployed four armies on their southwestern front. Their plan was almost the exact counterpart of the Austrian. They purposed to hold the Austrian offensive wing by a defensive force of two armies on the line Lublin-Chełm, and to smash the Austrian defensive wing by an offensive group of two armies advancing west from the Kiev military district on Lemberg. Each of the opponents was thus dependent on the power of his defensive wing to resist the shock of the other's striking force long enough to enable him to gain a decision by his main effort.

Both armies had large masses of cavalry, but there was a pronounced difference in their tactics. The Austrian cavalry seldom practised dismounted fire action and were singularly ineffective on foot; the Russian cavalry, on the other hand, fought largely as mounted infantry. The Russian artillery shot well and was far more effective than the Austrian, but the musketry of the Austrian infantryman was better than that of his rival; he was also handier in manoeuvre. The morale on both sides was excellent at the beginning, although that of the Austrian was to deteriorate rapidly under defeat. In the higher command the Russians held the advantage. Ivanov, the generalissimo of the southwestern front, was no strategist, though an experienced and well-loved commander; but his chief of staff, Aleksyeev, was one of the best brains of the Army; and in Ruzski (III. Army), Plehve (V. Army), Brusilov (VIII. Army), and Ewarth (IV. Army) he had under him probably the four ablest army commanders in Russia—certainly the four most successful. Conrad, the virtual Commander-in-Chief of the Austrian armies—the Archduke Friedrich was the nominal head—was a man of determined and obstinate character, but a better strategist in the office than in the field; nor were the Austrian army commanders the equals of the Russian.

Numerically, the Russians had an advantage, though by no means an overwhelming one. The Austrian striking wing, which comprised 350 battalions, 150 squadrons and 150 batteries, was superior in strength to the Russian IV. and V. Armies which had each four corps and two cavalry divisions; but their defensive wing (200 battalions, 170 squadrons, 130 batteries) was considerably inferior to the Russian III. and VIII. Armies, especially before the arrival of the two corps of the II. Army which had been left opposite Serbia.

On Aug. 15, before concentration was complete, the Austrian cavalry pushed forward to ascertain the Russian movements, but gathered little information. On Aug. 20 the I. and IV. Armies began their offensive. The first engagements in the neighbourhood of Krasnik were favourable to the Austrians, the advanced troops of the Russian IV. Army being driven back on Lublin. The Austrian I. Army was strengthened by Kummer's Landsturm Corps, which crossed the Vistula to join it, while Woyrsch's Corps of German Landwehr was in close touch on the left bank of the Vistula. The mission of these two formations to foment an insurrection in Russian Poland had proved fruitless.

Battle of Komarów.—The Austrian IV. Army now became engaged in a battle with the Russian V. Army, which lasted from Aug. 26 to Sept. 1. Assisted by the Archduke Joseph Ferdinand's group, which had been formed from troops of the III. Army to manoeuvre between its left and the right of the IV. Army, Auffenberg attempted a double envelopment of the Russian force. This manoeuvre met with considerable success; a large part of Plehve's Army was at one time surrounded, and escaped only owing to the sudden withdrawal of the Austrian Corps which had seized its line of retreat—a withdrawal actuated by false reports of Russian troops in its rear. The Russian Army was broken in two, part retiring on Chełm and part on Hrubieszów on the Bug. Before the Austrians could gather the fruits of

their victory, events in Eastern Galicia occasioned their recall. Losses in the battle were heavy on both sides.

Operations in Eastern Galicia.—Meanwhile the Austrian covering force (II. and III. Armies) had met with disaster. Although the II. Army consisted of one corps only and the III. Army was weakened by the absorption of the Archduke Joseph Ferdinand's group in the Kómarow battle, yet the High Command sent the two armies forward to the attack. They joined battle with the Russian III. and VIII. Armies on Aug. 26 on the line of the Złota Lipa about Złoczów. On the evening of Aug. 27 they were forced to retreat. Reinforced by the VII. Corps from Serbia, they again gave battle on the Gniła Lipa on Aug. 29 and 30, and again suffered defeat. They now fell back through Lemberg, which was evacuated on Sept. 2, and took up a defensive position west of the city on the line of the Wereszyca and the Gródek lakes.

Battle of Grôdek—Rawa-Ruska.—The rear of the victorious Austrian I. and IV. Armies was seriously threatened by the failure of the eastern wing. The question now arose of withdrawing the whole of the Austrian forces to the line of the San, or of continuing the battle round Lemberg on a different plan. Conrad chose the bolder course and determined to seek an immediate victory. He ordered the IV. Army to break off pursuit of the Russians and to change front from north to south. The plan was that this army should strike towards Lemberg at the right flank of the advancing Russians, while the II. and III. Armies held them frontally. The complicated wheel of the IV. Army had been executed by Sept. 5. On Sept. 6 it commenced its march southwards, leaving behind a group under the Archduke Joseph Ferdinand to protect its rear. As it advanced south, its left column became engaged with the right of the Russian III. Army and was pinned to the east of Rawa-Ruska, while the centre and right columns, meeting no resistance, continued southwards, and eventually wheeled into line with the Austrian III. and II. Armies, facing east.

Conrad changed his plan again; he had missed with his left, so now, like an obstinate but unskilful boxer, swung his right at the enemy, viciously but ineffectively. On Sept. 7 he ordered the IV. Army to stand fast and hold the Russians to their ground, while the II. and III. Armies left their prepared defensive positions and struck northward at the Russian left wing. A radical change of plan so hurriedly evolved was hardly likely to succeed. The II. and III. Armies could make little ground, while the position of the IV. Army rapidly became untenable. In its rear the I. Army was being forced back from Lublin by the reinforced Russian IV. Army, while the Russian V. Army had rallied and was again advancing, driving before it the Archduke Joseph Ferdinand's weak group. Finally the left wing of the IV. Army itself was being outflanked north of Rawa-Ruska by the Russian III. Army. On Sept. 11 Conrad issued orders for a general retreat to the line of the San.

Austrian Retreat.—The withdrawal was successfully carried out without serious interference by the Russians. The II. Army retired in the direction of Sambor, and the III. towards Przemyśl, the IV. on Jarosław, and the I., together with Kummer's and Woyrsch's forces, to the lower San. The detachments farther east, along the Dniester, retired to the Carpathians. The line of the San was not held for long. The Russian IV. Army had been reinforced by the IX. Army from Warsaw and forced a passage of the lower San on Sept. 14. The Austrians were too shaken and disorganised to enter on a new battle, and resumed their retreat, leaving the fortress of Przemyśl to stand siege. They finally halted on Sept. 26 some 50 m. east of Cracow on the line of the Dunajec by Tarnow and Gorlice to the Carpathians. The Russians, who also required a pause for reorganisation—losses had been very heavy on both sides—made no serious attempt to follow up beyond the San.

Causes of Austrian Failure.—The advantage of "interior lines" which the Austrians enjoyed in this campaign has been partly discounted by the great size of modern armies and the time required to obtain the decision in a battle. It is true that the Germans were at this very period gaining brilliant successes by action on interior lines against Samsonov and Rennenkampf in East Prussia, but their achievements were only rendered possible by the inertia of Rennenkampf. In Galicia, the continued pressure by Ruzski's and Brusilov's armies on the Austrian detaining wing denied to Conrad the time required to complete his successes in Poland. But the Austrian High Command appear to have suffered throughout from lack of a clear-cut plan, and to have depended too much on the course of events. It is difficult to trace in their original organisation for the campaign any recognition of the need for that "mass of manoeuvre," capable of being transferred from one wing to the other, which is the essence of action on interior lines. Also, the ineffectiveness for delaying action of their masses of cavalry deprived the Austrians of a powerful weapon. The Russian scheme of operations was straightforward and demanded only driving power by the higher commanders and hard fighting and marching by the troops. An opportunity of turning the Austrian retreat into a rout seems, however, to have been missed, when the IX. Army from Warsaw directly reinforced the IV. Army instead of being directed west of the Vistula on the Austrian line of retreat.

II. THE BATTLES OF 1915

The fighting which led up to the second series of battles round Lemberg in the summer of 1915 is described under the heading DUNAJEC-SAN. After being driven from the San, the Russian III. Army (now under Lesh instead of Radko Dimitriev) and VIII. Army (Brusilov) took up a position to the northwest and west of Lemberg. Their line ran from the Vistula along the heights north of the Tanew river, thence west of Rawa-Ruska by Magierów and Janów to the Wereszyca river and Gródek lakes. The XI. and IX. Armies continued the line southeast along the Dniester.

Comparison of Adversaries.—Mackensen's pursuing force consisted of the Austrian IV., German XI. and Austrian II. Armies, in that order from north to south. On the Dniester were Linsingen's Southern Army and Pflanzer-Baltin's VII. Army. In the number of available formations there was no great disparity between Mackensen's group of armies and the Russian III. and VIII. Armies; on each side there were about 40 infantry divisions, and the Russians had five or six cavalry divisions to Mackensen's two. But the two Russian armies now embraced an improvised assembly of formations and units taken from all parts of the line; even so their losses had not been made good and they were much under strength; there was a shortage of ammunition, both for guns and rifles; and morale had naturally suffered under two and a half months of continual defeat.

Austro-German Attack.—As usual, the main thrust at the Russian position was delivered by the German XI. Army. It was directed through Magierów against the line Zólkiew-Rawa-Ruska, approximately at the joint between the Russian III. and VIII. Armies. The assault was made on June 19, after the Russian position had been battered by the German guns, and the attackers broke right through to the Rawa-Ruska-Lemberg railway. Brusilov held on to a fortified position west of Lemberg till the 22nd, and then evacuated it under the threat that came from the north and the direct pressure from the Austrian II. Army.

Re-grouping of Armies.—The Russian armies were now split apart; the VIII. Army retired fighting to the line of the Upper Bug and Gniła Lipa; at the same time the XI. and IX. Armies gave up the Dniester line below Halicz. The III. Army meanwhile, to protect the left flank of the Warsaw salient, was forced to retire north towards Lublin and Chełm. To fill the gap between the III. and VIII. Armies, a new army, the XIII. under Gorbatovski, was formed of troops drawn from the right of the III. Army and left of the VIII. The Austrian armies were also re-grouped; the II. Army, the Southern Army and VII. Army were to continue the pursuit eastwards; Mackensen with the IV., XI. and a new "Army of the Bug," to be formed under Linsingen, was to strike northwards between the Bug and Vistula; while the I. Army, withdrawn from the west of the Vistula, was to fill the gap between the two groups.

The Eastern group drove the Russians back at the beginning of July from the Gnita Lipa to the Zlota Lipa; no farther fighting took place here till the end of August. Farther east, Pflanzer-Baltin's VII. Army and Lechitski's IX. were engaged in an indecisive conflict along the Dniester between July 14 and 19. Meanwhile on Mackensen's front the Austrian IV. Army had been heavily counter-attacked near Krasnik by the Russian IV. Army and had been driven back some distance, losing 17,000 prisoners. The check was only temporary, and so soon as the re-grouping was completed, Mackensen again advanced. For the further operations of this force, *see* BREST-LITOVSK, BATTLES OF. (*See* also EASTERN FRONT CAMPAIGNS.)

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LEMONNIER, ANTOINE LOUIS CAMILLE (1844–1913), Belgian poet (*see* 16.415), published among his later works *L'amant passionné* (1904); *Tante Amy* (1906); *La maison qui dort* (1909) and *La chanson du carillon* (1911); as well as *L'école belge de peinture, 1830–1905* (1906). He died in Brussels June 13 1913. See L. Bazalgette, *Camille Lemonnier* (1904).

LENGLEN, SUZANNE (1899–), French lawn-tennis player, was born at Compiègne May 24 1899. She was taught to play tennis by her father and began to show brilliance at an early age, winning the championship of Picardy when only 14 years old. In June 1914 she won the hard court singles and doubles in Paris. During the World War she played in exhibition matches on the Riviera for the French Red Cross 1916–8. In 1919 she made her first appearance at the Wimbledon tournament and won both the singles and doubles championships, defeating Mrs. Lambert Chambers in the final round. In the following year she won the ladies' singles at Wimbledon and mixed doubles champion with G. L. Patterson. In Aug. 1921, after again winning the singles and doubles at Wimbledon, she visited America and was defeated (2–6 retired) by Mrs. Mallory in the second round of the U.S.A. ladies' singles championships. At Wimbledon however, in the following year Mlle. Lenglen defeated Mrs. Mallory 6–2, 6–0 in the final round of the ladies' singles. In the same year she also won the French National Championship, took all three championships in the Brussels tournament and was undefeated throughout the season. She again won the singles at Wimbledon in 1923 and 1925, but was obliged to retire in 1924 owing to illness, as she was also in 1926. (*See* LAWN TENNIS.)

LENIN, VLADIMIR ILYICH ULYANOV (1870–1924), founder and guiding spirit of the Soviet Republics and the Communist International, the disciple of Marx both in theory and in practice, the leader of the Bolshevik party and the organiser of the Oct. revolution in Russia, was born on April 9 (22) 1870 in the town of Simbirsk, now Ulyanovsk. His father, Ilya Nicolaevitch, was a schoolmaster. His mother, Maria Alexandrovna, whose maiden name was Berg, was the daughter of a doctor. His eldest brother (b. 1866) joined the "Narodovoltze" (Freedom of the People movement),[1] and took part in the unsuccessful attempt on the life of Alexander III. For this he was executed in his 22nd year. Lenin, the third of a family of six, completed his course at the Simbirsk gymnasium in 1887, winning the gold medal. His brother's execution, indelibly stamped on his consciousness, helped to determine his later life.

In the summer of 1887 Lenin entered the Kazan University to study law, but was sent down in Dec. of the same year for taking part in a gathering of students and was banished to the countryside. His repeated petitions in 1888–9 for permission to re-enter the University of Kazan or to be allowed to go abroad to continue his studies met with refusal. In the autumn, however, he was allowed to return to Kazan, where he began the systematic study of Marx and first entered into relations with the members of the local Marxist circle. In 1891 Lenin passed the law examinations of the St. Petersburg University, and in 1892 he began to practise as a barrister at Samara. During this year and the next he appeared for the defence in several trials. His life, however, was chiefly filled by the study of Marxism and its application to the investigation of the course of the economic and political development of Russia and subsequently of the whole world.

In 1894 he moved to St. Petersburg, where he came into touch with the workers and began his propaganda work. To this period belong Lenin's first polemical writings directed against the popular party, who taught that Russia would know neither capitalism nor the proletariat. These were passed from hand to hand in manuscript form. Soon after, Lenin started a theoretical struggle against the falsifiers of Marx, in the legal Press.[2] In April 1895 Lenin first went abroad with the intention of entering into relations with the Marxist group abroad known as the "Osvobozhdenie Truda," "Deliverance of Labour" (Plekhanov, Zasulich, Axelrod). On his return to St. Petersburg, he organised the illegal "Union for the struggle for the liberation of the Working Class," which rapidly became an important organisation, carrying on propaganda and agitation among the workers and getting into touch with the provinces. In Dec. 1895 Lenin and his closest collaborators were arrested. He spent the year 1896 in prison, where he studied the lines of Russia's economic development. In Feb. 1897 he was sent into exile for three years to the Yenisei province in eastern Siberia. At this time, 1898, he married N. K. Krupskaya, his comrade in the work of the St. Petersburg Union and his faithful companion during the remaining 26 years of his life and revolutionary struggle. During his exile he finished his most important economic work, *The Development of Capitalism in Russia*, based on a comprehensive and systematic study of an enormous mass of statistical material (1899). In 1900 Lenin went abroad to Switzerland with the intention of organising, with the "Deliverance of Labour" group, the publication of a revolutionary paper intended for Russia. At the end of the year the first number of the paper *Iskra* (The Spark) appeared in Munich, with the motto "From the Spark to the Flame!" The aim of the paper was to give a Marxian interpretation of the problems facing the revolution, to give the political watchwords of the struggle, and to organise on this basis a centralised "underground" revolutionary party of Social Democrats, which, standing at the head of the proletariat, should open the struggle against Tsarism, rousing the oppressed masses, and, above all, the many millions of peasants.

The idea of an organised party leadership of the struggle of the proletariat in all its forms and manifestations, which is one of the central ideas of Leninism, is closely connected with the idea of the hegemony of the working class within the democratic movement of the country. This idea of hegemony, having become the central point of the Leninist political conception and practical work, found direct expression in the programme of the dictatorship of the proletariat when the development of the revolutionary movement had prepared the conditions for the Oct. revolution.

The second Congress of the R.S.D.R.P. (Brussels, London) in July and Aug. 1903 accepted the programme worked out by Plekhanov and Lenin, but ended with the historic split of the party into Bolsheviks and Mensheviks. Thereupon Lenin entered on his separate path as leader of the Bolshevik section, later the Bolshevik party. The differences, which began at first with questions of party organisation, gradually extended to fundamental questions concerning tactics and finally to the question of the party programme. The Mensheviks tried to bring the policy of the Russian proletariat into line with that of the liberal bourgeoisie. Lenin saw in the peasantry the closest ally of the proletariat. The occasional agreements and closer relations with the Mensheviks failed to arrest the constant widening of the two lines—the revolutionary and the opportunist—the proletarian and the petty bourgeois. The struggle with the Mensheviks forged the policy which led to the break with the Second International (1914), to the Oct. revolution (1917) and to the change of the party's name from the compromised title of Social Democrat to that of Communist (1918).

A revolutionary situation was created in the country by the defeat of the army and navy in the Russo-Japanese War, the

[1] Narodovoltze was a revolutionary terrorist society.

[2] As distinct from the Press which was published illegally—"underground" by revolutionaries.

shooting of the workers on Jan. 9 (22) in 1905, by the agrarian disturbances and the political strikes. Lenin's programme was the preparation of an armed rising of the masses against Tsarism, the creation of a provisional revolutionary Government which was to organise the revolutionary democratic dictatorship of the workmen and peasants for the radical deliverance of the country from Tsarism, serfdom and all medieval rubbish. Accordingly, the third congress of the party, consisting exclusively of Bolsheviks (May 1905), passed a new agrarian programme which included the confiscation of the domains of the landowners and the Tsar.

In Oct. 1905 the All-Russian strike began. On the 17th of the month the Tsar issued his manifesto about the "Constitution." In the beginning of Nov. Lenin returned to Russia from Geneva, and already, in his first article, appealed to the Bolsheviks, in view of the new situation, to increase the scope of their organisation and to bring into the party wider circles of workers, but to preserve their illegal apparatus in anticipation of the counter-revolutionary blows which were inevitable. In Dec. Tsarism began to counter-attack. The rising in Moscow at the end of Dec., lacking as it did the support of the army, without simultaneous risings in other towns and sufficient response in the country districts, was quickly suppressed.

In the events of 1905 Lenin distinguished three main features—(1) the temporary seizure by the people of real political freedom, real in the sense of not being limited by their class enemies, apart from and in spite of all existing laws and institutions; (2) the creation of new and as yet only potential organs of revolutionary power in the shape of soviets of workers', soldiers' and peasants' deputies; (3) the use of force by the people against those who had employed it against them. Those conclusions, from the events of 1905, became the guiding principles of Lenin's policy in 1917 and led to the dictatorship of the proletariat in the form of the Soviet State.

The suppression of the Dec. rising in Moscow threw the masses into the background. The Liberal bourgeoisie came to the front. The epoch of the first two Dumas began. At this time, Lenin formulated the principles of the revolutionary exploitation of parliamentary methods in immediate connection with the struggle of the masses and as a means of preparation for a fresh attack.

In Dec. 1907 Lenin left Russia, to return only in 1917. Now (in 1907) began the epoch of victorious counter-revolution, prosecutions, exile, executions and emigration. Lenin led the struggle against all decadent tendencies among the revolutionaries; against the Mensheviks, the advocates of the liquidation of the "underground" party—hence those known as "liquidators"—and of the change of their methods of work into purely legal ones within the framework of the pseudo-constitutional régime; against the "conciliators" who failed to grasp the complete antagonism between Bolshevism and Menshevism and tried to take up an intermediate position—against the adventurist policy of the Socialist revolutionaries who tried to make up for the inertia of the masses by personal terrorism; finally, against the narrow partisanship of a part of the Bolsheviks, the so-called "callers-off," who demanded the recall of the Social Democratic deputies from the Duma in the name of immediate revolutionary activity, though conditions at that moment offered no opportunity for this. In this dim epoch Lenin showed very vividly a combination of his two fundamental qualities—that of being an implacable revolutionary at bottom, while yet remaining a realist who made no mistakes in the choice of methods and means.

At the same time, Lenin carried on an extensive campaign against the attempt to revise the theoretic basis of Marxism on which his whole policy was founded. In 1908 he wrote a major treatise dealing with the fundamental questions of knowledge and directed against the essentially idealistic philosophy of Mach, Avenarius and their Russian followers, who tried to unite empiric criticism with Marxism. On the basis of a deep and comprehensive study of science Lenin proved that the methods of dialectical materialism as formulated by Marx and Engels were entirely confirmed by the development of scientific thought in general and natural science in particular. Thus Lenin's constant revolutionary struggle, in which he never lost sight of the smallest practical details, went hand in hand with his equally constant theoretical controversies, in which he attained to the greatest heights of comprehensive generalisations.

The years 1912–4 were marked in Russia by a fresh outburst of activity in the workers' movement. Breaches made their appearance in the counter-revolutionary régime. At the beginning of 1912 Lenin summoned a secret conference of the Russian Bolshevik organisations in Prague. The "liquidators" were declared to be outside the party. The split with the Mensheviks became definite and final. A new central committee was elected. Lenin organised from abroad the publication in St. Petersburg of a legal newspaper, *Pravda*, which in its constant conflict with the censorship and the police exercised a guiding influence on the vanguard of the working class. In July 1912 Lenin, together with his closest collaborators, moved from Paris to Cracow in order to enable him to be in closer touch with Russia. The revolutionary movement in Russia was growing, and was thereby giving the Bolsheviks the preponderance. Lenin, in active contract with Russia, sent articles under different pseudonyms almost every day to the Bolshevik legal newspapers, drawing the inevitable inferences from them in the illegal ("underground") Press. At this time, as well as before and after it, N. K. Krupskaya, as his nearest helpmate, was the centre of the organising work. She received comrades coming from Russia, gave instructions to others on their way there, set up "underground" connections, wrote conspirative letters, coded and decoded. It was in the small town of Poronin in Galicia that the declaration of war found Lenin. The Austrian police suspected him of being a Russian spy and arrested him, but he was released after a fortnight and expelled to Switzerland.

A new and wider phase of Lenin's work now opened. It had an international scope. Lenin's manifesto, published in the name of the party on Nov. 1 1914, denounced the imperialistic character of the War and the war guilt of all the great powers, who for long past had been preparing a sanguinary struggle for the purpose of widening their markets and destroying their rivals. The patriotic agitation of the bourgeoisie on both sides, who threw the blame each upon the other, was shown to be a manoeuvre to deceive the workers. The manifesto points out that the majority of Social Democratic leaders were now on the side of the bourgeoisie of their own country, thus violating the resolution of the International Socialist congresses and bringing about the downfall of the Second International. It points out that from the point of view of the Russian Social Democrats the defeat of Tsarism would be the most desirable issue of the War. The defeat of their "own" governments should be the slogan of the Social Democrats of all countries. Lenin subjects to a merciless criticism not only Socialist patriotism, but different shades of pacifism which dreams of peace but capitulates to war, and, while occupied with platonic protests, withdraws from the revolutionary struggle with Imperialism. The struggle with pacifism develops into a great struggle with centrism, that is, with those elements of the working class movement which are midway between the Social Democrats and the Communists, supporting the former in actual practice (for instance, the I.L.P. in Great Britain).

The theorists and politicians of the Second International redoubled their accusations of anarchism which they had before brought against Lenin. As a matter of fact, all Lenin's theoretic and practical work, both up to 1914 and after, was characterised by a twofold struggle, on the one hand with reformism which from the beginning of the War gave its support to the imperialist policy of the propertied classes, and on the other hand with anarchism and all the different varieties of revolutionary adventurists.

On Nov. 1 1914 Lenin promulgated a programme for the creation of a new International "to undertake the task of organising the forces of the proletariat for the revolutionary attack on capitalist governments, for the civil war against the bourgeoisie of all countries, for the attainment of political power and the victory of Socialism."

In Sept. 1915 (Sept. 5 and 8) there was held at Zimmerwald in Switzerland the first conference of European Socialists who were opposed to the imperialistic war. Thirty-one delegates were present. The left wing of the Zimmerwald conference and of the later one at Kiental adopted Lenin's demand for the transformation of the imperialist war into a civil war, and became the nucleus of the future Communist International. The latter worked out its programme, tactics and organisation under Lenin's guidance, and it was Lenin who directly inspired the decisions of the first four congresses of the Communist International.

Lenin was prepared for his struggle on an international scale not only by his profound knowledge of Marxism and his experience of the revolutionary struggle and party organisation in Russia, but also by his intimate acquaintance with the workers' movement throughout the world. For many years he had followed closely the internal affairs of the most important capitalist States. He was a thorough master of the English, German and French languages, and could read Italian, Swedish and Polish. His realistic imagination and political intuition often enabled him to reconstruct a complete picture from isolated phenomena. Lenin was always firmly opposed to the mechanical application of the methods of one country to another, and he investigated and decided questions concerning revolutionary movements, not only in their international interreactions, but also in their concrete national form.

The revolution of Feb. 1917 found Lenin in Switzerland. His attempts to reach Russia met with the decided opposition of the British Government. He accordingly decided to exploit the antagonism of the belligerent countries and to reach Russia through Germany. The success of this plan gave occasion to Lenin's enemies for a fierce campaign of slander, which, however, was powerless to prevent him from assuming the leadership of his party and shortly afterwards of the revolution.

On the night of April 4, on leaving the train, Lenin made a speech in the Finlyandsky station in Petrograd. He repeated and developed the leading ideas it contained in the days which followed. The overthrow of Tsarism, he said, was only the first stage in the revolution. The bourgeois revolution could no longer satisfy the masses. The task of the proletariat was to arm, to strengthen the power of the Soviets, to rouse the country districts and to prepare for the conquest of supreme power in the name of the reconstruction of society on a Socialist basis.

This far-reaching programme was not only unwelcome to those engaged in propagating patriotic Socialism, but even roused opposition among the Bolsheviks themselves. Plekhanov called Lenin's programme "crazy." Lenin, however, built up his policy not on the inclinations and views of the temporary leaders of the revolution, but on the interrelations of the classes and the logic of mass movements. He foresaw that the distrust of the bourgeoisie and of the Provisional Government would grow stronger daily, that the Bolshevik party would obtain a majority in the Soviets and that the supreme power would pass into their hands. The small daily *Pravda* became at once in his hands a powerful instrument for the overthrow of bourgeois society.

The policy of coalition with the bourgeoisie pursued by the patriotic Socialists, and the hopeless attack which the Allies forced the Russian Army to assume at the front—both these roused the masses and led to armed demonstrations in Petrograd in the first days of July. The struggle against Bolshevism became most intense. On July 5th grossly forged "documents" were published by the counter-revolutionary secret service. These purported to prove that Lenin was acting under the orders of the German general staff. In the evening "reliable" detachments summoned from the front by Kerensky and Cadet officers from the districts round Petrograd occupied the city. The popular movement was crushed. The hounding of Lenin reached its height. He now began to work "underground," hiding first in Petrograd with a worker's family and then in Finland; he managed, however, to keep in touch with the leaders of the party.

The July days and the retributions which followed aroused a burst of energy in the masses—Lenin's forecast proved right in every particular. The Bolsheviks obtained a majority in the Soviets of Petrograd and Moscow. Lenin demanded decisive action to seize the supreme power, and on his side began an unremitting fight against the hesitations of the leaders of the party. He wrote articles and pamphlets, letters, both official and private, examining the question of the seizure of supreme power from every angle, refuting objections and dispelling doubts. He drew a picture of Russia's conversion into a foreign colony if the policy of Miliukov and Kerensky continued, and he predicted that they would consciously hand over Petrograd to the Germans in order to destroy the proletariat. "Now or never!" he repeated in passionate articles, letters and interviews.

The rising against the Provisional Government coincided with the opening of the second Congress of the Soviets on Oct. 25. On that day, Lenin, after being in hiding for three and a half months, appeared in the Smolny[1] and from there personally directed the fight. In the night sitting of Oct. 27 he proposed, at the session of the Congress of the Soviets, a draft decree about peace which was passed unanimously and another about the land, which was passed with one dissentient and eight abstentions. The Bolshevik majority, supported by the left wing of the Socialist revolutionaries, declared that supreme power was now vested in the Soviets. The Soviet of People's Commissaries was appointed, with Lenin at their head. Thus Lenin passed straight from the log cabin where he had been hiding from persecution to the place of highest authority.

The proletarian revolution spread quickly. Having obtained the land of the landed estate owners, the peasants forsook the Socialist revolutionaries and supported the Bolsheviks. The Soviets became masters of the situation both in the towns and the country districts. In such circumstances the constituent assembly which was elected in Nov. and met on Jan. 5 appeared a patent anachronism. The conflict between the two stages of the revolution was now at hand. Lenin did not hesitate for an instant. On the night of Jan. 7 the All-Russian Central Executive Committee, on Lenin's motion, passed a decree dissolving the constituent assembly. The dictatorship of the proletariat, said Lenin, meant the greatest possible degree of actual and not merely formal democracy for the toiling majority of the people. For it guaranteed to them the real possibility of utilising their abilities, putting as it did in the hands of labour all those material goods (buildings for meetings, printing presses and so on) lacking which "liberty" remains an empty word and an illusion. The dictatorship of the proletariat in Lenin's view is a necessary stage in the abolition of class divisions in society.

The question of war and peace provoked a new crisis in the party and the governing body. A considerable proportion of the party demanded a "revolutionary war" against the Hohenzollerns, leaving out of account altogether the economic situation of Russia and the temper of the peasantry. Lenin felt that it was necessary for propaganda purposes to drag out negotiations with the Germans for as long as possible. But he demanded that, in the event of a German ultimatum, peace should be signed even at the price of a loss of territory or the payment of an indemnity —"Let us give way in space, but gain time," he said. The revolution kindling in the west would sooner or later undo the hard terms of peace. Lenin's political realism manifested itself in all its strength in regard to this question. The majority of the Central Committee in opposition to Lenin made a further attempt to avoid yielding to German Imperialism by declaring the state of war at an end, but refusing at the same time to sign an imperialistic peace. This led to a renewed attack by the Germans. After heated debates in the Central Committee at the sitting of Feb. 18 Lenin won a majority for his proposal that negotiations should be reopened forthwith, and that the German terms which were now still more unfavourable should be signed.

The Soviet Govt. on Lenin's initiative transferred itself to Moscow. Peace having been attained, Lenin now brought before the party and the country the whole question of its economic and cultural organisation.

[1] Smolny, originally an institute for the daughters of noblemen, was the headquarters of the Bolsheviks during the revolution.

The greatest trials, however, were still to come. A counter-revolutionary movement was approaching from the borders. By the end of the summer of 1918 Central Russia found itself surrounded by a ring of fire. Hand in hand with the Russian counter-revolution there came the rising of the Czechoslovaks on the Volga; on the north and south came the British intervention (in Archangel on Aug. 2, in Baku on Aug. 14). Food supplies were cut off. In these conditions of unexampled difficulty, when things seemed hopeless, Lenin never even for so much as an hour ceased to direct his party and the Government. He estimated the extent of each new danger and showed the way to safety. He carried on propaganda work in meetings and in the press, roused ever new forces from among the masses, organised the sending of the workers into the country to get corn, directed the creation of new war divisions, followed the enemy's movements on the map; he was in direct telegraphic communication with the young divisions of the Red Army and looked after their equipment and supplies from the centre. He followed the international situation, finding his bearings by the dissensions in the camps of the imperialists. At the same time he found time for attentive interviews, both with the first foreign revolutionaries who appeared on Soviet soil and with Soviet engineers about plans for electrification or for new methods of utilising peat or of developing a system of radio stations, and so on and so on.

On Aug. 30 the Socialist-revolutionary Kaplan aimed two shots at Lenin when on his way to a workers' meeting. This attack intensified the civil war. Lenin's strong constitution quickly recovered from the effect of his wounds. During his convalescence he wrote a pamphlet, *The Proletarian Revolution and the Renegade Kautsky*, directed against the most prominent theorist of the Second International. By Oct. 22 he was again speaking in public.

The war on the home fronts remained as before his chief occupation. Economic and administrative problems had necessarily to take a subordinate place. The civil war fed from abroad was at its height. It was only thanks to Lenin's titanic energy, clear vision and unshaken will that the struggle ended (at the beginning of 1921) with the utter defeat of the counter-revolution. The Government grew in strength. The main instrument of the struggle as also of the further constructive work always was and still remains the party organised by Lenin—the party which received a thorough apprenticeship during its period of work "underground." The hard school of the civil war produced seasoned main cadres of organisers.

Lenin always considered the Oct. revolution from the standpoint of the European and world revolution. The fact that the War had not led immediately to a proletarian revolution in Europe had enormously increased the difficulties of Socialist reconstruction. The roots of these difficulties lay in the interrelation between the town and the village. This roused Lenin at the beginning of 1921 once again to consider the problems of the internal economic régime. The Socialist reconstruction of society was impossible without agreement between the proletariat and the peasantry. It was therefore essential to change radically the régime of "war communism" produced by the civil war. The system of requisitioning superfluities from the peasants must be replaced by a tax correctly assessed. Private interchange of commodities must be allowed. These measures, introduced by Lenin with the full concurrence of his party, began a new phase in the development of the Oct. (Nov.) revolution, that known as the "new economic policy." Lenin pointed out subsequently that such a policy—with of course the necessary modifications—would be an inevitable phase in the Socialist reconstruction of every country.

In his policy within the Soviet Federation Lenin paid the greatest attention to the position of the nationalities which had been oppressed under Tsarism, and he tried in every way to create for them the conditions of free national development. Lenin made unsparing war against all imperialist tendencies within the state organisation, and especially within the party itself—the purity of whose ideas he guarded with the utmost jealousy. The charges of oppressing nationalities made against Lenin and his party with reference to Georgia, etc., were by no means the product of any national struggle, but of the sharp class warfare within the nation.

The principles of national self-determination, which in the western European working class movements extend only to the national minorities of the so-called civilised countries, Lenin insisted on applying in full to the colonial peoples, and he championed their right to separate themselves completely from their mother country. His doctrine was that the Western European proletariat should refrain from mere declarations of sympathy with oppressed nationalities, and instead should join them in the struggle against imperialism.

At the eighth congress of Soviets (1920) Lenin made a report on the work carried out on his initiative for the drafting of a plan for the electrification of the country. The gradual effort towards a high degree of technical development is the mark of the successful transformation from the system of small scale peasant economy, with its lack of co-ordination, to the system of large scale Socialist production based on a single, comprehensive plan. "Socialism is a Soviet Govt. plus electrification."

The exhaustion brought on by excessive hard work over a number of years ruined Lenin's health. Sclerosis attacked his cerebral arteries. At the beginning of 1922 his doctors forbade him daily work. From June to Aug. the disease made rapid progress, and for the first time he began to lose, although transiently, the power of speech. At the beginning of Oct. his health had so much improved that he once again returned to work, but not for long. His last public utterance ends with the expression of his conviction that "from Russia under N.E.P. will come Socialist Russia."

On Dec. 16 he became paralysed in the right arm and leg. However, during Jan. and Feb. he still dictated a number of articles of great importance for the policy of the party on the struggle against bureaucracy in the Soviet and party organisation; on the importance of co-operation in gradually bringing the peasants into the Socialist organisation; on the struggle against illiteracy; and finally on the policy in regard to nationalities oppressed under Tsarism.

The disease progressed and he lost completely the power of speech. His work for the party came to an end, and very soon his life also. Lenin died on Jan. 21 1924, at 6:30 P.M., at Gorky, near Moscow. His funeral was the occasion for an unexampled manifestation of love and grief on the part of millions.

The main work of Lenin's life was the organisation of a party capable of carrying through the Oct. revolution and of directing the construction of Socialism. The theory of the proletarian revolution—the methods and tactics to be pursued—constitutes the fundamental content of Leninism which as an international system forms the culminating point of Marxism. Lenin's single aim filled his life from his school days onwards. He never knew hesitation in the fight against those he considered the enemies of the working class. In his passionate struggle there was never any personal element. He fulfilled what he considered to be the demands of an inevitable historical process. Lenin combined the ability to use the materialistic dialectic as a method of scientific orientation in social developments with the deep intuition of the true leader.

Lenin's outward appearance was distinguished by simplicity and strength. He was of middle or rather below the middle height, with the plebeian features of the Slavonic type of face, brightened, however, by piercing eyes; and his powerful forehead and his still more powerful head gave him a marked distinction. He was tireless in work to an unparalleled degree. His thoughts were equally concentrated whether in his Siberian exile, the British Museum or at a sitting of the People's Commissaries. He put the same exemplary conscientiousness into reading lectures in a small workmen's club in Zurich and in organising the first Socialist State in the world. He appreciated and loved to the full science, art and culture, but he never forgot that as yet these things are the property of a small minority. The simplicity of his literary and oratorical style expressed the extreme concentration of his spiritual forces bent on a single aim.

In personal intercourse Lenin was even-tempered, courteous and attentive, especially to the weak and oppressed and to children. His way of life in the Kremlin was little different from his life as an emigré abroad. The simplicity of his daily habits, his asceticism in regard to food, drink, clothes and the "good things" of life in general in his case did not spring from so called moral principles, but came about because intellectual work and intense struggle not only absorbed his interests and passions but also gave him such intense satisfaction as to leave no room for subsidiary enjoyments. His thoughts never ceased to labour at the task of freeing the workers till the moment of its final extinction.

His works include: *Ekonomicheskoye soderzhaniye narodnicheslvai Kritika evo v Knige g. Struve, 1895* (The Economic Content of the popular party and Mr. Struve's criticism of it. The reflection of Marxism on bourgeois literature); *K Kharakteristike ekonomicheskovo romantisma* (1897) (The characteristics of economic romanticism), Sismondi and our Sismondists; *Razvitiye Kapitalisma v Rossie*, 1899 (The development of Capitalism in Russia). The process of making a home market for large scale industry; *Chto Dyelat*, 1902. (What is to be done? French trans. *Que Faire?* The most urgent question of our movement; *Dve taktiki sotsial—demokratii v demokraticheskoi revolyutsii*, 1905 (Two tactics of the Social Democracy in the democratic revolution); *Agrarnaya programma sotsial demokratii v pervoi russkoi revolyutsii 1905–1907* (1907), (The agrarian programme of the Social-Democrats in the first Russian revolution 1905–7); *Za 12 let.*, 1908 (During 12 years), Two tendencies in Russian Marxism and Russian Social Democracy); *Materialism i empiriokrititsism*, 1909 (Materialism and empiriocriticism). Critical observations on a reactionary philosophy; *Krakh II. Internatsionala*, 1915 (Collapse of the Second International. Eng. trans., 1919; *Sotsialism i voina*, 1915 (Socialism and War. In collaboration with Zinoviev. German trans., 1915); *Imperialism, Kak noveishii etap. Kapitalisma, 1917* (Imperialism, the final stage of capitalism); French trans., 1923; *Pisma o taktike*, 1917 (Letters about tactics); *Uroki revolyutsii*, 1917 (Lessons of the Revolution. Eng. trans., 1918; German trans., 1921); *Gosudarstvo i revolyutsiya*, 1917 (The state and revolution. Engl. trans., 1919). The Marxist doctrine about the state and the tasks of the proletariat in a revolution. French. trans., 1919; German trans., 1918; *Grozyashchaya Katastrofa i Kak c nei borotsya*, 1917 (The catastrophe which threatens us and how to struggle with it. French trans., *La catastrophe imminente et les mesures de la conjurer*, 1918). German trans., 1918; *Uderzhat li bolsheviki goeydarst vennuyu vlast?* 1917 (Will the Bolsheviks maintain power? German trans., 1921); *Proletarskaya revolutsiya i renegat Kautskii*, 1918. (The proletarian revolution and Kautsky the Renegade. Eng. trans., 1920); French trans., 1919; German trans., 1918; *Vybory v Uchreditelnoye Sobraniye i diktatura proletariata*, 1919. (The dictatorship of the Proletariat and elections to the Constituent Assembly. Eng. trans., 1920); German trans., 1920; *Detskaya bolezn "levisny" v kommunisme*, 1920 ("Left Wing Communism, an infantile disorder." Eng. trans., 1921; French trans., 1921; German trans., 1921); *Krizis v partii*, 1921 (The Crisis in the Party); *O prodnaloge*, 1921 (On the tax in kind. German trans.); *Stranichki iz dnevnika*, 1923 (Pages from my diary); *O Kooperatsii*, 1923 (On co-operation. French trans. Sur la Coopération, 1924); *Luchshe menshe, da luchsche*, 1923 (Better little but good); *Sobraniye sochinenii T.T. 1–19*, 1921–4 (collected works in 19 vol.).

There are two German editions of Lenin's collected works—*Ausgewählte Werke Sammelband*, 1925, and *Auswahl aus seinen Werken*. (L. T.)

LENINGRAD: *see* PETROGRAD.

LEONCAVALLO, RUGGIERO (1858–1919), Italian composer (*see* 16.455), died at Montecatini Aug. 9 1919.

LEPROSY (*see* 16.479).—Since 1910 a new and more hopeful era in the 3,000-year-old leprosy problem has been opened up by the discovery of an improved treatment of at least the earlier stages of the disease. It still remains a great scourge, recent estimates placing the world's lepers, including early little recognised cases, at two to three millions, the great majority being met with in tropical and subtropical Asia and Africa, the last having the highest numbers in proportion to population.

Leprosy is most prevalent in hot damp climates, and least in very dry areas, humidity being apparently favourable to the survival of the lepra bacillus and its transmission to others, usually through long and close contact, 40% of traced infections being due to living in the same house and 30% more to sleeping in the same bed with a leper. Children and young adults are most susceptible. The disease is less infectious than tuberculosis, and many advanced crippled nerve cases lose their infectivity. One-third of the isolated lepers in South African institutions were recently released on this account, with great reduction in expenditure and in opposition to segregation, which is only necessary in infective stages, and has resulted in the reduction of the lepers in Norway to only 5% of the numbers known in 1856, when it was introduced there. Sweden and Iceland show very similar results. Under the more difficult conditions in poor tropical countries such as Hawaii and the Philippines, and in the absence of an effective treatment, the effects of this policy have not been so good and it has led to hiding of the earlier and more amenable cases, from whom infections may arise before they are discovered and isolated.

Treatment.—Numerous suggested remedies, including nastin, having failed to fulfil their early promise, only the old Indian drug, chaulmoogra oil, was known to have some power of retarding the progress of the disease by such doses as could be taken orally on account of its nauseating properties. But slightly better results were obtained by Victor G. Heiser in the Philippines by prolonged painful courses of intramuscular injections of the oil, which few patients would submit to. Real advance was made in 1916–7 when L. Rogers injected the soluble sodium salts of the fatty acids of chaulmoogra and other oils intramuscularly, and still better intravenously. This produced febrile and local reactions, accompanied by extensive destruction of the lepra bacilli in the diseased tissues, with subsequent absorption and eventually complete disappearance of the nodules and the organisms in a considerable proportion of not very advanced cases.

Dean and Hollmann at Honolulu soon after introduced the practically important modification of using intramuscular injections of ethyl esters in place of the more troublesome intravenous ones of the sodium salts, enabling a larger number of cases to be treated. The result was that in the last four recorded years the number of cases discharged as recovered by a board of medical experts, has numbered 53% of the 399 admissions during the same period, and the total lepers, including advanced incurable cases among whom the mortality is high, are being reduced at a rate which will nearly solve the problem in Hawaii within about 25 years.

Further, at the great Culion leper settlement of the Philippines a little over 4,000 cases in all stages have been treated during the last two or three years, and 645 have already cleared up and are bacteriologically negative. Good progress is also being made in many other countries. Many early cases are now coming forward, for the first time in the age-long history of leprosy, in the early amenable stages and asking for admission to the leper institutions in order to obtain the new treatment. They consequently recover before they have reached the more infective stages, cutting short numerous foci of infection in the houses. Active research work, still further to improve the treatment, is going forward in several important centres. The disheartening old asylums for hopelessly advanced and often quite harmless uninfective lepers are giving place to agricultural colonies, much on the lines of tuberculosis sanatoria for the infective cases amenable to treatment.

Hospital clinics are being established to enable the early uninfective cases to be treated as out-patients without the cost and disadvantages of separation from friends and relatives, and only sufficient funds and organisation are required to enable this loathsome disease to be reduced to negligible proportions in many parts of the world within a very few decades. (See F. Oldrieve, *India's Lepers*, 1924.) (L. Ro.)

LEROY-BEAULIEU, HENRI JEAN BAPTISTE ANATOLE (1842–1912), French publicist (*see* 16.485), died in Paris June 16 1912.

LEROY-BEAULIEU, PIERRE PAUL (1843–1916), French economist (*see* 16.485), died in Paris Dec. 9 1916.

LEVASSEUR, PIERRE ÉMILE (1828–1911), French economist (*see* 16.505), died July 9 1911.

LEVELLING: *see* SURVEYING.

LEVERHULME, WILLIAM HESKETH LEVER, 1ST VISCOUNT (1851–1925), British man of business born at Bolton Lancs. Sept. 19 1851, was the son of James Lever, a grocer. His education, received at the Bolton Church Institute, was cut short

in 1867 when he went into his father's wholesale warehouse as an apprentice. With his zeal for knowledge and a wonderful memory, he utilised every opportunity for self education, attending evening classes for shorthand, drawing, French and chemistry, and interesting himself particularly in accountancy, pictorial art and architecture. Persuading his father to make him his commercial traveller, he showed such capacity that in 1874 he was taken into partnership and was thus able to marry the friend of his childhood, Elizabeth Ellen, daughter of Mr. Crompton, linen draper, of Bolton.

In 1877, having foreseen that important economies in transport of goods could be effected by opening a branch of the business in Wigan, he established a centre there which ultimately became more profitable than the Bolton headquarters. It was doing so well in 1884 in the hands of his father and capable assistants that he was on the point of abandoning it to them and seeking a fresh field for his activities; but refreshed by a holiday in the Isle of Lewis he returned to the Wigan shop "full of ideas about soap." These "ideas," it soon appeared, could not be realised until he had personal control of the manufacture. He accordingly leased a small soap works at Warrington, which had previously been carried on at a loss, and speedily, by his energy, activity and general good management, transformed it into a well-organised, flourishing business, with London branch premises and agents all over the country, well encouraged and supported by their chief's extensive advertising schemes of striking novelty and enterprise.

Soon, a freehold site where he would have more space for expansion became urgently necessary, and this he found for himself, near Bebington, Cheshire, where on Bromborough Pool Mrs. Lever on March 3 1888 cut the first sod for the foundations of Port Sunlight, the now famed model industrial village—a conspicuous example of successful town planning, with parks, tree-bordered thoroughfares, open spaces and halls, institutions and dwelling houses of great and varied architectural interest, the last named well adapted in size to the needs of the occupants, and provided with baths and gardens in front and allotments behind. As for "the space for expansion," the original 56 acres (of which 24 were reserved for the works and 32 for the village) were latterly extended to 547 acres, 287 allotted to works and 260 to the village, including its extensions.

The firm's expansion overseas has become world-wide, for in 1925 it was recorded in *Progress*, one of the company's magazines, that over 250 companies in all quarters of the globe were associated with Lever Brothers. Through Bromborough Pool and the Mersey, Lord Leverhulme had from Port Sunlight secured access by water to London and to British ports generally for home trade, and to the waterways of the world for his exports, as well as to the sources of the raw materials for soap manufacture. These facilities, owing to his foresight and enterprise, are about to be greatly increased by the opening of the Bromborough dock under construction on the Mersey side, from and to which ocean steamers will take and bring cargo.

Mr. Lever and his brother, before they moved to Port Sunlight, had determined that their employees should share in their prosperity. The prosperity sharing pledge was primarily redeemed in the creation of Port Sunlight village with its abundant amenities, and in the spaciousness of the factory area and the buildings erected thereon with all the arrangements now comprehended in the term "factory workers' welfare." Those who lived in the village further enjoyed "prosperity-sharing rents," based on the cost of maintenance repairs and renewals, the interest on the capital expended being a charge on the company's profits. The same principle was applied to works welfare expenses, beginning with a pensions scheme called the Employers' Benefit Fund, long service awards, cottage hospital, holiday club, but including in later days the co-partnership scheme and the many benefits flowing from it, *e.g.*, free insurance policies, unemployment and sickness benefits, staff college training and scholarships. The effect of the prosperity-sharing environment on the workers was a frequent subject of inquiry on the part of visitors; to Mr. and Mrs. Lever it was a source of pride, cultivating as they did the affection of the children and missing no opportunity of promoting their health and happiness and entertainment, or of meeting them in their Sunday schools and day school festivals.

In 1906 (12 years after the incorporation of the private company of Lever Brothers Limited into a public company) an attack was directed by a powerful Press organisation against an arrangement made by Mr. Lever with some other soap makers, which was mistakenly denounced as a soap trust. It was shown, however, in the course of the legal action taken by Mr. Lever against his principal assailant, that on the contrary, the object of the plan was to render better service to the public as well as to the distributors, both wholesale and retail. On the third day of Mr. Lever's ordeal in the witness box the counsel for the defence withdrew the plea of justification, as well as every imputation made upon Mr. Levers' honour and integrity, and apologised for having made the attack upon him. Mr. Lever presented the University of Liverpool with the amount of the damages and costs awarded to him, together with an additional sum which brought the endowment up to £100,000.

Mr. Lever was in politics an advanced Liberal and, in aid of his party against strong Conservatives, allowed himself to be nominated a Parliamentary candidate six times in all, thrice for Birkenhead, twice for Wirral and once for the Ormskirk Division of Lancashire. He scored a notable victory on his second candidature for Wirral in 1906, and introduced bills on old age pensions and payment of members, which were afterwards taken up by the Government and became law. After being raised to the peerage he made a favourable impression in the House of Lords by his speeches on labour questions, and on decimal coinage he introduced a bill which was remitted, with another, to a select committee, which, however, did not complete its sittings within the life of that Parliament.

In 1909 Mr. Lever launched his great scheme of co-partnership with employees. "A remarkable year" he characterised this, for it happened to be the centenary of his father's birth, the 21st anniversary of the foundation of Port Sunlight, and the year in which his son was coming of age and entering the business. The scheme, avoiding the objections to ordinary profit-sharing arrangements, was contrived to give to managers and other employees a common interest with the employer in avoiding loss as well as in sharing gain, the motto of all being "Waste not, want not." A reduced *facsimile* of the partnership certificate is bound together with a number of Lord Leverhulme's addresses explaining his scheme, in "The Six-Hour Day" referred to below.

The years 1910–4 brought to the founder of Port Sunlight fresh honours but also severe personal sorrows. In 1910 his brother died. In 1911 he was made a baronet; in 1913 he received from the King of the Belgians the Cross of Grand Officer of the Order of Leopold II. On July 24 of the same year he suffered his heaviest bereavement in the loss of Lady Lever, who had been his companion on many voyages, had visited with him his concessions on the Congo, and, on her return, had been made a Fellow of the Royal Geographical Society. Her memory was honoured, when on the visit of King George V. and Queen Mary in 1914 His Majesty laid the foundation stone of the Lady Lever Memorial Art Gallery. The completion of this building was impossible until the close of the World War, but then became a lordly treasure house, built, furnished, endowed and dedicated to Lady Lever's memory by her husband, the Princess Beatrice opening it in 1922.

Sir William's war activities included the loan of several buildings as hospitals, and service on many committees, including the Liquor Control Board and the Army and Navy Canteen Board. He was also gazetted Hon. Col. of the 2nd Vol. Batt., the Cheshire Regt., in which, in its early days, as a volunteer training corps, he had drilled as a private.

After his baronetcy, many other public honours were bestowed on him. He was raised to the peerage in 1917 as Baron Leverhulme (a name chosen by himself as combining that of his late wife with his own) and the designation "of Bolton-le-

Moors" as indicating his unceasing affection for his native town. He was high sheriff of Lancashire in 1917 and mayor of Bolton in 1918–9. The University of Edinburgh conferred upon him the hon. degree of LL.D. He was also made hon. fellow of the Royal Institute of British Architects.

In 1918 Lord Leverhulme turned his attention to the subject of reconstruction after the War and advocated the running of machinery in factories in double shifts of six hours in order to absorb the unemployed and to increase production at a lower cost. Under the title of *The Six-Hour Day and Other Industrial Questions* a selection of Lord Leverhulme's speeches and writings on co-partnership, education and business was edited by Mr. Stanley Unwin, and published with an introduction by Viscount Haldane. The editor, in his preface, remarked that "Lord Leverhulme prescribes a six-hour day, but manages to work sixteen." He might have added that further time was saved for business transactions by his habit of travelling to and from London by night trains. When at home in London he rose at 4:30 A.M. to read reports and prepare for the day's interviews and correspondence. It was in 1918 also that Lord Leverhulme bought from Col. Duncan Matheson the Island of Lewis, acquiring later North and South Harris also. He spent large sums in a sincere effort to extend and develop the fishing industry and to help the islanders in other ways, but lack of support, especially on the part of the Scottish Office, led to the abandonment of his schemes as far as Lewis was concerned; and he gave the town of Stornoway, including Lewis Castle and its grounds, to the people of Stornoway. He continued his developments in Harris, where more local appreciation was shown, until his death.

One of Lord Leverhulme's personal enterprises for the economic development of his Hebridean properties was the opening or acquisition in 1919 of the retail fish shops, since familiar to the public as "Mac Fisheries," to serve as an outlet for the fishing industry of Lewis and Harris, the catches being conveyed by swift steamers to Fleetwood and then distributed to over 300 shops in England, of which 110 were in London. Lord Leverhulme, having borne the whole of the expenses of the formation and development of Mac Fisheries, handed the business over to Lever Brothers a year or two later with its capital intact.

Among Lord Leverhulme's many benefactions, the presentation to the nation of Stafford House, renamed in compliment to him Lancaster House, and now constituting a home for the London Museum, is conspicuous. He was a generous benefactor to the Congregationalist denomination, of which he was a member; and jointly with his brother he erected the Blackburn Road Church, Bolton, as a memorial to his parents. He also built Christ Church, Port Sunlight, St. George's Church, Thornton Hough, and Neston Congregational Church. He was a renowned collector of antique furniture, pictures and Chinese porcelain, and presented the larger part of his wonderful collection to the Lady Lever Art Gallery at Port Sunlight. In Freemasonry he reached the high rank of Grand Junior Warden of England.

In 1922 Lord Leverhulme was made a viscount. Awarded the Messel memorial medal in 1924, it fell to him to deliver the Messel memorial lecture to the Society of Chemical Industry entitled "Science, Religion and Workshop," a typical example of his happy gift of relieving solid and serious argument with brief intervals of humorous anecdote.

At the 15th distribution of partnership certificates to his employees, on his 72nd birthday, Lord Leverhulme protested against a suggestion that he was without hobbies "other than the unselfish and noble hobby of devising schemes for the benefit and interest of his workpeople." He said he had a great many hobbies, adding, "I think road-making is my greatest hobby, and then I have the building of towns. Port Sunlight was my first. I am now engaged on my 11th—Moor Park in Middlesex. There are five or six in the Congo and others in various places."

Lord Leverhulme began his seventh journey round the world on Nov. 14 1923 and completed it on March 24 1924. His last journey was to West Africa, returning to London on the morning of March 15 1925. He resumed his business activities with his usual unsparing disregard of self, and caught a chill, which suddenly ended his remarkable career, on May 7 1925.

The testimony of Lord Leverhulme's fellow directors, embodied in a resolution drawn up on the morning of his death, summed up his life and work as "distinguished by genius, courage, imagination and devotion to duty, a career inspired by the highest ideals of public spirit and service to his fellow men, and notably by his interest in the welfare, education, better housing and amelioration of the conditions of labour of every rank of industrial worker, as evinced by his creation of co-partnership, life insurance, old age pensions, educational and other schemes for the benefit of his employees and by his gifts to the communities of Port Sunlight and Merseyside, to his native town of Bolton and to the nation." The directors further testified to "his natural simplicity, the charm of his character, the wealth of his affection and the loyalty of his friendship." (A. P.)

LEVI, SYLVAIN (1863–), French orientalist, was born in Paris March 28 1863. Educated at the University of Paris, in 1886 he was appointed a lecturer at the school of higher studies in Paris. As special lecturer in Sanskrit he taught at the faculty of letters from 1889 to 1894 when he was appointed to a professorship at the Collège de France. In 1897 and 1898 he made important tours of scientific research in India and Japan, and from 1921 to 1923 he travelled in India, Indo-China, Japan, Korea, Siberia and Russia. Prof. Levi became a director at the school of higher studies and a member of numerous societies, including the Royal Asiatic Society, the Linguistic Society and the Society of Jewish Studies. In 1923 he was made an officer of the Legion of Honour. His works include *Le théâtre indien* (1890, Prix du Budget, Académie des Inscriptions et Belles-Lettres); *La doctrine du sacrifice dans les Brahmanas* (1898); *Le Népal* (1905–8).

LEVY, AUGUSTE MICHEL (1844–1911), French geologist (*see* 16.519), died Sept. 21 1911.

LEWIS, ISAAC NEWTON (1858–), American soldier and inventor, was born at New Salem, Pa., Oct. 12 1858. On graduating from the U.S. Military Academy in 1884 he was given a commission in the artillery. From 1894 to 1898 he was a member of the board on the regulation of coast artillery fire in New York harbour. In 1898 he became recorder of the Board of Ordnance and Fortification in Washington, and the same year made a study of ordnance in Europe which led to the re-armament of the U.S. field artillery. He is the inventor of a number of range finding and other mechanical and electrical instruments used for artillery fire control purposes in U.S. coast defences. From 1904 to 1911 he was instructor and director of the coast artillery school at Fort Monroe, becoming lieutenant-colonel in 1911. In 1913 he retired from active service with rank of colonel. The same year a machine-gun of his invention (the Lewis gun) was accepted by the British, French and Belgian Govts. after it had been rejected in America. Throughout the World War it was extensively used by all the Allies. Col. Lewis refused to accept the royalties, amounting to $1,276,000, on his guns made for the American Govt. after the United States entered the World War.

LEWIS, SINCLAIR (1885–), American author, was born at Sauk Centre, Minn., Feb. 7 1885. He graduated from Yale University in 1907, and was engaged for a time in newspaper work, being reporter on various papers. He acted in an editorial capacity for the Frederick A. Stokes Co., the Publishers' Newspaper Syndicate, and George H. Doran Co., at the same time writing short stories and novels. Among his works are: *Our Mr. Wrenn* (1914); *The Trail of the Hawk* (1915); *and Free Air* (1919). His early work owed much to the influence of H. G. Wells. By *Main Street* (1920), a study of a small town, he won wide recognition while he provoked much criticism. *Babbitt* (1922) was one of the most discussed novels of the century, and added a new word to the English language. It was followed by the scarcely less popular *Arrowsmith* (1924).

LEYGUES, GEORGES (1858–), French politician, was born at Villeneuve-sur-Lot on Nov. 28 1858, and educated in his native town, Toulouse and Bordeaux. On arriving in Paris he took up the study of the law, but his natural bent inclined him at the same time towards letters and he was well received in the Parnassian group of poets. After pursuing wide travels, ranging from the polar regions to the Levant, he

entered politics. At the age of 26 he was elected deputy for the Lot et Garonne department. In 1894 and 1895 he was given Ministerial posts, respectively in the Dupuy and Ribot Cabinets. In June 1898 he was elected vice-president of the Chamber, but he resumed ministerial office in the 3rd Dupuy Cabinet of the same year. In Waldeck-Rousseau's Cabinet (1899–1902) known as that of " defence and republican action," he held the portfolio of public instruction, while M. Sarrien appointed him Minister for the Colonies in 1906. In the Clemenceau Cabinet of 1917 he was Minister of Marine. In 1920, when M. Millerand became President, M. Leygues was asked to form a Government. He remained until 1921 Prime Minister and Minister for Foreign Affairs. He was again Minister of Marine in the cabinets formed by M. Briand in Nov. 1925 and March 1926. His publications include *Le Coffret Brisé* (1882); *L'École et la vie* (1904); *La Pologne* (1918); *Colbert et son oeuvre* (1920).

LIANG SHIH-YI (1869–), Chinese politician, was born in Kwangtung, and, unlike many other Chinese republican leaders of his time, was educated wholly in China and knew no other language than his own. Graduating with honours in classics, he was appointed secretary to Tang Shao-yi when that statesman led a mission to India in 1906, and then began a successful career in the civil service. He was appointed director of railways and assistant director of the Chiao T'ung Bank in 1907, acting director of Imperial Chinese Posts in 1911, acting minister of communications in 1912, acting vice-minister of finance in 1913, and a member of the council of state and director-general of customs and taxes in 1915. The failure of Yuan Shih-kai's monarchical *coup d'état*, of which he was one of the supporters, compelled him to resign, but in 1918 he returned to favour as Speaker of the Senate. Throwing in his lot with Chang Tso-lin in the contest between the latter and Wu Pei-fu, he became Prime Minister in 1921. The defeat of Chang, however, resulted in his fall, and he left Peking in 1922 to escape Wu's vengeance and took no further part in politics. He visited Europe in 1924.

LIAPUNOV, ALEXANDER MIKHAILOVICH (1857–1918), Russian mathematician, was born April 25 (old style) 1857, a son of the astronomy professor in the University of Kazan, and the brother of the musician and composer Sergei M. Liapunov. In 1901 he was made a member of the Russian academy of science and later was appointed professor at Kharkov University. He died Oct. 31 1918 in Odessa. His mathematical research belongs mainly to hydrodynamics and his chief work is *Sur les figures d'équilibre peu différentes des ellipsoïdes d'une masse liquide homogène douée d'un mouvement de rotation* (1909–12). His voluminous investigations are very specialised and not available to the ordinary reader, but they are of incomparable value to specialists. They are published in French and in the *Mémoirs* of the Russian Academy of Sciences (1895, etc.) and his first treatises, which appeared in Russian, are translated into French and published in the *Annales de Toulouse*.

LIBERAL PARTY (*see* 16.538).—When the House of Lords rejected the budget at the end of 1909, Mr. Asquith immediately dissolved Parliament and appealed to the electors. The appeal was not only for the passing of the budget, but also for the permanent removal of any control over finance by the Upper Chamber, and for a time limit on any veto on any other legislation passed by the House of Commons. In the election, the Liberal party lost a considerable section of its enormous majority. But Mr. Asquith had, in combination with the Irish and the Labour members, a majority of 124 pledged to these two operations.

The Parliament Act.—The budget was passed in April, but in May 1910 King Edward VII. died and a kind of truce of God was called on the important constitutional question between Lords and Commons. Delegates from both sides discussed all possible forms of double chamber government for the remaining nine months of the year. Agreement was finally found to be impossible. The conference broke up and immediately Mr. Asquith again dissolved Parliament, this time with the written guarantee of the new King, George V., that if the country again endorsed his policy the royal prerogative would be exercised to create a sufficient number of peers to cause the necessary bill to become law. The election resulted in almost exactly the same balance of numbers as that which was held nearly 12 months before. Mr. Asquith's Veto bill passed through all its stages in the House of Commons by majorities of over 100, and the amendments which the Lords endeavoured to make to it were rejected. The Conservatives were informed they must either allow the bill to pass or its passage would be effected by the creation of several hundred new peers. They chose the former course.

The Liberal Programme.—The Liberal Govt. then proceeded to endeavour to carry measures, the principles of which the House of Lords had previously rejected and the House of Commons previously approved—Home Rule for Ireland, Welsh Disestablishment, and the creation of a more democratic franchise by giving each man only one vote. Of these the last was withdrawn owing to its complication over the question of giving the votes to women. Home Rule passed after many months of most bitter controversy and the organisation of contingent rebellion both in Ireland and in England. But it was only put on the statute book after the opening of the World War in 1914, accompanied by a condition suspending its operation till that War was over. The Welsh Disestablishment bill was also passed and came into operation after the War was over. Mr. Lloyd George also passed his great contributory insurance scheme, and in 1913 he launched an ambitious land policy in town and country, which was accepted by the Liberal party and on which they intended to appeal to the country.

The War Period.—But all such plans were swept away by the outbreak of the World War in Aug. 1914. The Liberal Cabinet was seriously divided between the policy of neutrality and the policy of intervention, and at one time the resignation of the Govt. appeared inevitable. The War was conducted exclusively by the Liberal Cabinet until May 1915, when failures in the field, the anxiety of the people and the bitter attacks by the newspapers, made it essential that a *union sacrée* should be formed in Britain as it had been formed in other countries. There was therefore constructed the first Coalition, in which Mr. Asquith remained Prime Minister and the most important offices—the Foreign Office, the Chancellorship of the Exchequer, the Ministry of Munitions—were still held by Liberals; but in which all the Conservative leaders and some representatives of Labour were included.

This Govt. continued to direct the operations of war until the late autumn of 1916. Owing to that War's prolonged continuance, with many disastrous defeats, the renewed attacks of the popular newspapers, and the gigantic loss of life and treasure, the public mind was prepared for a further change. An intrigue of a few men, ostensibly directed toward giving Mr. Lloyd George control of the War operations but in fact designed to exclude Mr. Asquith and the Liberals from the Cabinet, proved unexpectedly successful. Mr. Asquith resigned with all his Liberal colleagues. Mr. Lloyd George constructed a Cabinet composed of Conservatives, some minor Liberal members, Labour members and business men.

Mr. Lloyd George as Premier.—For the next two years Mr. Asquith and his followers, being a substantial majority of the Liberal members in the House of Commons, confined themselves to suggestions and criticism. But their support for an inquiry into the allegations made by Sir Frederick Maurice on the conditions which led to the greatest defeat the British Army has ever experienced on March 21 1918, created a break between the two sections of the party. In the following autumn, when Germany was utterly vanquished, Mr. Lloyd George issued what was called a coupon, contained in a letter signed by himself and Mr. Bonar Law, which was published as a recommendation to voters in all constituencies to vote against Liberal members and candidates who still declared allegiance to Mr. Asquith.

The Election of 1918.—The result was a débâcle. Mr. Asquith and all the Liberal ex-ministers who were faithful to him were defeated and only some 30 such Liberals were returned. These, under the leadership of Sir Donald Maclean, who had

never held Cabinet office, maintained some sort of opposition against the overwhelming forces of Mr. Lloyd George's Coalition. It soon became apparent, however, that the great mass of the Liberals in the country were bitterly opposed to this Liberal-Tory combination. Mr. Asquith was returned for Paisley at a by-election and assumed the leadership of what was scornfully termed the Wee Frees. In a fierce political civil war, carried on for three years, it was obvious that Mr. Lloyd George's nominees could only be elected by Conservative votes and that the Liberals were either in large numbers joining Labour or remaining doggedly determined to destroy the Coalition.

In 1922 Mr. Lloyd George and his Coalition were overthrown by an intrigue, very similar to, and in part conducted by the same men, the one which had placed him in power. A conservative Govt. was formed and in the appeal to the country Liberal was still found fighting Liberal, the result being the destruction of a considerable section of Mr. Lloyd George's followers, thus leaving the two Liberal sections still in a negligible minority in the House of Commons.

Liberal Reunion.—The year after, however, Mr. Baldwin, who had succeeded Mr. Bonar Law as Prime Minister, unexpectedly appealed to the country for a general tariff as a means of relieving unemployment. The Liberal leaders came together on so vital a question; Mr. Lloyd George accepted Mr. Asquith as leader of the party, and the two ex-Prime Ministers issued a joint appeal. The distrust of the Coalition by the Liberals in the country, however, had caused so many to turn to Labour that, although those who had been followers of Mr. Asquith gained a large number of seats, the number of those who had been concerned with the Conservatives and the "coupon," were still further diminished. Although they had secured substantially the same number of votes, the Liberals found themselves in members 30 behind the Labour party, and with no party in a majority, Mr. Asquith announced the intention of the Liberals to support a Labour Government. For nearly a year that Labour Govt. was retained in office by the votes of Liberal members, although it refused any agreements or consultation concerning policy and set up candidates in almost every constituency against the Liberals who were supporting it in the House.

The Election of 1924.—Such an impossible position was terminated in unexpected and almost casual fashion. The Labour Prime Minister decided to dissolve Parliament in preference to accepting any form of inquiry concerning the vague insinuations associated with the initiation and then withdrawal of a prosecution against a communist newspaper and its temporary editor, Mr. Campbell. In the dissolution which followed, while Labour received a severe setback, the Liberal party in Parliament was almost annihilated although polling more than 3,000,000 votes and the largest Conservative majority was returned since the great Reform bill. Mr. Asquith, who was defeated, retired to the House of Lords as Lord Oxford, but remained leader of the Liberal party. Mr. Lloyd George was elected chairman of the Liberal "rump" of 40 that remained in the House of Commons, of whom some 10 formed themselves into a Radical group and refused to accept his leadership. The remaining 30 were mostly elected by Conservative votes and some were pledged, in critical divisions, never to vote against the Conservative Government.

This desperate condition in Parliament was, however, not reflected by the Liberals in the country who over large areas proceeded to initiate Liberal campaigns, to collect substantial funds, and to prepare for a reversal of the decision when the next general election should come. The Liberal party also set itself down to consider vital social programmes; to issue pronouncements on such subjects as coal and power, the land and the nation and towns and the land. A small group in the House of Commons maintained a lively opposition to Mr. Winston Churchill's Budget of 1925 and to any tampering with free trade in the Safeguarding of Industries bill.

The revolutionary conclusions of Mr. Lloyd George's Land Committee, in part watered down by a compromise with the Liberal candidates association, were accepted by the delegates in a great Liberal convention representing the whole of the country, as an essential part of Liberal policy. This formed a cause or an excuse for flight from the party of certain ex-ministers and persons of wealth. In 1926, however, Lord Oxford remained undisputed leader of the party as a whole, and Mr. Lloyd George chairman of a rather forlorn and divided group in the House of Commons, while great energy was being shown by a land and nation league to spread the new reform doctrines especially in rural England, and vigorous attempts were made to reverse the verdict of the last election and place some 500 Liberal candidates in the field before the next appeal to the electors. (*See* ENGLISH HISTORY.) (C. F. G. M.)

Early in May this co-operation was interrupted by a serious difference between Lord Oxford and Mr. Lloyd George over the general strike which broke out on May 3. Lord Oxford held with the Government that the general strike, being a threat to the constitution, must be defeated before any negotiations for peace were considered. Mr. Lloyd George attributed the strike to precipitate action by the Cabinet which he condemned and supported the plea of the Archbishop of Canterbury for a negotiated peace. On May 10 Mr. Lloyd George declined in writing to attend a meeting of the shadow Cabinet summoned by Lord Oxford who, in communications of some severity, interpreted this abstention as tantamount to resignation. Mr. Lloyd George refused to resign and at meetings of the Liberals who had seats in the House of Commons was supported in that attitude by 20 votes to 10. The situation was complicated by Mr. Lloyd George's contributions to the Press in the United States and by his alleged but strongly denied negotiations with Mr. Philip Snowden, representing moderate Labour. Also, Lord Gladstone accused Mr. Lloyd George of withholding the funds with which he was entrusted at the late general election. (ED. *E.B.*)

LIBERIA (*see* 16.539).—By an agreement reached in 1910 France obtained some 2,000 sq. m. of hinterland which Liberia had claimed but had not administered. This reduced the area of the republic to about 40,000 square miles. Estimates made up in 1925 put the Americo-Liberians at about 20,000, of whom approximately half live in Monrovia, the capital. The native population is believed to be decreasing, it numbers probably 1,000,000 to 1,250,000. Some thousands of negroes in the coast region have adopted the religion (Protestant forms of Christianity) and the standards and language (English) of the Americo-Liberians, whose authority has become generally recognised over the whole country. Primitive conditions prevail throughout the interior.

History.—The condition of Liberia in 1910–11 was far from satisfactory. It was burdened with debt, it had granted many concessions without being able to control the regions in which the concessionaires were to work, and its authority rarely extended more than 20 m. from the coast. The frontier regions, which adjoined French or British colonies, were in a disturbed condition; the French especially were troubled by the remnants of Samory's army (*see* 24.642) and other malcontents who took refuge in the Liberian forests and raided across the frontier; hence the annexation by France of part of the border region. It appeared as if the experiment of "running" the country by American negroes—as alien to the bulk of the natives as are white men—on the lines of the constitution of the United States would collapse. However the intervention of the United States Govt. led to a financial re-organisation which gave the Americo-Liberians a new start. There was some trouble with Germany in settling the matter. The German Govt. energetically pressed its claims, the gunboat "Panther" being anchored for a month off Monrovia, with its guns trained on the executive mansion. All difficulties were overcome however by June 1912, when an international loan of $1,700,000 (£340,000) was raised, the bonds to be issued for not fewer than 40 years. The customs duties and certain taxes were pledged as security for the loan, and are administered by an American receiver-general, who is also Financial Advisor to the Liberian Government. Thus in effect the control of finances is in the hands of the United States and expenditure is kept within the

limits of the revenue. A frontier police force was also organised by officers of the United States Army, and as a result Liberian authority was better maintained.

During the World War the Germans, deprived by force of arms of their own colonies, found in Liberia their last foothold in West Africa. But in Aug. 1917 Liberia declared herself in a state of war and expelled the Germans. She was a signatory of the Treaty of Versailles, her representative at the peace conference in Paris being Mr. C. D. B. King. Mr. King was in 1920 chosen as president of Liberia and in 1924 was re-elected for a second term. He strove, with some success, to improve conditions in Liberia and was the originator of a system of road building which gave a prospect of opening up the interior.

Economic Conditions.—The natural resources of Liberia are almost untouched; the only cultivated crop of importance for external trade is coffee and the other industries for export are practically confined to the products of the oil-palm and piassava fibre (prepared from the raphae palm). While Monrovia has two wireless stations and direct cable communication with Europe and New York, there are no harbours and no railways and until means of transport are developed the wealth of the forests and the mineral resources cannot be utilised. The Government, however, has no money to spend on reproductive works. In 1925 an American firm obtained a concession of 1,000,000 ac. primarily for the establishment of rubber plantations. Meanwhile the bulk of the trade was in the hands of British and German firms, the Dutch being next in importance. The United States took but an insignificant fraction of the trade. Between 1913 and 1923 the volume of trade about doubled. In the last named year imports were valued at £298,000 and exports at £242,000. Revenue in 1912–3 was $618,800, accounts being kept in American currency, though the money in circulation is British. In 1923–4 revenue was $380,000, expenditure $371,600.

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LIBERTY LOANS, the name given to the four loans floated by the U.S. Govt. during the World War. A fifth loan, floated after the Armistice, was called officially the Victory Liberty Loan, but is here considered as the Fifth Liberty Loan. Between May 14 1917, when the First Liberty Loan was offered to the public, and May 10 1919, when the campaign for the Fifth Loan was brought to a close, the people of the United States subscribed $24,072,111,400. Of this amount, $21,432,924,700 was finally accepted by the Secretary of the Treasury. The Fourth Liberty Loan, concluded Oct. 18 1918, was, however, larger than any single loan issued by any of the other belligerents, and realised a total of nearly seven thousand million dollars. The number of subscribers to this loan was more than 21,000,000, or one-fifth of the total population of the United States. Moreover, the U.S. Govt. was able to dispose of the Liberty Bonds on very favourable terms; they were issued at par, the rate of interest varying from $3\frac{1}{2}$% on the First Loan to $4\frac{3}{4}$% on the Fifth. There were a number of reasons for the favourable terms obtained. The United States was immensely wealthy and had just passed through a period of great prosperity; its record for quick payment was unique; patriotic spirit was at a high pitch; advertising on an unexampled scale was undertaken; and the rate offered, while lower than those of European countries, was high as compared with the 3% and 2% paid in recent years on U.S. Govt. bonds.

When America entered the World War the Govt. realised that, in addition to the money needed to prosecute the War by the United States itself, large sums must be raised to relieve the already overstrained credit of the European Allies. The total amount of these loans to foreign countries was $9,842,468,566, to which was added later from sales of war material, etc., $736,040,776, making a total of $10,578,509,342. This money, excluding that derived from sales of war material, etc., was part of the amounts raised in the Liberty Loans. The financial policy of the Govt. was to raise from one-fourth to one-third of the necessary funds from taxation, the remainder from loans. The Treasury Dept. throughout the War met current obligations by issuing short-term Certificates of Indebtedness, which were absorbed by the Federal Reserve Banks and to some extent by outside banks and private persons. These certificates were retired either by exchange for Liberty Bonds or by redemption from money obtained through the sale of such bonds. The Liberty Loans constituted therefore a series of funding operations. These operations were intended not only to extend the debt over a period of years, but to distribute it as widely as possible. The success of the policy is indicated by the facts that 53% of the individual subscriptions for the Fourth Loan were for $50 bonds, and that approximately 25,000,000 persons were, at the end of the War, holders of Liberty Bonds. Before the United States entered the War such a result would have been thought impossible, for it was then estimated that there were only about 350,000 bond investors in the United States.

Under the Act of April 24 1917 the Secretary of the Treasury was authorised to issue bonds to the extent of $5,000,000,000 at a rate not to exceed $3\frac{1}{2}$%, these bonds to be convertible into bonds of a higher rate if such should be issued before the end of the War. The Secretary of the Treasury made the first issue $2,000,000,000 and proceeded to create a War Loan Organisation in the Treasury Department. The 12 Federal Reserve Banks were used as the central agencies in the 12 Federal Reserve Districts, and each of these banks formed Liberty Loan Committees. To each district a "quota" or proportional part of the whole issue was allotted. The value of advertising in arousing the public had been clearly demonstrated in the campaigns for the British War Loans, and the Treasury Dept. made use of every available means of publicity. As a result the First Loan was oversubscribed by more than $1,000,000,000.

In subsequent campaigns the methods employed in placing the First Loan were developed and extended. In each city an organisation known as Four-Minute Men was formed; these men visited places of public resort, including the play- and motion-picture houses, and spoke for four minutes on behalf of the loans. The Govt. assisted local authorities in organising street parades in which men from the training camps participated; captured German war material was displayed; distinguished soldiers and other visitors from Great Britain, France and the other Allied nations were given elaborate receptions. These campaigns were of great value as a means not only of selling the war bonds but of keeping up the morale of the people.

The following are the figures of the number of persons subscribing to each of the five Liberty Loans, the total of the amount asked for, the subscriptions and the final allotments:—

Loan	Subscribers	Amount asked	Subscriptions	Allotments
		$	$	$
First (1917)	4,000,000	2,000,000,000	3,035,226,850	1,989,455,550
Second (1917)	9,400,000	3,000,000,000	4,617,532,300	3,807,865,000
Third (1918)	18,308,325	3,000,000,000	4,176,516,850	4,175,650,050
Fourth (1918)	22,777,680	6,000,000,000	6,992,927,100	6,964,581,100
Fifth (Victory, 1919)	11,803,895	4,500,000,000	5,249,908,300	4,495,373,000

(F. H, H.)

LIBRARIES (*see* 16.545).—This article is concerned with the main developments of the public library service and with certain special aspects of library work since 1910.

I. GREAT BRITAIN AND IRELAND

Great as was the advance achieved during the last quarter of the 19th century, and especially under the influence of Andrew Carnegie during the years 1900–10, a still greater advance took place after 1910, and especially from 1918 onwards. Up to the latter date the service had suffered in two main respects, namely, the 1d. rate limit which, except in the great cities, prevented anything like adequate expenditure on books and salaries, and the practical inapplicability of the Libraries Act in the smaller centres of population. These difficulties had been set forth with vigour and persistence by the Library Association, and in 1915 the position was restated by Professor W. G. S. Adams in a report

published by the Carnegie United Kingdom Trust, which showed that the great majority of public libraries were utterly unable to provide an adequate service on the 1d. rate, and that the only hope for rural areas and the smaller towns lay in the establishment of a co-operative system.

Acting on this report the Carnegie trustees set up a number of circulating systems on a regional basis.[1] The county was the most hopeful unit, and during the years 1915–8 a number of county councils, through their education committees, and with the aid of substantial trust grants, set up experimental schemes under which, from a central store, collections were sent out on periodic loan to villages where they were as a rule housed in the schools and administered by the schoolmaster. The earliest schemes were those of Staffordshire, Cardiganshire, Carnarvonshire, Perthshire. As the county authority then had no power to levy a library rate, the whole cost was borne by the Trust.

Legislation.—The success of the experiment was immediate and convincing. In the Education (Scotland) Act 1918 it was provided (clause 5) that the county education authority should have powers to levy a library rate. In England and Wales the principle was recognised by the Public Libraries Amendment Act of 1919 by which county councils were empowered to levy a rate, entrusting the administrative arrangements to their education committees. The same powers were set up in Northern Ireland by the Public Libraries Act of 1924, and in the Irish Free State by the Local Government Act of 1925.

After the passing of these Acts the system spread with great rapidity under the encouragement of the Carnegie trustees (who expended altogether £310,300 during the period 1915–25), and by the end of 1925 the only administrative counties which had not received trust grants were: in England, Westmoreland, Hampshire (Isle of Wight)—both of which, however, had less ambitious schemes, not under the 1919 Act—Rutland, Lincolnshire (the Holland division) and Scilly; in Wales, Carmarthenshire; in Scotland, Argyll. In Ireland there were schemes in three of the northern counties, and 14 of the southern counties.

The system began with the distribution of boxes of books to villages. Within 10 years in several counties the motor-van library had displaced the box; co-operation with municipal libraries had begun; sets of books were provided for all organised adult classes; special collections (*e.g.*, for teachers, agriculturalists, students of local history, etc.) had been made; in a few cases, on the basis of differential rating, small libraries of the municipal type were set up in semi-urban areas too large to be served on the purely circulating system.

The Act of 1919, besides establishing the county as a library unit, removed the rate-limit in England and Wales. In Scotland in 1920 the limit was raised to three pence. In Ireland the same extension was sanctioned in 1920, with a further extension to 6d. for county boroughs. The majority of municipal libraries took greater or less advantage of their new freedom, but there was much leeway to make good, and up to 1926 insufficient provision for book purchase and salaries was still common. The American library in 1926 was spending roughly four to five times as much per head as the average British library. Perhaps the most hopeful sign was a tendency on the part of the weaker libraries to co-operate with the new and vigorous county systems, or with other neighbouring boroughs.

The Central Library for Students.—Apart from the borough and the county service, the chief important development is the establishment of a national lending library of serious books,—known as the Central Library for Students—as a reserve to the local services which, under the most favourable conditions, must always find a difficulty in meeting the needs of specialist readers. This library was started in 1917, largely to supply organised adult education classes, but in 1925 it also served 235 borough and 47 county libraries; with a stock of roughly 31,000 books, the issues from the three depots (London, Dunfermline, Dublin) totalled approximately 54,000. The library has been financed chiefly by the Carnegie Trust with substantial contributions from the Cassel Trust, the Thomas Wall Trust, and the United Service Fund and a comparatively small revenue from the voluntary subscriptions of borrowing libraries. Its sponsors have stated a case for a government subsidy, the library being capable of becoming in a real sense the keystone of the national lending service.

Co-operation with Special Libraries.—Thanks to grants from the Carnegie Trust, many special libraries agreed during 1922–5 to place their collections (rare and irreplaceable works excepted) at the disposal of the central library—a step of great importance towards a systematic inter-loan service. This policy of co-ordination was advanced a further stage in 1925 by the establishment of the Association of Special Libraries and Information Bureaux, and the initiation by the Association of University Teachers of a tentative system of exchange between university libraries.

The Carnegie Trustees prepared a fresh report, issued in 1924, which surveyed the situation during the period 1921–3. It showed that the smaller borough libraries were still financially embarrassed, and indicated the desirability of co-operation between them and the county service. Similar conclusions emerged in the report of the adult education committee appointed by the President of the Board of Education (1921–3). Accordingly, in 1924, the President of the Board set up a departmental public libraries committee, under the chairmanship of Sir Frederic Kenyon, Director of the British Museum, and representing both librarianship and education. This committee was expected to report towards the end of 1926 or the beginning of 1927.

Librarianship.—The pressing importance of raising the standard of education among public librarians received continuous attention from the Library Association and the Carnegie trustees. There was a strong feeling in the profession against the appointment of persons over 16 years of age, which automatically excluded university graduates; moreover, up to 1919 and even afterwards salaries were too low to induce university graduates in any numbers to enter the service. In that year, however, with the aid of a Carnegie Trust grant, a school of librarianship was set up in University College, London, and since that date the number of students taking librarianship as a post-graduate course has appreciably increased. Summer schools have been successfully established both by the school and by the Library Association, and a number of chief librarians have arranged special courses for their junior staffs. Library committees in the United Kingdom were still, however, very far behind those of the United States in their appreciation of the importance of a high standard of general education in the ranks of librarianship, matriculation being normally the maximum requirement, with the understanding that promotion would depend upon the taking of the certificates of the Library Association (*see* 16.560).

Building Developments and Equipment.—The progress of library building was seriously interrupted by the World War, comparatively few libraries having been erected since 1914. The Carnegie Trust in 1917 ceased to make grants and in 1925 decided to consider no further applications. Between 1914 and 1926, however, existing promises were honoured in 26 cases, the more important being those made to Barrow-in-Furness, Nottingham (two branches), Barking, Bethnal Green, Ipswich, York, Gateshead, Exeter. The total sum expended by the Trust on public library buildings in 1914–26 was £295,600. In every case the modern system known as "open access" was adopted, and stress was laid upon accommodation for children. Great improvements were effected in design, with the object of securing better lighting, more effective supervision and the greater convenience of public and staff. Card catalogue and subject-lists have almost entirely taken the place of printed catalogues. There was a steady tendency to make the library, as in the United States, a

[1] The idea in itself was not a new one. The principle was already embodied in voluntary schemes in Dorsetshire, in Yorkshire (under the auspices of the Yorkshire Village Library), and had been tried in Scotland as early as the middle of the 17th century; in Indiana, U.S.A., as early as 1816. The trustees, however, for the first time in Great Britain systematised the principle by the adoption of the county authority as the administrative unit. Several attempts to set up rural services based upon a central borough library came to nothing.

more vital and potent factor in communal life, by developing the practice of giving lecture courses illustrative of the use and resources of the stock, of supplying schools with loan collections, and by co-operating generally with education authorities, of admitting non-residents to the reference room and (on payment of a small subscription) to the use of the lending department, and of giving special facilities to teachers and students. Library policy has, in fact, become far more liberal than it was before the War. Of the greatest importance to business men and students has been the establishment in great city libraries, since 1919, of commercial and technical departments, notably those of Birmingham, Manchester, Liverpool and Glasgow. The machinery of distribution, through branches, with the aid of union catalogues, was greatly developed (*e.g.*, especially in Glasgow).

National Libraries.—Since 1910 two new national libraries have come into existence, the National Library of Wales, on a splendid site just outside Aberystwyth and the National Library of Scotland, formerly the Advocates' Library (*see* 16.557*c*), in Edinburgh. The former is a magnificent building begun in 1911, opened in 1915. It was not yet complete in 1926, but it already housed a splendid collection of books, manuscripts, historic papers, etc. It had the finest Welsh collection in existence and was strong in other Celtic languages. Its printed books numbered 450,000. It was erected by funds subscribed by the Welsh people themselves with a pound-for-pound government grant. The Faculty of Advocates presented their historic library to the nation in 1923, and it was duly vested in trustees by Act of Parliament in 1925, having received a generous endowment of £100,000 from Sir Alexander Grant. The Advocates retain the law section. The copyright privilege is enjoyed by both these libraries.

Between 1910–26 considerable development took place in the British Museum library. The accommodation for readers was increased by the addition of a reserve reading-room in the northern extension. There was also an extension of storage room, and a scheme for increasing the book-stack was initiated. The length of shelving grew to some 55 miles. Of the other copyright libraries, plans were prepared for increased accommodation in the Bodleian Library and the library of the University of Cambridge, but financial difficulties prevented progress. The same difficulty confronted the library of Trinity College, Dublin. As regards the last-named, the reluctance of Irish publishers, after the recognition of the Irish Free State, to send books to the copyright libraries in Great Britain seemed likely to imperil the copyright privilege; the right was, however, confirmed. The National Library of Ireland was closed for some time during the period of political unrest, but was subsequently reopened.

II. THE UNITED STATES

The County System.—As in Great Britain, the most distinctive development in the United States since 1910—though not so widespread as in Great Britain—has been the attempt to deal with the needs of rural areas. The county system began in Indiana in 1816; Wyoming legislated in 1886. Travelling libraries were established in New York, Wisconsin and Michigan between 1890 and 1900. Ohio and Maryland adopted the county system in 1898; Wisconsin and Oregon in 1901 and 1903. After 1910, however, the system was put upon an entirely new level of efficiency in California, where there were in 1925 no less than 42 county schemes holding jointly 2,500,000 books, with a total annual income of $1,250,000. The system was greatly strengthened by the existence of the fine state library in Sacramento, which acts as a kind of clearing-house (with a union catalogue) and central reserve for the whole state.

In a single year (1924) county libraries borrowed no less than 37,000 volumes for special readers. It is remarkable that by 1926 some 60 independent town libraries had voluntarily merged themselves in their respective county systems, thus greatly adding to the service of books upon which their readers might draw, and reducing their expenditure. The local centres are as a rule upon a more elaborate scale than their British counterparts: they have small, but admirably arranged, reading-rooms, permanent collections, and paid librarians, the circulating system being, except in the case of very remote centres, only supplementary. A different system obtains, *e.g.*, in the State of Massachusetts and other eastern states, where the unit is the township, and the whole machinery is based upon a central office in the department of education. By 1926 the county systems had been established by statute in 29 states, but schemes were in operation in only 200 counties out of 2,964. There is, however, no doubt that under the influence of the Carnegie Corporation of New York, supported by the fine example of California, the scheme is likely to spread rapidly.[1]

Municipal Service.—There has also been great progress in the municipal library service which, though of the same general type as its British counterpart, has shown itself considerably more elastic. Several magnificent libraries, including those of Detroit, San Francisco and Cleveland, have recently been erected.

Librarianship.—The profession of librarianship is better paid and more highly esteemed than in the United Kingdom. Between 1887 and 1919 no less than 15 schools of librarianship were founded, the more important being the New York State library school at Albany, the Pratt institute school at Brooklyn, the Carnegie library school at Pittsburgh and the Drexel institute school at Philadelphia.[2] The profession is largely in the hands of women, though most of the senior posts in the large cities are still held by men. In 1921 nearly half the students in the library schools were college graduates. The American Library Association (membership nearly 7,000) is an active and efficient body founded in 1876, with headquarters in Chicago. It represents both the United States and Canada. It issues select bibliographies, a specimen catalogue, reading courses (etc.) and, with the aid of subsidies from the Carnegie Corporation of New York, has undertaken important inquiries into the training of librarians, and the relation of the public library to adult education. Some 60 committees were at work in 1925 upon important problems of various kinds. The association in 1924 established a library school in Paris with the aid of funds from the American committee for devastated France.

In 1923 a calculation showed that, as regards places having not less than 1,000 inhabitants, 53·5% of the population had access to public library facilities,[3] of which more than half owed their buildings mainly to Andrew Carnegie. In the more active city systems, *e.g.*, at Cleveland (which in 1925 opened a magnificent new building on the most modern lines at a cost of over $4,000,000 and which spends at the rate of rather more than $1·25 per head), in New York City, at Detroit, Chicago, Pittsburgh, Boston, Newark, Indianapolis, Brooklyn, all kinds of developments have been devised with the object of bringing the service into the closest contact with the life of the community. A great feature is made of commercial and technological collections; juvenile departments (usually under specially trained assistants), service to schools, library clubs for adolescents, service by telephone, teachers' libraries, music departments—all these illustrate the tendency to departmental specialisation which is making the public library a real factor in civic life. In the new Cleveland library the arrangement of book stacks and reading rooms gives a concrete illustration of this important development. The system of distribution through branches and sub-branches, in shops, factories and public buildings of many kinds, is likewise designed to bring the communal stock directly to the service of the public. The public library has in fact become the intelligence bureau of the community.

The Library of Congress.—The Library of Congress is the pinnacle of the whole structure. Unlike the British Museum, this library, under reasonable safeguards, lends the rarer books which state, municipal and county libraries do not possess. There is, in fact, a recognised inter-loan system, working upwards from the village to the Federal library, under which any reader may as a rule obtain access to any publication which

[1] See H. C. Long, *County Library Service* (1925).
[2] See C. C. Williamson, *Training for Library Service* (1923).
[3] W. S. Learned, *The American Public Library* (1924).

exists in the country. In this scheme the universities and many specialist libraries participate. Of the greatest importance in this connection is the national card-index system operated by the Library of Congress, which supplies (at a very low price, and yet on a self-supporting basis) accession cards, fully registered and annotated, to any library in the country. Several thousand libraries buy these cards, and thus tend gradually to standardise their systems of cataloguing and classification.

Special Libraries

The chief development is the tendency, both in the United Kingdom, and in the United States, towards systematic co-ordination with a view to greater accessibility of special resources both on the inter-loan basis and for the benefit of the general public. The American Association of Special Libraries was formed in 1909, and has issued a directory. The formation of a corresponding British Association has already been recorded, and a similar directory was begun by this body in 1926.

In Great Britain, during 1910–26 there was a great development of scientific, technical and commercial libraries and bureaux of information. The scientific and research associations, large commercial and manufacturing firms, and the great industrial groups, awakened to the necessity of having well-organised up-to-date collections for the use of their officials. The same movement has developed in America, probably to an even larger extent, though in that country the public library has, until recently, undertaken a larger proportion of this kind of service. Of great importance in this connection are compilations like the *World List of Scientific Periodicals*, the *Subject Index of Periodicals*, both started since 1915.

Mercantile Marine.—Reference may also be made to efforts on behalf of sailors in the Mercantile Marine. The British Sailors Society has attempted this service for more than a century. Since 1920 it has revived and developed its arrangements under the stimulus of a Carnegie Trust subsidy. The Seafarers' Education Service (founded 1920), also with the aid of a trust grant, and contributions from the owners and the men's unions, has succeeded in placing substantial libraries of a more advanced kind upon 150 ships. The Carnegie Corporation of New York has similarly financed the American Merchant Marine Library Association. In Great Britain a system of supply to lighthouses and lightships was initiated by the Carnegie Trust with the aid of the public authorities concerned.

Libraries for the Blind, etc.—In Great Britain the needs of the blind have been met by the establishment of the National Library for the Blind in London, founded in 1882. The present building was opened in 1916, and a large extension was begun in 1925, the total cost being roughly £50,000. Books in Moon or Braille type are lent freely to public libraries, and individual readers. A sectional library for deaf education was set up in the library of the University of Manchester in 1920. Hospital collections are distributed under the auspices of the Red Cross Society. A collection for the use of nurses and health visitors has been set up by the College of Nursing (1921). The libraries of most of the learned societies were financially embarrassed during and after the World War, but since about 1921 they have been doing their utmost to make up arrears of book purchase, binding and cataloguing. (J. M. M.)

LIBYA (*see* 16.578).—On the occupation of Tripolitania and Cyrenaica (Benghazi) by the Italians in 1911–2 Libya (Libia Italiana) was adopted as the common designation of the two colonies. (*See* Cyrenaica; Tripolitania.)

LICHNOWSKY, KARL MAX, Prince (1860–), German diplomatist, was born March 8 1860 at Kreuzenort in Upper Silesia. He entered the German Foreign Office in 1884 and from 1904 to 1911 held secretarial posts in different German embassies abroad. In 1912 he was sent to London as ambassador, and remained at that post until the outbreak of the World War. He took part in the negotiations for a convention with Great Britain regarding the Baghdad Railway and various colonial questions, which was initialled on June 12 1914. Lichnowsky was convinced that for years the relations between Germany and Great Britain had been mismanaged and misunderstood by the Foreign Office in Berlin, and, in particular, he believed that Bethmann Hollweg and his advisers failed to appreciate the pacific attitude and intentions of Sir Edward Grey and the British Govt. during the crisis that ended in the World War. He embodied his views in the pamphlet entitled *Meine Londoner Mission*, which he circulated privately in manuscript among his German friends. This document came into the hands of an opponent of the war, Capt. von Beerfelde, who was the means of its being published, without authorisation, in 1918. The publication exercised a very prejudicial effect upon the German war spirit and there were loud demands among the Conservatives and National Liberals for the prosecution of the author. The Prussian Upper House, of which Lichnowsky was a member, passed a resolution excluding him from that assembly. It became impossible for him to live in Germany, and he sought refuge in Switzerland.

LIEBERMANN, MAX (1847–), German painter, was born in Berlin July 20 1847. He studied from 1869–73 at the school of art in Weimar, from 1873–8 at the Paris Academy under Munkaczy, then for a short time in Barbizon with Millet, in Holland, and finally from 1878–84 at the Munich Academy. In 1898 he was appointed a professor at the university of Berlin. He became the chief exponent of the impressionist school of painting in Germany and the leader of the "secession." Liebermann won the Grand Prix at Paris in 1889 and received gold medals at Venice, Berlin, Vienna, Dresden, Munich and Antwerp. He became president of the Berlin Academy, a member of the Brussels, Dresden, Milan, Munich, Stockholm and Weimar academies and a corresponding member of the Institute of France. His chief pictures are "Jesus among the Scribes" (1879); "Jam Makers" (1879); "Women Plucking Geese" (1894); "Samson and Delilah" (1902); "The Board of Hamburg Professors" (1906); portraits of F. Maunann, Gerhart Hauptmann, Dehmel and Ed. Meyer.

See C. H. Rosenhagen, *Max Liebermann* (1900).

LIEBKNECHT, KARL (1871–1919), German politician, was born in Leipzig Aug. 13 1871. The son of Wilhelm Liebknecht (*see* 16.592), he qualified as a lawyer, and speedily became a prominent member of the extreme Left wing of the Socialist party. After serving a sentence of 18 months' imprisonment for high treason, in 1908 he was elected to the Prussian Chamber of Deputies, and in 1912 entered the Reichstag as a Social Democrat. Not long after the outbreak of the World War he was expelled from the Social Democratic party on account of his violent opposition to the policy of the Government and the successive votes of credit, and formed a faction of his own, *Die Sozialdemokratische Arbeitsgemeinschaft.* Arrested again in 1916 on a charge of high treason he was sentenced to four years' penal servitude; he was reprieved, however, on the eve of the revolution in Oct. 1918. He at once became the leader of the Spartacists, and was largely responsible for that party's insurrection in Jan. 1919. During the rioting he was arrested; and while being conveyed from military headquarters in the west end of Berlin to the prison at Moabit on Jan. 15, he was shot down by his escort while, as was subsequently alleged, he was attempting to escape. His associate, Rosa Luxemburg, perished the same night.

LIÉGE, Belgium (*see* 16.593), with a population in 1921 of 165,096, has been much improved in recent years, and has grown rapidly; it is a clean, prosperous and well-built city, and is the centre of the iron and armament manufacture of Belgium and of a coal-mining district. The production of zinc and of motor-cars has also become important. Of the 56 blast furnaces in the country in 1925 Liége had 20. There is also a large cattle market. Suburbs have arisen on the heights to the north, and a circular boulevard has been laid out with connecting roads. A number of houses near the university were destroyed by bombardment and by fires started after the German entry, and the bridges over the Meuse were blown up by the Belgians in their retreat; but the town as a whole, being an important centre, was spared by the Germans. The Place de l'Université has been renamed Place du 20 Août, in remembrance of the burning of houses and shooting

of 18 persons as they escaped from the fires, by the Germans. The Place Verte is now Place du Maréchal Foch. Liége was the first large town captured during the War. The valiant defence of its powerful ring of forts delayed the German advance for a week and caused the enemy heavy losses. A number of the citizens were deported in 1916 during the German occupation. The city has since been granted the Cross of the Legion of Honour, and a representation of the Perron Liégeois, which symbolises the liberty of Liége, has been reproduced on a postage stamp. The forts were repaired by the Krupp company in 1914–5 (*see* BELGIUM, INVASION OF).

LIFE: *see* BIOLOGY.

LIFTS: *see* ELEVATORS AND ESCALATORS.

LIGGETT, HUNTER (1857–), American soldier, was born at Reading, Pa., March 21 1857. He graduated from the U.S. Military Academy in 1879, and saw service in the west against the Indians. In the Spanish-American War in 1898 he served on the staff of the adjutant-general, and later was in the Philippines where, as major of volunteers he served for three years. In 1902 he was appointed a major in the regular army and spent several years with the Dept. of the Lakes and at Fort Leavenworth. In 1909 he attended the War College, and on graduating in 1910 was appointed a director there, and in 1913 president, becoming brigadier-general in the same year. From 1915 to 1917 he was again in the Philippines, being for one year commander of the Department. In 1917 he was made major-general and commander of the Western Dept., but in Sept. went to France as commander of the 41st Div. of the American Expeditionary Force. He was at the second battle of the Marne, at St. Mihiel, and in the Argonne commanding the I. Army Corps and later the I. Army, and commanded the III. Army of Occupation on the Rhine. In 1919 he was commander of the Western Div., and in 1920 commander of the IX. Corps Area, retiring March 21 1921.

LIGHTING: *see* ILLUMINATION ENGINEERING.

LIGHTNING: *see* ATMOSPHERIC ELECTRICITY.

LIGHT RAILWAYS, MILITARY.—These are 60 cm. gauge railways laid with steel rails, weighing 20 lb. to the linear yard of rail, on sleepers weighing from 11 to 22½ lb. each, according to the weight of the rolling stock used, and laid 2 ft. 6 in. apart on a ballast track, the ballast consisting of sand, gravel, mine earth or burnt clay.

Rolling Stock.—The rolling stock consists of three types of wagon:
1. Low-sided four-wheeled trucks with capacity of four tons.
2. Flat bogie wagons with carrying capacity of eight tons.
3. Bogie well wagons with carrying capacity of 10 tons. The latter being used almost entirely for transporting heavy ammunition.

Motive Power.—The motive power consists of:
1. Six-wheeled, coupled locomotives weighing up to 14 tons. capacity 60 H.P., and capable of hauling 65 tons up a gradient of 1 in 40.
2. Four-wheel coupled locomotives weighing up to eight tons, capacity 35 H.P., and capable of hauling 40 tons up a gradient of 1 in 40.
3. Petrol tractors weighing up to four tons and capable of hauling a load of 14 tons up a gradient of 1 in 40; these petrol tractors have two gears, the speed on the low gear being about four miles and on the high gear 10 m. per hour.

During the latter part of the World War 1917–8 light railways were very extensively used on the western front for transporting supplies to the smaller supply depôts away from the standard gauge railways, and ammunition to the heavy gun and howitzer positions. During 1917–8, 1,780 m. of light railway were laid but only about half of this was ever used. While the War was stationary light railways were of very great service to the armies, but as soon as a retreat or a continued advance took place they soon became out of action. They are not economical, the maintenance alone during 1917 being on an average 15 men per mile, which, as the lines became consolidated was reduced to five men per mile. The average effective haul of a locomotive was 23 train m. per day, and that of a tractor was 20 train m. per day. The average coal consumption per locomotive was 62 lb. of coal per effective train mile and the average petrol consumption per tractor was ·56 gal. of petrol per effective train mile. The average loaded wagon mile per day per effective was 4·25.

With the advance in Sept. 1918, light railways were of great assistance in getting forward ammunition and evacuating the wounded. They were joined on to the German 60 cm. railways which had not been destroyed, but they were soon left behind and the armies relied entirely on the standard gauge railways and road transport.

Light railways, when worked to their maximum capacity carry, on an average, about 140 tons of supplies per mile of track per day, according to the grading of the line, and the cost in man power for operating purposes only, as compared with a standard gauge railway, is as 3·45 to 1 per m., and cost in man power for construction as 2·2 to 4·7.

An extension to light railways, known as "*foreways*," and used for carrying supplies from the end of the light railways up to the trenches, consisted of 60 cm. gauge track laid on an unballasted formation; the rails weighing about 9 lb. per linear yard of rail on sleepers weighing 8 lb. and spaced 3 ft. apart, centre to centre; on these lines, flat-topped, four-wheel trollies were pushed by two men during the night right up to the communication trenches. Early on in the War the armies objected to these foreways being laid with steel rails urging that the noise of steel wheels grinding on steel rails would attract enemy fire. The first of these lines were made of pitch pine rails nailed on to wooden sleepers; but the friction between steel wheels and wooden rails was so great that the trollies were continually being derailed. (D. L.)

LILLE (*see* 16.685), the fifth largest town in France, had a population of 200,952 in 1921. About 1,000 houses were destroyed by German guns in 1914, and during the German occupation a munition dump on the southeast ramparts blew up causing much damage. The old church of St. Margaret was partially and the Hôtel de Ville completely destroyed. Before their departure the Germans blew up several of the town bridges. The Palais des Beaux Arts, from which many works of art were removed in 1914, has been reconstructed. Lille was made the seat of a bishop in 1913. Before the War Lille provided some four-fifths of the French production of cotton and linen fabrics and yarn, and both industries were in a flourishing condition, but the War caused immense loss; only one flax spinning mill was in a condition to resume work soon after the Armistice, and it is computed that two-thirds of the total number of spindles were lost. Their replacement, however, was practically completed by 1924, and the industry gradually recovered, though handicapped by scarcity of labour and yarn and the high price of the latter.

The War Period.—Lille was first reached by advance German patrols in Aug. 1914. It was afterwards re-occupied by the French, but they retired again early in Oct., the serious defence of the city not being part of the general plan of campaign. After several days' bombardment the Germans entered on Oct. 12 1914 and remained till Oct. 1918, when they were outflanked by the Allied capture of neighbouring towns. The deportation of a large number of citizens in 1916 was the culminating point of tyranny suffered by the people of Lille under German rule. The city was a favourite resort for German officers on leave, as it was not shelled by the Allies, although it was within range of the guns.

LIMA, PERU (*see* 16.689).—During the 20 years ending in 1926, and particularly since 1920, the city of Lima has experienced a series of modernising influences. The population, including that of Callao, was in 1926 estimated at 250,000 and was slowly rising. Many of the narrow streets radiating from Plaza Mayor, the heart of the city, have been paved, and new business houses have been erected, including one of the finest hotels in South America. Large sums have provided modern sanitation, waterworks and sewerage. In the Exposition and other newer parts of Lima, avenues and boulevards radiate from attractive circles and modern parks; there are thousands of ornamental trees, and many fine residences face these modern streets and boulevards. Seaside resorts at La Punta, Chorrillos,

Miraflores and Ancon are growing, and electric car lines and motor vehicles link them with Lima.

The educational system has made marked progress under revised laws. The general increase of Peruvian cotton, sugar, sheep-farming, petroleum, mining and new irrigated areas is the basis of this progress. Revised taxation provides several million dollars annually for highway construction. A motor-car in 1925 succeeded in making the trip over the trail from Lima to Arequipa. Automobiles can now be operated from Lima to Piura. Cement, cotton and other Lima industries are increasing their output, while land values in the capital and suburbs have more than doubled in a decade.

LIMAN VON SANDERS, OTTO (1855–), German soldier, was born in Stolp, Prussia, Feb. 17 1855. Entering the German Army in 1874, he held various posts in the cavalry and in 1913 he was sent to Turkey as leader of a German military mission. His appointment as commander of the I. Turkish Army was annulled on account of Russian protests, but he remained inspector of the Turkish Army. Made a Prussian general in Jan. 1914, in Nov. of the same year he was given the chief command of the Turkish troops in the Caucasus. In March 1915, as commander of the V. Turkish Army, he successfully opposed the British and French attacks on the Dardanelles and the peninsula of Gallipoli. In 1918 Von Sanders succeeded Von der Goltz as leader of the Turkish forces in the Middle East, and was thus in command in Syria and Palestine when General Allenby was victorious there. Von Sanders escaped capture, but after the Armistice he gave himself up to the Allies and was interned until Aug. 1919. He gave an account of his experiences in Turkey in *Fünf Jahre Turkei* (1920).

LINDAU, PAUL (1839–1919), German dramatist and novelist (*see* 16.717), published in 1909 a collection of short stories *Der Held des Tages.* A volume of memoirs, under the title *Nur Erinnerungen*, appeared in 1917. He died in Berlin Jan. 31 1919. His elder brother, RUDOLPH LINDAU, died in 1910.

LINDENTHAL, GUSTAV (1850–), American engineer, was born at Brünn, Austria, May 21 1850, and was educated there, and at Vienna. Having been engaged in railway and bridge work in Austria and Switzerland, he went to the United States in 1871. He was engineer at the Centennial Exposition, Philadelphia, from 1874 to 1877, after which date he practised in Pittsburgh as consulting engineer in railway and bridge construction till 1890, when he moved to New York City. He was commissioner of bridges for the City of New York, 1902–3. He designed and acted as consulting engineer for the steel arch bridge spanning the East river at Hell Gate. This bridge, known as Hell Gate Bridge, was commenced Nov. 1914, and opened for traffic March 1917. With its approaches, it is about $3\frac{1}{2}$ m. in length, and contains the longest steel arch in the world (1,017 feet). Its cost was approximately $18,500,000.

LINDLEY, NATHANIEL LINDLEY, BARON (1828–1921), English judge (*see* 16.719), died at Norwich Dec. 9 1921.

LINDSAY, NICHOLAS VACHEL (1879–), American writer, was born at Springfield, Ill., Nov. 10 1879. In 1897 he entered Hiram College, O., but left after three years to study art in Chicago and New York. For several winters he was a Y.M.C.A. lecturer, and during 1909–10 lectured for the Anti-Saloon League in his native state. Meanwhile he had begun during the summers a series of wanderings on foot which carried him through many states, reciting or singing his own verses like an ancient minstrel and delivering an occasional lecture, receiving in return food and lodging. In 1920 he visited England, where he gave recitals. Many of his poems have the true ballad ring, and are very popular.

His works include *General William Booth Enters Into Heaven, and Other Poems* (1913); *The Congo, and Other Poems* (1914); *Adventures While Preaching the Gospel of Beauty* (1914, prose); *The Art of the Moving Picture* (1915, prose); *A Handy Guide for Beggars* (1916, prose); *The Chinese Nightingale, and Other Poems* (1917); *The Golden Book of Springfield* (1920, prose); *The Golden Whales of California, and Other Rhymes in the American Language* (1920); *Going-to-the-Sun* (1923); and *Going-to-the-Stars* (1926), the two latter being illustrated by the author.

LINDSAY, NORMAN (1879–), Australian artist, was born at Creswick, Victoria, Feb. 23 1879. He began to draw for a Melbourne newspaper at 16, and in 1901 moved to New South Wales where he afterwards lived. He joined the staff of the Sydney *Bulletin*, and became its chief cartoonist, a post which he retained for many years. His chief characteristics as a cartoonist are imaginative power, grim strength, marked individuality of style and a certain coarseness. All of these qualities are apparent in his illustrations to Theocritus, Boccaccio, Casanova and Petronius, the best of which have been collected in *The Pen Drawings of Norman Lindsay* (1918). As an etcher he shows extraordinary facility in the treatment of flesh and massed figures; and he also achieved distinction as a painter in oils and water colours, a lithographer, an engraver and a maker of model ships. In 1925 an exhibition of his paintings was held at the Leicester Galleries, London.

LINDSEY, BENJAMIN BARR (1869–), American judge, was born at Jackson, Tenn., Nov. 25 1869. He was educated in the public schools and attended Notre Dame (Indiana) University and the Southwestern Baptist University, Jackson, Tennessee. At the age of 16 he began to earn his livelihood in Denver, continuing his studies in a law office. He was admitted to the Colorado bar in 1894. In Jan. 1899 he was appointed Public Guardian and Administrator of Denver. He was instrumental in securing the passage of The Colorado Juvenile Court Law of April 12 1899, which gradually changed the whole system of dealing with juvenile offenders in Denver, the change including the establishment of a Juvenile Court conducted solely in the interest of children. He was appointed judge of that court in Dec. 1900, to which he has since been elected for ten consecutive terms. Because of his championship of Juvenile Courts, he earned for himself the name of "the Father of the Juvenile Court." He was also the author of the first parental laws in the United States making the Juvenile Court a Parental and Family Court as well, and also of the "Chancery Court Procedure" in dealing with adult offenders. He wrote *Problems of the Children* (1903); *The Beast* (with Harvey O'Higgins) (1910); *Children in Bondage* (with George Creel) (1914); *Pan Germanism in America* (1919); *The Doughboy's Religion* (with Harvey O'Higgins) (1920); *The Revolt of Modern Youth* (with Wainwright Evans) (1925); *Childhood, Crime and the Movies* (1926) and a large number of brochures dealing with problems of juvenile delinquency, domestic relations and crime. (*See* CHILDREN'S COURTS.)

LINSEED: *see* OILS AND FATS.

LIQUID AIR.—An intensely cold, blue, somewhat magnetic liquid having a density nearly equal to that of water is obtained by subjecting compressed air to the action of intense cold. At atmospheric pressure, air liquefies at a temperature of $-191{\cdot}4°$ Centigrade. The properties of bodies plunged into it are greatly altered; *e.g.*, flowers and other delicate objects become exceedingly brittle and lead becomes hard, elastic and sonorous.

Cailletet Process.—Many unsuccessful attempts to liquefy air were made before M. Louis Cailletet, of Châtillon-sur-Seine, announced to the French Academy, in Dec. 1877, that he had liquefied air by a process in which cooled, compressed air, previously freed from carbon dioxide and moisture, was caused to issue from a nozzle into a receiver so as to expand suddenly; the receiver was made of glass and liquefaction was apparent from the formation of a mist.

Pictet Process.—At the same time, M. Raoul Pictet, of Geneva, working independently, made known his success, achieved by using a cascade or successive temperature-fall process. He obtained a temperature of about $-65°$ C. by the expansion of sulphur dioxide around an arrangement of tubes in which carbon dioxide was being liquefied and then using the resulting liquid to obtain a temperature of about $-130°$ C. around a tube conveying compressed air to a nozzle whence the air issued.

Other Processes.—By both these processes, liquid air was obtained but only to evaporate almost as soon as it was formed. The next achievement was the production of liquid air in quantities large enough to be collected. The importance of using a temperature as low as possible to effect liquefaction was more

fully appreciated and MM. Olszewski and Wroblewski of Cracow used ethylene instead of carbon dioxide in their cascade process and obtained a temperature low enough to effect liquefaction without final expansion of the compressed air. Another cascade process, carried out at the Cryogenic Laboratory of Leyden, under the direction of Prof. Kamerlingh-Onnes, made use of a temperature of −150° C., obtained by using methyl chloride and ethylene. During a long period of experiments, Prof. Dewar made large quantities of liquid air; he usually obtained the successive falls in temperature by means of liquid carbon dioxide and ethylene.

The cascade processes were complicated and too costly for commercial use and were abandoned in favour of improved expansion methods. As early as 1857, Mr. C. W. Siemens obtained provisional protection for an invention for obtaining very low temperatures by causing cooled compressed air to expand in an engine; the cold air thus produced was used to cool the compressed air on its way to the engine, a cold intensifying effect being thus obtained. No complete patent specification was filed and nothing further seems to have been done by the inventor. An apparatus of this type was patented, however, by M. Ernest Solvey of Brussels (British specification No. 13466 of 1885). It comprised an annular chamber in which compressed air expanded while doing work on a piston fitted in an extension of the outer wall of the annular chamber; this chamber was protected by a jacket packed with a thick layer of non-conducting material. It was assumed that, by the cold-intensifying effect obtained, as in Siemens' apparatus, liquefaction of the air would be effected. In practice, however, this did not take place. The difficulties of lubricating and working the engine and the inefficiency of the jacket prevented attaining a temperature below about −95° C.

Linde Process.—A process depending on reduction of temperature during expansion, but not employing an expansion engine was invented by Prof. Carl Linde, of Munich. The apparatus, described in British Specification No. 12528 of 1895, comprises an air compressor communicating with a cooling coil through which the compressed air passes on its way to a reversed-flow heat interchanger, having two tubes of different diameters and about 300 ft. long; one tube is inserted in the other so as to leave an annular space between them and then both are coiled helically. The convolutions are separated from one another and from the outer casing by raw sheep's wool. Cooled, compressed air passes through the inner coil and issues past a regulating valve into an expansion vessel, whence it flows back, through the annular space between the coils, to the compressor. This cycle of operations is repeated until the cold-intensifying effect of the interchanger becomes so great that some of the compressed air is liquefied, as it passes the regulating valve, and collects in the expansion vessel.

Hampson Process.—In his Patent Specification No. 10165 of 1895 Mr. W. Hampson describes an apparatus in which compressed air is passed through a long pipe and expanded to a lower pressure to return in its expanded state over the pipe in such a way as to intensify the cooling produced by the expansion.

Claude Process.—An ingenious process, invented by M. Georges Claude of Paris, employs an expansion engine working in association with a reversed-flow heat interchanger and a liquefying chamber. Pure, cold air at a pressure of about 40 atmospheres passes through the central pipe of the interchanger, and the greater part of this air is led to the expansion engine and expands therein to a pressure of about four atmospheres, while doing external work. The air leaves the engine at a temperature not substantially lower than −140° C., the critical point for air, enters the lower part of the liquefying chamber, circulates around a series of vertical tubes therein and is led away through the outer annular space in the heat interchanger. The smaller part of the pure, cooled, compressed air passes into the upper part of the liquefying chamber, flows through its tubes and is cooled and liquefied, the liquid air falling into the lower part of the chamber, whence it is withdrawn. By this means, the compressed air is not allowed to liquefy in the expansion engine, which can be worked satisfactorily, lubrication being effected, when necessary, by means of petroleum ether. In a modification, compound expansion is employed, an additional expansion cylinder with its corresponding liquefying chamber being provided. According to M. Claude (*Comptes Rendus*, vol. 142, p. 1335), the output of liquid air may be as much as 0·66 litre per horse-power hour in the single expansion and 0·85 in the compound process.

Manufacture of Oxygen.—The most important use of liquid air is in the manufacture of large quantities of commercially pure oxygen. Prof. Linde, in his British Patent Specification No. 12528 of 1895, describes a process and apparatus, working in association with his liquefying apparatus, for obtaining oxygen from the liquid air by fractional evaporation, the nitrogen being driven off first, since its boiling-point is about −194° C. while that of oxygen is −182·5° C., at atmospheric pressure. The products were substantially pure oxygen and nitrogen mixed with a rather large quantity of oxygen. The purer the oxygen obtained the less was the yield. To remedy this disadvantage, Prof. Linde, in a later improvement, treated the liquid air in a rectifying column and completed the process of separating the oxygen and nitrogen by a fractional evaporation.

Other Gases.—Since the introduction of Linde's process for obtaining oxygen, numerous inventions have been patented for obtaining oxygen, nitrogen, argon, helium, neon, xenon and krypton from the air. In the processes of M. Claude and La Société l'Air Liquide, the air is not liquefied as a whole but in such a way that it yields two liquid portions, one rich in oxygen and the other very rich in nitrogen; each of these liquid portions is rectified so as to obtain oxygen and nitrogen of a high degree of purity. For further information the reader is referred to the reports on the cross-action in the Chancery Division and the Court of Appeal between British Liquid Air Co., Ltd. and British Oxygen Co., Ltd. (*Reports of Patent Cases*, 1908, pp. 218–44; 577–614).

Liquid air is applicable for cooling objects which are required to be hooped and for fitting metal tubes into a tube plate having holes too small to receive the tubes. The use of liquid air as a motive fluid has been often proposed. An early use of liquid air was in the preparation of explosives, some of which were used during the construction of the Simplon Tunnel. Liquid air has also been used in mine rescue apparatus.

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LIQUOR CONTROL (*see* 16.759).—In this article it is proposed to give the outlines of restrictive legislation in respect to liquor except as regards prohibition in the United States, which is treated under PROHIBITION. *See* also BOOTLEGGING.

I. IN GREAT BRITAIN

In 1913 the Act was passed granting, *inter alia*, local option to Scotland. The Act provided that one-tenth of the electors of the area concerned could demand a poll to decide on the conditions of sale of intoxicating liquor. If 55% of the poll and 35% of the electors voted for no-licence the resolution to that effect would be carried: for a limitation of licences a bare majority of the poll and the votes of 35% of the electors would be sufficient. The third alternative to be put before the electors in each case was a resolution for no change. The local option sections of the Act did not come into operation until 1920; the result of a poll thereunder is binding in the area concerned for three years, and no further poll can be taken during that time.

Defence of the Realm Regulations.—The outbreak of the European War, in 1914, at once raised the question of the necessity of some form of liquor control alike in the interests of efficiency in the fighting forces and amongst civilians engaged in munition works and other vital industries, and of economy in the provision of essential supplies. The Defence of the Realm Act 1914 authorized the creation by Orders in Council of new authorities to provide for the safety of the Realm, and the delegation to such new or to existing authorities of power to issue regulations for the same purpose.

Under this Act regulations were immediately passed empowering competent naval and military authorities to control the opening of licensed houses in the neighbourhood of defended

harbours, and forbidding the sale or supply of intoxicating liquor to members of H.M. forces on duty or with intent to incapacitate them for duty. By further regulations in subsequent years the same authorities were to close down or regulate the opening of licensed houses and to prohibit trading within the area under their control, and received further special powers over dockyards. In 1916 a general order was made under the Act prohibiting the supply of intoxicating liquor to members of the fighting forces on duty or in hospital. When the food shortage became acute, the Food Controller imposed stringent restrictions on output in 1917–8.

Liquor Control Board.—The Liquor Control Board was created in June 1915, as the authority empowered under the Defence of the Realm Act (No. 3) 1915 to issue regulations under the 1914 Act to control the liquor trade in any district to which such control should be applied by Order in Council. The board was armed with wide discretionary powers including those of closing down licensed premises and clubs, regulating the hours of opening irrespective of the provisions of the Licensing laws, prohibition of the sale of specific liquors and of treating, and generally of regulating the supply and sale of intoxicating liquor. The control by the board was first applied to the Lowlands of Scotland and the more important shipbuilding and industrial centres in England, but it was subsequently extended until, by the middle of 1918, it had been applied to 29 areas covering in all three-quarters of England, Scotland and Wales.

In these areas the Board reduced the permitted hours of sale of all intoxicating liquors on week-days, which before the War had ranged from 19½ hours in London to 11 hours in Scotland, to a general maximum of 5½ hours for consumption on licensed premises and 4½ hours for off-sales, with a further reduction on Sundays of half an hour in each category. In the case of spirits the off-sale was further curtailed to 2½ hours 5 days in the week, and was prohibited altogether on Saturday and Sunday. In certain areas in the North and West of Scotland the sale of spirits was, at the instance of the Admiralty, prohibited absolutely and this prohibition remained in force until 1919. The Board further introduced compulsory dilution of spirits: spirits which before the War were retailed at 25° below proof (or 35·91% pure alcohol) were obliged to be diluted to 30° below proof (or 33·37% pure alcohol), and were permitted to be sold at 50° below proof (or 23·49% pure alcohol). Further regulations were made forbidding treating and extending existing provisions against credit sales of intoxicating liquor in licensed houses and clubs, and making illegal the common practice in the trade of giving an excessive measure to customers known as the "long pull."

Previously to the special powers given to the Liquor Control Board, extended powers had been given to the licensing justices by the Intoxicating Liquor (Temporary Restriction) Act 1914, but in view of the wider powers exercised by the Board these are comparatively unimportant. Many of the Board's regulations continued in force after the termination of hostilities in 1918, and the Board was not finally abolished until the passing of the Licensing Act of 1921.

Licensing Act 1921.—That Act, which applied to both England and Scotland, adopted and made permanent some of the regulations which the Board had instituted, notably the prohibition of the "long pull" and of credit sales in the case of "on" consumption. The Act fixed the permitted hours of sale at 9 hours in London and 8 hours elsewhere, between 9 A.M. and 11 P.M. in London, or 10 P.M. elsewhere, and made them applicable not only to licensed premises, but also to registered clubs which before the War had been free from such restrictions. The times of opening of licensed premises within the fixed limits were left to the discretion of the local licensing authorities, and in clubs at the option of the members, the hours so fixed to be included in the rules. The Act also encouraged dilution by permitting all spirits to be sold without special notice at 35° below proof, instead of the standard of 25° below proof required before the War for all spirits except gin. On the other hand beer of an original gravity not exceeding 1·016° and containing not more than 2% of proof spirit was by the Act not to be treated as intoxicating liquor, and no excise duty was required for its sale.

Sale to Young Persons.—In 1923 a bill was introduced in the House of Commons by a private member, Lady Astor, and became law, prohibiting the sale of intoxicating liquor to young persons under 18 for consumption on licensed premises, with a slight modification allowing certain non-spirituous alcoholic drinks to be served with a meal in the case of young persons over 16.

The Carlisle Experiment.—An important experiment of the Liquor Control Board, which has remained as a permanent institution, was the introduction in 1916 of a system of state purchase and state supply of intoxicating liquor in certain areas. It was first tried in the Carlisle area to combat drunkenness amongst the many thousands of munition workers drafted into the district for the new factories around Gretna. In view of the differences in English and Scottish licensing law, Gretna and Carlisle were made into separate districts for administration, and a third district was subsequently created when the experiment was extended to the area of Cromarty Firth including Dingwall and Invergordon. The working of the system was in the hands of the Board with the assistance of local advisory committees. On the final abolition of the Board its functions were taken over by the Home Office and the Scottish Office respectively.

The system was to purchase all breweries and licensed premises in the districts for agreed sums by way of compensation. Some of the breweries so purchased were closed down, the number in the Carlisle district alone being reduced from five to three, with considerable saving in working expenses in all cases, and the number of licences was cut down by nearly one-half. In addition all grocers' licences were suppressed, and facilities for "off"-sales reduced by about 80%. Many of the licensed premises retained were renovated, and where possible considerable structural improvements were made to allow for the provision of cheap and good meals; and disinterested management was completed by the appointment of salaried publicans who received commissions only on the sale of food and non-alcoholic beverages, and did not have to consider the interests of shareholders or of brewers or of competitors. Under this system no liquor advertisements are displayed on licensed premises, and no money is spent in advertising intoxicants either in newspapers or on hoardings. Further no money made out of the sale of intoxicants can be subscribed by the department which is responsible for providing drink to any political organisation or to any anti-temperance propagandist body.

II. MEASURES IN OTHER EUROPEAN COUNTRIES

Denmark.—A comprehensive licensing law came into force in Denmark on Jan. 1 1913. The new law had for its object the effective regulation and control by the municipal and communal authorities of all places of entertainment where meals, lodgings, refreshment, etc., are provided. A distinction in the regulations was made, as in other Scandinavian countries, between urban and rural districts.

The new law established "off" and "on" licences for the sale of "strong drinks" which included spirits, wines and all beers which contained 2¼% or more alcohol. Special licensing boards were constituted in each municipality, to whose discretion the allocation of licences was absolutely entrusted. The licences which might be issued by the licensing boards were to be for life or a fixed term of years, and all licensed premises were to be closed for at least five hours between 11 P.M. and 8 A.M. The age limit below which it was forbidden to supply young persons with strong drinks was to be fixed by local police regulation. In no case was the limit to be lower than 16, and only in four towns is it as low. Stringent penalties were enacted for violation of the Licencing Law, including heavy fines, imprisonment and forfeiture of the licence.

During the War, the distillation of spirits from home-grown wheat or rye was prohibited, though not from potatoes. An important law which came into operation in 1925 fixes the number of licensed premises in existence on Jan. 1 1924 as the maximum. New licences are subject to a form of local option, and the local authorities are empowered to restrict the issue of a new licence to a public utility company on the Gothenburg principle.

Iceland.—From 1912 there has been complete prohibition of the import or manufacture of liquor containing more than 2¼% of alcohol with limited exceptions for medical and industrial

use. A slight relaxation has, however, since been made, under pressure from Spain, to permit the importation of Spanish wines.

Sweden.—An important piece of liquor legislation was the law of 1917 which made the "Bratt System" universal throughout Sweden. This system of liquor control, which came into force throughout Sweden on Jan. 1 1919, was a striking development, on the basis of the "Gothenburg System" of disinterested management through controlling Companies, or "Bolags." The "Gothenburg System" had been confined to the control of the retail sale and distribution of the national spirit or "bränninn." The sale of wine, beer and imported spirits had been outside its monopoly.

The effect of the new law was to bring the retail liquor trade—the trade in ordinary beer excepted—under the control of the System companies. All intoxicating liquors of an alcoholic strength greater than 3·6% were thus affected. The beer manufactured and sold in Sweden is below that strength.

The transfer of "off" spirit licences was abolished; the import of spirits, wines and beers was only permitted through the agency of the "Bolags"; and the maximum amount of spirits purchasable by each citizen was limited to 4 litres *per mensem*. A new age limit was fixed, and persons under 21 and sometimes 25 were not allowed the right to purchase distilled liquor. Convicted drunkards were also debarred from purchasing intoxicants.

The private trader, however, still retained his interest in the wholesale liquor trade. The organisation of the wholesale trade under the System Companies was brought about through an enterprise founded by Dr. Bratt and his associates in 1917, called "Spritcentralen," which, by an enactment in 1923, obtained from the Government the right to the exclusive wholesale sale of liquors other than beer until 1928. The system worked by the "Bolags" is one of personal control, in which the "motbok" or pass-book, plays a large part. The "motbok," in effect, is a ration book with coupons entitling the holder to purchase his prescribed quantity of liquor in each month, and no more.

Norway.—A system of disinterested management has also been in force in Norway for a considerable period. The "Samlag" in Norway takes the place of the "Bolag" in Sweden, though its powers are more limited. The "Samlags" control the sale of "Braendevin," the national Norwegian spirit, whilst beer and wine, except in rare instances are still in the hands of private traders.

The Norwegian system, based on the Acts of 1871 and 1894, left two options open to each community at the periodical poll:

1. The "Samlag" system for the retail sale of spirits, or
2. Prohibition of all retail sale of spirits.

The results of the 1913 polling showed a definite voting down of existing "Samlags": out of 26 towns polling, the "Samlag" was voted down in 15.

But, outside the "Samlags," the sale of spirits is conducted by means of "privileged" (*i.e.*, life interest) licences, wholesale rights and special "off" and "on" licences issued by magistrates and town councils.

During the war period Norway imposed far-reaching restrictions, leading up to the total prohibition of the sale of spirits, both "on" and "off." The continuance of prohibition was endorsed at a national poll in 1919.

III. TEMPORARY WAR REGULATIONS

Liquor legislation in other European countries, since 1911, has mainly been concerned with the imposition of special restrictions during the War period, and the subsequent modification of those restrictions.

France.—In France, for instance, the need for some control of the liquor traffic was recognised soon after the outbreak of the War, and one of the first War-time restrictions was the absolute prohibition of the sale of absinthe in Feb. 1915.

The opening of new establishments for the sale of spirits and other liquors (except those having a wine basis) was also forbidden. In 1915, the "off" sale of alcohol was forbidden before 12 noon, and the "on" sale of spirits to women and children was absolutely prohibited. The sale of wine, beers and cider was, however, left untouched. The War regulations have since disappeared.

Switzerland.—On the outbreak of War the Swiss Government prohibited the use of potatoes for the manufacture of spirits, and rationed the sale of spirits by the state monopoly.

Italy.—In 1913 Italy prohibited the importation and manufacture of absinthe and enacted a law requiring special permits for the sale of spirits and liqueurs.

Germany.—In Germany the sale of alcohol was forbidden in the towns during the early mobilisation period; and restrictions were placed on the quantity of malt used in German breweries. Subsequently, in 1915, further restrictions were imposed:

1. The manufacture of spirits for beverages from potatoes and grain was prohibited.
2. The manufacture of beer was restricted by 40 per cent.
3. The sale of intoxicants in mobilisation centres was forbidden.
4. In Berlin the sale of spirituous liquors in restaurants was forbidden between 9 P.M. and 9 A.M.

Austria-Hungary.—Similar restrictions on the manufacture of spirits from potatoes and grain were imposed in Austria-Hungary during the continuance of the war emergency period.

Russia.—In Russia, the fact that a Government monopoly of the vodka trade had been established in 1894, enabled the Tsar to establish its total prohibition on the outbreak of the War. This state of things continued under the Soviet *régime* until 1921, when the sale of wine in limited quantities was authorised, whilst the sale of beer was permitted without limitation.

In 1924, by a decree of the Soviet Executive Council, the sale of vodka was permitted once more. The sales are restricted by a card system of control, under which each adult citizen is entitled to purchase one bottle of vodka every 14 days through the agencies of the state spirit monopoly.

Finland.—The prohibition of vodka throughout the war period applied also to Finland and to Estonia. The prohibition of beer over 2¼%, of wine, spirits and stronger beverages was enacted in Finland in 1919, and is still in force.

Estonia.—In Estonia, however, legislation was passed in 1920 for the repeal of prohibition and for the substitution of a "Check" system for the controlled sale of alcohol, somewhat on the Swedish model.

Belgium.—On the outbreak of War in 1914 the Government took prohibitive measures against the sale of spirits which continued in force during the German occupation. In Aug. 1919, an Act was passed prohibiting the sale and supply of spirits for consumption on the premises in any place of public resort, including hotels, restaurants and workshops. The "off-sale" of spirits was authorised provided that at least two litres were sold at a time to each purchaser. This Act was a modification of a scheme of total prohibition which had been promulgated by decree only when the Government had its seat at Havre in Nov. 1918.

In Poland in 1921 a law was passed introducing the local option principle. In 1924 a Government monopoly of the liquor trade was established under which the Government assumed the entire control of the manufacture and sale of all spirits.

Latvia and Lithuania have adopted laws regulating hours and conditions for the retail sale of alcohol.

For the supply of intoxicating liquor in mandated territories, *see* MANDATES.

BIBLIOGRAPHY.—*Report of the Massachusetts Committee on the Gothenburg System* (1893); E. Gordon, *The Breakdown of the Gothenburg System* (1911); J. Purves, *The Scottish Licensing Laws* (1923); J. Paterson, *The Licensing Acts* (1925). (A.)

IV. THE UNITED STATES AND CANADA

The article on Liquor Laws in the United States (*see* 16.766) reviews legislation prior to 1910 in its historical development and under the four chief types of state and local legislative control: (*a*) the licence system, (*b*) state prohibition, (*c*) local option, a combination of licence and prohibition, and (*d*) public dispensaries. It also covers Federal regulation of the liquor traffic: (*a*) in inter-state commerce, (*b*) in Federal territory, such as the District of Columbia, military and naval stations, Indian reservations, and in certain particulars in the insular possessions, and (*c*) the revenue laws where regulation is frequently a dominant motive in tax policy. Since 1910 there have been hundreds of state laws, local ordinances and Federal laws, not directly related to the adoption of national prohibition (*q.v.*) as well as many important decisions of Federal and State Courts. This further illustrates the great diversity of procedure and methods and the wide range of legislative experiment in dealing with the liquor traffic and its attendant evils, which probably has no equal in any other country in the world or in any other period of history. It also reflects the very great difficulties encountered in the enforcement of such legislation and in correcting unforeseen evils arising as by-products of regulatory measures. A fairly complete and accurate descriptive list of these measures will be found under "Chronology" in the Year Books of the Anti-Saloon League (pub. Westerville, O.) especially the Year Book for 1919.

The 18th Amendment.—War-time prohibition became effective on July 1 1919, and the Prohibition (18th) Amendment to the Constitution was ratified Jan. 16 1919, effective Jan. 16 1920,

and the combined War-time Prohibition Enforcement Code and the Constitutional Prohibition Enforcement Code, known as the "National Prohibition Act" and, popularly, as the Volstead law, was adopted Oct. 28 1919, in part effective immediately and in part relating to constitutional prohibition effective Jan. 16 1920 (*see* PROHIBITION).

As far as state and local measures (1910–9) are concerned there were no new devices for regulation, and nothing to show any serious departure from the types of regulation referred to above, and discussed in the previous article. There was a noticeable trend away from the public dispensary and the many proposals to eliminate private profits from the industry or the trade, such as those involved in the Gothenburg system, which was widely discussed, and licensing non-profit trading companies. There was also a marked and increasing trend in all sections of the country toward the extension of dry territory, the protection of dry areas under local option, and the extension of state-wide prohibition.

State Prohibition in 1910.—In 1910 state prohibition was in force in nine states. Large areas of local territory in other states were dry under local option. It was difficult to protect this dry territory from violation through illicit trade aided and promoted by adjacent wet areas. Texas in 1910 passed a law making the sale of liquors in no-licence territory a felony punishable by from three to five years' imprisonment. All the prohibition states had tried in various ways to check the flow of liquor protected in inter-state commerce over which the Federal authority had exclusive jurisdiction and with which no state had any constitutional right to interfere. Congress had sought to aid in this effort in the Wilson Act in 1890 to divest intoxicating liquors of their inter-state character by providing that "Liquors transported into a state . . . shall . . . upon arrival in such state . . . be subject to the operation and effect of the laws of such state enacted in the exercise of its police powers, to the same extent . . . as though such . . . liquors had been produced in such state."

Although the Wilson Act presented grave constitutional difficulties it was sustained by the Supreme Court in *In re Rahrer* in 1898 (140 U.S. 545) but the rule of the decision interpreted the phrase "upon arrival in such state" to mean that state control and regulation operated only "after the shipment had reached its point of destination and had actually been delivered to the consignee." This was not sufficient to stop the flow of liquor from wet areas outside the state. A Missouri statute imposing an inspection fee on all liquors shipped from other states into Missouri and offered for sale was upheld in 1905 (190 U.S. 17) as an exercise of the police power of the state within the meaning of the Wilson Act, and the chief aim of the Act was undoubtedly to increase the state's control over inter-state shipments. The Iowa Legislature had in the previous year 1904 passed a resolution asking Congress to amend the inter-state shipment law to prevent the shipment of liquors from one state to the dry territory of another.

In the meantime the Supreme Court in *Delameter v. So. Dakota* (205 U.S. 93), decided March 11 1907, upheld a South Dakota statute imposing an annual licence charge upon the business of soliciting orders for intoxicating liquors and its application when orders were to be filled from liquors at the time without the state. This was another method of checking inter-state traffic from wet areas to dry and of enforcing state regulation or prohibition. Still another effort was made in the same direction and this time with the direct assistance of Congress in the Act to codify, revise and amend the penal laws of the United States approved March 4 1909. Section 238 forbade any transportation company or its agents to deliver intoxicating liquors in inter-state or foreign commerce to any fictitious person or to any other person than the consignee, unless upon written order of the bona-fide consignee, and Sec. 239 forbade the collection by the transportation company or its agents of the purchase price or in any manner acting as the agent of the buyer or seller of such liquor, and Sec. 240 forbade the shipment in inter-state or foreign commerce of any package containing intoxicating liquors unless "such package be so labelled on the outside cover as to plainly show the name of the consignee, the nature of its contents and the quantity contained therein." Each of these sections provided heavy penalties for their violation.

The Webb-Kenyon Law.—With the passage of the Webb-Kenyon law, March 1 1913, Congress and the Federal Government took the first aggressive step in aiding effective state prohibition. The title of the Act, "An Act divesting intoxicating liquors of their intra-state character in certain cases," indicates its broader scope and purposes as compared with the earlier Wilson Act which merely removed the bar of the Original Package decision (1890) to effective enforcement by holding that a state prohibitory law was inapplicable to sales of liquor in the original packages in which they were received from other states (*Leisy v. Harden*, 135 U.S. 100). The Webb-Kenyon Act removed another bar, namely, the Federal protection of inter-state commerce, from the exercise of a state's conceded powers over inter-state when applied to such inter-state commerce as Congress, in the exercise of its exclusive powers over inter-state commerce, has interdicted or from which it has removed the protection of inter-state commerce. Congress in this Act forbids the transportation of intoxicating liquors into a state by any persons interested therein "to be received, possessed, sold, or in any manner used, either in the original package or otherwise, in violation of any law of such state." The Act presented grave constitutional difficulties, which led President Taft to veto it on purely constitutional grounds, and in this judgment he was supported by his able attorney-general, Mr. George W. Wickersham, and the ablest lawyers in the Senate. Nevertheless, Congress passed the Act over the veto of the President, and the Supreme Court sustained its view in the Clark Distilling Co. v. Western Maryland Railway Co., and Clark Distilling Co. v. American Express Co. and the State of West Virginia cases (242 U.S. 311) decided Jan. 8 1917.

Effects of Webb-Kenyon Law.—The immediate effect of the Webb-Kenyon law was to stimulate state prohibition. The year 1914 saw state constitutional prohibition amendments adopted by popular vote and substantial majorities in Arizona, Colorado and Washington, and rejected by substantial majorities in California and Ohio. A state-wide prohibition law in Oregon was adopted by a popular vote of 136,842 for, to 100,362 against, and in Virginia by a majority of 30,365 out of a total of 150,000 votes. A considerable extension of dry territory was secured under local option votes in many other states. That this rising tide of prohibition was not confined to the states is seen in the adoption for the first time in 1914 in either House of Congress of a resolution submitting a prohibitory amendment to the Federal Constitution. The Hobson resolution passed the House of Representatives Dec. 22 by a vote of 193 to 189, but did not receive the two-thirds majority required. In 1915 Alabama re-enacted a prohibitory law which was adopted in 1907 and repealed in 1911, and Idaho, Iowa, Arkansas and South Carolina adopted state-wide prohibitory laws, Idaho, in addition, submitting to the people of the state a constitutional amendment, which was adopted in 1916 to become effective Jan. 1 1917.

The year 1916 also witnessed constitutional state prohibition adopted in Michigan, Montana, Nebraska and South Dakota. In 1917 Congressional action again moved forward. The resolution for the prohibition amendment to the Federal Constitution received the necessary two-thirds majority in both Houses, and the amendment was submitted to the states for ratification. Congressional enactments also prescribed prohibition for the District of Columbia and for the territory of Alaska. A referendum on prohibition was provided for the I. of Porto Rico, which voted in July 1917 to adopt it by 99,775 for, to 61,295 against. Early in 1917 Congress enacted the anti-liquor advertising law with the so-called Reed "bone-dry" amendment, the whole being an amendment to the Post Office Appropriation Act. This was a drastic prohibition of the use of the mails for advertising, or soliciting orders for liquor in "dry" territory, and was, therefore, a further application of the principle of the Webb-Kenyon Act.

Among the states in 1917 Indiana, New Hampshire and Utah adopted state-wide prohibition statutes, and New Mexico a prohibition constitutional amendment. This made in all 25 of the 48 states, and, in addition the District of Columbia, Alaska and Porto Rico, which had adopted statutory state-wide or constitutional prohibition before the Federal Amendment was submitted for ratification; and in 1918, while ratification was proceeding, Florida, Nevada, Ohio, Texas and Wyoming adopted state-wide prohibition statutes. Utah adopted a prohibitory amendment to the state Constitution. Congress enacted a prohibition statute for Hawaii, and passed the War Prohibition Act as an amendment to the agricultural appropriation bill. A constitutional prohibitory amendment received a majority of 15,932 votes in Minnesota, but failed by 756 votes to receive the majority required by the state election law. A constitutional state prohibition amendment was defeated in Missouri by 300,354 votes against, to 227,501 for; and also in California. Other state measures extended dry territory, and in several states state constitutional amendments were submitted to be voted on in 1919. The war prohibition Federal legislation is noted under *After Ratification-Provisions for Enforcement* in the discussion of prohibition (*q.v.*).

State Action Since 1919.—From Jan. 10 1919, the date when the Federal Constitutional Amendment received the necessary ratification by two-thirds of the states, to 1926 state legislation in relation to prohibition, chiefly consisted in state enforcement measures of great variety based on the concurrent powers provided for in the amendment although in some states, a state constitutional amendment or state-wide prohibition statutes, previously adopted went into effect by their terms after Jan 1 1919. In all to date (1926), 47 of the 48 states (Maryland alone excepted) have adopted state codes or measures to enforce national prohibition. New York alone has repealed such a statute; and no other state has weakened its enforcement legislation by subsequent amendments, and several have repeatedly tried to strengthen their enforcement legislation.

The Laws in Canada

Liquor laws in Canada have followed closely in structure and in the forces determining their modification and enforcement those of the United States. They have not gone as far as to adopt national prohibition except for a brief period during the War, by Order-in-Council, March 11 1918, in force from April 1 1918 until Dec. 31 1919. Since 1910 local option with respect to licence extending to complete provincial prohibition of sale has been permissible under a Federal law, the Canada Temperance Act (1875). But under the British North America Act, which serves as the Constitution of the Dominion, only the Federal authority can prohibit the manufacture, importation, exportation and transportation of liquors for beverage purposes. On May 18 1916 a Federal Act " in aid of Provincial Legislation prohibiting or restricting the sale or use of intoxicating liquors " (6–7 Geo. V. Ch. 19) was adopted and penalised the transportation and delivery of intoxicating liquor or sale for transportation into a province in violation of the law of the province. This effort to remove " Federal protection " from manufacture and shipment, legal under Dominion law, of intoxicating liquors whose sale was prohibited under provincial law or local option votes, was similar to the Wilson and Webb-Kenyon Acts in the United States. This Act was amended Nov. 10 1919 (10 Geo. V. Ch. 21) to include manufacture for illegal sale; but an amendment, adopted on the same day, to the Canada Temperance Act (10 Geo. V. Ch. 9) added Part IV., " Importation and manufacture of intoxicating liquor," and provided an alternative plan which it was thought would be more effective and better applicable locally to accomplish the same purpose. It provided for prohibition of importation and of manufacture for illegal importation in any province by Order-in-Council after an approving referendum had been taken by the Dominion Govt. at the request of the provincial Legislature.

Referenda in All Provinces.—From Feb. 1 1921 to May 21 1923 seven of the nine provinces decided by referenda to prohibit importation. Similarly exportation of liquor from any province, except by brewers and distillers, could be prohibited by Order-in-Council under a further amendment of 1923. Four provinces in 1922 and 1923 invoked this law. Neither the importation nor exportation prohibitions were sufficient without a real Federal prohibition law to enable the provinces to enforce satisfactorily their province-wide prohibition laws after the Dominion declared the War prohibition for the Dominion at an end. So three of the seven prohibition provinces swung over to state control, and there were in 1926 only four (Ontario, New Brunswick, Nova Scotia and Prince Edward Island) wherein prohibition of sale continues. In Feb. 1925 an amendment to the Ontario Temperance Act permitted the sale of 4·4 beer, which does not seem to have made the enforcement of the prohibitory features of the Ontario Temperance Act any easier. Government ownership and sale or state control take various forms in the different provinces. The amount of liquor sold seems to have increased each year since 1921, when British Columbia adopted the system of government warehouses and salesrooms with public liquor stores, only on a local vote which has been favourable thereto, only in the larger cities and towns; and there is said to be little or no curtailment of illegal sale and the abuses therefrom. In Quebec, Manitoba, Saskatchewan, Alberta and British Columbia liquor is sold under government regulations.

See Prohibition and the authorities cited there in addition to the following: U.S. Bur. of Int. Rev., *Laws relating to National Prohibition Enforcement* (1923); Laws of 65th and 66th Congresses relating to Liquor (contains text of laws of previous Congresses since 1890) and Regulations No. 60, app. by Secy. of Treas. Jan. 16 1920, under Prohibition Enforcement Act, 1920; Anti-Saloon League Year Books (1910–25); Ernest H. Cherrington, *Evolution of Prohibition in the U.S.*, a chronological history (1920); *Prohibition and Its Enforcement*, Annals American Academy of Political Social Science, vol. 109 (Phila., 1923); T. R. Powell, " The Webb-Kenyon Law and Decisions Thereunder," *Southern Law Quarterly*, April 1917.

(S. McC. L.)

LISTER, JOSEPH LISTER, Baron (1827–1912), British physician (*see* 16.777), died at Walmer, Kent, Feb. 10 1912.

LISZT, FRANZ VON (1851–1919), German jurist, a younger cousin of the composer, Franz Liszt, was born in Vienna March 2 1851. He qualified in 1875 as a teacher of criminal law at Graz in Austria, was a professor at Giessen 1879, Marburg 1882, Halle 1889, and in Berlin in 1899. In 1912 he became a member of the Fortschrittliche Volkspartei (Progressive People's party) in the Reichstag. Liszt's life work was the scientific foundation and reform of the criminal law of which the basic principles are contained in his treatise *Der Zweckgedanke im Strafrecht* (1882). It opposes the principle of regarding punishment as a reprisal and sets up the claim of systematic prevention of a special nature. In the fight against the law breaker, Liszt, together with the Dutchman Van Hamel and the Belgian Prins, founded the *Internationale Kriminalistische Vereinigung* (International Criminalist Union) in 1889 in which all reforms, which became the basis of modern criminal law, were initiated. Liszt's claims in favour of conditional sentence and pardon as well as postponement of punishment later passed into actual practice. At Marburg he created the Criminalist Seminary, which later in Halle and especially in Berlin became a world-famed criminal institute at which students from all lands met. Liszt was also a leading authority on international law. He died at Seeheim June 22 1919.

His chief works are *Meineid und falsches Zeugnis* (1876); *Lehrbuch des deutschen Strafrechts* (1881, 21st ed. 1919); *Lehrbuch des Völkerrechts* (1898, 11th ed. 1918); *Strafrechtsfälle zum akademischen Gebrauch*, 13th ed. (1922); *Strafrechtliche Aufsätze und Vorträge* (1905). See also *Abhandlungen des Kriminalistischen Seminars* (1889, etc.); *Mitteilungen der Internationalen Kriminalistischen Vereinigung* (1890, etc.).

LITHUANIA (Lietuva), an independent European republic and a member of the League of Nations (*see* 9.916). Lithuanian territory includes the former Russian Govt. of Kovno (Kaunas), parts of Suvalki and Vilna governments and the autonomous territory of Memel. The land frontiers are with Latvia on

the north, Poland on the east and the south, and East Prussia on the southwest. The Lithuanian seaboard is short, but is extended by the addition of Memel. The town and territory of Vilna (Wilno), claimed by the Lithuanians as part of their state, is incorporated in Poland (*see* VILNA). The area is (1926) 22,590 sq. m. and the population, 1924 (excluding Memel), 2,203,312, of whom 83·9% were officially given as Lithuanians, 7·6% as Jews, 3·2% as Poles and 2·5% as Russians.[1] The town of Memel includes 24,000 Germans.

Lithuania is, on the whole, a low-lying country watered by the Niemen ("Nemunas"—name of a heathen deity) and its tributaries. The highest part is in the south and east, where the Baltic hills extend in crescent formation from Gumbinnen in East Prussia through Suwalki (Suvalki) and Vilna (Wilno) to Dvinsk. This chain of hills is broken by two valleys, that of the Niemen

flowing through Grodno and Olita (Alytus) to Kovno, that of the Wilija (Nerys), flowing from Vilna to Janow (Jonaya) to its junction with the Niemen below Kovno. In the northwest is situated another triangle of hills, the Telšiai-Shavli (Šiauliai)-Raseiniai. Between these two hilly regions lies the plain of the Niemen with its two principal tributaries, the Nevežis and the Dubysa flowing in from the north. The only other river of importance is the Šventoji, flowing southwest to join the Wilija near Janow, and in the north the Muša, which joins the Aa (Lielupe) at Bauska in Latvia.

I. POLITICAL HISTORY

Early History.—(*See* 16.789.) The union between the kingdom of Poland and the grand duchy of Lithuania was brought about on Feb. 14 1386 by the marriage of the Lithuanian Grand Duke Jogaila (Jagiello) to the Polish Queen Jadviga, and was confirmed by the subsequent pacts of Vilna in 1401 and 1432, of Horodlo in 1413, of Grodno in 1501 and 1512, and, parliamentarily, of Lublin in 1569. Thus was established a political combination in which Lithuania in point of territory was three times the size of Poland. The contracting parties were to retain their names, laws, administrative institutions, financial and military organisations. Through the fact, however, that from 1501 onwards the Lithuanians and the Poles were ruled over by one sovereign and from 1569 onwards had a common legislature, the Lithuanians, though ever anxious to break away, gradually sank into a state of dependence. The Poles, past-masters in the art of political intrigue, never lost an opportunity of imposing their hegemony. Accordingly the dual state was involved in a common downfall, and in the three partitions of 1772, 1792 and 1795, to which it was subjected at the hands of Russia, Prussia and Austria, Lithuania fell a prey to Russia and Prussia. But, while the Tsarist régime, unable to denationalise a homogeneous population of a different religion and language, initially conceded a minimum of rights to the Polish nation, in Lithuania proper from the outset an unrelenting system of tyranny was established which was designed to break by force every non-Russian element in the country.

Russia had annexed the six Lithuanian governments between 1772 and 1795 and united them as the "Litovskaya Gubernia" in 1797, that is to say, before the Treaty of Vienna conceded her the kingdom of Poland in 1815. At the Warsaw diet of 1818, the liberal-minded Alexander I. still spoke of the reunion of Lithuania with Poland under constitutional forms. But the project lapsed because any measure of self-government by extending the power of the Polish "szlachta" (land-owning noble class) in Lithuania menaced Russia's influence in that country. Yet, under the influence of the Polish Prince Adam Czartoryski, Alexander I. encouraged education and enterprise. Under Nicholas I., the plan of the reunion of the two States was definitely rejected, his ukase of 1839 making Lithuania the "Syevero-Zapadni Krai" (northwestern Province).

As a result of the Polish rebellion of 1830, in which the peasantry, whether Lithuanian, Polish or White Russian, did not take so great a part as the upper classes, the Lithuanian Statute, which had remained the law of the land through four centuries of union with Poland, was replaced by the Russian code in 1840. Prominent Lithuanians were forced to emigrate or exiled to Siberia. As even the reign of Alexander II. brought no change in Lithuania, the revolutionary spirit led to the great rebellion of 1863.

This abortive insurrection, in which the Polish nobility and intelligentsia were primarily involved, though the Lithuanians also took a prominent part, led to the suppression of the printing of Lithuanian books by the dictator Gen. Muraviev, which measure was only abolished in 1904. Tsarist policy was henceforth perfectly consistent in that it strove to make Lithuania a genuine part of Russia and sought to extirpate Polish culture beyond the frontiers of the kingdom.

Period of Popular Representation 1905–14.—Russia's defeat in the Russo-Japanese War and the revolution which followed in its wake led, in Sept. 1905, to a measure of reform. The first National Lithuanian Assembly which, however, in the eyes of the Tsar's Govt. was merely a revolutionary body tolerated for the time being, met at Vilna. It consisted of 2,000 delegates who demanded an autonomy for the four governments of Vilna, Kovno, Grodno and Suvalki under a Diet at Vilna. It was the first modern attempt to define Lithuania ethnographically, to respect national minorities and continue the connection with Russia upon the federative principle. The electoral statute of 1905, by granting the four-class franchise (landowners, peasants, townsmen and workmen) favoured the rural population. Only Poles were elected to the first Duma of 1906.

As the Imperial ukase which followed the dissolution of the second Duma of 1907 conferred more power upon the great landowners, it was modified as regards Lithuania by a nationality clause which provided that the total of electors of each class should be in proportion to the amount of land possessed by the respective nationalities in the district. This measure, applied by Russian officials, was designed against the Poles and the Lithuanian Nationalists, for not even the Progressives who favoured autonomy for Poland contemplated its grant to Lithuania. In the third Duma the five delegates allotted to the non-Russian population of the government were all Poles who joined the Polish party; in Kovno three delegates were Lithuanians, one was a Pole and one a Jew.

The War Period.—The outbreak of the World War in 1914 led to a German invasion which, from midsummer 1915 until Aug. 1919, lay heavily upon the land. To further their own purpose, which was the lasting hold over Lithuania, the Germans after the military collapse of Russia allowed the phantom existence of a state. A Lithuanian conference met at Vilna (Sept. 18–23 1917) and, in negotiations which dragged until March 1918, petitioned the German Chancellor, Count Hertling, for the restoration of the country's independence under condition of a perpetual alliance between it and the German Empire (*Bundesverhältnis*). The German clerical party caused the "Taryba," or Council of State, which was then largely under the control of their army of occupation authorities, to offer the Lithuanian crown to Prince William of Urach, a younger member of the Württemberg reigning family. On July 11 1918 he accepted under the title of "Mindove II., King of Lithuania," choosing the style of a heathen prince of the 13th century who had fiercely resisted the Teutonic order. The German annexationists thwarted this candidature, which the Council of State eventually cancelled (Nov. 2 1918), but their delegates at the peace negotiations of Brest-Litovsk, in March 1918, upheld against Trotsky the authority of the Lithuanian Council of State. Their last argument rested upon this, that "Germany had recognised Lithuania's independence only on the condition that the conventions to be concluded among them the form of constitution and the choice of a ruler, shall correspond to German interests" (*Nordd. Allgem. Zeitung*, Aug. 1918). By the peace of Brest-Litovsk (March 3 1918), Germany forced Russia to abandon all claim on Lithuania.

[1] *Economic and financial situation of Lithuania* (Lithuanian State Printing Office, 1925).

By Nov. 1918, the magnitude of Germany's defeat being no longer in doubt, the Taryba, or Council of State, promulgated a provisional constitution under which it became the Lithuanian Parliament. The supreme power was vested in three persons, A. Smetona, J. Staugaitis and St. Silingas, who on Nov. 5 1918 invited Prof. Voldemaras to form the first independent administration on non-party lines, and reach an understanding with the national minorities within the still indeterminate frontiers, viz.: White Russians, Poles, Jews and Great Russians. Alone the Pan-Polish party reverted irreconcilably to the historic solution of union or federation with Poland. The initial difficulties of setting up an administrative machine on national lines were the greater as the troops of the occupying Power were affected by the revolution which had broken out in Germany. Although Kovno itself was evacuated in June 1919 and shortly afterwards Southern and Eastern Lithuania, the area Mitau-Shavli-Taurage remained in German hands until Dec. 13. Upon their final withdrawal, the Germans allowed the Bolshevik troops to march into evacuated zones at a mean distance of 10 kilometres. This was in direct violation of the terms of the Armistice, concluded with the Entente Powers on Nov. 11 1918.

The Voldemaras administration resigned on Dec. 26 1918, the new Premier, M. Slezevicius, widening the Cabinet. Prof. Voldemaras, whom the precarious situation of the country and the approaching Peace Conference called to Paris, served as Foreign Minister, M. Yčas as Finance Minister, M. Velykis as Minister of War. In Jan. 1919 the near approach of the Bolsheviks to Wilno caused the removal of the Government to Kovno (Kaunas) where the Provisional National Assembly recognised the Council of State ("Taryba") and the Slezevicius Cabinet as the regular Government of Lithuania. The Taryba voted the provisional constitution, elected A. Smetona President of the State and composed the statute for the election of the Constituent Assembly, on the basis of proportional representation. National defence began to be organised. The Bolshevik advance reached its culminating point in May 1919 when Kovno itself was threatened. Until Sept. 1919 fighting took place against the Soviet forces, which were cleared out of the northern districts of the country, and until Dec. against the so-called Bermondt troops. Meanwhile, the Poles also had attacked the Bolsheviks and in April 1919 captured Vilna, establishing themselves there.

On Dec. 8 1919 the Supreme Council of the Allies in Paris laid down a provisional eastern frontier for Poland, the so-called "Curzon line," which assigned to Poland most territories where the Polish element was in a majority, but excluded mixed and doubtful districts, the principal among which was Vilna, city and province, which fell to Lithuania. The Polish Govt. proposed to the Lithuanian Govt. joint action against the Bolsheviks, but the latter refused pending Lithuania's recognition as an independent State with Wilno for its capital.

The consequence was that the Poles embarked upon large scale military operations against Soviet Russia single-handed. But although their invasion of the Ukraine, in April 1920, was successful, the Bolshevik counter-offensive, in July 1920, compelled the Poles to retreat almost to the confines of Warsaw. The Lithuanians took advantage of the situation and reoccupied Wilno (July 14 1920) which had had a Polish garrison at the time when the Curzon line was laid down. But shortly afterwards the approach of a Red Army caused the Lithuanians to evacuate in all haste, which action laid them open to the reproach that they were not able to hold what they had so long claimed as their patrimony. The Poles believed that they were fighting not only in defence of their own newly resurrected country, but that they were stemming the tide of the Red invasion which threatened to overflow into Central Europe. They accused the Lithuanians of surrendering an important strategic centre and an important railhead, with the consequence that the left flank of the hard-pressed Polish army was exposed. But, as it happened, the face of the war changed and the Poles, turning on their Bolshevik pursuers, defeated them and drove them back into Great Russia. Immediately the Lithuanians reoccupied Vilna (Aug. 24 1920) but came into conflict with the Poles there and at Suwałki.

Meanwhile the Lithuanian Constituent Assembly, or "Seim," composed of 112 members, met on May 15 1920. The President of the State, the National Council and the Cabinet resigned and, all power passing to the Seim, the provisional government gave way to the permanent government. The state of war with Soviet Russia had been concluded by a Peace Treaty signed at Moscow, on July 12 1920, under which the Lithuanian claim to Vilna and Grodno was recognised by the Bolsheviks, and Lithuania received 3,000,000 roubles in gold and 100,000 hectares of forest land for exploitation. A Polish protest to the League of Nations on Sept. 5 1920 was followed by an agreement between the Polish and Lithuanian governments to refrain from hostilities and to respect the limits laid down for them by an Allied Military Commission. A line of demarcation agreed upon at Suwałki on Oct. 7, to come into force on Oct. 10, again left Wilno on the Lithuanian side. But the *coup de main* of Oct. 9 by the Polish so-called "rebel" Gen. Zeligowski (*see* VILNA) placed Vilna in Polish hands. On March 14 1923 the Allies recognised the *fait accompli*.

The Lithuanians were compelled to remove their capital to Kovno (Kaunas) where it has since remained, but the Vilna dispute continued to embitter relations between the two Powers. The Conference of Ambassadors, in a note of June 2 1924, invited the Lithuanian Govt. to enter into diplomatic and consular relations with the Polish Government. The Lithuanian Govt. countered with a proposal that the Allied Powers should call a conference at which their representatives would meet Polish and Lithuanian delegates to reopen the territorial question. The Conference of Ambassadors replied in effect that the frontier question could not be reopened. The Memel (*q.v.*) question proved to be almost as difficult of solution, but the Lithuanians, imitating the conduct of the Poles at Vilna, seized Memel on Jan. 15 1923 by a *coup de main*. The Convention signed at Paris on May 8 1924 laid down that the Memel (Klaipéda) territory constitutes an autonomous unit under Lithuanian sovereignty.

The *de jure* independence of Lithuania was recognised by Germany on March 23 1918, by Soviet Russia on July 12 1920 and by Latvia and Estonia in Feb. 1921, and by the Argentine Republic in March 1921. The long-drawn Vilna dispute delayed formal recognition by the Allies and the United States of America until the end of 1922. Lithuania became a member of the League of Nations on Sept. 22 1921.

Constitution.—Under the provisional constitution of June 2 1920, the then President of the Constituent Assembly, M. A. Stulginskis, acted as Temporary President, his acts being countersigned by the Premier. His election was subsequently confirmed by the Seim. The definite constitution of Aug. 1 1922 provides for a President, elected by the Seim, and for a Cabinet with a Premier responsible to the Seim. The Seim consists of 78 deputies, elected by universal, direct, secret suffrage on the basis of proportional representation, the electoral unit being of 50,000 inhabitants.

Internal Affairs.—In the constituent Assembly, the majority was formed by the Christian Peasant party, which in 1921 carried an agrarian reform bill for the twofold purpose of breaking up large estates and of reducing the influence of the Polish gentry who owned many of the biggest properties. In 1922 the first Lithuanian Seim was constituted, but the German, Jewish and Polish minorities abstained from taking part in the elections on the ground that the Government had treated them unfairly. In that year the revival of trade caused exports to exceed imports by nearly 500,000,000 marks, but the inflationary period in Germany made it imperative for Lithuania to adopt a currency of her own. Accordingly, the gold standard was established and maintained, on the basis of a Lithuanian litai (the litai to be $^1/_{10}$ of a dollar). The exploitation of flax was made a State monopoly.

The necessity of getting an absolute majority caused the dissolution of the Seim in March 1923. The new elections showed the state of parties as follows: Christian Democrats 40, People's Party 15, National Minorities 14, Social Democrats 9. As a result a coalition between the two first named returned the Galvanauskas Cabinet to power, which continued in office until June 1924.

Then the Christian Democratic party took over the administration, M. A. Tumenas becoming Premier. Once again friction occurred with the minorities, especially with the Jews, who make up 14% of the population. But Tumenas prevailed, and the Ministry for Jewish Affairs was abolished.

Foreign Policy.—The feud with Poland caused Lithuania to stand aloof from all negotiations for a Baltic alliance. The resulting isolation was accentuated by misunderstandings with other Powers. First and foremost among these was France, the friend of Poland, which at the time of the Lithuanian *coup de main* against Memel maintained a small garrison in that town. Further, the Agrarian reform bill affected the proprietary interests of "national minorities," Polish, German, Latvian, etc., which endeavoured to secure diplomatic protection outside the limits of Lithuanian territory. Again, the closing of the Niemen, which was an economic measure designed to exert political pressure, invited commercial retaliation, while friction arose within the State itself between the purely Lithuanian clergy and the clergy of Polish extraction and education, which for a time vitiated diplomatic relations with the Holy See. Finally, the circulation of the "Ostmark," which had been issued during the German occupation and was not redeemed, was resented by the people, the more so as the German Reichsmark was legal currency until 1922, with the result that the Lithuanian State suffered heavily by its depreciation. These troubles were, however, to some extent counterbalanced by happy relations with Soviet Russia which culminated in a treaty of non-aggression imposing strict neutrality on both parties in the event of a conflict between either and a third State. This treaty (as yet unratified) was negotiated in April 1926 by Prof. Reinys, Lithuanian Foreign Minister.

In 1922 Lithuania concluded a commercial treaty with Great Britain; in 1924, commercial treaties with Germany and Czechoslovakia. On May 19 1924 she agreed at the Conference of Kovno to enter into a tariff and customs union with Latvia and Estonia; and these three States also agreed to pursue a concerted foreign policy, especially in the Assembly of the League of Nations.

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II. ECONOMIC AND FINANCIAL HISTORY

Lithuania is essentially an agricultural state. Of its total population (2,203,312 in 1923), nearly 80% live in the country. The only large town is the capital Kaunas (Kovno), which had 92,446 inhabitants in 1923. The second town was Klaipeda (Memel) with 35,715 inhabitants; then came Panevezys (19,197), Siauliai (Shavli) (21,387) and Ukmerge (10,604); the population of the three last-named towns is, however, largely agricultural.

Education.—Thanks to the cultural conflict between the Russian Govt. and the Lithuanian people before the War, the abolition of the monasteries at the end of the 19th century and the Russianisation of elementary education, a large proportion of the population is illiterate. According to the 1923 census 43·18% of the men and 44·98% of the women could not read. Considerable efforts were made by the Lithuanian Govt. to improve the educational system of the country and the budgetary educational grants rose steadily from year to year. In 1924 there were over 2,000 elementary and over 100 secondary schools. In Feb. 1922 a university was opened at Kaunas.

The economic organisation of the country on its present basis may be considered as beginning after the treaty of July 12 1920 with Russia; but progress was hampered by the protracted disputes over Memel (*q.v.*) and Vilna (*q.v.*).

Agriculture.—The estimated distribution of Lithuanian territory is as follows:—

	Hectares	% of Total area
Arable	2,595,000	46·2
Meadow and pasture	1,415,000	25·2
Orchards and gardens	169,000	3·
Woods and forests	909,000	16·2
Peat bogs	180,000	3·2
Uncultivated	349,000	6·2
	5,617,000	100·

The chief crops are rye, flax, oats and potatoes. The production of potatoes and rye would appear to have increased considerably since the War; but the returns are somewhat doubtful. The figures for 1924 and 1925 are given here.

	Area under Crops Hectares		Harvest (Quintals)	
	1924	1925	1924	1925
Rye	537,600	542,000	4,647,200	7,163,900
Wheat	84,900	112,000	903,200	1,461,000
Barley	196,000	205,000	2,028,600	2,562,500
Oats	325,000	345,000	2,697,500	3,415,500
Flax seed	61,500	76,000	338,300	458,400
Flax fibre			326,000	387,800
Potatoes	176,400	163,000	16,581,500	14,670,000

In spite of a recovery since 1920 the production per hectare of rye in 1923 was only 10·4 quintals, in 1924 8·6; wheat 9·9 and 10·6; barley 9·9 and 10·3. Efforts were, however, being made to improve agriculture with the help of the co-operative organisations. Experimental and model farms were started in different parts of the country, stations for cleansing grain set up and breeding stock imported. As in the other Baltic States co-operative societies play an important rôle. The most popular and numerous are, however, the consumers societies. Indeed, agricultural co-operatives for the marketing of goods only began to develop after the monetary reform at the end of 1922. Since the foundation of the so-called "Gamintojas" (Producer) or League of Agricultural Co-operatives early in 1923 with the object of organising the export of grain, flax, eggs, etc., and the import of fertilisers, implements and other agricultural requirements, the movement, assisted by the Government, made very considerable progress. In 1924 flax was the most important article of agricultural export, accounting for about 20% of the total value of all exports. Great hopes are, however, placed on the development of intensive dairy farming on Danish lines.

As under the Agrarian law (*see* LAND TENURE) no person may own more than 25 hectares of forest, nearly the whole of the forest area is exploited by the State; exclusive of the Memel district, 828,500 out of 872,000 hectares.

Timber.—In the 25 years preceding the War, however, very large districts were denuded of trees, and during the War the forests suffered heavily as a result both of deliberate destruction and of the abnormal demand for timber. It is officially estimated that about 2,200,000 cu. metres could be cut per annum without deforestating the country, granted adequate transport facilities. Timber and manufactured and semi-manufactured wood constitute the most important group of exports. From 1920 on the export of sawn timber made rapid progress as against that of unsawn timber, as shown by the following table:—

Amount in Cubic Metres (000's omitted)						
Principal articles	1920	1921	Jan.–Sept. 1922	Oct.–Dec. 1922	1923	1924
Wood: unmanufactured	317	244	226	19	44	48
Wood: manufactured	122	184	313	70	293	200

Industry.—No coal or mineral ore is mined in Lithuania, and such industries as exist are, therefore, mainly dependent upon agriculture. Industry suffered severely from the wars, and from subsequent political difficulties with Poland, the Memel problem, to some extent from the loss of the Russian market for metal manufactures and more recently from a banking and credit crisis. About half of the existing undertakings are occupied with the preparation of food products and beverages. The export of manufactured products is negligible.

Trade.—Owing to the system of valuation employed the trade statistics up to the end of 1922 probably somewhat exaggerated the magnitude of the imports. The total turnover has increased steadily from year to year.

Imports and Exports of Merchandise and of Bullion and Specie

Special Trade[1] Value in millions of litai						
Merchandise	1920	1921	1922	1923	1924	1925
Import . . .	72	95	75	157	207	253[2]
Export . . .	55	58	77	147	267	243
Balance[3] . . .	−17	−37	+2	−10	+60	−10

[1] Imports for home consumption and exports of domestic produce.
[2] Provisional.
[3] Excluding the movement of bullion and specie.

The chief articles of export are: wood and wood products (about 25% of the total value of all exports in 1924), flax 20%, live stock 13%, eggs 7·5%, leather and hides 5·5%, and grain and flour 4%. In 1924 43% of Lithuania's total exports went to Germany and 28% to the United Kingdom. Of her imports, which are essentially miscellaneous in character, over 80% were derived from Germany in 1923 and about 63% in 1924.

Currency.—Since the autumn of 1922 Lithuania has had her own currency: the litai (one-tenth of a dollar). This unit of currency was adopted as, owing to the number of emigrants and the extent to which dollar notes sent from the U.S.A. had circulated in the country during the preceding years when the German Ost marks were depreciating in value, the population had become habituated to it. In connection with the monetary reform a central bank was established which has the sole right of note issue.

National Finance.—In 1923 the budget was balanced and from 1923–5 the proportion of total expenditure for military purposes and of total revenue derived from the felling of timber steadily diminished. The estimates for this period balanced at the following totals:—

	1923	1924	1925
Litai (in millions)	208·3	229·7	259·3

The actual receipts and expenditure in 1923 amounted to 176·9, and 171·8, and in 1924 to 241 and 232·3 million litai. On Jan. 1 1924 the total debt of the republic amounted to 72·8 million litai of which 2·6 million litai was domestic. Arrangements had been made with all creditor countries concerning the service of the foreign debt.

Communications.—The means of communication in Lithuania were constructed to meet the requirements of a province of the Russian Empire and are ill-adapted for present purposes. Thus Memel, which is the chief port for the whole country, can only be reached from Kaunas, either by an extremely circuitous route via Liaulian, Taurage and Papegiai, or over Latvian territory. For this reason the Lithuanian Govt. contemplated laying down two short lines linking Kaunas with Memel and giving northern Lithuania a direct outlet at Memel to the sea via Pelsiai. The length of the railways in 1925 was 1,138 km. large gauge, and 454 km. narrow gauge under State control, plus 48 km. of line under private management and the Highways Board and some 110 km. of private lines in Memel.

The Niemen, however, forms an important natural highway, being navigable for 419 km. and utilisable for the floating of logs for a much greater distance. The rivers Necys and Nevežys are likewise navigable for 20–30 kilometres. But these rivers are all frozen in winter when the transport of timber from the forests to the nearest clearing station is accomplished.

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LITTLE ENTENTE.—The Little Entente is a political organisation, created after the World War, which binds together three Central European States, Czechoslovakia, Yugoslavia and Rumania, for purposes of their common interest.

Origins under the Dual Monarchy.—Those nations had in the past been throttled by the Germanising and Magyarising system of the old Austria-Hungary; one of the objects of the Little Entente is to defend the freedom they won after the War against all attempts to restore the former régime. The Little Entente had its roots in a series of political acts and declarations dating back to the days of the old monarchy. In the Austrian half of the Habsburg Empire the representatives of the small nations in the Parliament at Vienna joined in opposition to the centralising system which opposed the non-German peoples. In the Hungarian half the oppressed Slovaks, Serbs, Croats and Rumanians met in 1848 and made a protest against Magyar imperialism; they did so again in 1895 at Budapest; and in 1905 10 non-Magyar deputies of the Budapest Parliament formed a club for a like purpose.

During the World War, when the Austro-Hungarian peoples revolted and helped the Western Entente to break the system of militarist imperialism, a common aim again produced common action. In April 1918 a congress of the oppressed Austro-Hungarian peoples was held at Rome, and in the autumn of that year the Central European Democratic Union was formed in America. A year earlier a great meeting of representatives of the Austro-Hungarian nations had taken place at Kiev in Russia and had established a special committee to fight against German and Austro-Hungarian imperialism. A prominent place was taken in all these actions by the Czechoslovaks, Yugoslavs and Rumanians, supported by Poles, by the Italians of "Italia irridenta" and finally by Ukrainians. The co-operation of the first three nations was particularly close, and toward the end of the War they undertook diplomatic action in common. The Little Entente was formed soon after the Peace treaties had been signed, when attempts began to be made by various elements of the pre-War régime to bring about a restoration of the Habsburg dynasty.

The Formation of the Little Entente.—The Czechoslovaks, Yugoslavs and Rumanians knew that a return of the Habsburgs would mean the restoration of the German-Magyar absolutism and the destruction of the freedom won by the political revolution of 1918. The Habsburg intrigues were chiefly engineered in Hungary, where the new régime in Central Europe was last to be recognised and where intense propaganda was conducted for the recapture of the Slovak, Serbo-Croat and Rumanian territory. The Habsburg menace led to corresponding defensive measures on the part of the threatened States. The Czechoslovak Foreign Minister travelled on Aug. 13 1920 to Belgrade, where, on the following day, a defence treaty, of which the broad outlines had already been negotiated, was concluded between the kingdom of the Serbs, Croats and Slovenes and the Czechoslovak Republic, binding both States, in case of an unprovoked attack by Hungary on either of them, to provide mutual aid the one to the other, and to refrain from making any alliance with a third Power without the consent of both. At Bucharest, whither the Czechoslovak Foreign Minister proceeded from Belgrade, the basis was negotiated on Sept. 17 for an analogous entente.

After all the questions of detail had been settled, that agreement also was given the form of a defensive treaty, and concluded on April 23 1921. On Sept. 19 1920 Rumania informed both those States that she recognised a similar obligation. She concluded special treaties to that effect with Czechoslovakia on April 23 1921, and with Yugoslavia in June of that year. The opportuneness of that defensive alliance was proved in April and in Oct. 1921, when two attempts were made to restore the Habsburgs. Those attempts failed only because they met with the combined armed resistance of Czechoslovakia, Yugoslavia and Rumania.

The European Side of the Little Entente.—The three States forming the Little Entente were aware from the beginning that mere defence measures would not suffice for the maintenance of the new régime if the States concerned were themselves lacking in creative forces, or failed to attain the greatest possible degree of political and economic solidarity and an atmosphere of mutual trust and fruitful co-operation throughout the whole area of Central Europe. The ultimate and wider aim of the Little Entente is therefore to educate Central Europe as to the advantages of universal peace and European consolidation. The progress made in the realisation of this policy is best seen in the political and economic spheres. The main political object was to persuade all the Central European States to work in peaceful co-operation with the new States, and much success has been achieved. Starting from the Treaty of Rapallo between Yugoslavia and Italy and the agreements worked out on the occasion of the visit of the Czechoslovak Foreign Minister to Rome in Jan. 1921, that policy bore fruit in the Czechoslovak-Austrian agreement of Dec. 16 1921, which bound both States to abandon hostile propaganda and to settle all disputes by peaceful arbitration. The same principles were the basis of the Czechoslovak-Polish treaty of Nov. 6 1921, which, although not ratified, created better relations between the two States, and, being followed by the Polish-Rumanian political treaty, materially improved the relations of Poland with the Little Entente as a whole.

In the measures taken to save Austria from financial ruin Czechoslovakia had a large share, and did not hesitate to make sacrifices in the interests of mutual confidence. A like policy was followed by the Little Entente towards Hungary, despite the fact that it had been the nationalist elements of Hungary and their Habsburg sympathies that had brought the defensive alliance of the Little Entente into existence. The latter knew from the beginning that correct and, as far as possible, friendly relations between it and Hungary were essential to the complete pacification and consolidation of Central Europe. The States forming the Little Entente showed the best of good will in this respect, as is proved by the frequently repeated attempts of Czechoslovakia to negotiate with the Hungarian Govt. from as early a date as 1921. If those attempts were unsuccessful, it was because Hungary sought by an adventurous policy to avoid an understanding with her neighbours. The recent change in this respect, clearly due to the failure of that Hungarian policy, is nowhere more welcomed than in the countries of the Little Entente, whose only wish is that the change be permanent, so that a new Hungary, consolidated both economically and politically, may co-operate in the reconstruction of Central Europe.

Economic Policy.—The economic policy of the Little Entente starts from the conviction that in Central Europe it is necessary not only to overcome the harmful results of the depreciated currency, the obstacles to trade connections and the disturbances in the industrial world, but also to make up for the consequences of the disintegration of the old monarchy, which had constituted an economic whole. The basis of its economic policy, therefore, is the minimising of these results by the earliest possible establishment of commercial relations with each other and with the rest of the world. The political negotiations have therefore always been combined with economic negotiations, which have been the basis of a series of commercial treaties, at first between the States of the Little Entente and then with all the neighbouring countries. Questions of common interest to all the States springing from the former Austria-Hungary have been discussed with good results at special conferences, *e.g.*, those at Rome and Portoroso in 1921, and, later, the special conferences dealing with passport, transport and other problems. The results of this economic co-operation have not of course been equally satisfactory in each of the States concerned, nor have they been enough in themselves to restore healthy conditions to those States whose economic, financial and currency difficulties left them with no alternative to calling in international financial help.

Expansion of the System.—The increased activity and the determined policy of the States forming the Little Entente have outgrown the limits of the simple defence treaties which constituted the original basis. On Aug. 31 1922 that formal basis was considerably enlarged by the conclusion of a new treaty, in the second article of which both Czechoslovakia and Yugoslavia recognised the treaties concluded by Czechoslovakia with Rumania, Austria and Poland on the one hand, and by Yugoslavia with Rumania and Italy on the other. In the third article both parties agreed to put their economic, financial and transport relations on a firm basis by co-operation; and finally in a further article they undertook to support one another in their international political and diplomatic relations and to take common measures if their common interests should be threatened.

The principles incorporated in that treaty reveal both the spirit underlying the Little Entente and the basis of its future activity. Emphasis is laid on the importance of economic co-operation and of solidarity in international affairs; the periodical renewal and extension of the existing system of commercial treaties, together with the ever increasing moral weight of the Little Entente in the councils of Europe, prove that the statesmen of the Little Entente have a firm grasp of both political and economic realities. At international conferences, such as those of the League of Nations, the representatives of the Little Entente have regularly spoken as one man, and have therefore contributed to a considerable simplification of international relations; their behaviour is particularly noteworthy in that it is not only of a united but of a pacifist character. The future aim of the Little Entente will be still further to promote the pacification and the consolidation of Central Europe. *See* also CZECHOSLOVAKIA; EUROPE; RUMANIA; YUGOSLAVIA, etc. (E. BE.)

LITVINOV, MAXIM MAXIMOVICH (1876–), Russian politician, was born at Bielostok. When only 17 he entered military service as a volunteer and while in the army became interested in Marxism. When his term of service was completed, he devoted himself to propaganda, and became a member of the Kiev committee of the Social Democratic party. The president of that committee proved to be a police agent and the whole committee was arrested. After a year and a half in prison Litvinov with 11 companions escaped from gaol, went abroad and took an active part in the *Iskra*, the Social Democratic newspaper. When the split in the Social Democratic party occurred, Litvinov joined the Bolsheviks, or majority section, returned to Russia illegally in 1903 and worked there as a member of the central committee until the revolution of 1905. In that year he attended the London Congress as a delegate from the Riga Committee and took part with Gorky in founding *Novaya Zhizn* (*The New Life*), the first legal Social Democratic newspaper to appear within the boundaries of Russia.

During the succeeding years of reaction, Litvinov lived abroad, where he organised the sending of weapons to the revolutionaries in the Caucasus. He took part in the International Socialist Bureau which he left at the beginning of the World War after protesting against the entry of Socialists into bourgeois governments and in general against Socialist support of the War. After the November revolution (1917) in Russia he was appointed diplomatic agent of the Soviet Government in England. He was subsequently arrested as a hostage for Mr. Lockhart, for whom he was exchanged. He afterwards became one of the most important figures in the Soviet diplomatic service, as assistant commissar for foreign affairs taking part in the initiation of peace negotiations with Estonia, in negotiations at Copenhagen with England, in the Genoa conference and, as president of the Russian delegation, in the subsequent conference at The Hague. In 1925 he became a member of the Revolutionary military council of the Union and later chief-of-staff of the Red Army.

LIVERPOOL, England (*see* 16.804).—The population of Liverpool increased from 753,353 in 1911 to 802,940 in 1921. The municipal area was enlarged in 1913 by the inclusion of Allerton, Childwall, Little Woolton and Much Woolton to a total area (exclusive of 2,883 ac. of river bed) of 21,242 acres. The death-rate per 1,000 fell to 13·6 in 1924. The policy of slum clearance and the erection of large numbers of cottages followed by the council, which was begun before the War, has had beneficial results. Over 6,000 houses had been built by 1924 under municipal housing schemes on large estates at Larkhill, Allerton and elsewhere, and 460 ac. were acquired in 1925 for a further big scheme at Norris Green, just outside the city boundaries. Garston has become an important shipping and coal export centre. Since 1918 the borough has returned 11 members to Parliament.

Public Utilities, etc.—The total area of parks and open spaces is 1,396 ac., including the Harthill estate of 32½ ac. (1913), the Walton Hall estate of 130½ ac. (1913), the Woolton Wood estate of 62 ac. (1917) and the Allerton and Allerton Towers estates of 228 ac. (1924). Among important buildings erected since 1910 are the prominent Royal Liver and Cunard buildings, near the landing stage; an art gallery at Port Sunlight, erected in memory of Lady Leverhulme; and the Midland Adelphi Hotel. Recent monuments include a bronze statue of King Edward VII. in front of the Cunard buildings; one to the engine room heroes, erected by international subscription in 1916, overlooking Prince's landing stage; one to Sir A. L. Jones at the George pierhead; and the Cunard company's War memorial column. The proposed Liverpool War memorial is a cenotaph in front of St. George's Hall, in addition to the Cathedral War memorial, which is a cenotaph and includes the Roll of Honour. A holiday home for orphans was opened in 1924 as a memorial gift from the churches of the city.

A Merseyside municipal co-ordination committee was formed in 1922, with the object of improving local communications, particularly across the river. Negotiations for financial assistance from the Government were successful in 1924, and in Dec. 1925 the boring of the Mersey tunnel, which, it is hoped, will provide a solution of the very difficult traffic problem, was begun by the sinking of a shaft on the site of the old George's dock. When completed, the tunnel, 44 ft. across, will contain a roadway for heavy traffic 36 ft. wide, with footways on each side, and beneath one for lighter vehicles. There will be two approaches on the Liverpool side, one for heavy traffic at New Quay and one for lighter at Whitechapel. On the Birkenhead side there will be one approach, near the Woodside Hotel. The urgent need of an additional water supply led to plans for the construction of a third pipe-line from Lake Vyrnwy (to be followed by a fourth), and the crossing of the Mersey is to be effected by laying pipes in the river bed. Work was begun in 1925.

Cathedral.—The work of building the cathedral, practically stopped during the War, was resumed in 1920. Owing to the exigencies of the site on St. James' Mount the building lies north and south, the rubrical "east" thus pointing south. The general plan, which is marked by strong individuality of style, consists of a great central space (200 by 72 ft.) formed beneath a central tower by the crossings of two pairs of transepts, a choir in three bays and a nave—the whole to have an interior length of 480 feet. The principal portal of the cathedral will be at the west side of the tower, not at the traditional west end. The stone is Woolton red sandstone, which weathers to a greyish pink in a smoky atmosphere. The first section, which includes the Lady Chapel, was consecrated in 1910 and the choir, two transepts, and the chapter house were consecrated in July 1924. In the southeast transept is a memorial to the 55th division, and in the War memorial northeast transept there is a cenotaph. The building is heated by the hypocaust system. Work on the great central space and the west transept was begun in 1925. (*See* ARCHITECTURE.)

Markets.—A market was established at Garston in 1920, and in 1922 a general market was set up on the site of the wholesale vegetable market in order to do away with the holding of unauthorised markets on waste ground. In the same year the frozen meat market was acquired, as a preliminary to the building of abattoirs and a meat market on the site of the Stanley cattle market.

Port Improvement Schemes.—Large schemes for the improvement of the port have been in process of execution by the Mersey Docks and Harbour Board since 1906. They include the construction of a great vestibule dock, 1,070 ft. long and 130 ft. wide, with a river lock entrance and two branch docks, at the north end of the dock estate. A lock 645 ft. long and 90 ft. wide, opened in 1921, connects the new dock with the adjacent Hornby dock. These new docks will add $2\frac{3}{4}$ m. of quays to the port, and will be, it is said, the largest and best equipped in the world. Work was suspended during the War, but was afterwards pressed forward. Large extensions have been made to the electric equipment of the port, the landing stages enlarged to provide further facilities for the embarkation of passengers, and a wireless telephone installed from the Bar Lightship to the Harbour Board offices. About one-third of the total overseas trade of Great Britain passes through Liverpool, but since the War Liverpool has given place to London as the first port for wheat imports. To provide accommodation for the growing oil industry a large area of land, known as the Parkhill and Dingle estate, has been set apart at the extreme south end of the dock estate for the erection of oil tanks, with pipe-lines to berths in the Herculaneum dock. (O. J. R. H.)

LIVERPOOL, UNIVERSITY OF (*see* 10.43).—New chairs have been founded in classical archaeology, geography, commerce, civic design, social science, applied mathematics, organic chemistry, industrial chemistry (fats and oils), bacteriology, geology, oceanography, entomology, parasitology, tropical diseases of Africa, dental surgery, veterinary anatomy, care of animals (causation and prevention of disease), international law, engineering, electrical machinery, applied mechanics, civil engineering, metallurgy and naval architecture. New fellowships have been created for modern history, English literature, Celtic, chemistry, anatomy, orthopaedic surgery, engineering. A number of scholarships have been instituted, in architecture, travelling, research (offered in the faculties of arts, science and engineering in rotation), chemistry, marine biology, medical subjects, engineering and law.

New buildings were erected for arts building extension, Students' Union and Gilmour Hall, engineering building extension, school of tropical medicine, chemistry school extension, department of geology, hall of residence for women extension, dental school extension, athletic pavilion, laboratory for research in tropical diseases (Sierra Leone). Residential buildings have been altered and equipped for accommodating the departments of education, geography, school veterinary surgery, metallurgy, school of social science, hostels for men, institute of archaeology. New departments have been instituted in civic design and town planning, poetry, music, art of the theatre, medieval history, analysis of observations, geology, cytology, pharmacology, radiology and electrology, orthopaedic surgery, parasitology, chemical physiology, public health chemistry and refrigeration. New degrees have been ordered for commerce, architecture, hygiene, orthopaedic surgery, veterinary science and philosophy, while diplomas have been instituted in radiology and electrology, tropical hygiene, archaeology, geography and social studies. In 1919 a tidal institute was established by the university in association with local shipowners. In connection with the department of oceanography, founded in 1919, a sea fisheries laboratory is maintained at Port Erin. Extensive researches are carried on in the local sea fisheries in regard to diseases of fish and kindred subjects.

Extramural Work.—The university extension board extended its influence to the Isle of Man, to Crewe in the south and to Blackpool and Carlisle in the north, at 23 centres, in co-operation with local committees and organising bodies. Christmas lectures for boys and girls have been inaugurated. A scholarship open to extramural students provides the holder with the means of proceeding to a degree course in the university. Free public lectures have become a feature in university life at Liverpool. Courses of lectures and single lectures are given almost nightly, in the winter, in many subjects taught in the university.

Industrial Relations.—For some years advisory boards have been established in commerce and in science and engineering subjects, including representatives of commercial and industrial firms. The university has adopted special regulations for the proper conduct of what is termed "outside work." Facilities are offered by a large number of firms permitting students to visit works and examine processes, etc. Much is done in finding suitable posts for graduates on leaving the university.

Numbers of Students.—The following table shows the increase of students in 1924–5 as compared with the entries for 1910–11:—

1910–1			1924–5		
Full time	Part time	Total	Full time	Part time	Total
919	279	1,198	1,651	400	2,051

The University in Wartime.—During the War the resources of the university (particularly of the science, engineering and medical departments) were devoted to national service, and accommodation in the university buildings was found for many Government departments. Research work was undertaken for the Government in chemistry (dyeing, edible oils, high explosives, etc.), insect pests, mathematics (Admiralty work and guns), optical instruments, engineering and medical science (particularly in tropical diseases, bacteriology, pathology, orthopaedic surgery and dentistry). The engineering staff organised classes for the manufacture of shells, and the staff and students made over 1,500 gauges. The inspection of high explosives for the Liverpool area was centred in the chemical laboratories, and over 250,000 tons of high explosives were passed there. Mem-

bers of the university who served in the War (staff, students and servants) numbered 1,673 of whom 197 were killed in action or died on service, and five gained the Victoria Cross (one with bar).

LLANDAFF, HENRY MATTHEWS, 1ST VISCOUNT (1826–1913), British politician, died in London April 3 1913.

LLOYD OF DOLOBRAN, GEORGE AMBROSE LLOYD, 1ST BARON (1879–), British administrator, was born on Sept. 19 1879, the son of Sampson Samuel Lloyd of Dolobran, Montgomeryshire, and was educated at Eton and Cambridge. He became a close student of politics and travelled widely in Burma, India, Little Tibet, the Himalayas, Egypt, Morocco and Asia Minor. In 1905 he was appointed attaché to the British Embassy at Constantinople, and in 1908 acted as special commissioner for the British Govt. to inquire into and report upon the future of British trade in Turkey, Mesopotamia and the Persian Gulf. During the World War he saw service in Egypt, Gallipoli, Russia, Mesopotamia and with the sheriff of Mecca's forces in the Hejāz, gaining the D.S.O. in 1917. He was Conservative M.P. for West Staffordshire from 1910 until 1918, when he was appointed governor of Bombay, a post which he held until 1923. He was created G.C.I.E. in 1918 and G.C.S.I. in 1924 when he was again returned to Parliament as M.P. for Eastbourne. In May 1925 he was appointed high commissioner for Egypt, and in Oct. was raised to the peerage.

LOCARNO, PACT OF.—Locarno is a fact of European significance. If, therefore, we wish to treat of the particular outlook of one nation or another it cannot be in relation to the great objectives shared by all, towards which the policy of Locarno was directed. The German people, indeed, have expressed their opinion of the actual documents in which the results of Locarno are enshrined, in less unanimous terms than other nations, but it may be said that in the overwhelming majority they are as convinced as any nation of the desirability of those great aims.

It was not altogether easy to make it clear to German public opinion that the problem of security was fundamental to any practical approach to these ends. The man in the street, seeing the harbours empty, the barracks deserted, the armament industries destroyed and the richest areas of his country overrun by foreign troops, found it hard to understand that it was not his own security but that of his armed neighbours, old and new, that stood in need of a guarantee. The difficulties would, therefore, have been excessive had not Great Britain stepped in at Germany's suggestion and declared herself ready to throw the whole weight of her power into the scale in the defence of Germany's western frontier, no less than eastern frontiers of France and Belgium.

It is too much to say that Great Britain's intervention, beneficent as it was, amounted to a solution in itself. The path which it opened was still encumbered by many obstacles. The sincerity of the German proposal was not everywhere realised with the same clear-sightedness shown by the British statesmen. Germany was credited with designing to secure a British guarantee on the Rhine to enable her to effect a forcible rectification of certain frontiers in the east which were not in harmony with racial justice and sound economics. It was feared, moreover, that a separate pact between the Great Powers interested in the Rhine would overshadow a pact concluded within the framework of the League of Nations and undermine the prestige of the League itself. It was by no means easy to remove the first source of anxiety, despite Germany's sincere wish to develop her relations in the east along peaceful lines, since France, as Poland's military ally, could not be seriously regarded as an impartial guarantor of German-Polish relations. The second ground of apprehension would, it seemed, vanish when Germany entered the League of Nations. She was, however, compelled to demand that she should enter as a completely equal partner. It was therefore necessary that consideration of the inequalities of armament be secured beforehand.

An unusual measure of goodwill on the part of all concerned was needed to overcome these and other difficulties. Happily the hour of Locarno was favourable and the statesmen assembled there actually incorporated this goodwill in a high degree. Personal contact strengthened in each that determination to conquer the spirit of mistrust, which in such circumstances is the sole warrant of success. Accordingly, there was little delay in drawing up the documents which were signed in London on Dec. 1.

From the German point of view their immediate significance is clear and simple:—

1. They set Europe free from the nightmare of warlike complications in one of the danger-points of the Continent.
2. They substitute a system of objective legal procedure and amicable arrangement for high-handed militarism and the one-sided interpretation of treaties.
3. They pave the way for Germany's co-operation in the League of Nations, by ensuring that she shall not be involved against her will in conflicts for which she is unfitted by her geographical position and her military situation.

Even if it had no other than this immediate significance, the Pact of Locarno would be one of the most important documents of 20th century history. But it was recognised with a rare unanimity and, further, was emphatically laid down in the protocol of Locarno that its full import entailed further consequences. Everything in fact in this complex of treaties has a bearing upon the future.

The legal disputes, often of a very subtle order, which in recent years have stirred passions to a frenzy, will in future be referred to the calm atmosphere of international courts of equity, so that our generation may acquire a clear outlook, enabling it to co-operate in mutual confidence in the political, economic and cultural reconstruction of Europe. There is hardly any aspect of this infinitely complicated problem which will not sooner or later be made to feel the beneficial influence of this clarifying process. The particular problem, however, which will be most immediately and decisively affected is undoubtedly that of universal disarmament. Germany's practical interest in this issue is less than that of other countries. For the chief financial relief will be enjoyed by those countries which disarm, while the diminution of the military burden will benefit the Powers competing with them in armaments. For Germany, on the other hand, the effect is primarily a moral one in three ways.

Firstly, because disarmament will mean the beginning of the long-delayed fulfilment of a solemn promise, confidence in which brought the German people to lay down its arms; a promise which was solemnly reaffirmed to it in Versailles.

Secondly, because in the words of the distinguished statesman who represented Belgium at Locarno it is impossible "to keep a rich and powerful people disarmed by duress and in a one-sided way for an indefinite period, while its former enemies in Europe remain armed to the teeth."

Thirdly, because this is the best way of convincing the German people that the pledges which Germany has offered of her own free will, and under the guarantees of Great Britain and Italy, for the security of her Western neighbours, are appreciated at their full value by the latter. How could the German people be asked to believe in the security pact if the signatory Powers most immediately concerned continue to base their security exclusively upon heavy artillery, tanks and aerial bombs?

Regarded in this light, it becomes intelligible why public opinion in Germany more than anywhere else looks so eagerly for the realisation of what in Locarno was so justly styled the "logical outcome." Every recognition is due to the fact that the responsible statesmen on their return to the turmoil of their capitals from the calm and reflective atmosphere of Locarno have honourably striven without waste of time to bring about the realisation of a part of that "logical outcome." It must alike be recognised that before the full programme can be realised, time is necessary to prepare public opinion in each country. The document of Locarno is no prescription, merely needing the physician's signature, to allay the fever of mistrust. But in the last resort the prescription of Locarno will have to prove its efficacy by one fact alone: that no State shall ever again hold it necessary or even compatible with the Treaty to seek for the guarantees of its security by accumulating the machinery of violence on the territory of its neighbour. When

that hour strikes, even those sections of German opinion, which are still skeptical of Europe's miraculous healing from the spirit of destructiveness, will no longer be able to stand aside. Then will the whole German people engage its ambition in being outdistanced by none in peaceful co-operation for the welfare of Europe. (*See* SECURITY.) (G. St.)

LOCKJAW: *see* TETANUS.

LOCKOUTS: *see* STRIKES AND LOCKOUTS.

LOCKROY, EDOUARD (1838–1913), French politician (*see* 16.854), died Nov. 22 1913.

LOCKWOOD, WILTON (1861–1914), American painter (*see* 16.855), died at Brookline, Mass., March 20 1914. In 1912 he was elected a member of the National Academy of Design.

LOCKYER, SIR JOSEPH NORMAN (1836–1920), British astronomer (*see* 16.855), died at Sidmouth, Devonshire, Aug. 16 1920. In 1912 he became president of the British Science Guild.

LOCOMOTIVE: *see* RAILWAYS.

LÓCZY, LÁJOS DE LÓCZ (1849–1920), Hungarian geologist, was born at Pressburg (Bratislava) Nov. 2 1849. He studied at the Zurich Polytechnic, obtaining his engineer's diploma in 1874, and from 1877–80 travelled through India and China as geologist to the expedition of Count Bela Szechenyi. In 1886 he became professor of geology at the University of Budapest, and in 1908 director of the Hungarian Geological Institute. He completed geological researches in China, in Hungary and, during the World War, in Serbia. His principal work, *The Scientific Results of the Expedition of Count Bela Szechenyi to Eastern Asia* (1890), comprises the first scientific description of the mountains which connect the Kuen Lun chains with the Northeast Indian chains behind the red basin of Szechwan. His researches concerning the steppe-formations of the Gobi and the northern Hwang Ho territory are also of great importance. His other important work, *The Results of the Scientific Research of the Balaton*, forms a great monograph of the Hungarian lake, in which the formations of the Balaton region are explained. His posthumous works are: *The New Geological Map of (pre-War) Hungary*, and *Geology of West-Serbia*, which revolutionised the geological knowledge of Serbia. He died at Balatonaracs May 13 1920.

LODER, BERNARD CORNELIUS JOHANNES (1849–), Dutch jurist. From 1873 to 1908 Loder practised as a lawyer in Rotterdam and from 1908 to 1921 was a judge of the high court of justice of the Netherlands. In 1905, 1909, 1910 and 1922 he represented the Netherlands at the diplomatic Sea Conferences at Brussels. He presided at the conference of the Scandinavian kingdoms, Switzerland and Holland, held in 1920. The Permanent Court of International Justice at The Hague appointed him its first president in 1922 and he retained this position until early in 1925.

LODGE, HENRY CABOT (1850–1924), American statesman and author (*see* 16.860), in view of his continuous service in the Senate since 1893 was recognised during the closing years of the Roosevelt administration and under Taft as one of the Republican leaders. This position he maintained at the time of the Republican-Progressive split which led to the election of Woodrow Wilson in 1912; his personal friendship with Roosevelt remained unbroken, but he held true to his long-established principles of party regularity. He was well equipped for leadership in opposition, for his talents were critical rather than constructive and he possessed the qualifications of a great parliamentary debater. His prime interest lay in foreign affairs and it was as a member of the Senate Foreign Relations Committee and later as opponent of President Wilson that he exercised his chief interest. This opposition was originally in no way personal, as has been frequently suggested.

In 1914 Lodge supported Wilson's demand for the repeal of the Panama Tolls exemption on the ground that the President had a right to expect such assistance as would enable him to conduct foreign affairs effectively; "the great responsibility," said Lodge "of initiating and shaping our foreign policy must rest with the Executive and cannot rest anywhere else." He lost confidence in Wilson, however, as a result of the President's handling of the Mexican problem in 1914, and thereafter became one of his principal critics. He regarded him as a man of words with no capacity for well-considered action: "I wonder if the future historian will find him out," he wrote in his diary. This distrust increased after the outbreak of the World War. Lodge's intense nationalism, which in the past had given him the reputation of being an Anglophobe, led him to protest strongly against the failure to protect American lives and property, whether destroyed by Mexican revolutionaries or by German submarines. He successfully opposed the Shipping Bill in Jan. 1915, ostensibly on the ground that it would lead to foreign complications, chiefly, however, because he feared it would result in the purchase of the German ships in American harbours, an act which he regarded as unneutral and unfriendly to the Entente. He desired the United States to enter the War against Germany after the sinking of the "Lusitania," and warmly objected to every suggestion of placing an embargo upon the export of American munitions, which he looked upon as a pro-German manoeuvre. He steadily opposed Wilson's Caribbean policy; in Feb. 1914 he refused to support the treaty negotiated with Colombia providing for the payment of $25,000,000 and expressing regret for incidents connected with the United States recognition of the independence of Panama and the acquisition of the Canal Zone; in Jan. 1916 he offered a resolution calling for armed intervention in Mexico. He advocated enthusiastically a larger army and navy.

With the entrance of the United States into the War, Lodge called for non-partisan support of the President in all policies that might increase the War effort of the United States and its assistance to the Entente Allies, and he helped to carry through many of the Administration's War measures, although he opposed one of the most important designed to organise war-making agencies, the Overman Act, on the ground that it gave unlimited power to the Executive. Wilson's peace policies Lodge neither understood nor approved. In 1915 and 1916 he had himself advocated a League of Nations and the principle of compulsory arbitration, but he later confessed that he changed his mind and saw in Wilson's proposals more danger than advantage. In Aug. 1918 Lodge was elected Republican Floor Leader of the Senate, and as a result of the autumn elections which gave control to the Republicans he became chairman of the Senate Foreign Relations Committee. At the moment of the opening of the Peace Conference he was thus titular and actual leader of the opposition to Wilsonian peace policies, a post for which he was fitted by his convictions as well as his ability.

On Dec. 21 1918 Senator Lodge inaugurated what developed into a successful campaign against the Wilson peace plan by a speech in the Senate in which he insisted upon the need of separating the League from the treaty. Under his guidance and that of Senator Knox, both men of long experience in matters of foreign policy, the Senatorial opposition to Wilson developed rapidly; it was not broken by Wilson's conference with the committee on Feb. 26 1919. "The President," recorded Lodge, "answered questions for two hours about the draft of the constitution of the League of Nations, and told us nothing." On March 4, Lodge with 38 Republican Senators issued a declaration expressing disapproval of the Covenant in its existing form and its inclusion in the treaty of peace. Thus when Wilson finally returned from Paris in July 1919 he found a well-organised opposition to the Covenant, which capitalised the increasing protest against the President's alleged autocracy of method and the dissatisfaction with various aspects of the Versailles Treaty, together with the discontent inevitably arising from after-War conditions and directed against the party in power.

Lodge did not hope to defeat the treaty by a straight vote of disapproval; the popular demand for peace was too compelling. He did hope to attach a number of amendments or reservations which would attract the support of the die-hard enemies of Wilson and the Covenant, and which would protect the "interests and safety of the United States." This policy he carried through successfully, aided by the President's illness and his

refusal to consider any compromise. On Sept. 10 1919 Lodge presented the report of the committee to the Senate, which finally adopted 15 reservations to the treaty. When, on Nov. 19, the treaty with these reservations was voted upon, 42 Democrats, of whom nearly all approved the Covenant and treaty but objected to the reservations, voted against it. It was accordingly defeated, 39–55. A motion for ratification without reservations was lost, 38–53. Efforts to secure a compromise followed but proved unsuccessful. Wilson refused to accept the Lodge reservations, and Lodge was able to hold his group firm in refusing to pass the treaty without reservations. His tactical success was unquestionable when on Mar. 19 1920 the treaty, which had been reintroduced, failed to secure the necessary two-thirds vote of the Senate by seven votes, for it was lost through the votes of Democratic Senators who voted against it at the wish of the President. Senator Lodge himself was doubtless sincere in his willingness that the treaty should pass, with his reservations attached, but he later expressed relief that it had failed; writing only a month before his death he seemed convinced that " the League cannot do anything to stop wars."

As the successful leader of the opposition to Wilson, Lodge's prestige was increased and his influence in the succeeding administration was for a time great. He served as permanent chairman of the Republican National Convention in 1920, and as one of the four U.S. delegates at the Washington Conference on the Limitation of Armaments in 1921. Thereafter his influence waned to some extent, especially after he opposed Harding's proposal for joining the World Court. He was re-elected to the Senate in 1922 by a narrow margin; under Coolidge, although leader of the Senate, he did not work in close co-operation with the President. He died at Nahant, Mass., on Nov. 9 1924 at the age of 74.

Senator Lodge was one of the great Congressional figures of the last decade of the 19th and the first two decades of the 20th centuries. Reputed cold and distant in manner, a " Boston Brahmin," he enjoyed the prestige indicated by his popular appellation, the " scholar in politics," and held the respect of his colleagues on both sides of the Senate, who admired his ability as a debater, his tactical skill upon the floor, and the knowledge and experience which he brought to prolonged and assiduous labour in committee. An historical writer of high reputation and productivity, fate denied him the opportunity to become responsible for great legislative measures and forced him at the apex of his career into the rôle of critic. (C. Sey.)

LODGE, SIR OLIVER JOSEPH (1851–), British scientist, (*see* 16.860). After 1910 Sir Oliver Lodge became increasingly prominent as a leader of psychical research and a strong believer in the possibility of communicating with the dead, and he distinguished himself more than any scientist of his time in the serious endeavour to reconcile science and religion. Among his publications dealing with this subject are *The Survival of Man* (1909); *Reason and Belief*, 3rd ed. (1911); *The War and After* (1915); *Raymond, or Life and Death* (1916), a memoir of his son killed in the World War, with an account of communications believed to have been received from him since; *Christopher: a Study in Human Personality* (1918). Early in 1920 he made an extensive lecturing tour of the United States, having just previously retired from his post as principal of Birmingham University; and a few years later he published a series of popular scientific books of which the best known are *The Making of Man* (1924), *Ether and Reality* (1925), *Relativity* (1925), and *Talks about Wireless* (1925). In 1919 he received the Albert Medal of the Royal Society of Arts for his pioneer work in wireless telegraphy. He was president of the British Association in 1913–4, and of the Radio Society of Great Britain in 1925, and had been an F.R.S. since 1902.

ŁÓDŹ, Poland (*see* 16.862), the most important centre of cotton and woollen manufacture in the country before the World War, has been deprived of its former outlet in the Russian Empire, but cotton spinning and weaving remains its most important industry. Łódź had a population of 451,813 in 1921, of whom 60% were Poles and some 180,000 Jews. An exchange has been established, and a school of social and economic studies was opened in 1925. Work on the drainage system and gas-works was to have begun in 1924. Łódź became the seat of a Roman Catholic bishop in 1920.

ŁÓDŹ-CRACOW, BATTLES OF.—The repulse at the end of Oct. 1914 of their first offensive in Poland (*see* Vistula-San) placed the Germans in a perilous position on the Eastern Front. The Austrian armies were again in retreat, and were rapidly becoming demoralised; the Germans themselves, on the northern part of the Eastern Front, were greatly outnumbered and could expect no considerable reinforcement till the Ypres battle in the west had been decided. The evident intention of the Russian Commander-in-Chief, the Grand Duke Nicholas, was to advance on the great industrial region of Silesia. In their retreat from Warsaw and Poland the Germans had done their best by elaborate destruction of communications to impose as slow a rate as possible on this advance; but their numbers were insufficient to stem the oncoming tide of Russia's hordes by a direct defence. Invasion of German territory might be slow, but it seemed inevitable.

Ludendorff's Plan.—The German High Command solved their portion of the problem by placing Hindenburg, commander of the IX. Army, in charge of all German forces on the Eastern Front (VIII. and IX. Armies and Woyrsch's detachment) and instructing him to do his best without immediate reinforcement. Hindenburg kept Ludendorff as his chief of staff, and the latter at once proposed a characteristically bold solution. This was to withdraw the IX. Army from central and southern Poland and, taking advantage of the excellent railway system, to transfer it north to a base between Posen and Toruń (Thorn), from which to strike a blow at the Grand Duke's communications as he advanced southwest on Silesia. The plan was an audacious one. In the first place it left the direct route to the enemy's objective, the province of Silesia, barred only by the unreliable Austrians and by weak German elements. Ludendorff trusted to the destroyed communications and to the customary Russian sluggishness of manoeuvre for time sufficient to carry out the contemplated counterstroke. Secondly, East Prussia, again threatened by invasion, would be further denuded of defenders, for Ludendorff proposed to call on the VIII. Army to furnish a quota to his striking force. Lastly, the manoeuvre involved thrusting a body of between five and six corps within reach of Russian forces twice that size, and the greater the success of the blow, the deeper the penetration into the Russian rear, the heavier would be the weight of the enemy masses concentrated on it. But the result of the battle of Tannenberg had been to persuade Hindenburg and Ludendorff that disparity in numbers could be largely discounted with the Russians as foes.

Disposition of the Russian Forces.—On the Russian side, the first fortnight of Nov. 1914 saw the high-water mark of that onward sweep towards Germany of Russia's exhaustless masses, on which the Allies had built such high hopes. There were at this time eight Russian armies deployed. The X. Army, which had replaced the defeated I. Army on the eastern frontier of East Prussia, had begun to move forward. The I. and II. Armies, to the northwest and west of Warsaw, protected the flank of the main advance by the V., IV. and IX. Armies; on the south, the III. and VIII. Armies covered the left flank by pressure on the Austrian main forces in the direction of Cracow. But progress was slow, hampered by difficulties of supply; and already the Russians were beginning to feel that shortage of munitions and of trained drafts which was to lead to their disasters of 1915. Their armies were strung out in linear formation and no central reserves were available.

The point of attack chosen by Ludendorff for the IX. Army under Mackensen, which now comprised 5½ corps and two cavalry divisions, was the junction between the I. and II. Russian Armies. The Vistula and Warta rivers, to east and west, would protect the flanks of the German advance. To prevent any transfer of Russian forces from north of the Vistula, a detachment, mainly of fortress troops, was to advance on Mława, while another pushed up the right bank of the river towards Płock.

The Russian I. Army was spread over a wide front with three corps north of the Vistula between Mława and Płock and two corps south of the river—the V. Siberian at Włocławek and the II. Corps (lately transferred from the II. Army) between Kutno and Łęczyca. The II. Army was on the Warta, west of Lódź, directed on Kalisz. The V. Army was on the left of the II. and was approaching the upper Warta.

First Battle of Lódź.—Mackensen began his advance on Nov. 11. On the 12th the isolated Siberian V. Corps at Włocławek was overwhelmed and driven back on Płock. Two days later the II. Corps acting as a link between the I. and II. Armies about Kutno, and the XXIII., the right corps of the II. Army, were defeated by greatly superior numbers and driven south. Scheidemann, commander of the Russian II. Army, now tried to wheel his corps from their line on the Warta to a position northeast of Lódź, the chief manufacturing town of Poland. But the German movements were too sure and rapid for the ponderous Russian counter-march. The columns of the II. Army were attacked in turn as they came up and were thrown back on Lódź.

Meanwhile the two defeated corps of the I. Army, now joined by the Siberian VI. Corps from north of the Vistula, were forced back towards Warsaw and away from Lódź. Into the gap between the two Russian armies Mackensen thrust three divisions, the two of the XXV. Res. Corps and the 3rd Guard Div. and his two cavalry divisions, with instructions to pass round the right flank of the II. Army and encircle Lódź from the south. A corps formed from the Breslau garrison, which had now come up from the west, was to turn the left wing of the Russian II. Army, pinned in front by the attacks of the German XI., XVII. and XX. Corps. Ludendorff was aiming at a second Tannenberg, in which Scheidemann's army was to fill the same rôle as had the unfortunate Samsonov's. The I. Res. Corps meanwhile was by persistent attack to prevent the I. Army from intervening.

By Nov. 18 the position of the Russian II. Army seemed well-nigh desperate. It was being driven into a narrow semi-circle round Lódź with both flanks turned, and was becoming exhausted and dispirited. But help from the V. Army was now close at hand. Plehve, its commander, on receiving orders to turn back to the assistance of the II. Army, acted promptly and with resolution. He attempted to rail one division north to Skierniewice but only one regiment got through before Mackensen's cavalry cut the line. The rest of the division came into action on Nov. 19, south of Lódź against the turning movement of the German XXV. Res. Corps. The whole of the remainder of the V. Army marched north on the 18th, the gap it left on the

IV. Army's right being filled with cavalry. That same night the Siberian I. Corps relieved the pressure on Scheidemann's left by a successful attack on the German XI. Corps. Next day the XIX. Corps routed the Breslau troops. This restored the situation on the west side of Lódź; but to the east and south of the town Schaffer's XXV. Res. Corps and 3rd Guard Div. were still advancing. By the evening of Nov. 20 they had completely turned the right of the Russian II. Army and were attacking Lódź from the south.

During Nov. 21 Ludendorff persisted in a last effort to accomplish the destruction of the Russian II. Army, but the attacks definitely failed. By the 22nd the tables had been turned, and Schaffer's force was itself completely surrounded. While part of Plehve's army, after rescuing the left of the II. Army, turned to attack Schaffer's group south of Lódź, Rennenkampf, the commander of the I. Army, had been ordered to despatch forces from Łowicz and Skierniewice to gain touch with the II. Army and close the German line of retreat to the north. The Łowicz force, which consisted of $3\frac{1}{2}$ divisions, started on Nov. 20 and by the evening of the 22nd, in spite of three changes of command and indifferent staff work, had captured Stryków and Brzeziny, and had apparently sealed the gap between the Russian I. and II. Armies. The Russians actually ordered up 18 trains to remove the anticipated harvest of prisoners. The Skierniewice column of a division and a regiment accomplished nothing.

Escape of Schaffer's Force.—In the evening of the 22nd, Schaffer, heavily engaged with part of Plehve's army, south of Lódź, received a wireless order from Mackensen to cut his way out by Brzeziny. During the night of Nov. 22, in intense cold, he succeeded in slipping from the grasp of the enemy opposing him and concentrating his weary divisions to make their bid for release. Unknown to him, the Russians had already opened a breach. The centre columns of the Łowicz force had marched on to Lódź, leaving the left column, the Siberian 6th Div., isolated west of Koluszki on the Warsaw-Lódź railway. This division fought gallantly during Nov. 23 and repulsed all efforts of the XXV. Res. Corps to escape. Further west, however, the 3rd Guard Div. moving through the Galkówek forests, found the gap in the Russian net and captured Brzeziny in the early hours of Nov. 24. Encouraged by this success, the XXV. Corps renewed its efforts against the hapless Siberian 6th Div., whose appeals for help were disregarded by other Russian formations within easy reach of the battlefield. Finally, the division, with both flanks turned and overborne by weight of numbers, broke and left the way open for the XXV. Res. Corps to rejoin the 3rd Guard Div. at Brzeziny. Schaffer's line of retreat was now clear, and on the 25th his whole force, moving by Stryków, rejoined Mackensen. He brought with him several thousands of prisoners and a number of captured guns.

Effect of the Battle.—Ludendorff's bold stroke had stopped the grand duke's intended invasion of Silesia as effectively as Sir John Moore, by a similar move, had halted Napoleon's incursion into Spain a little more than 100 years before. Never again during the War were the Russians in a position to threaten German territory. The campaign shows well the value of mobility as a strategical weapon. On Oct. 26 the IX. Army was engaged opposite Warsaw during Hindenburg's first offensive. During the next fortnight it retired 120 m. destroying the communications as it went; reorganised and repaired its losses; was transferred by railway across the enemy front; and deployed in complete fighting trim for its new offensive on Nov. 11. This shows German organisation and efficiency at its highest. The quality of German leadership was also well-displayed, and was in strong contrast with the irresolution and inertia shown by some of the Russian commanders.

Schaffer's exploit was a masterly one; within a few hours of receiving his orders to retire, he had succeeded in breaking off action and setting his columns in motion to seek a way to safety, which his determination and the fine fighting spirit of his troops was to win. Compare this with the inaction of many of the Russian commanders, particularly the failure of the numerous bodies within reach to come to the rescue of the Siberian 6th Div. on Nov. 23. Ludendorff had owed much to Rennenkampf's passivity for his victory at Tannenberg; here again Rennenkampf's inefficiency and lack of the will to victory saved him from the loss of Schaffer's force which his rashness and obstinacy had exposed. Yet Rennenkampf had been accounted a dashing leader of men before the War. The Grand Duke himself, Ruzski (the commander of the Northwest Front), and Plehve, who hid an iron will in a weak and wizened frame, all acted promptly and with determination to take advantage of the opportunity.

Second Battle of Lódź: Dec. 1–15.—At the end of Nov. Hindenburg received reinforcements of four corps from the west, released by the termination of the first battle of Ypres. He now advanced again and captured Lódź on Dec. 6 and Łowicz on Dec. 15. The Russians fell back to the Bzura-Rawka river line in front of Warsaw, which they were to hold until Aug. 1915. Meantime an attack by the Austrian II. Army towards Piotrków in the first week of Dec. had been repulsed.

Battles round Cracow: Nov. 15–Dec. 25.—While the fighting round Lódź was taking place in the north, fierce battles were being waged in southeast Poland and western Galicia between the Austrian main armies and the Russian left wing. These battles were indecisive in their results and have less interest, strategically and tactically, than the battles round Lódź.

After the fighting on the San and round Dęblin (Iwangórod) in the latter part of Oct. the Austrian I. and IV. Armies fell back gradually on Cracow, followed up slowly by the Russian IV. and IX. Armies. The Austrian II. Army (two corps), was railed north to fill the gap on the left of Woyrsch's force caused by the withdrawal of the German IX. Army for Hindenburg's counterstroke in north Poland. The front of the II. Army was taken over by the III. Army, which now held the line of the Carpathians as far east as the Uzsok pass. The eastern Carpathians down to the Bukowina were guarded by Pflanzer-Baltin's group. To defend western Galicia between the fortress of Cracow and the Carpathians, a group consisting of the XI. Corps and some cavalry was formed and took up station on the line of the middle Dunajec. The Austrian plan was to meet the expected attack towards Silesia of the Russian V., IV. and IX. Armies with Woyrsch's army and the I. Army, while the II. Army from the north and the IV. Army from the south wheeled against the enemy's flanks.

The Russian advance was slower and more cautious than had been expected; their V. Army had to turn about on Nov. 17 to rescue the II. Army at Lódź; while the IV. and IX. Armies on approaching Cracow halted for the III. Army in Galicia to come forward and invest the fortress. On Nov. 17, therefore, as soon as the Austrian II. Army had completed its detrainment and come up into line, the Austrian armies north of the Vistula took the offensive. A week of attack and counter-attack followed with little advantage to either side. Radko-Dimitriev's III. Army had meanwhile come up to the Dunajec; he passed one corps over to the north of the Vistula to enable the IX. Army to parry the thrust at its left flank of the Austrian IV. Army; with the remainder he drove back the Austrian XI. Corps to a defended position east of Cracow.

Final Encounters of 1914.—Conrad, the Austrian chief of the general staff, now planned a new combination. He passed part of the IV. Army over by rail to the left wing of the Austrian III. Army near Limanowa for a counter-stroke at Radko-Dimitriev's left. This was made on Dec. 3, and the fighting soon became general along the whole front between the Vistula and the Carpathians. Brusilov's VIII. Army, facing the Austrian III. Army along the Carpathians, sent a corps by Nowy Sacz to the assistance of Radko-Dimitriev, but was thereafter itself heavily attacked. On Dec. 15, after the loss of Lódź and Łowicz in the north, the Grand Duke issued orders for a general withdrawal in South Poland and Galicia to winter lines. The V., IV. and IX. Armies fell back to the Nida line, and the III. Army to the Dunajec. Brusilov's VIII. Army, however, on the extreme left, counter-attacked the Austrian III. Army between Dec. 18 and 25 and drove it back to its former position in the Carpathians (battle of Jasto). This brought to an end the campaigns of 1914.

The Russian "steam-roller," which the Allies in the West had so confidently expected to see smashing over its foes with irresistible, if deliberate, momentum, had come to a standstill for want of fuel. The Grand Duke's decision in the middle of Dec. to break off battle and retire was occasioned mainly by the shortage of munitions and the impossibility of keeping the ranks filled with trained drafts to replace the heavy wastage due principally to that very lack of a sufficiency of shells and other material of war. But the Russians had most loyally done their best under great disadvantages to live up to the expectations which their allies had formed of them. It was the machine, antiquated and behind the age, that fell short of the stern requirements of modern war.

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LOEB, JACQUES (1859–1924), American physiologist, was born in Alsace, France, April 7 1859. Graduating at Ascanisches Gymnasium, Berlin, he studied medicine in Munich and Strasbourg (M.D., 1884). He was assistant in physiology at the universities of Wurtzburg (1886–8) and Strasbourg (1888–90), working also at the Naples biological station from 1889–91. He went to the United States in 1891 and taught biology at Bryn Mawr for a year. He became assistant professor of physiology and experimental biology at the University of Chicago in 1892, being appointed associate professor in 1895 and professor in 1900. In 1902 he became professor of physiology at the University of California. From 1910 to the date of his death he was head of the division of general physiology at the Rockefeller Institute for Medical Research. He died at Hamilton, Bermuda, Feb. 11 1924. Dr. Loeb's work was chiefly directed to a pursuit of the real distinction between living and dead matter, the thesis upon which he worked being that all living things are chemical machines and that their workings are open to the same mechanistic explanation as are those of any machines made of inert matter. Among his published works are *The Heliotropism of Animals and Its Identity with the Heliotropism of Plants* (1890); *Physiological Morphology* in 2 vol. (1891–2); *Comparative Physiology of the Brain and Comparative Psychology* (1900); *Studies in General Physiology* (1906); *The Dynamics of Living Matter* (1906); *The Mechanistic Conception of Life* (1912); *Artificial Parthenogenesis and Fertilisation* (1913); *The Organism as a Whole* (1916); *Forced Movements: Tropisms and Animal Conduct* (1918).

LOEB, JAMES (1867–), American banker and philanthropist, was born in New York City Aug. 6 1867. On his graduation from Harvard College in 1888, he became a member of the firm of Kuhn, Loeb & Co., bankers, New York City, retiring from business in 1901. In 1905 he founded and endowed the Institute of Musical Art in New York City. He devoted much of his time to classical archaeology. He was the founder of the Loeb Classical Library of Latin and Greek authors, works which give text and translation on adjacent pages. The first volume appeared in 1912. He was instrumental in founding the Deutsche Forschungsanstalt für Psychiatrie, an institution in Munich for the systematic study of the causes of mental diseases. He translated from the French: P. Decharme's *Euripides and the Spirit of His Dramas* (1906), M. Croiset's *Aristophanes and the Political Parties at Athens* (1909) and P. L. Legrand's *Daos* (1917).

LOGIC (*see* 16.879).—The most important contributions to logic during the pre-War years, 1911–4, are to be found in two works of H. Driesch, *Ordnungslehre* (1912) and *Die Logik als Aufgabe* (1913), in the *Encyclopaedia of Philosophical Sciences*, vol. 1, *Logic* (1913), and in the new, enlarged edition of B. Bosanquet's *Logic, or the Morphology of Knowledge*, 2nd ed. (1911). J. M. Baldwin's *Genetic Logic*, vol. 3 (1911) only carried a stage further the work which was inaugurated five years earlier; Miss E. E. C. Jones' *New Law of Thought* (1910, etc.) was of limited interest; P. Coffey's *Science of Logic* (1912) was intended as a textbook for Catholic students; C. A. Mercier's *New Logic* (1912) and F. C. S. Schiller's *Formal Logic* (1912) display more contempt than understanding for traditional logic.

Like other human pursuits logic suffered during the World War. The years 1915–8 are almost a blank in the history of logic—J. Dewey's *Essays in Experimental Logic* (1916) being mainly a collection of older essays, and A. E. Davies' *Textbook of Logic* (1915) being only a textbook.

WRITERS AND THEIR VIEWS

Driesch.—According to Driesch, logic is the theory of order. The theory of order results from self-reflection. Its most comprehensive principle is that of the economy of assertions. This principle is not merely a matter of convenience, but expresses the essential nature of thought. In this respect Driesch differs from Avenarius and Mach. According to Driesch the fundamental truth of philosophy is "I think something." Now whatever is thought is thought to be orderly; and the task of logic is to ascertain what makes experience orderly. Thought is always directed to problems, which it endeavours to solve by placing them in some orderly system. It is with the help of thought that life achieves progressive orderliness.

Royce.—Of the six essays on logic contained in the first volume of the *Encyclopaedia of the Philosophical Sciences* the most important is that by J. Royce, who, like Driesch, tries to treat logic as a science of order. In his account of induction, he denies that inductive reasoning is guided by the principle of the uniformity of nature, or by the principle of sufficient reason. Neither helps the investigator to decide whether, or to what extent, he may generalise in a given case. According to Royce the validity of induction rests on the assumption of some order in the objects investigated, and the reliability of a "fair sample" as a means of judging a whole range of facts. A fair sample is one chosen without bias. Of such samples, he maintains, there are always more that more or less resemble the whole than such as differ widely from it; so that judging a whole range of facts by means of a random sample is more often approximately right than wholly wrong. The chief advantage of mathematical sciences is that the mathematical results deducible from hypotheses needing verification present a vast range of samples, and the precision of mathematical concepts renders it easy to decide whether an observed sample agrees with the anticipated result.

Bosanquet.—The new edition of Bosanquet's *Logic* contains considerable additions. Book II., Chapter 8, deals with the criticism that his theory of judgment commits him from the start to metaphysical absolutism. If every judgment qualifies reality by an abstract universal, and no combination of such universals can confer particular individuality, there can be but one ultimate individual to which all predicates belong. This is absolutism. Bosanquet retorts that no finite individual is self-dependent or self-contained, that is, a real substance. Even the self finds its reality in something beyond itself. But an individual not self-complete can be predicated of the whole of which it is a part. Chapter 9 discusses criticisms of the coherence theory of truth. Bosanquet maintains that Truth is its own criterion—it can only be tested by more of itself. Any system can be tested further only by being made more complete. The view that truth is only an adaptation to vital needs, is claimed by Bosanquet to be the same view in principle. But while approving the attempt to claim for logic the realm of life and practice, and to apply the general idea of natural selection to the development of thought, Bosanquet protests against the narrow conception of practice which limits it to external action.

Intimately connected with the coherence theory of truth is his subsequent book on *Implication and Linear Inference* (1920). According to this all inference is of the same type, namely, implication. The essence of implication is interrelation between the parts of a system (or concrete universal), which makes modification in some parts clues to the modification of others. Syllogistic inference is linear, not systematic, and therefore not true inference. In true inference we survey a system of facts, see it in its relation to the whole of reality, and read off the implications. The inference is immediate if we can read off the implica-

tions directly; it is mediate if we must construct this system first. The starting-point of all inference is the realisation that to deny the truth of *all* propositions would involve self-contradiction, denying this very denial. We must consequently believe *some* propositions, even if we question the truth of this or that proposition. In true inference we transfer our certainty that *some* propositions are true to the truth of the proposition inferred. In the last resort, all inferences may be reduced to the alternatives: "Either this proposition is true, or no proposition is." Within the system from which we start we read off conclusions the denial of which would shatter the whole world of our experience.

Bradley.—The philosophical absolutism of Bosanquet is also emphasised in F. H. Bradley's *Essays on Truth and Reality* (1914) and in the new edition of his *Principles of Logic* (published in 1922 with numerous additions). Bradley repudiates his previous assumption of ideas divorced from judgments, and of judgments divorced from inference. The concrete conceptual fact is inference, of which mere ideas and simple judgments are bare abstractions. Inference is the ideal self-development of a given object taken as real. The given object is an ideal content before us, and it is taken to be real as being in one with reality, or the real universe. The possibility of inference rests upon the fact that the object is not only itself, but is also contained as an element in a whole; in fact, it *is* itself only as being so contained. From the nature of the case inference must always be incomplete, and subject to unknown conditions. But this ultimate problem does not concern logic.

Other Writers.—Among new editions of older books on logic mention may also be made of H. W. B. Joseph's *Introduction to Logic*, 2nd ed. (1916), W. Wundt's *Logik* (3 vol., 4th edition, 1919–21), L. T. Hobhouse's *Theory of Knowledge* (1921) and A. Höfler's *Logik* (1922). Wundt's *Logik* has not undergone any radical changes, and retains its important place. Hobhouse reasserts his fundamental principles that the systematic interconnection of judgments is the true line of advance in the interpretation of reality, and that the categorical judgment asserts a reality independent of itself. Höfler's *Logik* is practically a new book. While excluding epistemology it includes a good deal of psychology and philosophy. More particularly it shows the influence of A. Meinong's *Gegenstandslehre*, which distinguishes "existence" from "being," of which it is only one species. Whatever is false has being, but not the being of what is true. On the whole, Höfler defends traditional logic, holding that the syllogism, for instance, formulates a kind of reasoning actually used in practical life, even if there are also other forms of reasoning. One of the novelties of the book is the classification of judgments into four classes according to their evidence, namely, (1) those immediately evident and certain, (2) those mediately evident and certain, (3) those immediately evident and probable, and (4) those mediately evident and probable. The book also contains a number of essays on logistics by E. Mally.

Johnson.—The most ambitious new work on logic during the period 1911–25 is that of W. E. Johnson. His *Logic* is planned in four parts and is intended to cover the whole field. (Part I. appeared in 1921, Part II. in 1922 and Part III. in 1924; Part IV. has not appeared yet.) Logic is conceived to be concerned with the analysis and criticism of thought, and it is considered impossible to draw a rigid distinction between logic and philosophy, or between logic and science. In thought he distinguishes two aspects, an epistemic and a constitutive aspect. The constitutive aspect consists of the content of knowledge (which has itself a logically analysable form); the epistemic aspect is that which depends on the variable conditions and capacities for the acquisition of knowledge. The unit of logic is the proposition (or that of which truth and falsity can be significantly predicated). In contrast with the rather common class-interpretation of propositions, Johnson lays stress on the intensive aspect. "Implication" is potential inference, and assumes different relations in different cases. There are two principles of deductive inference:—(1) The applicative principle states that a proposition of the form *All S is P* warrants the inference of a proposition of the form *The given S is P*. (2) The implicative principle states that a compound proposition of the form '*x*' *and* '*x implies y*' warrants the inference of a proposition of the form '*y*'. The syllogism involves both principles. The following argument may illustrate each of the two principles and their combination in the syllogism.

(1) Applicative principle:
All quadrilaterals have their opposite sides equal, if they are parallel (every MP is *p* if *m*).
∴ The quadrilateral ABCD has its opposite sides equal, if they are parallel (the given MP is *p* if *m*).

(2) Implicative principle:
The quadrilateral ABCD has its opposite sides paralled (the given MP is *m*).
∴ The quadrilateral ABCD has its opposite sides equal (the given MP is *p*).

Johnson distinguishes between the constitutive and the epistemic conditions of valid inference. The constitutive condition is that the premises must be *true* and must *imply* the conclusion. The epistemic condition is that the thinker must be in a position to *know* that the premises are true, and that they imply the conclusion, without having to know beforehand that the conclusion is true. But now, the two principles of deductive inference require universal premises. How are these obtained? Johnson says, by *induction*. But he uses the term induction in an unusually wide sense, namely:—for any process of starting from certain instantial premises and reaching a generalisation. He formulates four types of induction, namely:— (1) *intuitive*, (2) *summary*, (3) *demonstrative* and (4) *probable*. Of these the last corresponds to ordinary empirical induction; and *summary* induction corresponds to so-called perfect induction. By *intuitive* induction Johnson means the process by which we obtain the fundamental principles of inference and the axioms of pure logic, mathematics, etc. It is not suggested that these are merely empirical generalisations, but that they are obtained by reflection on particular instances of them. This may happen in two ways:— (1) the *counter-applicative* way, when we can see that what is true of this instance is true of any other instance, and (2) the *counter-implicative* way, when, having made a particular inference which is valid, we can see that its validity is due to a certain type of formal relation which holds between the premises and the conclusion. These modes of procedure cannot be safely applied without special insight into the subject-matter of the investigation.

Under *demonstrative* induction are included certain types of hypothetical syllogism in which the instantial premise leads to a universal conclusion. For example:— "Every specimen of argon has some the same atomic weight. This specimen of argon has atomic weight 39·9. Therefore, every specimen of argon has atomic weight 39·9." Under the same head Johnson also includes the familiar canons of induction as reformulated by himself in four figures of agreement, difference, composition and resolution. Of *problematic* induction there are two varieties. There is *pure generalisation*, that "All things which are *m* are *p*," if all the observed things which were *m* were also *p*; and there is *class-fractional* induction (usually called statistical generalisation), that "a certain proportion of things which are *m* are also *p*," that proportion having been noted in the observed cases. From all these forms of induction Johnson distinguishes under the name of *Eduction*, the argument from "certain instances of *s* which are *m* are *p*" to "the next *s* that is *m* will also be *p*." The discussion of various psychological and metaphysical problems is a striking feature of Johnson's *Logic*.

The only other contemporary attempt at a comprehensive logic is Th. Ziehen's *Lehrbuch der Logik auf positivistischer Grundlage*, etc. (1920). This treatise contains not only much that is psychological and metaphysical but also a history of logic, which is perhaps the most useful part of it.

On the whole, logic has not yet reached the stage of having clearly defined boundaries, and is apt to trespass on the domains of mathematics and psychology, of epistemology and ontology,

according to the taste of the writer. Its state is like that of Israel under the Judges, every man doeth that which is right in his own eyes. There are signs, however, that the necessary differentiation may come about in another way. There is a marked tendency towards a greater division of labour, as may be seen from the number of treatises devoted entirely to special groups of logical problems, such as those of formal-symbolic inference (or logistic), the methodology of the sciences, the theory of knowledge (or epistemology) at the basis of science, etc.

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LOGUE, MICHAEL (1840–1924), Irish ecclesiastic, was born at Kilmacrenan, Co. Donegal, Oct. 1 1840. He was appointed professor of theology and belles-lettres at the Irish College in Paris, where he was ordained a priest in 1866. He became Bishop of Raphoe in 1879, archbishop of Armagh in 1887, and in 1893 was raised to the cardinalate. During the World War he deprecated participation by the clergy in Sinn Fein agitations, but in 1918 opposed conscription on moral grounds. In 1919 and 1921 he rigorously denounced the campaign of murder against the police and the military, at the same time criticising severely the policy and methods of the British Government. He died at Armagh Nov. 19 1924.

LONDON, JACK (1876–1916), American novelist, was born at San Francisco Jan 12 1876, and educated at the University of California. A born adventurer, he went to sea at the age of 17 and served before the mast. He went with the first rush to Klondike in 1897 and tramped across the States and Canada, being in gaol more than once as a vagabond. In 1904 he went to Japan as war correspondent, and in 1914 to Mexico in the same capacity. In 1906 he started on a voyage round the world in a 50-ft. ketch-rigged yacht and disappeared for two years. His novels, for the most part published first in London, reflect his wild, adventurous life, the best known being *The Son of the Wolf* (1900); *The Call of the Wild* (1903); *Moon Face* (1906); *Martin Eden* (1909); *South Sea Tales* (1912); and his last, *The Little Lady of the Big House* (1916). He died at Glen Ellen, Cal., Nov. 22 1916. See *The Book of Jack London* (1921), by his wife, Charmian London.

LONDON (*see* 16.938).—Greater London had, in 1926, a population of about 7,500,000 persons, but nothing has occurred in the years since 1910 to alter materially the story of its site, although under the heading of climate some diminution in the density of its fogs may be noted.

Divisions, Buildings and Communications

The characteristic divisions so well marked in the past have been gradually broken down since the close of the War, and for various reasons many large private houses have been converted into flats, maisonettes, boarding-houses, and, nearer the centre, business premises. The residential turnover is most marked in regions north and south of Hyde Park, while in boroughs such as Hackney or Stepney or those lining the south bank of the river the tendency is towards the intrusion of business. In the suburbs, after the complete cessation of house building, growth has been resumed, and has been fostered by the electrification of railways or the extension of railways previously electrified and the development of motor transport. An interesting feature before the War was the establishment of the Hampstead Garden Suburb in the north of London, in which the houses were limited to eight per acre. A very important factor in the development of Greater London was the passing of the Unemployment (Relief Works) Act of 1920, designed to benefit ex-service men, which permitted land required for new roads to be entered upon within seven days. Under this Act it was possible to provide in the outer area many of the urgently required main and relief roads before access to the centre was hopelessly blocked by the multiplication of housing schemes.

The period since 1910 included also some very important changes in the aspect of the streets in the central area, the greatest perhaps being the passing of Nash's Regent street and Quadrant. All idea of a unified scheme for rebuilding was abandoned except for the Quadrant itself, where an adaptation of the plan of Shaw's Piccadilly Hotel was followed. The widening of the Strand advanced considerably, and the Kingsway and Aldwych improvement initiated in 1899 was brought appreciably nearer conclusion. Other improvements completed included the Woolwich Tunnel in 1912 and the opening from Trafalgar Square into the Mall by way of the Admiralty Arch. Cross-river communications were improved by the reconstruction of Southwark Bridge, while the money for a new road bridge at Lambeth was voted by the London County Council. A movement that threatened completely to alter the appearance of the western districts was inaugurated by the sale of the garden ground in Mornington Crescent and Endsleigh Gardens, a new building on a portion of the latter open space being finished in 1926.

Parks.—Parks and open spaces continued to be added to the amenities of the city and the outer areas, the most important including the clearance and opening to the public of a portion of the river front at Shadwell and the preservation of Prince's Square, Stepney, in the built-up area. In the outer areas progress was made in the preservation for the public enjoyment of the wooded bastion of Shooters Hill to the south-east, and an important addition to Hampstead Heath and Parliament Hill Fields on the north was secured by the purchase of a considerable portion of Lord Mansfield's estate known as Kenwood.

Monuments.—The historical monuments of the past were not greatly interfered with during the period, although considerable perturbation was caused by the publication of a report containing suggestions for reorganising the work of the Church of England in the City of London that indicated the possible sale of 19 churches, including many designed by Wren. Later still signs of weakness appeared in the foundations of Waterloo Bridge which led to a unanimous resolution of the London County Council to remove the entire structure, action being only delayed on the urgent representations of a number of leading professional and learned societies. The report of the experts on the steps necessary for preserving the dome of St. Paul's Cathedral led to the closing to the public in 1925 of the whole space beneath the dome and the choir. Important works of preservation were also undertaken for the roofs of Westminster Hall and the Great Hall at Hampton Court Palace.

New Buildings.—The modern architecture of the metropolis was enriched by the addition of a number of striking buildings, including (to mention only a few) the new London County Hall at the east end of Westminster Bridge, the Port of London Authority home in Trinity Square, Britannic House and Adelaide House in the City, Bush House at the end of Kingsway, Australia House in Aldwych, the Wesleyan Central Hall and the Middlesex Guildhall in Westminster, the Royal Automobile Club in Pall Mall, the new north frontage of the British Museum and the headquarters of the British Medical Association in Bloomsbury. A considerable impetus was given to the production of fine street architecture by the institution of a medal by the Royal Institute of British Architects for the best street façade completed each year. The first to win the award was the new Wolseley building in Piccadilly, and the next the Shepherds Bush Pavilion. The general tendency towards change was most

marked in the City area, where the spires and towers of Wren that had so long dominated the view were slowly but surely engulfed in the rising tide of commercial architecture, the most notable instance being the almost total eclipse of the view of St. Magnus spire and the Monument from London Bridge by the erection of Adelaide House.

In the west end another marked transformation was the erection of a huge block of millionaire flats and shops on the site of Devonshire House, Piccadilly. The monuments and memorials in the metropolis were added to in a marked degree, though not always as the result of the World War, for the period included the completion of the Queen Victoria Memorial before Buckingham Palace and the King Edward VII. Memorial in Waterloo place. Amongst the many war memorials should be mentioned the Cenotaph in Whitehall, the Grave of the Unknown Warrior in Westminster Abbey, the memorial to London's soldiers in front of the Royal Exchange, Belgium's Gratitude and the Air Force Monument on the Embankment, and the Artillery and Machine Gunners' memorials at Hyde Park Corner. Work on the Guards' Memorial on the Horse Guards Parade was started in 1925. Interesting additions to the nomenclature of London were made in various districts, particularly the revival of the name Aldwych for the crescent section of the Holborn to Strand improvement, and that of Petty France to the roadway in Westminster passing under the shadow of Queen Anne's Mansions.

Communications.—Communications, as far as the trunk lines serving the metropolis were concerned, received no additions, but a vast change was almost imperceptibly carried out by the grouping of the great companies. The introduction of electrical working on many suburban lines was another feature of this period. Although no entirely new tube was opened, the reconstruction of the old City and South London line was taken in hand and completed, with its junction with the Hampstead Tube at Camden Town, and work was started on an extension of the line to Morden. The Golders Green terminus was connected with Edgware, and a new tunnel beneath the Thames from Charing Cross to Waterloo and Kensington was also started. A tube was specially constructed by the Post Office for connecting up the various sorting offices, and private proposals for an even more comprehensive system for goods traffic connecting the various termini were laid before the Ministry of Transport. Horse traction vanished finally from the tramway systems, now operated almost entirely by the London and Middlesex County Councils, and the L.C.C. lines were extended a little nearer the City by being carried over the new Southwark Bridge, but no lines were actually permitted through the City or West End, although proposals for this were discussed.

The principal change in traffic was, however, the enormous increase in the number of motor omnibuses plying in the streets, brought about by the appearance of numerous independent companies, popularly termed "pirates," while the London General Omnibus Co. ran more frequent services and operated many fresh routes, including some running right out into the surrounding country during the summer months; and many new and improved types of omnibuses were placed on the streets, including a few with covered tops. The chaotic conditions introduced by this great increase in the number of vehicles, and by the appearance of independent omnibus companies, combined at times with the operation of a great number of road repairs, some no doubt delayed by the War, finally led to a great step forward in the control of traffic, which took the form of the appointment of a London traffic advisory committee, whose duties were to advise the Ministry of Transport on matters relating to London traffic.

An important addition to the continental facilities of London was the opening of daily Air Services to Paris, Brussels and Amsterdam, connecting with other services to all parts of Europe and also to Africa.

Population, Education and Amenities

The population of Greater London in 1911 was 7,251,358, and in 1921 7,480,201; while that of the administrative county was 4,521,685 in 1911, and 4,484,523 in 1921. That of the outer ring was 2,729,673 in 1911 and 2,995,678 in 1921, while that of the City was 19,657 in 1911 and 13,709 in 1921. Greater London increased by 10·2% between 1901 and 1911, and by 3·2% between 1911 and 1921, while the county of London had decreased by 0·3% and 0·8%. The statistics for the metropolitan boroughs are as follows:—

	Area in statute ac.	Population		Increase (+) or Decrease (−)
		1911	1921	
Battersea	2,163	167,743	167,693	− 50
Bermondsey	1,503	125,903	119,455	+ 6,448
Bethnal Green	760	128,183	117,238	−10,945
Camberwell	4,480	261,328	267,235	+ 5,907
Chelsea	660	66,385	63,700	− 2,685
Deptford	1,564	109,496	112,500	+ 3,004
Finsbury	587	87,923	76,019	−11,904
Fulham	1,706	153,284	157,944	+ 4,660
Greenwich	3,859	95,968	100,493	+ 4,525
Hackney	3,287	222,533	222,159	− 374
Hammersmith	2,287	121,521	130,287	+ 8,766
Hampstead	2,265	85,495	86,080	+ 585
Holborn	405	49,357	42,796	− 6,561
Islington	3,992	327,403	330,028	+ 2,625
Kensington	2,290	172,317	175,686	+ 3,369
Lambeth	4,083	298,058	302,960	+ 4,902
Lewisham	7,015	160,834	174,194	+13,360
Paddington	1,357	142,551	144,273	+ 1,722
Poplar	2,331	162,442	162,618	+ 176
St. Marylebone	1,473	118,160	104,222	−13,938
St. Pancras	2,694	218,387	210,986	− 7,401
Shoreditch	658	111,390	104,308	− 7,082
Southwark	1,131	191,907	184,388	− 7,519
Stepney	1,767	279,804	249,738	−30,066
Stoke Newington	863	50,659	52,167	+ 1,508
Wandsworth	9,107	311,360	328,656	+17,296
Westminster, City of	2,503	160,261	141,317	−18,944
Woolwich	8,282	121,376	140,403	+19,027
City of London (County Corporate)	678	19,657	13,706	− 5,951

Health and Hospitals.—The birth-rate for the administrative county was 20·9 in 1922 and 20·1 in 1923 per 1,000 population. In Greater London the figures for the same years were 20·2 and 19·5. The death-rate for the same periods in the administrative county was 13·5 and 11·4 per 1,000 population, and for Greater London 12·5 and 10·7. In the hospital world great campaigns were instituted to place the leading institutions on a firm financial basis, and considerable alterations and improvements were carried out at Westminster and St. George's amongst others, while the removal of King's College Hospital to Denmark Hill was completed. During 1925 it was decided to rebuild the Middlesex Hospital. The growing share of women in the hospital work of London was illustrated by the existence of several hospitals entirely managed by them. The activity of the London County Council was notable in the direction of the improved treatment of tuberculosis and other virulent diseases, and in the campaign against infant mortality.

Water, Lighting and Heating.—The water supply of London was largely increased by the completion in June 1925 of the huge reservoir at Littleton with a capacity of 6,750 million gallons and a water surface of 723 acres. The estimated income of the Water Board for 1925–6 from all sources was £4,695,000, and the estimated expenditure £4,809,120, but as a balance was brought forward no precept on the participating authorities was needed. The policy of the board, adopted in 1916, to save coal by chlorinating raw Thames water, some 70,000,000 to 100,000,000 gal. per day, was entirely successful both financially and from the point of view of the public safety. The treated water is allowed to flow by gravity down the Staines aqueduct instead of being pumped into the reservoir. Figures give but little idea of the size of the board's undertaking to the average person, but it may be stated briefly that in the average daily consumption of water (about 36 gal. per head), London would empty $2\frac{1}{2}$ times daily a tank as large as Trafalgar Square (two and a half acres) and as high as the Nelson Column.

An important step in the lighting (and heating) of London

was the appointment under the Electricity (Supply) Act 1919 of electricity commissioners to supervise the supply of electricity under the Ministry of Transport. The electricity district as determined extends well beyond the area known as Greater London, covering 1,858 sq. m.; the current in this area being distributed by 44 local authorities and 44 private companies. That there is plenty of room for both electricity and gas in supplying the metropolis with light and heat is evident from the fact that one of the largest of the gas companies in 1925 reported an increase of 24% in its sales during the preceding 10 years.

By the end of 1922–3 the cost of the fire brigade had risen to nearly £800,000 (including pensions), and the number of calls attended, other than chimney calls, during the same period was 3,845. The curve of value of insured property in London showed a marked increase in the preceding 10 years, the total reaching over £2,000 million.

Education.—The general trend of education in London is naturally in accordance with that of the whole country, but it is interesting to note that its total cost to London during 1922–3 amounted to over £12,000,000, of which, of course, approximately half was refunded by exchequer grants, so that the actual charge on the rates amounted to a fraction over 31d. in the £1. The London County Council is the statutory authority for the administrative county of London, and the education committee of 50 includes 12 co-opted members who must be persons of experience in education and of whom five must be women. In 1925 there were 17 women members altogether on the committee. The council had not in 1925 availed themselves of the power to extend the age for compulsory attendance at school conferred on them by the Education Act of 1921.

Recreation.—The museums, art galleries, etc., requisitioned for use during the War, gradually resumed their normal functions, and a new feature was introduced in the form of guide lecturers to conduct parties round the various sections. New rooms were added to the Tate Gallery, and the British Museum was greatly enlarged by the wing to the north opened in 1914. The London Museum, on the lines of the Musée Carnavalet in Paris, was removed from Kensington Palace to Stafford (now renamed Lancaster) House owing to the generosity of Lord Leverhulme, and a special museum illustrating the development of furniture making was opened in Hoxton in 1914 in the centre of the cabinet-making district of London.

Several new theatres were opened during the early part of the period under review, including the Winter Garden in Drury Lane, the Ambassadors and St. Martin's in Seven Dials and Princes in Shaftesbury avenue. A movement was started to reconstruct the old Sadlers Wells Theatre and open it on the same lines as the "Old Vic." After the War few new theatres were built, but on the other hand there was an enormous increase in the number and size of cinematograph houses, one of which, namely, that at Shepherds Bush, as already mentioned, won the medal for the best street frontage for the year offered by the Royal Institute of British Architects.

The demand for playing pitches for games of all sorts in public recreation and other open spaces increased exceedingly, and amongst other innovations many hard courts for lawn tennis were laid down by the London County Council. Professional football was largely supported also, and the construction of the British Empire Exhibition grounds at Wembley saw the removal of the Final for the Football Assn. Cup to the Stadium. "Saturday" starts in first-class cricket, and increased interest in county cricket generally, led to considerable additions to the accommodation for spectators at both Lord's and the Oval.

The Government of the Metropolis

At the elections to the London County Council in 1919 (postponed during the War) 68 Municipal Reformers, 40 Progressives, one Independent and 15 Labour members were elected. At the 1922 elections the figures were—Municipal Reformers 82, Progressives 25, Labour 17; and in March 1925, Municipal Reformers 83, Labour 35, Progressives six. In contested elections only, the number voting in 1919 was 16·6% and 36·8% in 1922. For the metropolitan borough councils the figures were—27·9% in 1919 and 36·4% in 1922. For the guardians' elections the results were much lower, being only 7·7% in 1919 and 22·8% in 1922. In Dec. 1924 there were no contested elections for the court of common council of the City of London.

The boundaries of all the London Parliamentary boroughs were re-arranged by the Act of 1918, except those of the City of London, the total number of constituencies being 61, each returning one member and the City two.

Finance.—The financial government of London was not modified to any important extent during the 15 years, although some temporary measures had to be adopted during the War. A 1d. rate over the administrative area was estimated to produce £207,555 for 1924–5 on the statutory assessable value of the county which was computed as £49,813,091 on April 6 1924. The average rate for the area was rather over 11s., the highest figure being 23s. in Poplar and the lowest 9s. 9d. in the city of Westminster. The total net debt of London on March 31 1923 was given as £122,988,798, and the total charge for interest and repayment was £7,492,473. One of the principal financial obligations left by the War was the provision of working-class dwellings, and the net debt on these throughout the county area in the year 1922–3 stood at £20,160,004, with a charge of £1,174,788. The total net debt of London has increased by about £18,000,000 since the year 1918.

The history of London during the period under review has really been the story of the interruption of its natural growth in population, extent, wealth and progress and its gradual resumption. In 1915 the City suffered from the first hostile attacks launched against it for nine centuries, and it was remarkable that in spite of persistent attempts from the air the total material damage throughout the whole area amounted to less than one-fifth of that sustained in the Great Fire of 1666, while hardly a building of historical value was injured.

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(P. W. L.)

LONDON, CONFERENCES OF.—Five meetings of Allied statesmen for the purpose of adjusting matters arising out of the peace treaties which concluded the World War were held in London in 1921–2.

Feb. 21–March 14 1921.—The representatives of the principal Allied Powers here carried on alternately two separate sets of negotiations, one with the representatives of the Athens, Con-

stantinople and Angora Govts. on the Near Eastern question (*see* TURKEY), and the other with the German Foreign Minister, Dr. Simons. Both sets of negotiations were failures. A week after the conference dispersed the Greeks launched a new offensive in their war with the Turkish Nationalists; while, a week before the conference dispersed, sanctions were taken against Germany by the Allied military occupation of Düsseldorf, Duisburg and Ruhrort, outside the area occupied under the Versailles Treaty, and by the impounding of German customs receipts and the establishment of a new customs cordon between occupied and unoccupied territory. The cause of these measures was the presentation by Dr. Simons of an unacceptable counter-proposal to the reparation demands which the Allied Governments had put forward at the Paris Conference of the preceding Jan. 24–30 (*see* PARIS, CONFERENCE OF). Germany appealed against the Allied sanctions to the League of Nations, but the League took no action.

April 29–May 5 1921.—Under Article 235 of the Versailles Treaty, Germany was required by April 30 1921 to have made a first instalment of reparation payments in cash and kind to a total value of 20 milliard gold marks (approximately one milliard pounds sterling). As this period approached, it became evident to the reparation commission that Germany would be in default under this head, and on April 29 the Allied statesmen, after a preliminary meeting on the 23rd and 24th at Lympne, met again in London to consider what should be done. New sanctions against Germany were discussed, and an additional class of the French Army was actually mobilised; but meanwhile, on April 27, the reparation commission had declared their estimate of Germany's total liability, and the Allied statesmen turned their attention from the non-execution of Article 235 to the drawing up of a " Schedule of Payments describing the Time and Manner for securing and discharging the entire Obligation of Germany for Reparation under Articles 231, 232 and 233 of the Treaty of Versailles." This document, which seems to have been drawn up by the heads of the Allied Governments, though issued in the name of the reparation commission, was sent to Berlin on May 5, together with an ultimatum. Meanwhile the German Govt. had fallen; but on May 11, one day before the ultimatum was due to expire, a new ministry accepted the Allies' terms with the sanction of the Reichstag.

Dec. 18–22 1921.—A meeting between Mr. Lloyd George and M. Briand (accompanied by M. Loucheur), in consequence of a declaration by the German Govt. that it would be unable to pay the two instalments next due under the schedule imposed by the ultimatum of May 5 1921, followed. The Prime Ministers decided to call a meeting of the Supreme Council of the Allies at Cannes, and drafted, for submission to this meeting, a memorandum on the reparation problem in which they proposed to grant Germany a partial moratorium in exchange for an increase in the stringency of Allied control over German finances. At this meeting the eventual convening of a general European conference on reconstruction was also foreshadowed (*see* CANNES, CONFERENCE OF).

Aug. 7–14 1922.—A meeting which arose out of the failure of Germany to carry out the schedule of reparation payments to which she had pledged herself under duress on May 11 1921. The arrangement made between the German Govt. and the reparation commission during the Cannes Conference (*q.v.*) had only postponed disaster, and since then the finances of Germany had gone from bad to worse. At the London Conference M. Poincaré brought forward, as conditions for granting Germany a moratorium, proposals for " productive guarantees " which he had attempted to carry out next year after the Franco-Belgian military occupation of the Ruhr. When these proposals were referred to an inter-Allied committee of experts, the French found themselves in a minority of one, the other experts declaring that M. Poincaré's proposals would bring in diminishing returns. Counter-proposals of a milder kind were put forward by the British delegation, but as these in turn proved unacceptable to M. Poincaré the conference broke up without reaching a decision (*see* REPARATIONS).

Dec. 9–11 1922.—A meeting to consider the conditions for granting a reparations moratorium to Germany, on which no agreement had been reached at the London Conference of the preceding August. At this meeting M. Poincaré again pressed his plan for " productive guarantees," which he expounded in greater detail than four months before. He made it clear that he would not consent to a moratorium without taking these pledges, which included the military occupation of the Ruhr. At the same time he countered the British plan for remitting a portion of Germany's total liability in return for the remission to France of part of her war-debt to Great Britain, by declaring that even in return for this *quid pro quo* he would only be willing to cancel " C " bonds, which were of merely nominal value. As these French terms were not acceptable to Great Britain the conference was adjourned. (A. J. T.)

LONDON, PORT OF (*see* 16.949).—On March 31 1909 the Port of London Authority became the chief body controlling the Port of London.

Before 1909, no public body had been charged with the duty of maintaining and improving the accommodation in the port. The City Corporation, Trinity House, and the Thames Conservancy had each exercised certain powers of conservancy, and the dock companies had enlarged their docks as and when it seemed profitable to them to do so. The outstanding change made by the Port of London Act of 1908 was that it set up a public body whose principal duty is to investigate the accommodation and facilities in the port and execute such works in the river and docks as are necessary to keep the Port up to a standard befitting the first port of the world. The main features of the Authority's policy have, therefore, been more concerned with the improvement of the Port than with the reorganisation of port methods and practice.

A comprehensive programme of new works was tentatively adopted in 1910. The principal works put in hand at once were:—

(*a*) the construction of a modern dock to the south of the Royal Albert Dock, 64 acres in extent with a length of quay of 12,700 ft., capable of receiving vessels of about 35,000 tons burthen.
(*b*) an extension of the Tilbury Dock.
(*c*) the rebuilding of the north quays of the East India and West India Docks.
(*d*) a river cargo jetty at Tilbury.

The World War delayed the completion of the new dock which was opened by George V. on July 8 1921. By the opening of this dock the total water area of the docks was increased to 704 acres and the length of dock quays to 156,450 feet.

Improvements.—An enormous amount of deepening and dredging of the river channels and docks has been carried out between 1909 and 1925. During 1924–5 alone, 3,897,000 cu. yd. of material were removed from the river, and the quantity of mud removed from the docks was 1,206,000 cubic yards. The result of the deepening operations in the river is that for the greater part of the 25 m. below Tilbury and for the 10 m. above Tilbury, the channel at low water had, in 1925, a minimum depth of 30 ft. with a width of over 1,000 feet. For the remaining 6 m. up to the King George V. Dock, the width of the channel is maintained at 600 ft., with a minimum low water depth of about 27 feet. At high water, these channels are wider, while the depths are from 17 to 21 ft. greater. The new works in hand in 1925 included a new dock in the Surrey Commercial system. Preparations were well advanced for a new dry dock, a new river entrance, and a passenger landing stage at Tilbury. Up to March 31 1925 the sum spent on new works by the Port Authority approximated £11,000,000.

Value of the Port Shipping.—The amount of merchant shipping entering and leaving the port was affected by the War, especially during 1918, when the tonnage was only 14,564,000 tons as compared with 40,080,000 tons in 1913. Since 1918, recovery has rapidly taken place, the figure for 1924 being 45,393,000. The total value of the overseas trade of the port for 1924 was £677,342,000, compared with £582,464,000 at Liverpool and £121,186,000 at Hull. Though the Port of London Authority provides most of the accommodation in the port, there is an im-

portant system of private riverside wharves and warehouses, where small vessels are discharged and warehousing business is carried on in competition with the Authority. Recent developments in the river below Barking Creek favour the establishment of industrial enterprises which expect to benefit by their easy access to Thames port facilities.

There have been several labour disputes in the port during the period 1910-25. A general strike for higher wages took place in the summer of 1911; a more serious strike occurred in 1912, when the question at issue was the employment of non-union labour. During the War, labour was comparatfvely quiescent, threats of trouble being averted by concessions of higher wages to meet the increased cost of living. Another strike took place in 1924, in resistance of a reduction of wages previously agreed upon. The minimum rate of pay in the port in 1925 was 12s per day. The organisation of labour in the port has greatly improved since 1910. The administration of the port by the Authority may, on the whole, be regarded as successful. Dock charges are doubtless higher than they would have been had the dock companies not been dispossessed, but compensation for this is found in the more comprehensive treatment of port problems under the management of a body in which the traders using the port are in a majority. (J. G. B.)

LONDON, UNIVERSITY OF (*see* 27.772).—London University has problems which are directly related to its dual nature and to its immediate history. The first attempt to found a university in London was made by Sir Thomas Gresham in 1548 when seven professorships—divinity, music, physic, astronomy, geometry, law and rhetoric were endowed, but this project never attained full fruition. In 1825 Thomas Campbell, the poet, addressed a public letter to Brougham, as a result of which University College came into being and opened classes in 1828 in arts, law and medicine.

Creation by Charter.—On Nov. 28 1836 the University of London and University College, respectively, received charters. The university was constituted an examining body, while University and King's Colleges were constituted the teaching centres. The university was thus created as an examining body and as such undoubtedly achieved a great reputation for impartiality, thoroughness and high standard, so great being its prestige in medicine and surgery in particular that its degrees were and still are sought after even in preference to those of older universities, especially by students from the Dominions.

Teaching University Established.—The Cowper Commission (1894) submitted a report in 1894, embodied in the University Act of 1898, which forms the present constitution of the university. In accordance with statutes approved by Parliament in 1900, the teaching colleges were federated with the university but were not subject to any financial control. Indeed, the authority of the university is limited to the recognition, or refusal of recognition, as teachers of the university, of teachers in the colleges and to the approval of courses of study. Thus a dual university was established, combining the functions of examination with the functions of teaching in its federated schools.

All affairs appertaining to the teaching institutions of the university fall under the administration of the Academic Council, which reports directly to the Senate. This section of the university has become known as the internal side. All other functions not to do with teaching, which had been performed by the old examining body, fall under the administration of the Council for External Students which also reports directly to the Senate. This section of the work of the university is known as the external side, and the degrees granted to students examined by this body, but not taught necessarily in the schools of the university, are called external degrees. The Senate remains the executive authority to accept, to modify, or to reject as it wills the recommendations coming from these two great statutory councils thus constituted.

The Senate.—The Senate, as the executive and co-ordinating body, comprises three nearly equal sections. One represents the teaching or academic side (16 representatives chosen by the faculties), one represents the external side (16 representatives chosen by the graduates constituting Convocation) and a third section of 21 members consists of representatives chosen by the Crown and other outside electing bodies. The chancellor and chairman of Convocation, who are elected by the whole body of Convocation, complete a Senate of 55 members. The third section named above acts in some sense as a jury between the equal bodies representing the academic and external interests. Practically all the business of the university is conducted by committees. The Senate exercises its important functions by reception of reports from these committees, and has proved in practice a remarkably efficient instrument.

Incorporation of Colleges.—In 1905 University College was incorporated with the university. This was followed in 1908 by the incorporation of King's College. The effect of incorporation is difficult to estimate. Nominally the colleges are under the control of the university; in fact they are very largely independent of that control. No other school has wished to secure incorporation, while King's College has expressed the desire to cancel incorporation if this should be possible.

Royal Commission.—In 1909 a Royal Commission, over which Lord Haldane presided, was appointed with wide terms of reference and after taking evidence published its report in 1913. The following significant remark was made by a commissioner on the first day of taking evidence:—

> My point is this: What is the use of a royal commission or any other body attempting to organise university teaching, and to elevate it and to enhance the value of the degree if the external degree remains, if unrecognised colleges are doing as good work as the recognised ones?

The Commission made recommendations which would result in the complete extinction of external degrees in the more or less near future.

The Commission further recommended the constitution of a Senate of 15 members of whom two only were to be representatives of the teachers with one representative of graduates of Convocation, while the 12 others were to be appointed variously but in such a manner as to ensure bureaucratic control of the university. These drastic proposals met with very little public approval and lapsed during the War. However, a departmental committee was appointed by the Board of Education in 1924, when Lord Haldane was Lord Chancellor in the Ministry of Mr. Ramsay MacDonald, for the purpose of preparing statutes for legislative approval to give effect to the recommendations of the Royal Commission. Vigorous protests have been made against the constitution of the departmental Committee.[1]

Progress and Development.—Notwithstanding the disturbance inseparable from these repeated Commissions, the university under its present constitution has prospered exceedingly. Since 1915, roughly speaking, the internal side has trebled and the external side doubled in the number of students. Inasmuch as the internal side started from zero it has naturally progressed at a greater pace than the external side. Twenty-five colleges have sought and obtained recognition as "Schools of the University." Faithful to its tradition of far-seeing initiative, the university has founded degrees in commerce, which have already proved a most notable success. New chairs have been founded—largely by private munificence—in response to the ever-increasing complexity of modern science and industry. Research in every field of scholarship and science is sedulously encouraged. The university library has been developed and improved.

More recently the university has solved the very difficult problem of its relation with the Imperial College of Science and Technology. This college had long nursed the ambition to form a technological university giving its own degrees. It has now, by the adjustment of certain examinations, accepted wholeheartedly the position of a "School of the University." The

[1] The committee recommend—*inter alia*—the creation of a Council of the University to control finance, and of a Collegiate Council composed of members of the Senate. To give effect to these recommendations, which have been vigorously criticised, legislation will be required. Some financial control is unavoidable if co-ordination is to be secured, and to effect this without discouraging prospective or annoying actual benefactors will not be easy. (Ed. *E. B.*)

great medical schools with their splendid traditions, so much older than the university itself, have accepted the system of the appointment of their professorial teachers by the university.

Very significant is the change that has taken place in the relations between the internal and the external sides. The external side, threatened with extermination, was placed upon its defence, and a perfectly unnecessary feud between external and internal interests became thus accentuated. With the increasing prospect that the commission's report would never be carried into effect hostilities died down and when the Haldane recommendations were revived by the appointment of the departmental committee the two sides of the university joined in a united protest which was submitted to the departmental committee in an identical memorandum prepared by the academic and the external council respectively.

The secret of the increasing confidence of the schools in the university central administration is to be found in the lightness and tactfulness of the control exercised by that administration. The colleges are free institutions, voluntarily submitting to guidance and leadership, but retaining essential independence. Any attempt to substitute for this system an encroachment upon the liberties of these federal institutions would spell disaster.

The university has become the largest university in the British Empire. Indeed, it is an increasingly important link of attachment, for it accepts students from every part of it on terms entirely equal. It still holds out an ever more helpful hand to the poor student unable to obtain a collegiate education. At the same time the number of its collegiate students, multiplied threefold in 10 years, testifies to the confidence which academic bodies repose in it. It continues to attract to its governing body men distinguished in every walk of life. (E. G. L.)

LONDONDERRY, CHARLES STEWART HENRY VANE-TEMPEST-STEWART, 7TH MARQUESS OF (1878–1915), British politician, was born in London May 13 1878. Educated at Eton and Sandhurst, he entered the House of Commons in 1906 as Unionist member for Maidstone. From 1914–9 he served in the World War, being twice mentioned in despatches. Made a privy councillor for Ireland in 1918 and a K.G. in 1919, in 1920–1 he was under-secretary for air, and in June 1921 took office as Minister of Education for Northern Ireland. From this position he resigned Jan. 6 1926 and was succeeded by Viscount Charlemont.

His father, Charles Stewart Vane-Tempest-Stewart, the 6th marquess (1852–1915) (*see* 16.969), was a prominent leader of the opposition to the Home Rule Bill of 1912 and was one of the first to sign the Ulster Covenant, Sept. 28 1912. He died at Wynyard Park, Stockton-on-Tees, Feb. 8 1915.

LONG, WALTER HUME LONG, 1ST VISCOUNT (1854–1924), English politician, born at Bath July 13 1854, was the eldest son of Richard Penruddocke Long, of Rood Ashton, Wilts., and his wife Charlotte, daughter of Fitzwilliam Hume Dick. He was educated at Harrow and Christ Church, Oxford. Being the heir of an old county family with a tradition of Parliamentary service, it was natural that he should contemplate a political career. He entered Parliament in 1880 as Conservative member for North Wilts, and sat in every House of Commons till he was created a peer in May 1921, though he changed his constituency several times. He obtained office early, and showed administrative power and common sense in positions agreeable to a capable country gentleman—Parliamentary Secretary to the Local Government Board 1886–92, President of the Board of Agriculture 1895–1900 and President of the Local Government Board 1900–5. His administration at the Board of Agriculture was marked by the stamping out of hydrophobia through the strict enforcement of a muzzling order for dogs; and the tenacity and resolution which he showed in carrying his policy through, in the face of a violent agitation by many dog owners and dog lovers, raised him greatly in public esteem.

In March 1905 Mr. Long was chosen by Mr. Balfour to succeed Mr. Wyndham, after the latter's breach with Irish Unionism, as Chief Secretary for Ireland. He at once restored Unionist confidence by reducing the under-secretary Sir Anthony (afterwards Lord) MacDonnell, to definite subordination to himself as the responsible minister, and by the firmness with which he proceeded to enforce the law and repress agrarian intimidation. The impression which he produced in Ireland in the few months before Mr. Balfour's resignation was so considerable that he, an Englishman, was returned to Parliament in the general election of 1906 for a Dublin seat. In the years of opposition which followed he proved a vigorous opponent of Mr. Birrell's policy of *laissez-faire* in Ireland and of Mr. Lloyd George's proposals with regard to the land; and a more benevolent critic of the Government Old Age Pension scheme and of Mr. Burns's administration at the Local Government Board. When Mr. Balfour resigned the leadership of the Conservative party in Nov. 1911 he was the candidate of the more conservative branch of the party; but both he and his rival, Mr. Austen Chamberlain, agreed to stand aside in favour of Mr. Bonar Law.

With the other conservative leaders he joined the first Coalition Ministry in 1915, returning to his old post of President of the Local Government Board; and in the second Coalition Ministry (1916) he was Colonial Secretary. He had been hitherto a decided opponent of woman suffrage, but, along with Mr. Asquith and others, he was converted by the services of women during the World War, and in 1917 he introduced in the House of Commons the Franchise Bill, which became law in the following year, and under which women over 30 obtained the vote. When Mr. Lloyd George reconstructed his Ministry in the beginning of 1919 Mr. Long became First Lord of the Admiralty and had the difficult task of supervising the reduction to a peace basis of the gigantic navy which had been built up during the War. For some years his health had been periodically unsatisfactory, and in the spring of 1921 he resigned office. Mr. Bonar Law's break-down in health occurred almost immediately afterwards, and Mr. Long heartily supported the election of his old rival Mr. Austen Chamberlain to the leadership of the Conservative party. A few months later he was raised to the House of Lords, amid general approval, as Viscount Long of Wraxall. He did not hold office in either Mr. Bonar Law's or Mr. Baldwin's Government, and died Sept. 26 1924 at Rood Ashton, Wiltshire. He had married in 1878 Lady Doreen Boyle, daughter of the 9th Earl of Cork. His elder son, Brig.-Gen. Walter Long, C.M.G., D.S.O., fell in action Jan. 27 1917, and Lord Long was therefore succeeded in the peerage by his young grandson. (G. E. B.)

LONG, JOHN DAVIS (1838–1915), American lawyer and politician (*see* 16.974), died at Hingham, Mass., Aug. 28 1915.

LOOS, BATTLE OF, was fought between the British and German Armies, Sept. 25–8 1915. The British offensives in the spring of 1915 at Neuve Chapelle, Aubers and Festubert, and the French offensive against the Lorette ridge, made only small gains, at heavy cost, and by July the Arras front was again stabilised. A stalemate ruled on the Western Front for the rest of the summer.

Plans of French Headquarters.—Despite the non-success of their spring offensive, French Headquarters were not disposed to relinquish all efforts to break through the German lines in France until such time as the British could attack on a great scale. It was desirable to do something in the West to relieve the situation in Russia, which was steadily growing worse. Accordingly, Gen. Joffre laid his plans for a big effort in Champagne to be combined with a Franco-British attack in Artois, the French X. Army attacking the Vimy ridge, the British I. Army between Lens and the La Bassée canal. If both succeeded it was hoped to establish touch between them east of Lens, which was to be "pinched out," not attacked direct, and should this coincide with a real break-through in Champagne there might be a chance of intercepting the Germans in the great salient between Soissons and Arras.

Composition of British Force.—The British share was to be on a far larger scale than in May; for the main attack nine divisions were available, six others were to contribute by creating diversions elsewhere. Careful economy in ammunition and the greatly increased output from the factories at home had allowed the accumulation of a fair supply of shells, and the enemy's own

weapon, gas, was to be employed. It was hoped that by using gas it would be possible to attack on a really wide front, much more extensive than would have been possible if the bombardment by the artillery had been the sole means of preparing for the assault.

To the main attack three corps were allotted: on the right, Sir H. Rawlinson's IV. Corps attacked from Loos to Hulluch; Sir H. Gough's I. Corps, on the left, making for the line Hulluch-Haisnes-Auchy. On both wings defensive flanks were to be formed under cover, of which the central divisions would push on towards the Haute-Deule canal, cross it at Pont à Vendin, and connect up with Foch's troops. The cavalry and the newly formed XI. Corps (Sir R. Haking), which included the Guards, making their début as a division, and the newly arrived 21st and 24th Divs., would support this advance.

Assault on German Front Line.—Four days' bombardment, of an intensity as yet unknown, preceded the assault, which was launched at 6.30 A.M. on Sept. 25. The bombardment was as effective as the limited amount of ammunition allowed, and the Germans' deep dug-outs greatly reduced its results by sheltering the trench garrisons, while unluckily the wind practically failed and the gas therefore proved a great disappointment. This was all the more serious because the artillery had been unable to do as much damage all over the wide front attacked as they had accomplished at Neuve Chapelle on the narrow frontage then attacked. However, over most of the front the wire had been well cut and the attackers carried the German front system and swept on towards their second set of trenches, about a mile in rear. On the extreme right the 47th Div. successfully established a defensive flank connecting their old line with Loos, which was reached and carried by the Scots of the 15th Division. The 15th's left, however, was exposed by the failure of the 1st Div's. right brigade, which found a long stretch of uncut wire covering trenches at Lone Tree, so that the left brigade which got in and penetrated to Hulluch, though after heavy losses, found its right uncovered and could not maintain its advanced position. The 7th Div., on the right of the I. Corps, carried its first objective after heavy fighting but could not pierce the German second system of defences in front of Cité St. Elie. On its left the 9th (Scottish) Div. took the Hohenzollern redoubt and Fosse 8, and a detachment reached the German second system but in insufficient strength to break through. The left division, the 2nd, attacking astride the La Bassée canal failed to take its objective.

Results of the Attack.—The attack had resulted in the capture of a long stretch of the German front line with 20 guns and many prisoners; losses, however, had been heavy, and though at several points the second system had been reached there was no touch between the different parties. These, moreover, had pushed beyond the range of effective artillery support, while neither Gough nor Rawlinson had sufficient reserves in hand to link up the different advanced parties; the XI. Corps was too far back to reach the front in time and the check to the 1st Div. at Lone Tree left the 15th's flank dangerously uncovered. As at Neuve Chapelle, there was an opening but there were delays. The Germans threw in their reserves, drove the advanced troops of the 15th Div. back to Hill 70, just east of Loos, ousted those of the 1st from Hulluch, got in after nightfall between the 7th and the 9th, and retook some quarries west of Cité St. Elie and made the 9th's centre recoil to Fosse 8. But at no point could they regain their old front line and they had to pay heavily for the ground they regained.

Second Attack.—On Sept. 26 an effort was made to break through between Hulluch and Loos, using the two "New Army" divisions of the XI. Corps. But the Germans were pressing so hard at the Hohenzollern redoubt and on Hill 70 that two brigades had to be diverted to those points, and the advance of the main bodies was greatly retarded by the congestion of the roads with transport, and other unforeseen delays. They could not reach their assigned position in time, and before the attack could be started a German counter-attack recaptured Bois Hugo, midway between Hulluch and Loos. This point had been reached by the right of the 1st Div. late on the previous evening, the dislodgment of the Germans at Lone Tree having at last let it get forward but too late to do much consolidation or link up with its left brigade at Hulluch or with the 15th Div. at Hill 70. Early in the morning a brigade of the 21st Div. had taken over Bois Hugo but had barely done so before the counter-attack dislodged it. Moreover, the British guns had been unable to register the German second line defences and the bombardment of them was ineffective. The 24th Div. pushed forward across the Lens-La Bassée road but was enfiladed from Bois Hugo by machine-guns, found the German wire and defences practically intact, and fell back in some disorder. The 21st Div. had already done the same after failing to retake Bois Hugo, and the greater part of Hill 70 passed back into German keeping, the defences being outflanked from the north as well as attacked in front. The I. Corps, too fully occupied in holding its ground, could make no progress.

Unsatisfactory Result.—By the evening of Sept. 28 the chance of a break-through was gone. On Sept. 27 the Guards Div. regained much lost ground on Hill 70 and secured a better line from Bois Hugo to Hulluch, but this merely improved the tactical situation at an awkward point. Elsewhere, German pressure was heavy, especially against the I. Corps. Fosse 8 was lost and efforts to retake the quarries failed, and though for several days a hold was with great difficulty maintained on the Hohenzollern redoubt it, too, was lost on Oct. 3. However, a big German counter-attack on Oct. 8 all the way round from Loos to the Hohenzollern, was decisively repulsed, and five days later the 46th (N. Midland T.F.) Div. covered part of the Hohenzollern, and the 12th (Eastern) Div. considerably improved the position nearer Cité St. Elie. This was the last attack on any large scale; the position in the salient which had been driven into the German lines gradually quieted down and before the end of Oct. had become as thoroughly stabilised as any other part of the fronts.

Long before the fighting on the British front had relapsed into normal "trench warfare" the French had abandoned their Artois offensive. The German front line was cheaply carried (Sept. 25), but though for some hours the German defences on the Vimy ridge were only scantily manned the French failed to reach them in time. Their plan of limiting their objectives strictly meant that what they took they secured but it meant also delays in reaching the more distant objectives. By Sept. 27 reserves had filled the gap and brought the French to a standstill, Vimy remaining in German hands.

Thus, Loos, like Neuve Chapelle and the May offensive, had failed to produce any change in the strategical situation, the tactical gains made had been dearly bought and no really substantial relief had been given to the Russians. Still, the Germans also had lost heavily, and the experience gained in the planning of so large an attack, far the biggest operation as yet attempted by the British Army, had been most valuable. At Loos it had been attempted to apply the lessons and to avoid the errors of Neuve Chapelle. There, chances had been lost through over-deliberation and rigidity, through waiting till others were up level, so that all might go forward together; at Loos, pushing on too deep, regardless of what others were doing, had occasioned overrunning and ultimately losing positions which greater deliberation might have secured. But Loos showed the Germans that the "New Army" divisions were a factor with which they must reckon seriously, that when the whole of the "New Armies" were in the field a great British offensive would be a formidable danger.

See J. Ewing, *The History of the 9th (Scottish) Division, 1914–19* (1921); also *see* WORLD WAR: BIBLIOGRAPHY. (C. T. A.)

LOREBURN, ROBERT THRESHIE REID, 1ST EARL (1846–1923), British lawyer and politician, was born at Corfu April 3 1846, and was educated at Cheltenham and Balliol College, Oxford, where he had a distinguished career, winning the Ireland scholarship in 1868. He was called to the bar in 1871, and in 1880 entered politics as Liberal member for Hereford. In 1882 he became a Q.C. and, having in 1885 lost his seat at Hereford,

was returned in 1886 for Dumfries Burghs, retaining the seat until 1905. In 1894 he was for a few months Solicitor-General and was knighted, and during 1894–5 was Attorney-General. He received the G.C.M.G. in 1899, and from that year until 1906 he was counsel to the University of Oxford. On the formation of Sir Henry Campbell-Bannerman's Govt. in 1905, Sir Robert Reid became Lord Chancellor, and was raised to the peerage as Baron Loreburn. To him, while Chancellor, the passage of the Court of Criminal Appeal Act (1907) was largely due. In 1912 he resigned on grounds of health. Lord Loreburn, who was created an earl in July 1911, published *Capture at Sea* (1913) and *How the War Came* (1919). He died without issue Nov. 30 1923, when the title became extinct.

LORENTZ, HENDRIK ANTOON (1853–), Dutch physicist, was born at Arnheim July 18 1853. In 1878 he was appointed a professor in the University of Leyden, a post which he held until 1923. From 1883 to 1895 he worked upon his electron theory and in 1892 published his *Théorie électromagnétique de Maxwell et son application aux corps mouvants*. This was followed in 1895 by the famous treatise *Versuch einer Theorie der elektrischen und optischen Erscheinungen in bewegten Körpern*. In 1909 appeared his *Theory of Electrons and its Application to the Phenomena of Light and Heat*, which gives the résumé of Lorentz's researches and contains the lectures he delivered in New York in 1906. In 1902 he was awarded, with Pieter Zeeman, the Nobel Prize for physics. Among his other works may be mentioned *Text Book of the Differential and Integral Calculus* (1882; German ed., 1900); *Visible and Invisible Movements* (1901); *Abhandlungen über theoretische Physik* (1907); *The Einstein Theory of Relativity: a Concise Statement* (1920); *Clerk Maxwell's Electromagnetic Theory* (1924). From 1919 his lectures for the university courses were published, under his personal supervision, with the title of *Lessons on Theoretical Physics*, eight volumes of which had appeared in 1925.

LORENZ, ADOLF (1854–), Austrian surgeon, was born at Vidnava, Silesia, April 21 1854, of poor parents. He entered Vienna University and studied surgery under Billroth, Nicoladini and Eduard Albert, afterwards becoming a demonstrator, and then a professor at the university. His best known studies are those relating to club-foot and flat-foot. He published numerous studies on his special subjects, the most important being *Die Lehre vom ererbten Plattfusse* and *Ueber die operative Orthopädie des Klumpfusses*. Lorenz also invented the *deutsches Gipsbett* which proved to be a great advance on Bradford's plaster beds which had previously been in general use.

LORIMER, GEORGE HORACE (1868–), American editor, was born at Louisville, Ky., Oct. 6 1868. His early education was received at the Mosely High School, Chicago, whence he proceeded to Colby (Me.) and Yale universities. After being for a short time in business in Chicago, he turned to journalism, becoming a reporter and correspondent on several newspapers. In 1897 he became literary editor of *The Saturday Evening Post*, and in 1899 was made editor-in-chief. The remarkable success of this periodical can be attributed in no small measure to Mr. Lorimer's keen appreciation of the public taste coupled with his ability to meet it. He adopted the policy of selling *The Saturday Evening Post* at a price (5 cents) much below the cost of manufacture, and thereby securing a circulation that made its pages an extremely attractive advertising medium. He wrote *Letters from a Self-Made Merchant to His Son* (1902), which achieved great popularity; *Old Gorgon Graham* (1904); *The False Gods* (1906); *Jack Spurlock Prodigal* (1908).

LORRAINE, EARLY OPERATIONS IN: *see* FRONTIERS, BATTLES OF THE.

LOS ANGELES, Cal., U.S.A. (*see* 17.12), had, at the end of 1925, a population estimated at over a million and an area of 421·71 sq. miles. The population within the city limits increased from 319,198 in 1910 to 576,673 in 1920. There were 15,579 negroes, 14,230 Japanese, Chinese and Indians and 112,057 foreign-born whites. About 1920 began an influx of population to southern California which surpassed even the movement of earlier years. Because of its geographical position and the embryonic state of most of its industries, Los Angeles had no war-time inflation and consequently escaped the experience of post-War deflation. On the contrary, the influx of population and the discovery, at almost the same time, of rich new oil-fields in the vicinity, caused a "boom" which lasted through the first quarter of 1924, reaching its greatest intensity in 1923. Business generally fell off in 1924, and in the first half of 1925 an actual decrease of population was discernible, but this was more than made up by gains in the last six months of the year.

Communications.—In 1919 only six steamship lines made the port of Los Angeles regularly. In 1925 there were 60 lines handling general cargo, 35 tank lines and 35 lumber lines. The total number of ship arrivals in the year ending June 30 1925 was 5,901. The harbour had, at the end of 1925, 10 m. of wharves (6 m. owned and operated by the city) and more than 50 m. of municipal harbour belt-line railway tracks; the channels and basin in the inner harbour had a depth of 30 ft. at low tide; in the outer harbour, at more than a mile of wharfage, of 35 ft.; the main channel had been doubled in width, to 1,000 feet. The electric railways in 1925 operated over 1,508 m. of track, extending to a radius of 75 m. outside the city. A one-mile subway and a terminal building, constructed 1924–6, greatly improved the service between important residential sections and the business district.

Commerce.—Within a few years after the close of the World War the commerce of the port of Los Angeles rose to more than that of any other ocean port in America except New York. The total tonnage (imports, exports, coastwise and inter-coastal) was 2,380,622 short tons in the year 1918–9, 26,550,464 in 1923–4 and 22,268,421 in 1924–5, with a value respectively of $86,481,470, $643,221,303 and $671,406,570. Exports to foreign countries amounted to about $75,000,000 in 1925; imports from foreign countries, to about $35,000,000. The increase was due partly to the demand for lumber (most of it from British Columbia) and other building materials, and for crude rubber, but chiefly to the great increase in the production of oil. It was at first piped out through the harbour in a crude form. With the development of refineries a larger part of it (by 1924) was shipped in a refined state. Great Britain was the principal market for gasolene (162,615,222 gal. in the year 1924–5); China for kerosene; Chile for fuel oil.

Industries.—Between 1910–9 Los Angeles became an important industrial centre, and after 1919 its manufactures grew fully as fast as its population. Factory products, within the city limits, were valued at $68,586,000 in 1909; $278,184,000 in 1919; $313,589,985 in 1921; $417,654,081 in 1923. The Federal census of manufactures, however, limited to factory products, does not include motion-picture films, which until 1924 were the city's most valuable product, or such commodities as manufactured gas; and it does not include any plants outside the city limits. Tabulations by the Chamber of Commerce, including all manufactured products, give the following figures for the metropolitan area: (1919) $618,772,000; (1921) $800,926,641; (1923) $1,151,643,537; (1924) $1,202,677,004. The leading industries in 1924, with the value of their products, were petroleum products, $221,880,293; motion-picture films, $168,000,000 (estimated to be 75% of all produced in the U.S.); iron and steel machinery, $99,117,430; meat products, $67,987,146; lumber and planing-mill products, $64,327,685. Petroleum products occupied the leading position for the first time in 1924, having increased steadily each year from $83,867,716 in 1919.

Water and Power.—The Los Angeles aqueduct, 250 m. long, bringing water from the Owens river in the Sierras, in amounts to supply a population of 2,000,000, was placed in service in 1913. In the process of extending the city service to the vast new areas which had been annexed, new water mains were installed at the rate of over one mile a day during the year ending Sept. 1 1925, bringing the total in service to 2,654 miles. To provide for anticipated needs in the future, plans were already well advanced for constructing a still longer and larger aqueduct to bring water sufficient for a population of 7,500,000 from the Colorado river. A bond issue of $2,000,000 was authorised June 2 1925, to begin preliminary work and acquire the necessary rights of way. The Bureau of Power and Light (established 1909), owned and operated, by 1925, five hydroelectric power generating plants along the line of the aqueduct, producing a total of 110,000 h.p., which furnished 60% of the total amount of energy distributed by the bureau, the other 40% being purchased wholesale from a private corporation.

Public Buildings and Improvements.—A fine Hall of Justice was completed in Dec. 1925, including a county jail to replace the one constructed in 1902. In 1925 plans had been accepted and a site chosen for a new city hall; a new public library was approaching completion (cost $2,000,000); the first unit of the $12,000,000 project for a county museum was completed; also the Coliseum (seating capacity, 77,000) built by the city and county jointly; and the Patriotic Hall, built by the county as a memorial to the soldiers and sailors of the country's wars. A city-planning commission was set up in 1910. By 1925 the city had a plan covering its entire area, and including zoning provisions, major and minor highway system, park, boulevard and channel parkway system.

Education.—The public-school system included (Nov. 1925) 234 elementary schools, 11 special schools, 14 junior and 23 senior high schools, with 7,495 teachers. The University of Southern California (enrolment 12,097 in 1924–5) established about 1920 an extension division known as the Metropolitan University, which had an enrolment of 4,900 in the autumn of 1925.

Government.—A new charter, adopted in 1924 and operative from July 1 1925, provides for the initiative, the referendum, the recall and an executive budget. The mayor (the chief executive, with wide appointive powers), the city attorney, the controller and the seven members of the Board of Education are elected at large. The 15 members of the council (the legislative body) are elected by districts. The principal functions of government are entrusted to 16 commissions of five members each, appointed by the mayor and serving without salary, which in turn appoint and fix the salary of general managers for their respective departments.

LOSSKI, NIKOLAI ONUFRIEVICH (1870–), Russian philosopher, was born at Kreslavka, Vitebsk province. He was educated at Kreslavka and at the University of St. Petersburg (Leningrad) where he studied first science and then philology. From 1916 to 1921 he was professor of the same university, but in 1922 he was compelled to leave Russia and went to live in Prague. Losski is the representative of intuitionalism in epistemology. According to his views, knowledge is immediate contemplation (intuition). His intuitionalism differs from Bergson's in so far as he considers the ideal-rational forms to be elements of realities, intuitively cognisable. His kind of intuitionalism leads to concrete ideal-realism, his idealism being as concrete as realism. He assumes not only concrete real being, but concrete ideal being as well, *i.e.*, supra-temporal and supra-spatial substantial agents with creative force, which are the basis of spatio-temporal being. Abstract ideas obtain their significance and importance exclusively from the substantial agents, who create the real according to constitutive abstract ideas (*e.g.*, mathematical principles) and normative abstract ideas (*e.g.*, moral ideas, etc.). The doctrine of the creative force and superqualitativeness of substantial agents leads Losski to his teaching of the freedom of the will.

Among Losski's most important books are *Die Grundlehre der Psychologie vom Standpunkte des Voluntarismus*, published in Russian (1903), in German (1905); *The Intuitive Bases of Knowledge* (1904; Eng. trans., 1919); and *Handbuch der Logik* (1922), in German (1926). The titles of his untranslated Russian works may be given in English as follows: *Introduction to Philosophy; The World as an Organic Whole; Principles of Epistemology; Matter and Life; Freedom of Will.*

LOUCHEUR, LOUIS (1872–), French politician, was born at Roubaix Aug. 12 1872. After studying at the École Polytechnique he embarked upon a highly successful career as an engineer and contractor. Both in France and abroad he gradually developed an extensive business, and the advent of the World War with its necessities gave fresh prosperity to those industries concerned with the manufacture of arms and munitions. When in Dec. 1916 M. Briand decided to give certain offices to non-political men of high technical ability, he called upon M. Loucheur to be an under-secretary of state. In the Cabinet formed by M. Clemenceau in 1917, which lasted until Jan. 1920, he was Minister of Munitions. After entering Parliament in Nov. 1919 as deputy for the Nord Department, he became Minister for the Liberated Regions in the Briand Cabinet, Jan. 1921. In that capacity he negotiated with the German Minister of Reconstruction, Herr Walter Rathenau, the Wiesbaden Convention for facilitating payment in kind of part of the Reparations. During the two years which ensued, M. Loucheur distinguished himself by upholding before the Chamber, with great argumentative ingenuity, various schemes for remedying the financial situation. On Nov. 28 1925 M. Briand appointed him Minister of Finance in his new Cabinet. But he found every group in Parliament violently hostile to the seven proposals which he submitted for alleviating the financial crisis. The Finance Commission of the Chamber twice rejected five of these proposals and he therefore resigned Dec. 15, having held his portfolio exactly 17 days.

LOUIS III., ex-King of Bavaria (1845–1921), was born Jan. 7 1845 and assumed the regency in succession to his father (*see* 3.550) on Dec. 12 1912. In accordance with the bill passed by the Bavarian diet he assumed the crown on Nov. 5 1913.[1] After the proclamation of the republic on Nov. 7 1918, the King, with the Queen and his daughters, left Munich. The royal family resided first at Berchtesgaden, and afterwards at a castle assigned to them on the shores of Chiem See. On Nov. 13 he formally signed his abdication, and relieved all Bavarian officials, officers and soldiers from their oath of allegiance. He died at Sarvar, Hungary, Oct. 17 1921.

LOUISIANA (*see* 17.53).—The population of the state as estimated in 1926 was 1,918,591, compared with a census enumeration of 1,798,509 in 1920 and of 1,656,388 in 1910. During 1910–20 the negro population decreased from 713,874 to 700,257, or from 43·1 to 38·9% of the total. The population of New Orleans, the principal city, was estimated on July 1 1924 at 409,534 compared with a census enumeration of 387,219 in 1920 and of 339,075 in 1910.

Agriculture.—The most important industry of the state has always been agriculture. The total value of all farm crops in 1920 as reported by the Bureau of the Census was $231,506,000. The total number of farms in 1920 was 135,463, representing a gain of 14,917 during the decade, but a slight decrease occurred in the following four years, there being 132,451 in 1925. Corn, cotton, sugar-cane, rice and hay, in the order named, constituted the most important field crops. The boll weevil temporarily caused a sharp decline in the production of cotton, but with better methods of combatting this pest and the stimulus of high prices the yield increased from 279,000 bales in 1921 to 501,523 bales in 1924. Another effect of the boll weevil has been the trend toward more diversified farming, with a consequent increase in the yield of maize (Indian corn) which reached the maximum of 35,022,000 bu. in 1921. The yield in bushels in subsequent years was as follows: 1922, 29,002,000; 1923, 24,702,000; 1924, 18,998,000. This decline was a result of low prices in this period as compared with the price of cotton, which made the latter the more profitable crop. The livestock industry also gained in importance as a result of this diversification, although the state in 1924 still ranked only thirty-fourth in the value of livestock on the farms. Louisiana leads all other states in the production of rice, the yield over a period of years averaging nearly half the total raised in the United States. The crop of 1924 amounted to 17,078,000 bu., with a value of $23,226,000. Practically all the cane sugar produced in the United States comes from Louisiana. The trucking industry has acquired considerable importance in the vicinity of New Orleans, and the raising of strawberries has proved profitable on the cut-over pine lands of Livingston and Tangipahoa parishes. Citrus fruits are grown in considerable quantity along the Mississippi river below New Orleans.

Manufacturing.—The value of manufactured products, at factory prices, in 1923 was $624,682,620, a gain of 30·4% as compared with 1921. The average number of wage-earners employed in factories during 1923 was 94,597, a gain of 11·1% over 1921. The production of lumber and timber products is the leading manufacturing industry of the state, both in respect to value of products and number of persons employed. The total value of lumber and timber produced in 1923 was $132,682,000, an increase of 44·3% over 1921. Petroleum refining came second in 1923 in value of products, with a total output valued at $102,405,962, representing a gain of 8·6% over 1921. Sugar refining came third, with products in 1923 valued at $88,151,711 and showing a gain of 66% over 1921, when the sugar industry was suffering from severe depression. In spite of the increase in tariff duties on sugar in 1922 the Louisiana sugar industry is at a disadvantage in competing with tropical countries that are free from the hazard of frost and also enjoy the advantage of cheaper labour. The number of sugar factories in the state decreased from 124 in 1921 to 82 in 1924. In 1924 many of these establishments shifted from the manufacture of raw sugar to the production of syrup, the output of which amounted to 9,920,000 gal., compared with 6,718,000 gal. in 1923.

[1] King Otto, who had been kept in confinement as a lunatic, died on Oct. 11 1916.

Minerals.—Until 1924 Louisiana led all other states in the production of sulphur, but late in that year production in Calcasieu parish was suspended because of the exhaustion of the deposit. This came after 25 years of production with a total yield of about 10,000,000 tons of sulphur. It was this deposit which made the United States the chief sulphur-producing country in the world, and the Louisiana product virtually displaced Sicilian sulphur, which at one time held first place in the world's markets. In 1923 Louisiana ranked third in the production of rock salt and fifth in that of all salt. The output in that year was 359,000 tons, compared with 265,000 tons in 1920. The rock-salt deposits lie in the extreme southern portion of the state, and yield a product of unusual purity. Most of the petroleum produced in the state comes from the parishes of Caddo, Red River, De Soto and Claiborne. The state's output in 1924 was 21,124,000 barrels. The record output of 35,714,000 bbl. was attained in 1920 after the opening of the great Homer pool in Claiborne parish. Some of the wells in this district for a time yielded as much as 30,000 bbl. daily, but after 1920 production steadily declined.

Education.—The constitution of 1921 vests control of the public elementary and high schools and all other state educational institutions except the state university in a Board of Education of eleven members. School attendance is compulsory for 140 days in each school year by all children between the ages of 7 and 14 years. This law, however, has not been strictly enforced because of the lack of school facilities, and in 1923 only 76·8% of the white children of school age, and 58·2% of the negro children were enrolled. Substantial improvement in school facilities, however, occurred after 1919. In that year total school expenditures were $9,702,000; by 1923 they had increased to $25,430,000. The average salary for white male teachers in 1923 was $1,353, compared with $1,011 in 1919; for white female teachers $1,009 in 1923, compared with $598 in 1919. Between 1919 and 1923 salaries of negro male teachers increased from $298 to $525, and of female negro teachers from $217 to $408.

History.—Although the state is normally democratic, there was a temporary defection from the Democratic party after 1913 in that section of the state where the production of cane sugar is the chief industry. This was due to the unpopularity of the Tariff Act of 1913, enacted by a democratic congress and materially reducing the duties on sugar. By 1920 the breach in the party was healed. The state ratified the Eighteenth (Prohibition) Federal Amendment Aug. 3 1918. The industrial canal at New Orleans was opened to navigation Feb. 6 1923. This canal connects the Mississippi river with Lake Pontchartrain and gives shipping more direct access to the sea than is possible by following the winding course of the river for 90 m. to its mouth. The canal is 5½ m. long and was 5 years in building. The governors after 1908 were: Jared Y. Sanders (Dem.) 1908–12; Luther E. Hall (Dem.) 1912–6; Ruffin G. Pleasant (Dem.) 1916–20; John M. Parker (Dem.) 1920–4; Henry M. Fuqua (Dem.) 1924–.

(W. O. S.)

LOUISVILLE, Ky., U.S.A. (*see* 17.63), lost one of its principal industries through the elimination of its distilleries by the Eighteenth (Prohibition) Amendment to the Federal Constitution. Its tobacco market was affected by the development of co-operative marketing and loose-leaf marketing of tobacco in Kentucky. In compensation many new industries were added to the already long list. The total output of the plants within the city was valued at $101,284,000 in 1909; $204,566,000 in 1919; $240,537,718 in 1923. In 1922 annexations of territory (11,000 ac.) increased the area to 36 sq. m., but important plants were still outside the corporate limits. The leading industries in the Louisville district in 1925 were tobacco (value in 1923, $25,678,000), car works, sanitary plumbing fixtures, petroleum refining, slaughtering and meat-packing. The population in 1920 was 234,891 (91·4 males to 100 females), of whom 40,087 were negroes (a slight decrease since 1910) and 11,667 foreign-born (a decrease of 34%). A special census in Dec. 1925, under the supervision of of the U.S. Census Bureau, showed a population of 305,935.

Bank clearings increased from $667,947,515 in 1914 to $1,611,927,608 in 1924. Investment in building in the six years following the World War amounted to over $100,000,000, of which more than half was for 10,000 dwellings. Many of the characteristic low structures were replaced by apartment houses, hotels and tall business buildings. By 1925 sewer construction costing $4,600,000 was completed, and additional work of an equal amount was under way; the municipally-owned water company was beginning a four-year programme of expansion, to cost $4,498,000; construction of the war memorial auditorium was awaiting the outcome of litigation over the site; a new municipal highway bridge to Jeffersonville, Ind., was planned; work was begun on the elimination of grade crossings, and also on a hydroelectric plant (initial capacity 108,000 H.P.) at the Falls of the Ohio. Canalisation of the Ohio river from Pittsburgh to Louisville was completed in 1925, and completion of the project to Cairo is expected by 1929.

In 1910 the public schools were placed under the control of a non-partisan Board of Education. The University of Louisville (enrolment, 1925, 1,200) moved its school of arts and sciences to a new 55-ac. campus in Sept. 1925, and $1,000,000 was voted by the city in November for new buildings. Additions to the university include the Speed Scientific School (opened 1925); the Louisville College of Dentistry (formerly affiliated to Centre College); an Art Museum (under construction); and an extension centre for negroes (to be opened 1926). The Southern Baptist Theological Seminary also moved (Jan. 1926) to a new campus of 51 ac. and a fine plant built at a cost of $2,000,000.

LOURENÇO MARQUES, Delagoa Bay (*see* 17.65), has a population (1925) estimated at 22,000, including 8,000 Europeans. There is safe entrance to the harbour and the minimum depth of water in the Cockburn Channel is 25 feet. The port offers ample accommodation and facilities to shipping, including coaling and cold storage plant. Many of the leading merchants are British and most of the traffic of the port is transit trade with the Transvaal, whence it obtains its coal for export and bunkering.

Competition between the port and Durban for the Rand trade led to a convention (known as the Mozambique convention) being made with the Transvaal in 1909. Among other things it provided that 50 to 55% of the railway traffic in the "competitive area" of the Transvaal should pass through Delagoa Bay; the percentage going through the bay in 1914 was 48·79 and never exceeded that figure until 1922, when it was 52·86. The Union Govt. then denounced the convention, which lapsed on March 31 1923. The provisions it contained for the recruitment in Portuguese territory of native labour for the Transvaal mines and forbidding differential duties on merchandise passing between Lourenço Marques and the Transvaal were, however, preserved by a *modus vivendi*. Negotiations for a new convention had not, up to the middle of 1926, resulted in an agreement.

The value of goods in transit through Lourenço Marques was £4,547,000 in 1912; £2,334,000 in 1915; £5,176,000 in 1919 and £4,806,000 in 1923, in which year re-exports were valued at £1,244,000, as against £411,000 in 1912. Exports of local produce were valued at £162,000 in 1913 and at £789,000 in 1923. The number of vessels entering the port in 1924 was 644, the tonnage being 3,060,000 gross. In the latter part of 1925 the depreciation of the Portuguese currency and the abolition of the use of sterling currency caused serious difficulties to importers and led to strikes and disturbances which continued into 1926 when the position began to improve.

See the *Delagoa Directory, 1925* (Lourenço Marques and London) and the *South and East African Year Book* (London, annually).

LOUVAIN, Belgium (*see* 17.67), with a population of 40,693 in 1923, suffered very severely during the World War, and was given the Croix de Guerre in 1925. In Aug. 1914, after the German entry, about one-third of the town was burnt, including the whole of the Rue de la Station and the Place du Peuple, the Vieux Marché, the Palais de Justice, the Théâtre, and the famous Halles Universitaires, with its splendid library; the interior and roofs of the collegiate Church of St. Peter were seriously damaged, and the chimes destroyed. The elaborate Gothic Hôtel de Ville, damaged in 1890 and in process of restoration in 1914, was

used as headquarters by the Germans, and was not further harmed; the restoration has since been completed.

Restoration Works.—Rebuilding, studiously on the old models, was started soon after the War, and early in 1925 few signs of the ruin done were outwardly visible, though much remained to be finished. The Place de la Station, where a number of civilians were killed and buried, has been renamed Place des Martyrs, and the rebuilt Rue de la Station is now called Avenue des Alliés. A striking War memorial has been erected. The university was reopened in 1919, with a larger number of students than before the War. The foundation stone of the new university library was laid in 1921, and the first wing opened in 1923. The building, in the Flemish style, is being paid for by American citizens, and books and fittings have been contributed by many nations. About 500,000 books had been collected when the new wing was opened, nearly 50,000 coming from the John Rylands Library, Manchester. The church of St. Peter was undergoing restoration in 1926.

LOW, SETH (1850–1916), American administrator and educationalist (*see* 17.72), died at Bedford Hills, N.Y., Sept. 17 1916.

LOWELL, ABBOTT LAWRENCE (1856–), American educationalist (*see* 17.73), built for Harvard at his own expense a president's house, which was finished in 1912. From the time that he became president (1909) he took great interest in the social life of the students (*see* HARVARD UNIVERSITY). President Lowell was a strong supporter of free speech among the members of the faculty. After the outbreak of the World War in 1914 he refused to accept the resignation of Prof. Münsterberg, who had defended the German cause. In 1915 Prof. Kuno Meyer, of the University of Berlin, sent a letter of protest because of the publication in one of the college magazines of a satirical poem, *Gott mit Uns*, by an undergraduate. In his reply President Lowell pointed out that freedom of speech was an important characteristic of American universities as distinguished from those in Germany. He was chairman of the executive committee of the League to Enforce Peace, and later was a strong supporter of the League of Nations. Lowell was the author of *Public Opinion and Popular Government* (1913), based on lectures at Johns Hopkins University; *The Governments of France, Italy and Germany* (1914), abridged from his earlier *Government and Parties in Continental Europe;* and *Greater European Governments* (1918), abridged from earlier works.

His brother, PERCIVAL LOWELL (1855–1916), American astronomer (*see* 17.73), died at Flagstaff, Ariz., Nov. 12 1916. In 1910 he lectured in London before the Royal Institute, and in Paris before the Association Astronomique.

LOWELL, AMY (1874–1925), American poet, critic and lecturer, was born Feb. 9 1874 in Brookline, Mass., being a sister of Abbott L. and Percival Lowell She came of a line of public-spirited lawyers and men of affairs, who for three generations had been, like herself, lovers and planters of gardens. She received her education from her mother, who was an accomplished musician and linguist, and from private schools; and she later travelled abroad extensively, visiting Greece, Constantinople and Egypt. After her father's death in 1900 she occupied herself with municipal affairs, until "about 1902," she writes, "I discovered that poetry . . . was my natural mode of expression. And from that moment I began to devote myself to it seriously." But she published nothing for nine years, when, in 1910, her first published poem appeared in *The Atlantic Monthly*. Her first volume, *A Dome of Many-Coloured Glass*, is dated 1912. Thereafter her books followed each other in rapid succession: *Sword Blades and Poppy Seeds* (1914); *Six French Poets: Studies in Contemporary Literature* (1915); *Men, Women and Ghosts* (1916); *Tendencies in Modern American Poetry* (1917); *Can Grande's Castle* (1918); *Pictures of the Floating World* (1919); *Legends* (1921); *Fir-Flower Tablets*, with Florence Ayscough (1921); *A Critical Fable* (1922); *John Keats* (1925); *What's O'clock* (1925); *East Wind* (1926). During all this period Miss Lowell contributed critical articles to various magazines, and lectured extensively. In 1920 she received the degree of Litt.D. from Baylor University. She had suffered from a serious malady for years, and on the eve of a visit to England, during which she was to have lectured at Oxford, Cambridge, Eton, Edinburgh and elsewhere, it became acute, and she died suddenly, May 12 1925, at Brookline, Mass.

Miss Lowell, during her later years, was the most striking figure in contemporary American poetry. Her vivid and powerful personality, her intellectual vigour and independence, and her zest in life gave her a conspicuous and in some respects a unique position. She was an acknowledged leader of the group in America and England which called itself the Imagists. But through all her radicalism ran a strong conservative strain, and she never abandoned conventional verse forms, nor for some years before her death had she been affiliated with any school. Among her contributions to poetry must be reckoned the perfecting, in her best work, of the technique of "free" verse; her almost unrivalled command of the vocabulary of sensuous impressions; the wide range of the themes to which she has given poetical expression, and the clarity and restrained beauty of many of her shorter poems. Her most important critical work, the result of long and devoted labour, is the biography of Keats, which essays to reinterpret him as "a new generation of poets and critics" regards him. (J. L. L.*)

LOWELL, Mass., U.S.A. (*see* 17.76), had in 1920 a population of 112,759, an increase of 6·1% in 10 years. The foreign-born population numbered 38,116 (including 10,180 French Canadians), a decrease of 12·5%. In 1925 the state census showed a decrease of the total population to 110,542. The factory output had a value of $59,688,000 in 1909; $137,802,000 in 1919; $80,645,704 in 1921; $100,998,057 in 1923. Lowell was affected by the long strike of the textile workers in 1922. The commission form of government was adopted in 1911, but in 1920 the charter was again amended, providing for a mayor elected at large and a city council composed of one member from each of the nine wards and six elected at large. On Dec. 9 1925, 10 officials, including the mayor and a former mayor, were arraigned on charge of corruption. A beautiful memorial auditorium was erected (1921) in honour of the men and women of the city who took part in the wars of the country. Lowell has the usual characteristics of a mill town—a preponderance of women in the population (92·8 males to 100 females, 1920), a high proportion of women and children at work (38·7% of all females 10 years of age and over, 8·8% of the children 10–15), a high infant mortality (107 deaths under one year per 1,000 births, 1923) and a low percentage of home ownership (26·1% in 1920), due to mobility of labour.

See George F. Kenngott, *The Record of a City; a Social Survey of Lowell, Massachusetts* (1912).

LOYSON, CHARLES (1827–1912), better known as Père Hyacinthe, a famous French preacher, was born at Orléans. He was educated for the priesthood and entered the Carmélite order. His eloquence drew large crowds to his Advent sermons in Notre-Dame between 1865 and 1869, but his orthodoxy fell under suspicion, and in 1870 he associated himself with Döllinger's protest against the dogma of papal infallibility (*see* 14.512, 20.67). Being excommunicated he broke finally with the Church of Rome, and removed first to Geneva and then to London. He married an English lady, Emily Jane Merriman, and settled in Paris in 1877, where he founded an Old Catholic Church. He died in Paris Feb. 9 1912.

LUCAS, EDWARD VERRALL (1865–), British man of letters, was born at Brighton and educated at University College, London. He then started journalism, working first on a Sussex newspaper, then in London with *The Globe*, and became a frequent contributor to *Punch* and later its assistant editor. He acted for many years as publisher's reader to the firm of Methuen, and became head of this company after the death of its founder (1925). Lucas wrote a very large number of miscellaneous books, but is best known as a light essayist in the vein of Elia, and published many collections of these essays. His edition of the *Letters of Charles and Mary Lamb* (1903–5) and his *Life of Lamb* (1905) likewise showed how congenial was his talent with that of Elia. He was successful also as a writer of travel impressions,

among these being *A Wanderer in Holland* (1905), *A Wanderer in London* (1906) and *A Wanderer in Paris* (1909), and his books on art showed powers of wide appreciation, as in *The British School* (1913), *Vermeer of Delft* (1922), *John Constable* (1924). Light fiction, children's books, humorous skits and many anthologies have also issued from his singularly fluent pen.

LUCAS, JOHN SEYMOUR (1849–1923), British painter (*see* 17.93), died in hospital at Southwold, Suffolk, after an accident, on May 8 1923.

ŁUCK, or LUTSK, BATTLES OF.—Under this heading are described the Russian attacks on their southwestern front—which extended from the Pinsk marshes to the northern frontier of Rumania—during the summer and autumn of 1916. These attacks are generally known as "Brusilov's offensive." The original break-through of the Austrian front occurred near the town of Łuck (Lutsk), in Volhynia, on the river Styr, which thus gives its name to the whole series of operations (*see* EASTERN EUROPEAN FRONT: MAP).

General Situation in May 1916.—After the costly failure of their attacks in March (*see* LAKE NAROCH, BATTLES OF), the Russian supreme command had set to work to prepare a large scale offensive on the front west of Mołodeczno, as their contribution to the great general Allied offensive which was to open on all fronts on July 1. Elaborate preparations were made during April and May for this Mołodeczno attack, in which 26 divisions were to carry out the initial assault. The Russian line was at this time divided into three fronts: the Northern, from the Gulf of Riga to south of Dvinsk, containing 38 divisions; the Western, down to and inclusive of the Pinsk marshes, containing 58 divisions; and the Southwestern, down to the Rumanian frontier, containing 38 divisions. The Pinsk marshes also formed the dividing line between the German and Austrian sectors of the Eastern front. In the German sector there were approximately 42 German and two Austrian divisions; in the Austrian sector there were 38 Austrian and three German divisions. Since the great offensive of the Central Powers against Russia had come to an end in the autumn of 1915, their forces on the Eastern Front had been considerably reduced. The Germans had taken troops for their Verdun offensive, and the Austrians during the spring had withdrawn formations for an offensive against Italy. The Russians, on the other hand, had recovered rapidly from their disasters of the previous year; the ranks were full and munitions more plentiful than before.

Preparation of Brusilov's Offensive.—Gen. Brusilov succeeded Ivanov as Commander-in-Chief of the south-western front in March. He was a cavalry soldier and had commanded the VIII. Army since the commencement of the War with conspicuous success. He received instructions to prepare attacks on the south-western front to distract the enemy's attention from the main Russian effort at Mołodeczno. The four armies under Brusilov were: the VIII. (Kaledin) from the Kowel-Kiev railway near Rafałowka to about Kremenets, 11 divisions and four cavalry divisions; the XI. (Sakharov) from Kremenets to near Tarnupol, eight divisions and one cavalry division; the VII. (Shcherbachev) from near Tarnupol to Potok, seven divisions and $3\frac{1}{2}$ cavalry divisions; and the IX. (Lechitski) from Potok to the Rumanian frontier, 10 divisions and three cavalry divisions. There was one corps (two divisions) in reserve.

The Austrian IV. Army (Archduke Joseph Ferdinand), from near Rafałowka to Dubno, with $10\frac{1}{2}$ divisions and one cavalry division, and the II. Army (Böhn-Ermolli, from Dubno to near Kremenets, with eight infantry and two cavalry divisions, were opposed to Kaledin; the German Southern Army (von Bothmer) with one German and nine Austrian divisions and two cavalry divisions, held a long front, corresponding approximately with those held by the Russian XI. and VII. Armies; while the Austrian VII. Army (Pflanzer-Baltin), with $8\frac{1}{2}$ divisions and four cavalry divisions, opposed Lechitski. In the actual number of divisions there was little disparity between the total forces at the disposal of either side; the Russians had 38 divisions and 12 cavalry divisions to the Austro-German 37 divisions and nine cavalry divisions; but the Russian divisions were larger. The Austrian front had been strongly fortified and organised, and in spite of the removal of some of their most reliable divisions and much heavy artillery to the Italian front the Austrians were confident of being able to hold their ground.

About the middle of April, Brusilov had ordered each of his army commanders to select a sector of attack and to make preparations with the resources at his disposal within his own army to penetrate the enemy's front in that sector. Preparations were to be complete before the middle of May. These attacks were designed simply as aids to the main Russian offensive in the north, timed for July 1. On May 14, however, the Austrians began an offensive in the Trentino against Italy. The Italians appealed to the Russians to relieve the pressure by attacking the Austrians on their front. Brusilov accordingly launched his attacks on all four army fronts on June 4, without any expectation of a decisive break-through or arrangements for exploitation of success on a large scale.

The Break-through at Łuck.—The sector of attack chosen by Kaledin, commander of the VIII. Army, centred on the village of Olika, east of Łuck. The bombardment began on June 4 and the assault was made by the XL. and VIII. Corps early on June 5. The XL. Corps carried three lines of enemy trenches and penetrated over two miles, and the VIII. Corps, though less successful, made considerable progress. The advance continued on June 6 and on June 7 reached Łuck. By this time a wide gap had been made between the Austrian IV. Army and the II. Army further south, and a great opportunity for the numerous Russian cavalry seemed to have come. But of the four cavalry divisions allotted to Kaledin's army, two had been used to hold trenches so as to enable infantry to be concentrated for the assault and one was dispatched by Brusilov in a fruitless raid along the railway towards Kowel through marshes entirely unsuited for cavalry action. The one remaining division could accomplish little. Meanwhile the left wing of the VIII. Army occupied Dubno on June 9; on June 10 the front of the army lay along the line of the rivers Styr and Ikwa, from Rozyszcze through Łuck to Dubno.

Attacks of the XI., VII. and IX. Armies.—The attack of the XI. Army northwest of Tarnupol was a failure. Shcherbachev's VII. Army attacked in a sector on its extreme left near the village of Jaziowec. After two-days' bombardment the infantry assaulted early on June 6 and carried the enemy positions; next day the Austrians were driven behind the Strypa. The Russians crossed the river on the 8th and gained further ground during the next two days. Counter-attacks then arrested their advance for the time being. Lechitski's IX. Army attacked some 20 m. north of Czernowitz, near the village of Okna, with complete success. By June 10 the front was broken and the Austrians retreated in disorder behind the Prut. Czernowitz was captured on June 17.

Consequences of Brusilov's Success.—Thus by the middle of June the Austro-German front south of the Pinsk marshes was completely broken on both flanks, and two armies, the IV. and VII., were in full retreat. In the centre Böhm-Ermolli's and von Bothmer's armies still held, though their outer flanks had been driven in. On three-quarters of the whole Russian southwestern front their armies were moving forward. These entirely unexpected results of an offensive undertaken purely as a demonstration reacted instantly on the whole strategy both of the Russians and of the Central Powers. On the Russian side, the new situation demanded the immediate transfer of the principal reserves from the north, where they had been grouped for the Mołodeczno offensive, if Brusilov's success in the south were to be exploited. The decision was taken promptly enough, the Mołodeczno offensive was abandoned, Lesh's III. Army astride the Pripet was added to Brusilov's command and troops were hurried south as rapidly as the capacity of the railways would permit. Unfortunately for the Russians, the poverty and low efficiency of their communications gave the enemy time to concentrate sufficient reinforcements to restore their front before the full weight of the Russian reserves could give a fresh impetus to the advance.

For the Germans, the sudden reverse came at a difficult time,

for they were fully engaged at Verdun and were expecting a Franco-British offensive at an early date; obviously, too, events might have a decisive influence on the attitude of Rumania. Reinforcements were at once collected to restore the situation; to close the principal gap, it was decided to stage a counter-attack on a large scale on both sides of the Kowel-Rowne railway. This attack was entrusted to von Linsingen, the German commander of the Austro-German Army holding the area of the Pinsk marshes opposite the Russian III. Army. He was reinforced by three German divisions from the northern part of the Eastern Front, four from France and two Austrian divisions from the Trentino. During the whole of the latter half of June, as these reinforcements arrived, he counter-attacked persistently towards Łuck and to the north and south of it. These attacks, though they brought the Austro-German forces little gain of ground, had at least the effect of limiting Kaledin's break-through. On July 4, the left of Lesh's III. Army, in conjunction with Kaledin's right, launched an attack in the bend of the Styr east of Kowel and drove von Linsingen's army back to the Stochód river. This put an end to the Austro-German counter-attacks, and there were no further important operations on this part of the front till the end of July.

Occupation of Bukoviva.—Meantime, Lechitski in the south was completing the conquest of the Bukovina. After the capture of Czernowitz, part of the Austrian VII. Army retreated precipitately south to the Carpathians, pursued by the left wing of Lechitski's army, which occupied Kimpolung on June 24. His right wing, advancing between the Dniester and the Prut, won a victory on June 28 and occupied Kolomyja on the following day. At the beginning of July the Austrians in the south received reinforcements and made a series of counter-attacks opposite Kimpolung and Delatyn. These were defeated, and Lechitski's right wing occupied Delatyn on July 10. His army was now, however, enormously extended and had to halt to await reinforcements.

Reorganisation of Command by the Central Powers.—The German command, which had since the beginning of June sent 16 divisions to the front south of the Pinsk marshes, naturally claimed an increased influence on the direction of operations on this front. Very shortly after the first break-through at Łuck they had insisted on the removal from his command of the IV. Army of the Archduke Joseph Ferdinand and on the extension of von Linsingen's sphere of command southwards to the northern frontier of Galicia. The greater portion of Pflanzer-Baltin's VII. Army had also been transferred to von Bothmer commanding the German Southern Army. It was now proposed to appoint Hindenburg to the supreme command of the Eastern Front as far south as Lemberg; the remainder of the front, on both sides of the Dniester and in the Carpathians, was to be under the Austrian heir apparent, Archduke Charles Francis Joseph, with the German General von Seeckt as his chief of staff.

This arrangement was eventually brought into force early in August. The Archduke Charles had originally come from the Italian front at the beginning of July to command a XII. Army, which was to be formed from troops on the spot and fresh reinforcements, and was to deliver a counter attack on a large scale on both sides of the Dniester in a southeasterly direction. But as the incoming reinforcements had always to be thrown into the battle so soon as they arrived, the formation of the XII. Army and the proposed counter-offensive never took place. Instead, the III. Army command from Tirol took over the troops between the Carpathians and the Dniester. The Archduke's command thus comprised the VII., III. and Southern armies.

Battle of Brody.—During the latter half of July, while the VIII. and IX. armies on the flanks paused to await reinforcements, Brusilov ordered Sakharov's XI. Army, which had extended its front northwards to beyond Dubno, to take the offensive. It attacked near Boromel, southwest of Łuck, on July 16 and drove the enemy back across the Lipa. Sakharov then moved south on Brody, which he captured with 40,000 prisoners on July 28—a fine victory. Meanwhile Shcherbachev's VII. Army, in spite of repeated attacks northwest of Buczacz towards Monasterzyska, had failed to make much impression on von Bothmer's Southern Army. Lechitski, however, at the end of July gained some ground towards Stanislau.

Attack on Kowel.—Towards the end of July the Russian Guard Army (I. and II. Guard Corps, I. Corps, XXX. Corps, Guard Cav. Corps) detrained from the north and took up a front between the III. and VIII. armies. The Guard had not been in action since the previous Sept. and had been carefully trained and kept in hand for a great occasion. It was now decided to use it to force the line of the Stochód river and capture Kowel. It is difficult to understand why this line of advance was chosen for a supreme effort. The terrain is mainly marsh and advance is usually possible only on narrow causeways. The attacks, which commenced on July 28 and were continued up to Aug. 10 resulted in a complete and costly failure. The Guard Army lost 55,000 men for a trifling gain of unimportant ground. Brusilov thereafter abandoned the direct advance on Kowel; but continued up till the middle of Oct. attempts to enlarge the Łuck salient in the direction of Włodzimierz Wolynski. All these attempts ended in failure.

Conclusion of the Offensive.—In the south, Lechitski attacked again south of the Dniester on Aug. 7 and drove back Kövess' III. Army. He occupied Stanislau on Aug. 10 and Nadwórna on Aug. 12. On this latter date the VII. Army occupied Monasterzyska. Under the threat from this flank and pressure from Sakharov's army south of Brody, von Bothmer now at last gave up the original line which he had held throughout all the turmoil, and withdrew towards Brzezany.

Austro-German counter-attacks in the Carpathians in the first half of Aug. had little success. On Aug. 20 the Russians reorganised their front so as to allow Lechitski's IX. Army to have as its only task the forcing of the Carpathian passes between Delatyn and Kimpolung, in order to protect the right flank of the Rumanians, who joined the Allies on Aug. 27. In spite of severe fighting throughout Sept. little progress was made on this front. Nor was any appreciable advance made elsewhere on the southwestern front in spite of repeated assaults. In Oct. the defeat of the Rumanians necessitated the transfer of troops to that theatre and the abandonment of further offensive operations. The summer which had opened so brilliantly ended in disappointment and failure.

Results of the Offensive.—Although Brusilov had recaptured practically the whole of the Bukovina and large portions of Eastern Galicia and Volhynia and had taken some 350,000 prisoners and over 400 guns, the cost had been exceedingly heavy. The casualties on the southwestern front were over a million. These losses and those suffered in the abortive attacks on the Northern and Western fronts in 1916, at Lake Naroch, Baranowicze and Riga, were in the end the principal cause of the rapid infection of the army with anti-war propaganda when the revolution came. In fact the revolution itself was partly due to disappointment at the outcome of the 1916 campaign, from which so much had been hoped. The campaign showed the striking contrast in fighting qualities between Austrian, German and Russian troops. In spite of their lack of artillery and technical equipment, Brusilov's armies broke through the strongly fortified Austrian lines and would have completely destroyed the Austrian armies but for the presence of German troops, against whom their assaults invariably broke down.

It is difficult to trace any strategical conception underlying the Russian operations; the time and place for the various attacks seem to have been chosen on purely local considerations. This was largely due to the unexpected nature of the success and to the poor communications, which prevented the timely transfer of reserves from one portion of the front to another. Hailed by her Allies as proof of the complete regeneration of the Russian Army, Brusilov's offensive was really its death-knell.

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LUCY, SIR HENRY (1845–1924), British journalist, was born at Crosby, near Liverpool, Dec. 5 1845. Educated in Liverpool, he began life in a Liverpool merchant's office, but soon became a reporter for a Shrewsbury periodical. In 1870 he joined the staff of *The Pall Mall Gazette*, London, and in 1873 became parliamentary reporter to *The Daily News*, with which paper he had a long connection in various capacities. In 1881 he also joined the staff of *Punch* and won a great reputation as the contributor of its parliamentary sketch signed "Toby M.P." He was knighted in 1909 and retired from parliamentary work in 1916. He published his autobiography, *Sixty Years in the Wilderness*, in 1909, and *The Diary of a Journalist* in 1920. He died Feb. 20 1924.

LUDENDORFF, ERICH (1865–), German soldier, was born at Kruszevnia, in the province of Posen, April 9 1865. When 18 years old, he entered the Prussian Army. In 1894 he joined the General Staff, and, except for an interval of two years as company commander, remained on it from 1894 to 1913, under Count Schlieffen and the younger General von Moltke. As chief of the *Aufmarschabteilung*[1] since 1908 he played a prominent part in the mobilisation preparations. The last great increase in the strength of the army in 1913 was largely due to his initiative and energy. During the year preceding the outbreak of the World War he commanded first the 39th Fusilier Regiment at Düsseldorf, and afterwards an infantry brigade at Strasbourg.

At the outbreak of the World War Ludendorff was quartermaster general of the II. Army. His voluntary assumption in the beginning of Aug. of a decisive rôle at the capture of the fortress of Liége gave him his first great opportunity. He took over the command of the 14th brigade of infantry, in the place of General von Wussow who was killed, and, breaking through the ring of fortifications at its head, seized the interior of the town. He was rewarded on Aug. 22 by being made chief of staff to Hindenburg in the VIII. Army which was fighting in East Prussia.

Campaigns in East Prussia.—The battle of Tannenberg revealed his powers of generalship, for he there demonstrated the justice of the theory of annihilation. The victory of Tannenberg over the Russian Army of the Narew was more than another Cannae. For in this case there was not, as in former days on the Aufidus, merely one enemy to be dealt with. On the contrary, the attempt was made to envelop the greatly superior main body of Russians in the presence of a second enemy force threatening the rear. And the attempt proved successful. In the subsequent operations which led to the first battle on the Masurian Lakes and to the heavy defeat of the Russian Army of the Niemen, the enemy's right wing was supported on the lake, and so only an envelopment of the southern wing was possible. The operations, therefore, took the form of an attack on the enemy's front and on his exposed flank.

The strategic success lay in the liberation of East Prussia from the enemy. The German Army of the East became available for the immediate support of the Austro-Hungarian ally, by this time in dire straits. This support was rendered in the brilliant Oct. campaign of the newly-formed IX. German Army directed through Southern Poland upon the Vistula. Its purpose—to facilitate the Austrian efforts in Galicia by drawing off upon the IX. Army the strongest possible body of Russian troops—was attained in a degree entailing grave danger to the outnumbered Germans themselves. The menace of envelopment by a vastly superior enemy, pouring up from the direction of Warsaw, was parried and beaten off by Ludendorff by means of an exceedingly gallant defensive action, carried out during withdrawal. In Nov., after a rapid regrouping of the main German forces, an advance was made from the Wreschen-Thorn line against the right flank of the main body of the Russians, lying in West Poland. In the absence of sufficient strength a simultaneous frontal attack was impossible. But even so, the success achieved in the battle of Łódź was great. The Russians were definitely relegated to the defensive—and, in the pursuit which followed, were flung back behind the Bzura and the Rawka.

During the fighting in Masuria in Feb. 1915 Ludendorff achieved the destruction of another Russian Army in the region of the Upper Bobr. This was followed by a period of relative inactivity on the German Eastern Front lasting for several months. Not before the middle of July 1915 did the army group of Hindenburg resume the war of movement. By an attack directed upon and beyond the Lower Narew it relieved, by means of a converging offensive, the army group of Mackensen which had advanced from Galicia into Southern Poland between the Vistula and the Bug. In the ensuing operations the Russian Army was driven out of the Vistula positions and out of the whole of Poland towards the East. After a brief resistance the fortresses of Warsaw, Nowogeorgiewsk (Modlin) and Kovno fell. But no decisive issue was reached, because General von Falkenhayn, Chief of the German General Staff, rejected the proposal of Hindenburg and Ludendorff, which was to advance with the German left wing in a northerly direction through Kovno and Vilna upon Minsk, thereby cutting the Russian railway communications, north of the Polesia. Had the operations been conducted in accordance with the views of Hindenburg and Ludendorff, the Russian Army might have been dealt a mortal blow in the summer of 1915. Later, in Sept., the attempt was made on the German left wing, but with inadequate forces, to embarrass the retreat of the section of the Russian Army withdrawing northwards from Polesia past Vilna; but the moment for success on a grand scale had gone.

After the victorious conclusion of the Balkan campaign in the winter of 1915–6 Ludendorff contemplated a great offensive into the heart of the Ukraine, with the object of breaking the back of the economic resistance of Greater Russia, which was already cut off from the sea. The offensive necessitated the occupation of Rumania; but General von Falkenhayn rejected this scheme, and chose Verdun instead of Kiev as the objective for operations. Accordingly in the year 1916 the Eastern Front of the allied Central Powers was assigned the duty of protecting the rear of the offensive movement in France. This task was amply fulfilled on the northern wing but on the southern wing, held by the Austrians, the front completely collapsed in June and July at Łuck and in Galicia. The balance in the East was restored with difficulty by the intervention of the German command.

On Aug. 29 Field-Marshal von Hindenburg assumed the office of Chief of the General Staff of the armies in the field, in the place of Falkenhayn, and Ludendorff became First Quartermaster General. In contrast with their predecessor's point of view, the two men still promised themselves triumph, but a triumph which could only result from a more vigorous conduct of the War by drawing upon the whole available strength of the country in wealth and population. The methods adopted for the utilisation of these resources were expressed in the so-called "Hindenburg programme" of war industries and in the so-called law of auxiliary services; and here Ludendorff could only co-operate by means of suggestions and demands. In his own sphere too, he found that, owing to the almost desperate military situation inherited from his predecessor, he was not at first able to put into practice Schlieffen's doctrine of annihilation. The result of the offensive against Rumania was that this new enemy was overthrown in the winter of 1916. This victory was of inestimable value to the Central Powers, for new sources of economic power were thereby opened up.

Submarine Warfare.—After the defeat of the Rumanian Army there remained but one further task. This was the frustration of the attacks of the enemy in the West, greatly superior in numbers and material. The restoration of the balance of strength thus aimed at was to enable the Central Powers later to deliver an offensive with decisive effect. A favourable diversion of this kind, however, could only be counted upon, if, during the strategical defence on land, England could be reduced to desperate straits. An intensified U-boat warfare in the blockade area round England was therefore adopted, a weapon, recourse to which

[1] The department which draws up plans for transport, disposition of troops and advance.

had hitherto always been postponed on the score of political considerations. The disadvantage of this course was that it would give the United States a pretext for war on the side of the Entente; but regarding this as inevitable, Ludendorff hoped to render England disposed for peace before the Americans should be in a position to throw considerable forces into Europe.

Unrestricted U-boat warfare did not altogether fulfil expectations. The technical perfection of the enemy's defensive weapons and the ample scale upon which they had been completed contributed to this in a very material degree. On the other hand, without the adoption of unrestricted U-boat warfare the strategy of the Central Powers would have been altogether unable to hold the balance on land in suspense until, after Russia's collapse in the spring of 1918, there dawned a well-founded prospect of forcing a decision in France before the American forces on land became effective.

In the spring of 1917 in the Western theatre of war Ludendorff was enabled, by a timely withdrawal to the Siegfried position and by the elasticity of his defensive tactics, to impose a check upon the Allied attack carried out with a gigantic expenditure of men and material. Subsequently he had another opportunity of vindicating his theory of annihilation in the warfare on land. Under the blows dealt by the German hammer at Tarnopol, Riga, Dagö and Ösel, Russia fell. The reckoning with Italy followed in the autumn of 1917, but the situation in the West, particularly in Flanders where the fighting raged with undiminished fury, rendered it impossible for Ludendorff to secure a decisive victory.

The Offensive of 1918.—The German resolution to take the offensive in the spring of 1918 was rendered imperative by the general position. The psychological condition of the army peremptorily demanded that the rôle of anvil should be exchanged for that of hammer. Conditions at home called for a potent remedy against the threefold poison instilled by the hunger blockade, enemy propaganda and revolutionary agitation. Germany's hard pressed allies had for long rested their sole hopes of delivery on the efforts of Germany. Ludendorff saw only one road by which a tolerable peace, in harmony with the honour of the German people, could be reached, the road of military victory. This again could be attained solely by means of an offensive which should be decisive, and in taking this course he hazarded everything. A series of small attacks with limited objectives or a powerfully conducted defence would in favourable circumstances only have secured a temporary advantage, but could not prevent the enemy from finally giving full effect to his superior strength in a battle of annihilation. It is questionable whether the choice of direction for the offensive on French territory can be defended. Many critics would have preferred an offensive in Italy, but apart from the natural difficulties, even the destruction of the Italian Army could at best only have preceded the main decisive operations on French soil.

It has been questioned whether Ludendorff assembled adequate forces for the spring offensive of 1918. In March, at the beginning of this offensive, the Germans disposed of 193 divisions and three brigades in the Franco-Belgian theatre of war. The estimates of the forces commanded by the Entente in France and Belgium at the beginning of the spring offensive vary between 167 and 180 divisions. The Germans, therefore, enjoyed a slight superiority in the number of divisions. The original intention that a section of the Austro-Hungarian forces should take part in the decisive encounter in France was finally thwarted by the opposition of the Habsburg Emperor. Ludendorff accordingly chose the expedient of indirect assistance to be rendered by a relieving offensive carried out by the Austro-Hungarian Army in Upper Italy. This offensive, however, was undertaken much too late for the objective in view, in the middle of June, and, moreover, ended with a severe reverse. The occupation of Rumania called imperatively for four divisions and a greater number of Landsturm formations. The invasion of the Ukraine, carried out in Feb. and March, demanded about 20 weak divisions, including eight divisions of Landwehr and three of cavalry. It is disputable whether it would have been wiser to abandon the enterprise in the Ukraine. The secretary of state of the *Kriegsernährungsamt* urged with the utmost emphasis that the economic resources of the Ukraine should be thrown open to Germany. Failing this, the Austrians' system of food supplies would collapse. The delivery of meat was important for Germany, too, and the delivery of horses was, above all, a matter of the greatest urgency.

On political and military grounds Ludendorff had resolved to deal the first decisive blow in the West against the English. For this purpose he chose the southern flank, on both sides of St. Quentin, as tactically the least defensible, with the intention of forcing his way through at this point and by advancing north of the Somme towards the northwest, to roll up the whole front gradually and press the English towards the sea. The southern wing of the German offensive was to guard his flank against a relieving attack on the part of the French. This strategy became subject to certain changes in consequence of the unexpected magnitude of the initial success of the German southern wing, which continued the offensive across the Somme and the Crozat canal against the French, in order to effect a cleavage between the English and French at and beyond Amiens. This end was not completely attained, and the result of the first offensive, though great from the tactical standpoint was strategically nugatory. A second attack on the Lys front, against the English and Portuguese, was made in the middle of April and was designed to gain possession of the commanding heights north of Bailleul and to cut off the Ypres salient; its result, however, was indecisive.

During the following months, in spite of successive brilliant diversive attacks carried out against the French front, no further headway was made in forcing a decisive engagement in Flanders; and the heavy toll of the spring offensives could not be made good rapidly enough. And yet, prior to the last great attempt to break through on both sides of Reims in July 1918, there still remained a prospect of final victory for the German arms. The goal had nearly been reached—which was a proof that the strategy adopted might have succeeded and was, therefore, the right strategy. But the fortune of war was against Ludendorff. His plans were revealed by treachery to the enemy, at a time when everything depended on secrecy and surprise. The great successes hitherto achieved had led to a wide extension of the German front, calling for the employment of disproportionately large forces and offering in its many angles and salients dangerous surfaces to the enemy's attacks. These factors now made their disastrous influence felt.

But the final cause of Ludendorff's inability to resume the initiative lay in the absence of a free command of reserves, due to the drying up of the sources of supply at home. When the German command fell back on the defensive before hostile attacks, Ludendorff realised that there was nothing to be done except to hold out until diplomacy succeeded in securing a tolerable peace, or to perish with honour. On Oct. 26, however, he was overthrown by the Cabinet of Prince Max of Baden. The collapse of Germany's allies, combined with difficulties at home, rendered hopeless any further resistance by the army in the field now thrown upon its own resources.

General Ludendorff was above all a man of action, and one who rated formation of character and the attributes of leadership more highly than the acquisition of comprehensive learning. His resolution, his almost super-human and invincible powers of work and action, his understanding of the moral factors in warfare, inspired the German Army with boundless confidence in his leadership and qualified it for mighty exploits. If like Hannibal and Lee he failed in the final issue, it was through no fault in generalship, but was partly due to slowness in realising that his weapon had grown blunt and that the population at home was no longer capable of the effort of endurance and the indispensable will to victory. His powers of leadership reflected his character; brain, heart and will were all unsparingly enlisted in the service of one aim, the honour of his country. Along this path he was impelled to travel, whether it led to victory or defeat.

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LUGARD, SIR FREDERICK JOHN DEALTRY (1858–), British administrator (*see* 17.115), was, on the completion of his term of office as Governor of Hongkong, appointed in March 1912 Governor of both Northern and Southern Nigeria, with instructions to amalgamate the two administrations. The amalgamation became effective on Jan. 1 1914, Sir Frederick being given the personal title of governor-general. He guided the affairs of Nigeria throughout the World War, retiring in 1919, and was made a Privy Councillor in 1920. In 1922 he published *The Dual Mandate*, a book dealing with the duties of European Powers in tropical Africa. In Nov. of that year he became a member of the permanent mandates commission of the League of Nations (*see* MANDATES, NIGERIA).

LUKEMAN, HENRY AUGUSTUS (1871–), American sculptor, was born at Richmond, Va., Jan. 28 1871. He studied at the National Academy of Design, N.Y. City, and was a pupil of Launt Thompson and Daniel Chester French, perfecting his knowledge of anatomy by his year's study at Bellevue Hospital. In 1894 he spent a year in Paris studying under Falquière at the École des Beaux-Arts, and on his return to the United States settled in New York City. His work includes portraits, busts, statues, memorials and bas-reliefs, among the best known being "Mann, the Law Giver of India" for the Appellate Court building, New York City; the statue of President McKinley at Adams, Mass.; "Genoa," the figure of Columbus on the U.S. Customs House, New York City (1905); The Soldiers' Monument at Somerville, Mass. (1908); the group "Women of the Confederacy," at Raleigh, N.C. (1912); the Soldiers' Memorial, Red Hook Park, Brooklyn, N.Y. (1920); the equestrian statue of "Francis Asbury," Washington, D.C. (1921). He was appointed in 1925 to succeed Gutzon Borglum as sculptor in charge of the Stone Mountain memorial near Atlanta, Georgia. (*See* ATLANTA.)

LUNACHARSKY, ANATOLY VASILIEVICH (1873–), Russian politician, author and dramatist, was born in the province of Kiev of well-to-do parents. He joined the revolutionary movement when still at college in Kiev, and afterwards studied natural science and economics at the University of Zurich. He began his revolutionary activities in Russia in 1895 and was deported to Vologda in 1897, where he remained for three years, achieving a reputation as a brilliant writer and lecturer on Socialism. In 1903 Lunacharsky joined the Bolshevik or "majority" wing of the Social-Democratic party. He met Lenin in the following year, and also joined the editorial staff of the Bolshevik paper *Vpered* (Forward). While doing literary work of a general nature he was chiefly concerned with social democratic propaganda and with lectures and political meetings for Russian students and political refugees abroad. During the revolution of 1905 Lunacharsky was imprisoned for his political activities, and when the subsequent political reaction set in he left Russia and went to live in Italy. Together with Gorky and Bogdanov, a well-known Social Democrat, he formed the so-called "left-wing" of Bolshevism (opposed to Lenin on certain theoretical points), and was one of the promoters of the Social Democratic party schools at Capri and Bologna.

From the outbreak of the World War Lunacharsky maintained a determined internationalist attitude and disseminated violent anti-War propaganda in Paris and Switzerland, renewing closer contact with the Lenin group after a temporary estrangement. At the same time he made a careful study of educational problems in Switzerland, and this was to prove extremely useful to him later in his career. The revolution of March 1917 brought him back to Russia, and he immediately joined Lenin and Trotsky in their revolutionary opposition to the Provisional Government. He was arrested after the Bolshevik rising in July; but was subsequently liberated and elected vice-president of the Petrograd municipal board. In the initial stages of the Oct. revolution and during the civil war, Lunacharsky proved himself one of the ablest political speakers of the new Soviet State, and was an energetic and successful emissary of the Military Revolutionary Council to the various war fronts. As people's Commissar for Public Instruction in the new Soviet Govt., Lunacharsky rendered inestimable services by ensuring the preservation of works of culture and art during the civil war. He devoted himself to the promotion of mass instruction, and of culture and art in Soviet Russia, while his especial concern for the welfare of the theatre did much to further the development of the Russian stage.

A man of exceptional culture, steeped in philosophical and scientific studies, Lunacharsky also won his spurs in the field of literature. He wrote 14 plays (published in 2 vol.), of which several were produced with conspicuous success in Russia and in Berlin. "Vasilisa the Wise," "Faust and the City" and "The Magi" were translated into English by Leonard Magnus and published under the title of *Three Plays* (1923). He also wrote books on politics, economics, philosophy, literature and art.

LUNACY: *see* INSANITY.

LUND, TROELS FREDERIK (1840–1921), Danish historian (*see* 17.123), published in 1909 *Nye Tanker i det XVI. Aarhundreds*. In 1911–2 appeared his historical tales, *Tider og Tanker*. He died in 1921. See Knud Fabricius, *Troels Lund* (1921).

LUNG: *see* HEART AND LUNG SURGERY.

LUPU, NICHOLAS (1876–), Rumanian politician, was born at Arsura (Rumania) on Nov. 8 1876. He started his career as a country doctor and entered politics in 1905. He played an important part during the peasant revolt in 1907 when, as prefect of the Falciu district, he succeeded in pacifying the peasants without having recourse to violent measures. In 1913 he was elected deputy and in 1919 he entered the Vaida-Voevod Coalition Cabinet as minister of the interior, representing, together with Mihalache, the Peasant (Tsaranist) party, of which Dr. Lupu became one of the principal leaders. During the World War, Dr. Lupu visited Russia, France, England, Italy and the United States and carried on an active propaganda campaign on behalf of Rumania.

LUSCHAN, FELIX VON (1854–1924), Austrian anthropologist and ethnographer, was born on Aug. 11 1854 in Vienna. He studied medicine in Vienna, anthropology in Paris, became demonstrator in physiology at the university at Vienna, and in 1878 organised the Austro-Hungarian section for anthropology and ethnology at the World Exhibition in Paris. Whilst a military doctor in Bosnia, he studied anthropology and archaeology, and in 1880 travelled in Dalmatia, Montenegro and Albania. During the following 10 years he was often in Asia Minor and Egypt, and in 1883 excavated the ruins of Sendschirli in Northern Syria on behalf of the Berlin Oriental Committee. After a brief period as lecturer in anthropology in Vienna, he became directorial assistant at the Ethnological Museum in Berlin, of which he was director from 1904 until his death, on Feb. 7 1924. His works include: *Beiträge zur Völkerkunde der deutschen Schutzgebiete* (1897); *Die Ausgrabungen von Sendschirli*, 2 pts. (1893, 1898); *Beiträge zur Ethnographie von Neu-Guinea* (1899); *Beiträge zur Anthropologie von Kreta; Rassen und Völker* (1908); *Völker, Rassen und Sprachen* (1922); *Anthropological View of Race;* Papers on Inter-racial Problems communicated to the First Universal Race Congress (London, 1911); "The Early Inhabitants of Western Asia," *Jour. Roy. Anth. Inst. of Great Britain and Ireland* (1911).

LUTHER, HANS (1879–), German statesman, was born in Berlin March 10 1879, and studied law in Berlin, Kiel and Geneva. After ending his studies he entered the local administration service. At first he was stationed in Charlottenburg, and from 1907–13, in the Magistrat in Magdeburg under the former minister of finance, Lenze. In 1913 he was elected secretary to the German and Prussian "Städtetag," and thus was able during the World War to prove his high administrative abilities. On July 5 1918 he was elected burgomaster of Essen in the Ruhr district. In this responsible position he gained the reputation of being one of the best local administrative officials in the West of

Germany. On Dec. 2 1922 he entered the Cuno Cabinet, and became Minister of Food and Agriculture. He retained his post in Essen and, when the French marched into the Ruhr in Jan. 1923, he returned to Essen immediately. The episode is well-known of how the general commanding the troops marching into Essen wished to speak with the burgomaster at the door of the Rathaus (town hall). Dr. Luther sent a message that he was only to be seen in his office. The order was repeated twice, but at last the General was obliged to give way. This manly attitude of Dr. Luther earned him high esteem in the turbulent, warlike atmosphere in the Ruhr at that time.

After Cuno ceased to be Chancellor, Luther retained his office in the Stresemann Cabinet. In Stresemann's second Cabinet, he became Minister of Finance. As Finance Minister of the Reich, he was able to perform most signal services in stabilising the German currency (which had fallen into an abyss) and in restoring balance to the budget of the Reich. Dr. Luther kept his office in the Marx Ministry which followed, and had a share in the preparations for the Conference of London and the conclusion of the Dawes Agreement. In the autumn of 1924 he concluded the Dawes loan for Germany. He has himself given an account of his work in restoring the finances of Germany (see *Feste Mark—solide Wirtschaft, 1924*). After the elections in Dec. 1924, Marx, in spite of many endeavours, was not able to form a new cabinet, and Luther took over the task in the middle of Jan. 1925. A Cabinet was formed under him, which was the first since the revolution of 1918 to include members of the German National party. Luther carried through a great taxation reform, completed the revaluation legislation and made a provisional customs tariff which made it possible to commence negotiations for commercial agreements with some prospect of success for German economic life. This economic legislation was accompanied by the Locarno policy initiated by Stresemann with the essential agreement of Luther, who, as Chancellor, was responsible for the conduct of policy as a whole.

At the Conference of Locarno, the German delegation which initialled the clauses of the treaty, was led by Luther as Chancellor. After his return from Locarno, the German National party left the Government. In spite of this, the Cabinet found a majority for the policy of Locarno, and on Dec. 1 1925 signed the Rhine Pact and the Arbitration Treaties in London, after which it resigned. After tedious Government crises, Luther again received the mandate to form a Cabinet. As the Social Democrats forsook the Chancellor, there was nothing left but to form a Cabinet out of the moderate bourgeois parties. Dr. Luther was not a party politician, and often proclaimed his freedom from the parties in a pronounced fashion. While in charge of the affairs of the Reich he distinguished himself by extraordinary energy and sober clarity of political judgment, and the German people indubitably made important progress towards reconstruction under his leadership. On May 13 he resigned his office as chancellor. (*See* GERMANY.) (F. KLE.)

LUTHERANS (*see* 17.140).—The Lutheran churches of Europe were profoundly influenced by the War of 1914–8 and its after-effects. The external changes were least marked in Sweden, Denmark and Norway, where the relation between the churches and their states has remained undisturbed; in Germany and the new national states they have been far-reaching.

I. IN THE OLD WORLD

German Lutherans.—The German revolution of 1918 put an end to the *Summepiskopat* (*see* 17.142) and the reorganisation of the German Empire aimed at the separation of Church and State. Since an immediate complete separation would be disastrous to the churches and not to the best interest of the state, the churches were guaranteed diminishing state support, with the ultimate purpose of divorcing them entirely from the state governments. By this arrangement the churches have, in part, the character of voluntary associations and, in part, that of state controlled institutions. To meet this new situation they have been obliged to reorganise. The forms of reorganisation have not been identical in all the states, but two tendencies have been generally observable—one, to increase the powers of the synods at the expense of the consistories (*see* 17.142), the other, to vest the spiritual oversight of the church in a single official, known as bishop, chief pastor, or some other equivalent title.

Two problems have presented especial difficulties. The one is the problem of aim and purpose. Is the Church to continue, under new forms of administration, to be the one recognised institution of religion for that state (*Volkskirche*), or is it to be an institution for the promulgation of a single doctrinal type of Christianty (*Bekenntniskirche*)? The second problem concerns the relation of the Church to the state schools. No fully satisfactory solution of either problem has been reached as yet, though the idea of the *Volkskirche* seems, for the present, to have the stronger following, and the general trend is toward a separation of the Church from the schools.

The acute economic depression of 1922–4 affected most disastrously those elements of the laity from which the greatest measure of church support was to be expected, and it subjected the clergy to severe privations. All the activities of the churches were impaired, and the great voluntary associations for Christian work—the societies for foreign and inner missions—were practically paralysed. Substantial financial support was furnished during this crisis by Lutherans of foreign countries, especially of America, and with the beginning of economic recovery the normal church activities were, by 1926, gradually being resumed.

Central European Countries.—The formation of the new national states of Poland, Latvia, Estonia, Czechoslovakia, Yugoslavia and Hungary has been followed by a new organisation of the Lutheran churches in those countries. The same tendencies that were operative in Germany have shown themselves in these lands. The churches have tended to organise with a large measure of self-support and self-government. Where entire independence of the state has not been feasible it has been apparent as the ultimate aim. An episcopal form of spiritual oversight has also been introduced into most of these churches. All of them have had to contend with economic difficulties similar to those in Germany.

Russia and Rumania.—In 1924 the Lutherans of Russia were permitted, for the first time in their history, to organise as a Russian Church with a synod and two bishops. In Rumania, on the other hand, the disestablishment of the Transylvanian Lutheran Church has caused severe, if temporary, hardships.

Organisation.—The membership statistics for the Lutheran churches of Europe are, as a rule, quite unreliable. This is especially true of those countries where the churches have been in organic connection with the state, and where all those who did not formally withdraw were counted as members of the state church.

On questions of doctrine the same divergences (*see* 17.142) continue to exist. The more conservative element has been organised since 1868 in the General Lutheran Conference (*Allgemeine evangelisch-lutherische Konferenz*), an international society for the maintenance of confessional Lutheran teaching. In 1922 the conference united with the American National Lutheran Council in the calling of the First Lutheran World Convention, held at Eisenach, Germany, in Aug. 1923. The members of the convention came from 20 different countries, including the United States and Canada, and effected a new international organisation, with an executive committee of six members, charged especially to secure co-operation among the Lutherans of the world in works of mercy, foreign missions and care for migratory Lutherans, and "in cases of emergency to speak for the whole Lutheran Church." The Lutheran Alliance is a society of ultra-conservative Lutherans, the members of which are drawn chiefly from the free churches of Germany.

II. IN THE NEW WORLD

United States and Canada.—In 1924 the Lutheran Church in the United States and Canada had 2,622,554 communicant members divided among 20 ecclesiastical bodies. The largest of these were the United Lutheran Church (856,180), the Missouri Synod (645,969), the Norwegian Lutheran Church (299,213), the Augustana Synod (217,616), the Iowa Synod (168,266), the Joint

Synod of Ohio (161,021), the Joint Wisconsin Synod (139,226), the Lutheran Free Church (30,320), the Danish Church in America (20,645) and the Finnish National Church (20,000). The Synodical Conference, a consultative federation, comprising the Missouri Synod, the Joint Wisconsin Synod and two smaller bodies, formed a single well-defined group with a membership of more than 800,000. The names of many of these bodies point to one of the reasons for their separate existence. At their organisation nearly all of them were expressions of the church consciousness of groups of immigrants from the Lutheran countries of Europe, and they continue to perpetuate, to a greater or smaller degree, the religious tradition of the countries of their origin. With the slackening of north European immigration toward the end of the 19th century the nationalistic traits tended to become less marked, and the process of Americanisation was greatly hastened by the World War. Since 1914 the foreign languages are rapidly being replaced in the services by English and the separated bodies have been drawing closer together.

Organisation.—In 1918 the United Lutheran Church was formed by the union of the General Synod, the General Council and the United Synod in the South. These three bodies represented a single line of American tradition reaching back to colonial days. Most of their synods owed their foundation, directly or indirectly, to the work of Henry Melchior Mühlenberg, the great colonial missionary (d. 1787). They had had doctrinal differences, but these were regarded as too small to keep them longer apart. The Augustana Synod, a body of Lutherans of Swedish origin, did not enter the union, though it had been a part of the General Council. In 1917 three bodies of Norwegian Lutherans united to form the Norwegian Lutheran Church in America. Since 1921 discussions have been in progress looking towards the union of other separated bodies. The National Lutheran Commission for Soldiers' and Sailors' Welfare was organised in 1917 to minister to the spiritual welfare of the 400,000 Lutheran men in the army and navy of the United States. Its membership included all the larger bodies except the Missouri and Wisconsin Synods. It was dissolved in 1921. The National Lutheran Council was organised in 1918 by the same bodies that had previously organised the commission. Its purpose was to provide an agency for certain kinds of co-operative work. Its most important task has been to extend aid to the Lutheran churches of Europe during their period of reconstruction. Between 1918 and 1925 it distributed among the Lutherans of 20 different countries more than $6,500,000 in money and goods.

Doctrines.—Doctrinally, the Lutherans of America are pronounced conservatives. All of them subscribe to the Augsburg Confession and the Small Catechism, and most of them accept the whole body of the 16th century Lutheran confessions. Their doctrinal differences have been, at times, acute, but have usually concerned the theological interpretation of the confessions. Their form of government is theoretically congregational, but the whole tendency in the larger bodies is towards a rather highly centralised synodical administration. The most conservative type of American Lutheranism is represented by the Synodical Conference. Its theological standards are those of 17th-century orthodoxy; it strongly opposes any recognition of or co-operation with other churches, and it is vigorously hostile to the membership of its pastors and people in secret societies. The United Lutheran Church, though insistent upon the enforcement of confessional standards, is less rigid both in theology and practice.

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(C. M. J.)

LUTSK: *see* LUCK.

LUTYENS, SIR EDWIN LANDSEER (1869–), British architect, was born in London March 29 1869. After a brief training in the South Kensington Schools and in architects' offices, he received his first commission at the age of 19. He afterwards designed a number of country houses, in which he gradually developed an individuality of design which was, however, tempered by a reticence which dissociated his work from any attempts at "originality." Much of his domestic work was done in connection with the restoration of old houses; the largest example of his powers in this direction is the treatment of Lindisfarne Castle, Holy Island (1903–12). He also executed much civic work, being responsible for the *Country Life* offices in London and for the British sections at the exhibitions in Paris (1900) and Rome (1911). The garden suburb at Hampstead, London, has many good examples of his treatment of small houses. It was as the architect of the New Delhi (*see* DELHI) that the culmination of his professional career was reached. He also designed the Cenotaph in Whitehall, London. Sir Edwin, who was knighted in 1918, became an associate of the Royal Academy in 1913 and was elected a full academician in 1920. The Royal Institute of British Architects awarded him its gold medal in 1921.

LUXEMBOURG (*see* 17.145), a neutral and independent Grand Duchy, in economic union with Belgium. Its area is 1,034 sq. m., and the population 267,447 (1922). Luxembourg was admitted to the League of Nations on Dec. 16 1920.

Invasion of 1914.—On Aug. 2 1914 the German armies invaded the Grand Duchy on the pretext that it was necessary to protect the German control and working of the Luxembourg railways against a French invasion. The main line of the railways of the Grand Duchy, which belongs to the railway company of *Guillaume-Luxembourg*, had been first worked by the French railway company of the East, but from 1872, by a condition of theTreaty of Frankfurt, by the German state railways. On Aug. 4 Herr von Bethmann Hollweg admitted to the Reichstag that the violation of Luxembourg neutrality was wrong, and promised reparation.

The invasion was a violation of the Treaty of London of May 11 1867, which had placed the neutrality of the Grand Duchy under the collective guarantee of Great Britain, Austria, France, Prussia and Russia. The Luxembourg Govt. and the sovereign protested against this violation, but the Grand Duchy remained in German occupation for the duration of the War. After the Armistice, the railways of Guillaume-Luxembourg were provisionally run by France.

After the evacuation of the country by the German troops, Luxembourg denounced its accession to the German Zollverein, to which it had belonged since 1842, and from Jan. 1 1919 it constituted an autonomous customs territory, while, by virtue of articles 41 and 268 of the Treaty of Versailles, it enjoyed the right of exporting to Germany for five years, duty free, goods equivalent in quantity to its average pre-War export to Germany

The Dynasty.—Political complications decided the Grand Duchess, Marie-Adelaide, who had succeeded her father, Grand-Duke William, in 1912, to abdicate Jan. 10 1919, in order to save the independence of the Grand Duchy, and she was succeeded by her sister, Princess Charlotte, (b.1896). The latter married on Nov. 6 1919 Prince Felix of Bourbon-Parma, brother of the ex-empress Zita of Austria. Marie-Adelaide died Jan. 24 1924.

By the referendum of Sept. 28 1919 the Luxembourg people pronounced by 66,811 votes for the maintenance of the monarchy with the Grand Duchess Charlotte as sovereign, as against 16,885 votes for a republican régime, and by 60,133 votes for an economic union with France against 22,242 votes for an economic union with Belgium. Association with France would have helped the agrarian interest, while the vinegrowers stood to gain from association with Belgium.

Customs Union with Belgium.—After the occupation of Frankfurt, carried out jointly by French and Belgian troops (April 8 1920), the French Govt. made a declaration renouncing the negotiation of a customs union with Luxembourg in favour of Belgium. Relations with Belgium had been strained as a result of the plebiscite, but the new negotiations between

Belgium and Luxembourg culminated in a Convention (signed July 25 1921) establishing an economic union between the two countries which came into force May 1 1922, to last for 50 years. The chief stipulations of this treaty are as follows:—

1. The customs frontiers between Belgium and Luxembourg are abolished, commercial treaties in the name of the Union are to be drawn up by Belgium, Luxembourg adopts customs legislation and tariffs from Belgium, but preserves her own customs administration. The customs receipts of the two countries, as well as the yield of the taxes on beer, vinegar, sugar, tobacco, margarine, etc., with the exception of the tax on alcohol are pooled, and the total, after deducting a certain sum calculated according to the price of cereals, and devoted to the encouragement of the cultivation of cereals in the Grand Duchy, is divided between Belgium and Luxembourg in proportion to the population, approximately in the proportion of 28 to 1.
2. The paper currency in the Grand Duchy of State notes, resulting from the withdrawal of German notes after the Armistice, is reduced to 25,000,000 fr., and may only include notes not exceeding the value of 10 francs. The remainder of the note circulation of the Grand Duchy is made up of notes of the National Bank of Belgium, except a circulation of 6,250,000 fr. in notes of the International Bank of Luxembourg, which has the privilege of issue.
3. The Belgian State should share in working all the Luxembourg railways (standard normal gauge).[1]
4. Belgian consuls have charge of Luxembourg interests wherever there are no Luxembourg consuls. This provision leaves in force the agreement of Jan. 7 1880, between the Netherlands and Luxembourg, which placed Luxembourg political interests under the protection of Dutch diplomatic representatives, in all countries where Luxembourg has no diplomatic agents, except in Paris, Berlin and Brussels.

Constitution.—By a law of May 15 1919 the constitution of the Grand Duchy was revised in a more democratic direction. The powers of the sovereign were limited, universal suffrage, with proportional representation, was instituted, and the franchise was conferred on women. But the most interesting innovation was the creation of the law of April 4 1924, of five Chambers for traders, industrialists, agriculturists, artisans, private employees and workmen, election to the Chambers being by electors in these occupations above the age of 21, and maintenance by compulsory contributions by the electors. These Chambers have the power to create and maintain institutions, the right to propose bills which must be submitted to the Chamber of Deputies, and they have a right to be consulted before laws affecting their professional interests are passed by the Chamber of Deputies.

Population.—According to the census of 1922, the population of the Grand Duchy was 267,447, that is 101 persons per sq. km.; of these 33,436 were foreigners, chiefly Germans (15,500) and Italians (6,170), the latter being employed chiefly in the mining and metallurgical industries. According to the last census of occupations in 1907, 36·8% of the population was occupied in agriculture and gardening, 41·7% in industry and mines, 12·2% in commerce and transport. Since then the proportion in industry and commerce has certainly grown at the expense of agriculture.

The chief towns of the Grand Duchy are, besides the capital, Luxembourg, with 46,709 inhabitants, the three centres of the iron industry: Esch-sur-Alzette, 22,100; Differdange, 13,728; and Dudelange, 10,400 inhabitants.

Production, Industry and Trade.—In 1925 Luxembourg produced 5,984,000 tons of iron ore against 7,333,372 in 1913. There were, in 1925, 47 blast furnaces, out of which only 37 were going, which produced 2,344,000 tons of pig-iron as compared with 2,547,861 tons in 1913. The seven steel foundries of the Grand Duchy produced in 1925 2,084,000 tons of steel compared with 1,182,227 in 1913. German capital, which before the War dominated the metal works of the Grand Duchy, has been replaced since by Luxembourg, Belgian and French capital. Besides the factories which they own in Luxembourg, the Luxembourg metal companies own or control mines, collieries, blast furnaces, steel works and factories for iron and steel manufacture principally in France, Belgium, Germany and in Brazil. Their branches are established in all quarters of the globe.

Besides the ancient industries of sole leather, slates, metal constructions, china, explosives, gloves, drapery, woven wear, brewing and tobacco, long established in Luxembourg, new industries have grown up, and have made considerable way. These are the cement industry, which produced 75,441 tons in 1924, the manufacture of sparkling wines, fancy leather and brushes.

Finance.—In 1913 the public consolidated debt of the Grand Duchy was about 10,000,000 francs. In 1925 this debt had risen, in consequence of the charges which the State had to assume during the War to assure the feeding of the population and to meet the deficits in the budget caused by the upheavals during and after the War, to 196,000,000, plus a loan of 175,000,000 issued in Belgium in 1922 and intended for the exchange of notes of the Luxembourg State for notes of the National Bank of Belgium. Since 1924 the State budget has been balanced.

Railways.—On May 13 1924 a Convention between the Governments of Luxembourg and Belgium was signed at Brussels. Under the terms of this Convention the entire railway system of Luxembourg will be administered by the Société des Chemins de Fer Prince Henri, under the control of the Grand Ducal Govt., conjointly in so far as questions of interest to Belgium are concerned, particularly as regards transit, with the Belgian Government. This agreement was completed by a final protocol signed at Brussels on Oct. 14 1924, which settled the economic and technical questions, relating to the Belgian, Grand Ducal and French interests, raised by the separation of the Guillaume-Luxembourg railway system from that of Alsace-Lorraine.

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(A. C.)

LUXEMBURG, ROSA (1870–1919), German Socialist, was born at Zamość, Russian Poland, Dec. 25 1870. Having taken up socialist political activities in Poland, about 1895 she migrated to Germany, where she married a German workman in order to acquire German nationality. In 1898 she edited the Saxon *Arbeiterzeitung*, but shortly afterwards joined the staff of the *Leipziger Volkszeitung*. She took part in the Russian revolution of 1905, and on her return to Germany founded with Karl Liebknecht the Spartacus League. In 1914 she was sentenced to a year's imprisonment for inciting to insubordination and throughout the World War remained in preventive custody. After the revolution she edited, with Liebknecht, the Communist paper, *Rote Fähne*. They were arrested on Jan. 15 1919 on the charge of instigating the street fighting in Berlin which had taken place a few days earlier. Whilst being conveyed to the Moabit prison they were brutally attacked by the mob. Liebknecht was shot dead and Rosa Luxemburg died a few hours later from injuries received.

BIBLIOGRAPHY.—Her works include *Die Krise der Sozialdemocratie; Briefe aus dem Gefängnis* and *Briefe an Karl und Luise Kautsky, 1896–1918*. See also G. Zinoviev, *Karl Liebknecht et Rosa Luxemburg* (1919); C. P. A. F. Liebknecht, *The Murder of Karl Liebknecht and Rosa Luxemburg* (1924).

LVOV, PRINCE GEORGE EUGENIEVICH (1861–), Russian statesman, belonged to the old Russian nobility. He spent the greater part of his life in Zemstvo, that is, local government work (*see* 23.876), being a member of the executive board of the Tula Zemstvo from 1888 and president from 1902–5. In 1905 he was elected member of the first State Duma and joined the right wing of the Constitutional Democratic party. During the Russo-Japanese and World wars he took an active part in the organisation of Zemstvos for the relief of sick and wounded soldiers and in the latter war was president of the All-Russian Union. On March 14 1917 Lvov was elected Prime Minister and Minister of the Interior of the first Russian Provisional Government. Unfortunately his Government proved a complete failure. A new Coalition Cabinet was formed on May 16 and Lvov again accepted the leadership of the Cabinet and the portfolio of the Interior, but he had no real influence in political life, and he resigned from both offices on July 7. (*See* RUSSIA.) After the Bolshevist revolution in November, Lvov was arrested and imprisoned in Ekaterinburg but he escaped to Siberia and eventually settled down in Paris.

[1] Long negotiations on the railways question ended in a convention, signed at Brussels on May 13 1924, under which the Luxembourg system is administered by a Luxembourg company, the Belgian Govt. acting conjointly with the Luxembourg authority where Belgian interests, particularly transit interests, were concerned. But this Convention was rejected by the Luxembourg Chamber of Deputies on Jan. 20 1925. Therefore the line is still under French control. The negotiations between Luxembourg, Belgium and France over the Luxembourg railway are still continuing.

LYALL, SIR ALFRED COMYN (1835–1911), British writer (*see* 17.148), died in the Isle of Wight April 10 1911.

LYAUTEY, LOUIS HUBERT GONZALVE (1854–), French soldier, was born at Nancy (Meurthe-et-Moselle) Nov. 17 1854. Having passed through St. Cyr and the Staff College, he first served as a cavalry officer, and was then appointed in 1894 to the staff of the troops in Indo-China, where he took part, under General Galliéni, in the operations against the pirates of Upper Tongking. He accompanied General Galliéni to Madagascar, where he distinguished himself by repressing an insurrection and by his able government of the southern part of the island. He applied himself to working out and putting into practice new and eminently successful methods of colonial government. Having returned to his regiment as its colonel, he was soon after appointed to the command in the territory of Aïn Sefra, which was being disturbed by incursions from Morocco. He was then placed in command of the Oran division, and was entrusted with the carrying out of international agreements with regard to Morocco. Having restored order on the Algerian-Moroccan frontier, as far as Moulouya and Guis, he took command of the X. Corps at Rennes.

In April 1912, in view of the serious situation at Fez, the Government decided to send him to Morocco as high commissioner and résident-général to quell disturbances and to consolidate the recently declared protectorate. Immediately on his arrival he succeeded in relieving Fez, and initiated the work of pacification and colonisation which was to result in a few years in the creation of a well organised government on a solid basis. On the declaration of the World War, although formally ordered by the Government to evacuate the interior of Morocco, so as to liberate the greater part of his forces, he did not yield an inch of ground, and maintained for four years a glorious struggle against all the efforts of an enemy subsidised by Germany, while he actually increased the subjugated territory.

In Dec. 1917 General Lyautey was appointed War Minister, but resigned after three months in order to return to Morocco. From 1920 to 1924 he continued his work by conquering the Atlas, and by establishing a defensive barrier to the north of Ouergha. As a reward for these services he was made a marshal of France in Feb. 1921. In 1925 he organised a victorious resistance to the attacks of the Rifi under Abdel-Krim, and did not resign the post of résident-général until order was completely restored. The work of Marshal Lyautey in Morocco was of considerable importance. Not only was the country pacified by the adoption of judicious methods of colonial government, but by constructive work and fine organisation a province was built up with a great economic future (*see* MOROCCO). He was made a member of the French Academy in 1914, and wrote numerous articles on colonial administration. His letters from Tongking and Madagascar were published in 1920. (M. GU.)

LYNN, Mass., U.S.A. (*see* 17.172), increased in population from 89,336 in 1910 to 99,148 in 1920, of whom 27,858 were foreign-born, and 103,147 in 1925 (Massachusetts census). The aggregate value of its manufactures rose from $71,503,000 in 1909 to $160,906,000 in 1919, while the number of wage-earners in the factories remained unaltered. The effect of the post-War depression and of the dispersion of the boot and shoe industry is seen in the figures for 1923: value of products, $95,935,221; number of wage-earners, 22,506. From second place in 1905, Lynn had fallen to sixth in 1923 in the manufacture of boots and shoes, ranking after New York, Brockton, St. Louis, Haverhill and Milwaukee. In 1917 a lock-out in the shoe factories (April 18 to Sept. 20) affected 15,000 workers. The commission form of government, adopted in 1910, was abandoned in 1918 for a charter providing for 11 councillors and for a mayor with large powers.

LYONS, SIR JOSEPH (1848–1917), British business man, was born in London Sept. 29 1848 and educated at a Jewish school. In early life he studied painting and exhibited at the Royal Institute, but by 1886 he had turned to business enterprises, in conjunction with the brothers Isidore (d. 1920) and Montague Gluckstein. This led to the foundation of the catering firm of J. Lyons and Co., Ltd., of which he became chairman. He began by catering at public exhibitions, and next opened tea-shops in London, the first in 1894. Twenty years later these numbered over 200 and provided cheap food for the large class of clerical workers and junior members of professions. Later he opened several restaurants of a more ambitious nature, as well as hotels on the no-tipping principle. He was knighted in 1911, and died in London June 22 1917. See Mrs. Stuart Menzies, *Modern Men of Mark* (1920).

LYONS, France (*see* 17.174), had a population of 561,592 in 1921. In 1922 about 140,000 persons were employed in the silk industry and several large factories were built in 1924. The manufacture of artificial silk is of growing importance. The international fair, first held in 1916, has shown a notable increase of business and aims at rivalling Leipzig. A permanent exhibition building on the banks of the Rhône was nearing completion in 1926, and space for exhibitors was also being reserved on both sides of the road on the left bank of the river and in the square near the main railway station. Poland and Soviet Russia were represented at the exhibition for the first time in 1923. The Wilson bridge over the Rhône was opened in 1918. From 1916, during the War, Lyons was a centre for the exchange of seriously wounded French and German prisoners. A syndicalist congress was held in the city in 1919.

LYS, BATTLE OF THE: *see* GERMAN OFFENSIVE.

LYTTELTON, ALFRED (1857–1913), British politician, was born Feb. 7 1857, the youngest child and eighth son of the 4th Lord Lyttelton. His mother, daughter of Sir Stephen Glynne and sister of Mrs. W. E. Gladstone, died six months after his birth. All the eight boys were brought up to be keen cricketers, the cricket ground at Hagley, Worcs., their home, being close to the house; all went to Eton, and six were in the Eton eleven. The eldest, VISCOUNT COBHAM (1842–1922), became a land commissioner and a railway commissioner; GEN. SIR NEVILLE LYTTELTON, G.C.B. (b. 1845), an experienced soldier, was governor of Chelsea Hospital; SPENCER LYTTELTON, C.B. (1847–1913), was three times private secretary to his uncle W. E. Gladstone when Prime Minister; the RIGHT REV. ARTHUR LYTTELTON, D.D. (1852–1903), was Bishop of Southampton; and the REV. EDWARD LYTTELTON, D.D. (b. 1854) was headmaster, first of Haileybury, and then of Eton.

Alfred was the most famous cricketer of them all. Indeed for nearly all ball games he had an extraordinary aptitude. He excelled in football of three kinds, and in fives, racquets and especially tennis—holding the amateur championship for tennis from 1882 to 1896. At cricket he was equally good as a bat and as a wicket keeper. He was four years, 1872–5, in the Eton eleven, and captain the last year; four years, 1876–9, in the Cambridge eleven, and captain the last year. Moreover, he played for England against Australia, and for the Gentlemen against the Players; and for some years was a notable member of the Middlesex eleven. The infectious joyousness of his nature, his sterling character, his solid, though not brilliant, intellect and his prowess at games gave him an undisputed lead among his contemporaries. He was king of the place before he left Eton; and when he went up to Trinity College, Cambridge, in 1875, he gained a similar ascendancy.

After taking his degree with a second class in history, he was called to the English bar in 1881. Here his reputation stood him in good stead; he soon obtained a considerable practice, and in due course became K. C. His thoughts turned early to politics. Though by family tradition and in idealistic outlook a Liberal, he found himself unable to support the Home Rule policy of his uncle, W. E. Gladstone, and so postponed any attempt to enter Parliament until after the latter's retirement. But in 1895 he became M.P. for Warwick and Leamington as a Liberal Unionist, retaining the seat till 1906, when he was defeated. After a few months' interval, he was returned for a London constituency, St. George's, Hanover Square.

He was appointed, in 1900, chairman of a commission to enquire into the various concessions which President Kruger and the Volksraad had granted to companies and private individuals

in the Transvaal, and to report which should be maintained and which annulled. In pursuance of the investigation he spent the autumn of 1900 in South Africa; and he so impressed Lord Milner by his qualities that the high commissioner hoped to secure him as his successor. It was, however, as Colonial Secretary, in the Conservative Govt. of Mr. Balfour in 1903, that his South African experience was utilised. His tenure of office lasted two years and was marked by the drafting of a temporary constitution which should give representative institutions to the Transvaal until such time as it should be safe to concede responsible government. This constitution was never put in force, as Sir Henry Campbell-Bannerman's Ministry determined that they would risk the grant of responsible government at once. He incurred much odium by sanctioning the scheme for importing Chinese coolies into South Africa in order to remedy the shortage of native labour and to restart the mines and thereby the whole economic machinery of South Africa. When his party went into opposition he took an active share in resistance to the drastic Liberal policy, and especially to the Welsh Disestablishment Bill, which was repugnant to him as a man of deep religious feeling and an earnest Churchman. He also lent a helping hand to many social movements, and was a decided supporter of woman suffrage.

His first wife, whom he married in 1885 and who died in 1886, was the brilliant Laura Tennant, sister of Lady Oxford and Asquith; his second wife, married in 1892, was Edith Sophy, daughter of Archibald Balfour. She, with a son, Captain Oliver Lyttelton, and daughter, survived him. His death came very unexpectedly, on July 5 1913, after an injury in a local cricket match. Mr. Asquith, then Prime Minister, spoke of him in the House of Commons as having come nearest, of all men of his generation, to that ideal of manhood to which every English father would wish to see his son aspire. See Edith Lyttelton, *Alfred Lyitelton*, 1917. (G. E. B.)

McADOO, WILLIAM GIBBS (1863–), American lawyer and politician, was born near Marietta, Ga., Oct. 31 1863. He entered the University of Tennessee but did not finish his course. In 1882 he became clerk in the U.S. circuit court of Chattanooga, read law and three years later was admitted to the bar. He began practice in Chattanooga, but in 1892 removed to New York City. There he became interested in the problem of passenger transportation. In 1902 he formed the New York and New Jersey Railroad Company, which took over the abandoned Hudson river tunnel from Hoboken to New York, and in March 1904 this tunnel was completed. In 1909 the tunnel under the Hudson river to downtown New York was finished. In 1912 he was vice-chairman of the Democratic National Committee. He was a strong supporter of Woodrow Wilson for president, and on the latter's election he was appointed, in 1913, Secretary of the Treasury. In this position he contributed largely to the working-out of the new Federal Reserve Banks system.

At the outbreak of the World War in Europe he favoured strict neutrality. After America's entrance into the War he was called upon to raise unprecedented sums of money. He was successful in floating four Liberty Loans between May 1917 and Oct. 1918, amounting in all to more than $18,000,000,000. He also secured the creation of a Bureau of War Risk Insurance for shipping, later extended to include life insurance for soldiers and sailors in the World War. When the railways were taken over by the Federal Government in 1917 he was appointed director-general. He favoured the League of Nations, woman suffrage and the prohibition amendment. He resigned the secretaryship of the Treasury in Dec. 1918, and the directorship of railways the following January. He then resumed the practice of law in New York City. At the Democratic National Convention held at San Francisco, June 28 1920 and following days, Mr. McAdoo was placed in nomination for the presidency, and on the first ballot obtained the highest number of votes, 266; at the 36th ballot his vote ran to 399, but after that he lost ground, and J. M. Cox received the nomination on the 44th ballot. Mr. McAdoo was again placed in nomination for the presidency at the Democratic National Convention held at New York City in June 1924. On the first ballot he obtained the highest number of votes, 431½, on the 69th ballot he had 530, but after that his strength steadily declined, and on the 103rd ballot, when J. W. Davis was nominated, he received only 12 votes. Mr. McAdoo married, as his second wife, Eleanor Randolph, daughter of President Wilson.

MACARTHUR, MARY REID (1880–1921), British politician, was born Aug. 31 1880 in Glasgow, where her father had a large drapery establishment. Breaking with the Conservative traditions of her family, in 1903 she came to London to be secretary of the Women's Trade Union League, into whose work she breathed new life. In 1906 she founded a new general trade union for women—the National Federation of Women Workers. The Anti-Sweating League, which she helped to found, and her evidence before the Select Committee on Home Work did much to convince the public of the necessity of the Trade Boards Act, passed in 1909. It was mainly due to her efforts that boards were established in various sweated industries. In 1914 she became secretary of the Central Committee for the Employment of Women. Later she was instrumental in improving the condition of the women War workers. In 1911 she married W. C. Anderson, who was chairman of the Labour party in 1914 and M.P. for Attercliffe (Sheffield) from 1915–8. In 1918 she unsuccessfully contested Stourbridge in the Labour interest. After her husband's death in 1919, she lectured, mainly on peace, in the United States which she again visited for the Labour Convention conference at Washington. She died on Jan. 1 1921, leaving one child, a daughter, born in 1915.

See M. A. Hamilton, *Mary Macarthur: a Biographical Sketch* (1925).

McBRIDE, SIR RICHARD (1870–1917), Canadian politician, was born at New Westminster Dec. 15 1870, and was educated first in that city and later at Dalhousie University, Halifax, Nova Scotia. He was called to the Canadian Bar in 1892, and entered the British Columbian parliament as member for Dewdney in 1898. In 1900 he became minister of mines and in 1902 leader of the Opposition. In June 1903 he became Prime Minister for the province and retained that position until 1915, when he became agent-general for British Columbia in London. He was made K.C.M.G. in 1912 and died in London Aug. 6 1917.

M'CARTHY, JUSTIN (1830–1912), Irish politician and writer (*see* 17.200), died at Folkestone, Kent, April 24 1912.

McCORMICK, ROBERT RUTHERFORD (1880–), American editor, was born in Chicago, Ill., July 30 1880. He graduated from Yale University in 1903, studied law at Northwestern University law school and was admitted to the Illinois Bar in 1908, commencing practice in Chicago. He was active in civic circles from 1904 to 1910. In 1910 he became associated with his cousin, Joseph Medill Patterson, as co-editor and publisher of *The Chicago Tribune*, being president of the Chicago Tribune Company. Under their direction the *Tribune* enormously increased both in circulation and the amount of advertising matter carried, becoming one of the most influential papers in the United States. In 1916–7 McCormick served as major in the 1st Illinois Cavalry on the Mexican frontier, and in 1917 was attached to Gen. Pershing's staff, A.E.F., in France. Later he was transferred to the 5th F.A. of the 1st Div., and promoted to the rank of colonel. In 1921 in conjunction with his cousin, he started in New York City a daily illustrated paper, followed in 1924 by *Liberty*, a weekly publication, both of which obtained immediate and large circulations. In 1912 they organised the Ontario Paper Co. to make paper for their newspapers, followed in 1924 by the Tonawanda Paper Co., to make magazine paper, the two producing in 1925 about 500 tons of paper a day.

MACCUNN, HAMISH (1868–1916), British composer (*see* 17.209), died in London Aug. 2 1916.

MACDONALD, JAMES RAMSAY (1866–), British politician, was born on Oct. 12 1866 at Lossiemouth, a little fishing village on the Moray Firth. His father was a labourer, his first home a "but and a ben." At Drainie Board School he received an elementary education and continued as a pupil teacher. Coming to London at 18, he worked at 12/6d. a week as a clerk. He continued his own education by evening classes, laboratory work and incessant reading. A breakdown in health ended his dream of a scientific career, and sent him to journalism.

MacDonald's experience and reading made him a convinced socialist. He joined, in 1894, the Independent Labour party, founded by Keir Hardie, and in 1895 stood, unsuccessfully, for Southampton. As a member of the London County Council he completed his training for public service, and, after his marriage, in 1896, with Margaret Ethel Gladstone, niece of Lord Kelvin, made frequent journeys abroad. In 1897 he paid his first visit to Canada and the United States; in 1902 he went to South Africa; in 1906, travelled through the Pacific to Australia and New Zealand; in 1910, visited India, whither he returned in 1913 and 1914 as a member of the Royal Commission on the Civil Service. At meetings of the Socialist International, he was the spokesman of British Labour on the Continent.

Stages of His Career.—Three main stages may be noted in his political career: the creation of the Labour Party, the War and the Labour Government. In the 'nineties, the great trade unions still stood aloof from politics, or were satisfied with a vague alliance with the Liberal party. The propaganda of the Independent Labour Party, with which he was prominently associated, was directed to convincing the Unions of the need of a political party for Labour; in 1899 the Trade Union Congress was induced to set up a committee to consider parliamentary action. Out of

this came the Labour Representation Committee, of which Mr. MacDonald was secretary. Thanks to his energy, patience and tenacity, the hostility of some Unions and the apathy of others was broken down and a Labour party came into being in 1900. After the return of 29 M.Ps., run by the Labour Representation Committee in 1906, the battle was won; the party became an effective force. But it was in 1918 that Mr. MacDonald's ideas were fully realised. The party was reorganised and thrown open to all workers by hand or brain, and in 1925 had over 3,000,000 members.

Elected as M.P. for Leicester in 1906, by 1911 he was leader of the Labour party in the House of Commons. A constructive critic of Sir Edward Grey's foreign policy, he opposed, on Aug. 4 1914, the view that there was an "obligation of honour" to go to war. The speech was an agreed one, but the majority of the party broke away. He had already refused suggestions of office; he now resigned his leadership. He was denounced in public and private, and had to face the fact that his views were not accepted by the nation at war. In 1918 he lost his seat at Leicester, and in 1921 failed to get in for East Woolwich.

Although out of the House of Commons till late in 1922, his influence on opinion steadily grew. By 1922, the party took his view of the Peace Treaties, and resisted the tendencies that split nearly every Labour party abroad. In 1912, he had countered the demand for the substitution of industrial ("direct") for parliamentary action in *Syndicalism;* in 1919, when, under the stimulus of Russian events, this demand reappeared as the Communist doctrine of force, he wrote *Parliament and Revolution* and *Parliament and Democracy*, in which he gave a definite and logical lead against the tactics of violence and championed parliamentary democracy. The 1922 election registered his moral ascendancy. Labour, with 140 members, was the second party in the state, and he himself, returned for Aberavon, was chosen by his colleagues leader of the Opposition.

His leadership produced a marked change in public opinion, and focused general interest on himself and on Labour. He raised its claim to be fit to govern at the sudden election of 1923, and came back with 192 followers. The Conservatives had been defeated on the main item in their programme, and, at a great meeting in London, Mr. MacDonald declared that Labour would take office, if given the chance, in order to render national service. On Jan. 21 1924 he accordingly moved a vote of no confidence in the Unionists, which was carried with Liberal support. Next day the King called upon him to form a Government. The first Labour Cabinet was announced on Jan. 24, and on Feb. 12 the new Prime Minister set out its general programme in the House of Commons. In this, the first item was peace; with this supreme object in view, he took the post of Foreign Secretary in addition to that of First Lord of the Treasury.

The unsettled state of Europe, aggravated through the occupation of the Ruhr, was a primary cause of distress and unemployment in Britain. British prestige had fallen low: relations between Britain and France were bad, between France and Germany threatening. The Reparations question blocked the way. In letters to M. Poincaré, published on Feb. 4 and March 3, Mr. MacDonald, with firm friendliness, set out the British point of view, and had soon created a new atmosphere, one of confidence and hope. When, on April 13, the Experts Committee on Reparations issued a unanimous report, he at once accepted it on the part of Britain as a basis for settlement. In May, M. Poincaré was replaced by the Radical M. Herriot, who in June came over to London to discuss the European position with Mr. MacDonald. Friendship with Italy had already been established by the latter's action on Jubaland.

On July 16 1924 an Allied conference assembled in London, over which he presided, for the specific purpose of putting the Experts' Report into operation. Within a fortnight, agreement had been reached and the German delegates called in. On Aug. 16 the London Settlement, the first negotiated agreement since the War, was initialled. By mutual consent, the Experts' Plan was put in effect, and the Reparation problem thus lifted out of the political sphere. France, at the same time, agreed to evacuate the Ruhr within a year and certain towns at once. Negotiations for an Anglo-German Commercial Treaty, since signed, were initialled. In Sept. Mr. MacDonald and M. Herriot attended the Fifth Assembly of the League of Nations at Geneva, and there submitted a plan, the Protocol, for the elimination of private war and the submission of all disputes to arbitration, after general mutual disarmament.

In the House of Commons, meantime, the difficulties of the Government's minority position were growing. Mr. Snowden's Budget met with general approval; a Housing Act was passed, and the machinery for the relief of unemployment improved. But when Mr. MacDonald sought to complete his peace work by making treaties with Russia, whose *de jure* recognition had been his first act as Foreign Secretary, the Liberals broke away. In Oct. the Government was defeated on a motion, calling for a select committee, on their dropping of the prosecution of a Communist named Campbell. In the general election, then declared, the press was exceedingly hostile, and Labour was identified with Bolshevism. The campaign culminated in the publication of a document purporting to emanate from M. Zinoviev, president of the Moscow International, urging British Communists to tamper with the army, and of a note from the Foreign Office, issued without the signature or sanction of the Secretary, animadverting on Russian propaganda. Polling took place on Oct. 29; as a result the Conservatives came back with a great majority. The Labour vote went up by over a million, but its representation was reduced to 150. On Nov. 4 Mr. MacDonald resigned, and resumed his leadership of the Opposition. His party, in conference in 1925, confirmed his leadership with striking enthusiasm, and expressed its pride in the achievement of its first Government. In 1924, while Prime Minister, he was given an LL.D. by Glasgow University, and made a freeman of Glasgow, and of Dundee. In 1925 Edinburgh made him a freeman, and the university conferred an LL.D.

An Estimate.—The permanent significance in British political history of a man who had created a new political party and enabled it to conduct a Government, is obvious. But Mr. MacDonald's contribution cannot be measured by this unless it is also noted that he made the party the vehicle of a new political philosophy, which serves to give precision and content to the idea of democracy. His socialism, derived from wide study of men and institutions, of science and history, has been expressed through writings and speeches which have modified opinion over a wider range than that of professed adherents. In it, two main streams may be detached—the scientific and the moral. Accepting the design suggested by evolution, he postulates, instead of a haphazard and unwilling adaptation, or the resistance to change that provokes revolution, a conscious acceptance of its principle through a planned social organisation based on communal need and service—such an "organisation of things as invites the co-operation of minds." Mind, in his view, is the instrument, consent the method, of social advance. Consistently rejecting violence, he opposes war and revolution alike. A steadying as well as a constructive force in the British Labour movement, he realised that ideas are the moulding force in human development; the moral element colouring his thought and action, gave to his appeal to the masses the accents of a gospel.

MacDonald's views on socialism can best be studied in his books. Among them the more important are: *Socialism and Society* (1905); *Socialism and Government* (1909); *The Awakening of India* (1911); *The Socialist Movement* (1911); *Syndicalism* (1912); *The Social Unrest* (1913); *National Defence* (1917); *Parliament and Revolution* (1919); *Parliament and Democracy* (1919); *The Government of India* (1919); *A Policy for the Labour Party* (1920); and *Socialism, Critical and Constructive* (1921). In addition, his biography of his wife, *Margaret Ethel MacDonald* (1912); and a volume of essays and travel pictures, *Wanderings and Excursions* (1925) may also be mentioned. See C. W. Mullins, *The Patriotism of Ramsay MacDonald and Others* (1916); L. N. Le Roux, *J. Ramsay MacDonald. Sa vie, son œuvre et sa pensée* (1919); "Iconoclast" (M. A. Hamilton) *The Man of Tomorrow, J. Ramsay MacDonald* (1923); *J. Ramsay MacDonald, 1923–25* (1925); H. Tracey, *From Doughty Street to Downing Street. The Rt. Hon. J. Ramsay MacDonald, M.P.* (1924); J. Bardoux, *J. Ramsay MacDonald* (1924); G. Glasgow, *MacDonald as Diplomatist* (1924).

(M. A. H.)

MACDONELL, SIR JOHN (1846–1921), British jurist, was born at Brechin, Forfarshire, Aug. 11 1846, and was educated at the universities of Aberdeen and Edinburgh. He was called to the bar by the Middle Temple in 1873 and for some years was counsel to the Board of Trade and the London Chamber of Commerce. In 1889 he was made a master of the supreme court and in 1912 was appointed king's remembrancer. In 1901 he was made Quain professor of comparative law in the University of London and he was president of the society of public teachers of law (1912–3), a member of several royal commissions, and editor, for many years, of *The Journal of Comparative Legislation and International Law*. In 1913 he was elected a fellow of the British Academy and in 1914 was created K.C.B. Besides editing the *State Trials* (1887), the *Civil Judicial Statistics* (from 1894) and the *Criminal Judicial Statistics* (from 1900), he published works on the subjects of capture at sea and the law of master and servant, and was the author of many papers on international law. He was also for 40 years a leader writer on *The Times*, London. He died in London March 17 1921.

MACEDONIA (*see* 17.216), a territory embracing the former Turkish vilayets of Monastir and Salonika, and part of the vilayet of Kosovo, now divided between Greece and Serbia.

All statistics of Macedonian nationalities must be received with the greatest caution and have a very relative value. The "Peace Handbook for Macedonia" states with considerable diffidence that "before 1912 there were approximately 1,150,000 Slavs, 400,000 Turks, 120,000 Albanians, 300,000 Greeks, 200,000 Vlachs, 100,000 Jews and 10,000 Gipsies." M. Palles estimates the population of Greek Macedonia as 43% Greek before the immigration of the Greek refugees and as 90% Greek in 1925. There is a movement among the Greeks of Greek Macedonia for local government; this is quite distinct from the Bulgarian propaganda in favour of an "autonomous" Macedonia, which, like "autonomous" Eastern Roumelia in 1885, could be ultimately annexed to Bulgaria.

Political History.—Since 1911 Macedonia has thrice become a battlefield. When the first Balkan War of 1912 broke out, while the Bulgarians directed their principal efforts against the Turkish armies in Thrace, their Serbian and Greek allies advanced into Macedonia. The great Serbian victory at Kumanovo left Skoplje, the capital of Dushan's medieval Empire, open to the victors, and the Greek successes at Sarantaporos and Yenije-Vardar led to the occupation of Salonika. In 1913 the quarrel which arose out of the division of the Macedonian spoils between Bulgaria and her allies provoked the second Balkan War, of which Macedonia was again the theatre. The Greeks defeated the Bulgarians at Kilkis and the Serbians routed them at Ovčepolje. But the retreating Bulgarians laid Seres, a flourishing town, in ashes, and the writer, visiting it a year later, saw an empty petroleum tin in every Greek house. Violence was also practised at Nigrita, Doxaton and Drama.

The third Treaty of Bucharest, signed Aug. 10 1913, divided Macedonia between Greece and Serbia; the Greek frontier stretched from the Mesta, thus including the rich tobacco plantations of Kavalla, to Kenali near Monastir, which became Serbian. Bulgaria was excluded from what had been to her Nationalists her "promised land," and King Constantine was hailed at Athens as a second "Bulgar-slayer," the successor of Basil II. For the first time for five centuries Macedonia was governed by Christian nations. As inevitably happens whenever Turkish rule ceases there was everything to create. The victors of the wars of 1912–3 took over a land neglected completely by its Turkish governors; its marshes were undrained, its rivers unembanked, its ports undredged, its cultivable lands (with the exception of the tobacco fields) either uncultivated or else cultivated by the most primitive methods. Serbians and Greeks set to work upon this colossal task to the best of their experience and limited means, but they had had no time to achieve much when in 1914 the World War broke out, and in 1915 Macedonia for the third time in three years became the scene of Balkan conflicts and was soon converted into one of the European cockpits.

The entry of Bulgaria into war against Serbia, on Oct. 14 1915, was speedily followed by the capture of Shtip, Radovište, Veles and Skoplje and the evacuation of Monastir, although the Serbians held the Babuna pass between Skoplje and Prilep for more than a week. Meanwhile, the Allied troops had landed at Salonika (*q.v.*) on Oct. 5, which thenceforth became the base of their operations in Macedonia. But they had to retreat from Doiran and Krivolak to the Vardar and thence to Salonika in Dec., while in May 1916 the strategic position of Fort Rupel, commanding the Struma valley, was, with the acquiescence of the Greek Govt., betrayed to the Bulgarians, who occupied Kavalla and all eastern Macedonia. At last, after the appointment of Gen. Sarrail as commander-in-chief, the Allied offensive began. The British advanced on Doiran and along the Struma; the French and the reconstituted Serbian Army retook Monastir, while Italian troops landed at Salonika and the Provisional Govt. of M. Veniselos, now established there, on Nov. 23 declared war on Bulgaria and Germany. When the spring campaign of 1917 began, fighting was resumed near Monastir and Doiran, and the French and Russians extended their front towards the lake of Okhrida, while the Greeks at the battle of Srka in 1918 contributed to the Allied victory. The Franco-Serbian offensive on the Vardar in Sept. of that year, combined with the Anglo-Greek attack near Doiran, where a monument now commemorates the British fallen, led to a complete rout of the Bulgarians, who on the 25th asked for an armistice, signed on the 29th, on the day when the French entered Skoplje. Next day Bulgaria surrendered unconditionally; Macedonia had contributed her share to the defeat and at last had rest.

The peace settlement of 1919 divided Macedonia between Greece and Yugoslavia, while Bulgaria was excluded alike from Macedonia and the Aegean. But that she will permanently acquiesce in that settlement may be doubted from a study of her past claims. Bulgarian *komitadjis* still threaten from time to time the danger zone where the three frontiers converge. Incidents such as that between Greeks and Bulgarians near Petritch in Oct. 1925, referred by both parties to, and settled by, the League of Nations, remind western Europe that Macedonia is still volcanic soil.

Greek Settlement in Macedonia.—The emigration of the Greek refugees from Asia Minor and Turkish Thrace after the Greek disaster in the Asia Minor campaign of 1922 has, however, completely changed the ethnographical situation, and has solved the racial question in Greek Macedonia, whose population, formerly only 43%, is now 90% Greek. Economically the change is equally striking. Thanks to the work of the Refugees' Settlement Commission, created by the League of Nations in 1923, and to the Refugee Loan of £10,000,000, issued under the auspices of the League, villages have arisen throughout parts of Greek Macedonia where there was not a house before. Competent judges believe that the refugees from Asia Minor will in time do for Macedonia what the expelled French Huguenots did for England, for they have brought new industries with them. It is calculated that when the Anglo-American concession for draining the Vardar marshes has accomplished its work, not only will malaria, the curse of Macedonia, be diminished, but also that country will supply the rest of Greece with cereals, now imported, and will thus improve the rate of exchange.

Railway Communications.—Since the opening of the last section of the Greek railway between Thessaly and the Macedonian system in 1916—a connection long refused by the Turks—Macedonia is traversed by the Simplon-Orient and Prague expresses to Athens, and an improvement of the permanent way will further shorten the journey. Difficulties between Greece and Yugoslavia have, however, arisen with respect to the portion of the railway between Salonika and the Yugoslav frontier station, Gjevgjelija, which belonged to a French company, now bought out by the Greeks. The Yugoslavs have obtained a "Serbian zone" in the port of Salonika, but, despite the fact that since Aug. 1925 Serbia has for the first time had direct railway communication with the Adriatic at Spalato, Serbian nationalism tends to regard Salonika—towards which the Croats and Slovenes are indifferent—as the natural outlet of Serbian Macedonia. The signature of the Bulgarian Minorities' Protocol by the Greek representative at Geneva was the occasion of the denunciation by the Yugoslavs of their alliance with Greece, and the subsequent

negotiations for its renewal had (up to April 1926) failed, although the Greek Assembly refused to ratify the Minorities' Protocol. Meanwhile, considerable improvements have been made, notably in the railway stations of Serbian Macedonia, and the frontier question of the Monastery of St. Naum has been settled with Albania.

Production and Industrial Development.—But it would be impossible for Macedonia, after five centuries of Turkish neglect, to achieve a high grade of civilisation in 13 years. Nevertheless, Macedonia has already shown signs of an industrial future. Cotton is grown near Seres, woollen goods are produced and 17,000 tons of tobacco were grown in 1924, and 26,000 in 1923 in Macedonia and Thrace. The refugees have replaced the Turkish tobacco planters in Macedonia, and in 1924 they were cultivating 2,250 acres more than before. In 1923 the value of the tobacco exported from Kavalla reached three milliards of *drachmai*, and an American tobacco company is established there. The usual corollary of industrialism has made its appearance at Kavalla in the form of the labour disputes of 1924. Macedonia is, indeed, the only part of Greece where there are any signs of Bolshevism, a phenomenon to the growth of which the individualism of the Greek character is very unfavourable. The Greek peasant is naturally conservative, and it is only among the new elements of the Macedonian population, Greeks who in some cases speak only Turkish and have little to lose, that Bolshevik propaganda can find disciples.

Jewish Element.—Macedonia is the only Greek territory which furnishes a large Jewish element to the population. The Salonika Jews, settled there for centuries, probably preferred Turkish to Christian rule; but they have accepted Greek citizenship and formed a special electoral college for the elections to the new Greek Senate (still in abeyance). Their traditional business qualities contribute to the economic development of the province, now placed under a governor-general. *See* also BULGARIA.

BIBLIOGRAPHY.—N. B. Many books on this subject have racial bias and are propaganda. See however: Peace Handbooks, vol. 4, No. 21, *Macedonia* (1920); Gen. M. P. E. Sarrail, *Mon Commandement en Orient, 1916–8* (Paris, 1920); William Miller, *The Ottoman Empire and its Successors, 1801–1922*, ed. 2 (Cambridge, 1923); R. F. H. Duke, *Report on the Industrial and Economic Situation in Greece for the Years 1923 and 1924* (London, 1925). (W. Mi.)

McGILL UNIVERSITY (*see* 27.775).—The position of McGill as providing exceptionally ample facilities for instruction and research in applied science has been maintained and strengthened since 1910 in many respects. A new wing giving additional space to the work in electrical engineering has been erected. A university clinic has been established under direction of the professor of medicine who is also chief medical officer of the Royal Victoria Hospital. In 1910 the Carnegie Corporation of New York gave $1,000,000 in recognition of McGill's science and sacrifice in the World War. In 1920 the Rockefeller Foundation gave $1,000,000 for the faculty of medicine, $1,000,000 was given by the Provincial Govt. for general purposes and $4,400,000 was raised from the graduates and citizens of Montreal as a general endowment. The income from investments is about $1,000,000. In 1923–4 the Rockefeller Foundation gave $500,000 for medical research, Lady Strathcona gave $120,000 to endow a chair of zoology, and other substantial gifts and bequests have been made to the university since 1910. After the World War Sir Arthur Currie, G.C.M.G., K.C.B., was chosen principal of the university.

MACH, ERNST (1838–1916), Austrian physicist and psychologist (*see* 17.232), died near Munich Feb. 19 1916.

MACHAR, JAN SVATOPLUK (1864–), Czech poet, was born at Kolin Feb. 29 1864. His early works, such as *Confiteor* consist of sentimental verses written under the influence of Lermontov, Heine and De Musset. He afterwards turned his attention to social and political satire, exemplified in such volumes as *Magdalena* (1894), and *Warriors of God* (1895–6). The most important phase of his poetical activity began, however, with the publication of *Golgotha* (1901), the first of a series of volumes in which the destinies of mankind are surveyed through sceptical and anti-clerical eyes. *In the Glow of the Hellenic Sun* (1906) and *The Poison from Judaea* are titles which sufficiently indicate the point of view from which Machar wrote his historical impressions. He traced, in the form of monologues, portraits and short dramatic scenes, the chief personalities in history, from the earliest times to the Napoleonic era and beyond. As a prose writer, Machar exhibits the same incisive qualities which distinguish his poetry. He attracted much attention by his book, *Rome* (1907) in which personal bias is fully expressed and by *The Jail* (1917–8), a graphic description of his imprisonment by the Austrian authorities during the World War.

MACHINE GUNS (*see* 17.237).—The machine gun is an automatic small-arm weapon, usually provided with a fixed mounting and capable of sustained accurate fire. A heavy machine gun does not differ materially from an ordinary machine gun in design, but as its calibre may be from 0·5 to 0·9 in. it is necessarily of a heavier and stronger make. The weight of a machine gun, however, is limited by the consideration that by whatever means it may be transported, it must in the last resort be "man-handled" into position often over considerable distances and under difficult conditions. On the other hand lightness and portability are desirable only in so far as they are consistent with strength, for to a large extent it is on the strength, and therefore, weight, of the mechanism that the ability of a gun to sustain fire depends.

Ammunition.—Rifle ammunition can be projected by a machine gun with incapacitating effect at ranges at which the fire of the rifleman would be inaccurate and wasteful owing to the big variation caused by the personal error. Theoretically it might be desirable to have special machine gun ammunition such as the long-ranging (6,000 yd.) streamline bullet used by the United States and Swiss armies; but in view of the enormous quantities of ammunition required for the small arms of modern armies, it seems probable that any advantage would be more than counterbalanced by the difficulties of supply, organisation, etc., that would be involved in having different types of ammunition for rifles and machine guns.

Mounting.—The fixed mounting with which the machine gun is provided increases the accuracy of all ordinary shooting, and thus enables the gun to be used either for indirect fire, or for fire over the heads of friendly troops, when supporting an attack or covering a retirement. To support rigidly a machine gun weighing from 40 to 50 lb., the mounting must be strong and fairly heavy, otherwise the combination will be top heavy and unsteady, and the shooting in consequence will be inaccurate. The mounting must permit of the gun being traversed through as wide an arc as possible, and also permit alterations in elevation to be made. The tripod mounting of the American 0·3 Browning machine gun has elevating and traversing dials, graduated in degrees, etc., to facilitate "fire direction."

Fire Capabilities.—Machine guns for ground use normally have a rate of fire of about 450–500 rounds per minute, but, owing to the necessary replenishment of empty belts or magazines, etc., the number of rounds actually fired per minute is much less. In aircraft a higher rate of fire is desirable, and is usually obtained. By reason of its capacity for sustained fire the machine-gun can provide prolonged supporting fire on the battlefield besides being useful for barrage work. The ability to fire single shots is an advantage, because such shots do not disclose the identity of the machine gun and are useful for observation of range, for testing the working and for keeping water-cooled guns from freezing up in cold weather. There are also certain tactical advantages, especially in the case of detached units of cavalry, whose ammunition is on pack transport and is therefore limited.

Cooling Systems.—For sustained fire an efficient cooling system for the barrel is essential. The higher the temperature of the barrel, the less its resistance to wear. There are three systems in use, namely, radiation in air, a combination of radiation and draught of air and water-cooling. In the case of aircraft machine guns no special provision for cooling is necessary as the barrel is exposed to the rush of cold air. Heavy barrels with radiating rings are sometimes employed for ground use (*e.g.*, the French Hotchkiss). Such barrels are comparatively safe from damage by ordinary usage or by small-arm bullets, but they suffer from the disadvantage that when they get hot, the heated air rising from them, known as "mirage," causes the target to appear to be in movement, and thus interferes with the aiming of the gun by eye. The radiation and the draught system is employed in Lewis guns (*see* RIFLES AND LIGHT MACHINE GUNS).

The water-cooling system is the most common. The barrel, for nearly the whole of its length, is surrounded by water contained in a casing which, in the case of recoiling barrels, is fitted with glands to prevent leakage. Inasmuch as prolonged rapid fire causes the water to boil, a steam escape is necessary. In arid countries the renewal of the water given off as steam is often a serious difficulty, and in any case there is always the risk of the escaping steam disclosing the position of the gun. Accordingly a flexible tube is usually attached to the steam escape whereby the steam is led into a portable condensing chamber, and converted back into water for use again in the gun. In cold weather guns having recoiling barrels may be put out of action, except for single shots, by the water freezing, but no instance is known of a water-cooled gun being out of action by reason of heat, provided the water-casing has been kept well supplied. The water increases the weight of the gun by about 9 lb., and for this reason light machine guns rely on radiation for their cooling.

Mechanical Safety.—All automatic weapons are required to be "mechanically safe," that is, the design must be such that the gun cannot be fired unless the action is fully closed and the cartridge properly supported. Even then, it should only be able to fire by means of the trigger mechanism, which itself must be proof against heavy jarring. Safety catch ("applied safety") devices are usually operated by a single, simple movement. To be perfectly efficient, they should operate directly on the firing pin or striker, and should preclude the possibility of its ever being able to reach the cartridge by accident.

Typical Patterns.—A few details of typical different patterns of machine guns are given in the table at the bottom of the page. Bulgaria used a ·315 Maxim (tripod mounting and pack transport) and Switzerland a ·295 Maxim (tripod and reff carriage, pack and man's back). In other details both guns follow the German pattern. The Belgian Hotchkiss differs from the French in calibre (·301), mounting (carriage with removable tripod) and mode of transport (limber). The Czechoslovak Schwarzlose is identical with the Austrian weapon.

For the automatic operation of machine guns power may be obtained in three distinct ways, viz.: from the gases generated by the explosion of the charge, from the recoil of the barrel and from the backward thrust of the cartridge on explosion. In some types of gun two of these principles of operation are combined.

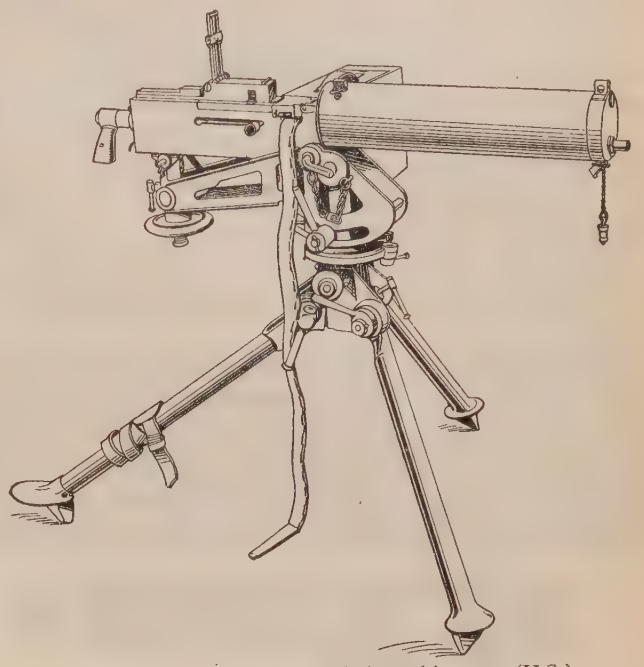


FIG. 1.—Browning water-cooled machine gun (U.S.).

Gas-Operated Guns.—Most light machine guns and the Hotchkiss, which is the primary machine gun of the French Army, are typical of the first method. The gas is diverted through a hole in the barrel near the muzzle to operate a piston or lever. In the Colt machine gun the gas issuing from a hole near the muzzle impinges

The Machine Guns of Six Countries

	Austria	France	Germany	Great Britain	Italy	U.S.A.
Pattern	Schwarzlose	Hotchkiss	Maxim (1908)[2]	Vickers Mk. I.[3]	Revelli	Browning
Calibre	·315	·315	·311	·303	·256	·300
Weight (lb.) Empty	44	52 (1902) 55½ (1916)	40	28½	37½	30
Weight (lb.) With water for cooling	49¾	. .	48½	38½	48½	37
Cooling System	Water	Air	Water	Water	Water	Water
How Operated	Cartridge projection[1]	Gas	Recoil assisted by gas	Recoil assisted by gas	Combination of recoil, inertia and cartridge projection	Recoil
How Fed	Belt 250 rounds	Metal strips 30 rounds	Belt 250 rounds	Belt 250 rounds	Magazine 50 rounds	Belt 250 rounds[4]
Locking System	Inertia heavy breech action having elbow joint and strong spring	Link on bolt dropping to lock in recess in body	Toggle joint	Toggle joint	Rotating wedge temporarily locking two moving parts	Locking block rising to engage with breech block
Mounting	Tripod 43¾ lb.	Tripod 72 lb. (1907) 58 lb. (1915)	4-legged sledge 77 lb.	Tripod 48½ lb.	Tripod 47½ lb.	Tripod 54 lb. (1917) 50 lb. (1919)
How Transported	Pack	One-horsed carriage and pack	Wagon or pack	Wagon or pack	Wagon or pack	Pack
Sighted up to (yd.)	2,620	2,190	2,190	2,900	2,190	2,800

[1] Rearward thrust of cartridge projects breech block to rear.
[2] During the World War the Erfurt gun was made. It was very similar to the 1908 gun, but weighed less—empty 31 lb., full 37 lb. Tripod 51½ pounds.
[3] Mark II. gun is for aircraft. It is air-cooled and uses a metal disintegrating link belt (any length).
[4] Belts for aircraft are of metal disintegrating links.

on the front end of a lever hinged at its rear. The front of the lever, being blown down by the gases, revolves backward round its hinge and in so doing extends springs which operate the mechanism. This gun is now practically obsolete.

Barrel Recoil Only.—The U.S. Browning water-cooled gun (see fig. 1) operates by barrel recoil alone. On the explosion of the cartridge the barrel, barrel extension and breech block move backwards locked together for $\frac{5}{8}$ inch. The locking block for the breech block is then forced downwards, and, the action being unlocked, the breech block travels to the rear, compressing the return spring. An extractor pivoted to the breech block then withdraws a live round from the belt in the feed block. At the end of its rearward travel, it is forced down, so placing the new round in grooves on the face of the breech block and in line with the chamber. The empty cartridge case is knocked off the face of the breech block through the ejection opening underneath the gun. The return spring then pushes the breech block forward to close and load the gun. The cartridge belt is led into the feed block by the action of a slide carrying a pawl, which, engaging behind the leading round, forces it into position for the extractor to grip. In this way the belt is led through the gun. A pawl on the floor of the feed block prevents the belt from slipping backwards. The slide is worked to left and right by a lever operated by a stud working on a cam-shaped slot in the top of the breech block.

The firing pin, housed within the breech block, is cocked by the action of a pivoting lever during the backward travel of the breech block. The other end of this lever, engaging with ramps on the top of the gun, is caused to rotate round its pivot. When the breech block goes forward it is pivoted into position for the next cocking action. To release the firing pin to fire the gun, a trigger, when the breech block is fully forward and locked, engages with a sear which holds back the firing pin against its spring. In this way, the "mechanical safety" of the gun is secured. When the trigger is pulled, the sear disengages from the firing pin, which then flies forward to

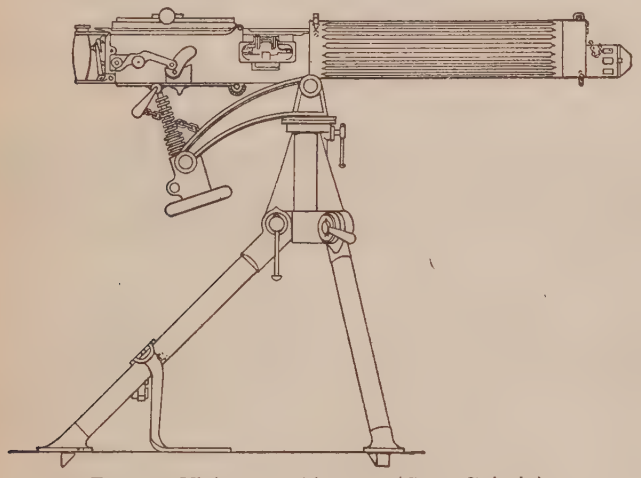


FIG. 2.—Vickers machine gun (Great Britain).

fire the round. So long as the trigger is pressed the gun fires automatically. A springed component called the accelerator is also embodied. Its function is to assist the recovery of the barrel and, cocked by the barrel extension moving backwards and released by the breech block going forward, regulates the timing of the locking of the latter.

Recoil and Gas.—In the Vickers gun (see fig. 2) recoil of the barrel is assisted by the backward thrust of the gases partially trapped at the muzzle. The barrel projects through the front of the water casing, and on it is carried a muzzle cup. Surrounding this is a muzzle attachment, screwed to the water casing and having a small hole in it, through which the bullet passes. The gases following the bullet strike the front end of this attachment and rebound on to the muzzle cup on the barrel, so increasing the recoil energy of the latter. The barrel, with side-plates attached, recoils about one inch. The left side-plate operates a lever, which, with another, works a slide on the feed block, to the right on recoil and to the left on recovery. This feed block is above the breech. The slide has two pawls, which, when it is to the right, engage behind the new round in the cartridge belt and push it to the left into position, where it is withdrawn from the belt by the moving extractor on the lock.

On recoil the lock, locked to the barrel, moves with it. In the rear of the lock is the crank to which the lock is connected by the head of the side levers and connecting rod, in which the former engages. Bearings in the rear of the right and left side-plates carry the crank, the left one being detachable. On the right, outside the casing, is a crank handle. This handle has a curved rearward extension called the tail. Just clear of this tail on the side of the gun is a roller. On recoil, the curved part of the tail hits this roller and is caused to rotate. Being attached to the crank, the latter is rotated, thereby causing the lock to be unlocked and withdrawn from the breech, during which movement the lock is cocked. There is, farther forward on the crank handle, a hump, which, when meeting the roller, causes the crank and side-plates to move forward, so returning the barrel to its forward position. In the left axis of the crank is a recess, into which a feathered lever called the fuzee engages. This, by means of links, engages with the fuzee spring, which is secured to the left of the casing. When the crank rotates, the fuzee rotates, and this spring is extended. When the rearward rotation of the crank is finished, the spring, working through the fuzee, rotates the crank in the opposite direction, so causing the lock to go fully forward into the locked position against the breech, with its firing pin cocked. The extractor is operated vertically on the lock face by side and extractor levers. It has two flanges in which the cartridge rims ride and are so held to it.

When the lock is fully forward, the extractor is at its highest point, and if a round be in the feed block, it is gripped by the extractor. When the lock goes back, this round is withdrawn from the belt, and, after about $3\frac{1}{2}$ in. of travel, the extractor falls and places the round in line with the chamber. When the lock goes forward this round is pushed into the chamber, and the extractor, rising again, grips another round in the feed block, there being then two rounds

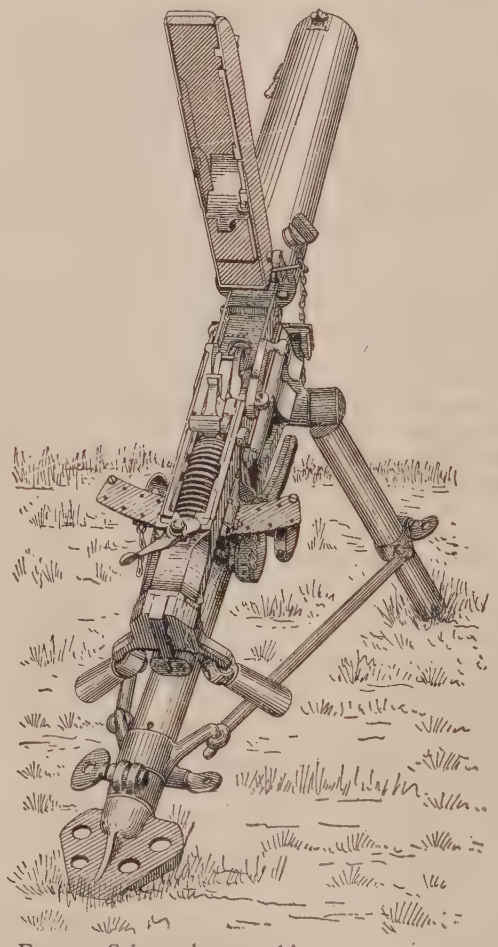


FIG. 3.—Schwarzlose machine gun (Austria).

on the extractor, one in the feed block, the other in the chamber. Through the extractor is a hole, through which the firing pin protrudes to fire the round in the chamber when the extractor is in its highest position. On the recoil of firing, the flanges, still gripping the case in the chamber, withdraw it, and when the extractor drops again, this empty case drops through the bottom of the casing.

Projecting from the top of the lock is the tail of the trigger. Along the cover of the gun is situated a spring-operated sliding trigger bar. The rear of this is connected by the trigger bar lever to the firing lever with thumb piece, which is carried on the rear crosspiece. When the thumb piece is pressed forward the trigger bar is drawn rearwards and pulls or trips the tail of the trigger projecting from the lock, thus releasing the firing pin and firing the gun. A spring-operated safety catch on the rear crosspiece prevents the operation of the thumb piece until disengaged by the fingers of the firer.

Cartridge Projection.—The Austrian Schwarzlose (see fig. 3) is operated on a principle known as "cartridge projection," *i. e.*, by the backward thrust of the cartridge driving the action to the rear. The barrel is fixed, and the moving parts are operated by the thrust of the cartridge head on the breech block. To ensure that the car-

tridge does not grip the chamber after the explosion, and so retard its rearward thrust, provision is made to oil each round entering the chamber. On firing, the breech block is driven to the rear against a strong spring, extracting the fired round from the chamber, and rotating the crank and handle.

In rear of and underneath the breech is the feed wheel, round which are studs. Underneath the bolt is a cam-shaped slot, in which each of these studs ride in turn, thus causing a rotating movement of the feed wheel. At the front of the fore part are two sets of teeth. The belt is led into the gun between these teeth, which then engage the rounds at each end and lift them into position for withdrawal from the belt by means of a claw on the underside of the breech block. The round is thus drawn to the rear into a channel in the feed wheel. During this withdrawal, the channel is rotated slightly to the left, so bringing the round into position in front of the breech block, which is now in its rearmost position. The main spring then drives the breech block forward and the round enters the chamber, rotation of the feed wheel being also effected, and the next round being prepared for a similar operation.

Ejection is effected by a plunger on the right of the breech block face. A heavy firing pin protrudes through the breech block, and at its rear is a solid arm that curves forward. This portion engages with a suitably shaped similar arm in the crank, when the latter is rotated during the backward travel of the breech block, thus withdrawing the firing pin. When withdrawn, the bent of the firing pin engages with the sear on the breech block, and it is cocked. On the left side of the solid arm of the firing pin is a pivoted arm, the trigger, projecting forward and downward. The front end of the trigger bar, which is ramp shaped, is in front of this arm when the firing pin is cocked. Its rear end is engaged with a trigger bar lever, operated by the firing lever thumb piece, mounted on the rear cross piece. On the thumb piece is the safety catch. To fire the gun, the safety catch is pressed towards the right and the thumb piece forward. This withdraws the trigger-bar, and the ramp at its forward end raises the pivoted arm, or trigger, until disengaging its bent from the sear on the breech block, when the firing pin is free to fly forward to fire.

Mechanical safety is provided by (*a*) the cap of the cartridge not being in line with the firing pin hole till the breech block is fully forward, and (*b*) by the main spring bearing against the solid metal at the rear of the firing pin, thus driving the breech block forward, so that it is impossible for the firing pin to strike the cartridge cap if the breech block be not fully forward.

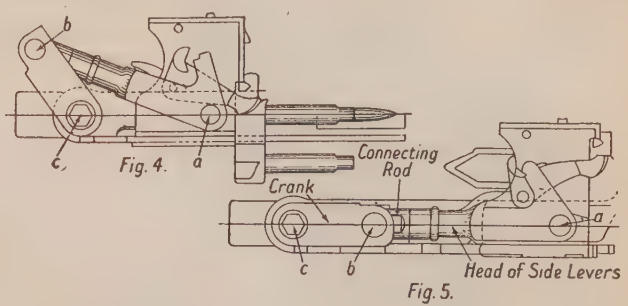
Recoil and Cartridge Projection.—The Italian Revelli uses a combination of barrel recoil and cartridge projection. At the rear of the barrel a sleeve is attached by means of ribs. Inside this sleeve is the breech block. When the gun is fired all three move together to the rear for a distance of 4 mm., after which the breech block goes on free for about 6 in., compressing the recovery spring within it. This spring also operates the firing pin within the breech block. The bent on the firing pin protrudes down through the breech block, and, when this goes forward under the influence of the recovery spring, the bent engages with the right hand, or primary, of two sears projecting upwards through the body casing. This sear is released by a spring plunger connected to a thumb piece in the rear crosspiece, and is disengaged from the bent on the firing pin to fire the gun. By setting a small lever on the rear crosspiece, the spring plunger can be regulated to give continuous or single shots. The secondary or left-hand sear is to ensure " mechanical safety." If the sleeve and breech block are not fully forward, this sear continues to protrude and engages with the bent on the firing pin. It is operated by an arm protruding from a rotary wedge underneath the sleeve. This wedge, by a spring, is rotated fully forward when the sleeve and breech block are in their forward positions. Its arm then rises, and pressing upwards the front end of the secondary sear, clears the rear end of this sear from the path of the bent of the firing pin.

The cartridges are contained in a magazine holding 50 rounds, there being 10 compartments, each with a platform and spring. As each compartment is emptied, the magazine is moved to the right and the next compartment is employed. The breech block, on going forward, takes the top round from the compartment and inserts it in the chamber. The moving across of the magazine as the compartments are emptied is effected by a lever protruding from inside the body casing, and engaging in spaces in the magazine. This lever is kept out of action by a spring plunger engaging with it, but, when the compartment platform rises on being emptied, it disengages the spring plunger, so permitting the lever to function. The lever is on a pivot, to one end of which is attached a strong spring. The other end of this spring is connected to a system of levers working in short grooves in the sleeve, every backward movement of which causes this spring to extend and endeavour to produce the requisite motion in the magazine lever.

Mechanical safety is further effected by means of a little rocking lever on the left front edge of the breech block, into which one end projects. In the body casing is a recess for the other end of this lever. The firing pin on going forward encounters the inner end and forces the other end outward. Unless the breech block be fully forward, the outer end is not in position to enter this recess in the body casing, and the firing pin is intercepted by the inner end of the lever, and so preventing from protruding to fire the round. Ejection with this gun is vertically upwards.

Locking Actions

As the locking action is perhaps the most important part of the mechanism of any automatic weapon, a short description is given of the well-known method employed in the Vickers gun and also the unusual methods employed in the Schwarzlose and Revelli guns.



Figs. 4 and 5.—Locking action of the Vickers machine gun.

The Vickers (see figs. 4 and 5).—The lock is connected to the crank by (1) the side lever head, whose axis is a, and (2) the connecting rod, whose axis is b. The axis of the crank is c. Fig. 4 shows the unlocked position with the lock back. Fig. 5 shows the locked position. In the locked position, axis b is slightly below axis a and c, and the crank, under b, bears hard on the crank stops. The rearward thrust of the cartridge on explosion thus passes through a, b and c. As b is lower than a and c, it cannot under pressure rise above the line ac and so unlock the action. It must tend downwards. However, the crank is already bearing on the crank stops under b, hence no movement here is possible and so the locking action is effected.

Except that the crank revolves downwards instead of upwards, the system of locking in the Maxim gun is practically identical with that employed in the Vickers.

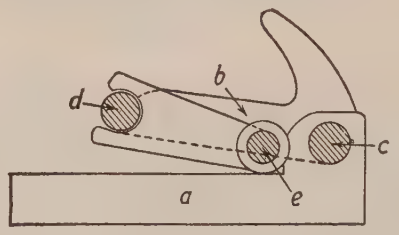


Fig. 6.—Inertia sealing of the breech in the Schwarzlose machine gun.

Inertia Sealing of the Breech in the Schwarzlose.—There is no positive locking in the gun, reliance being placed in heavy moving parts and a strong spring, to induce sufficient inertia to seal the breech. With a view to ensuring the exit of the bullet from the barrel before the inertia is overcome, the barrel is abnormally short.

The mechanism includes a massive, heavy breech block a (see fig. 6), connected by the crank link b (which is attached to it at axis c) to the upper axis of the crank, d. The lower axis of the crank e works in bearings in the body-casing of the gun and has no backward or forward movement. In rear is a strong spring pushing the bolt forward. The thrust on the face of the breech block pulls the crank link to the rear. It, in turn, pulls the crank to the rear.

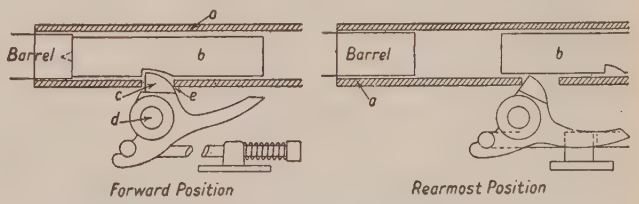


Fig. 7.—Locking action of the Revelli machine gun.

However, owing to the set of the crank with reference to its non-recoiling axis e, considerable resistance to the rearward motion of the breech block is set up. Thus it is that, coupled with the heavy resistance offered by the strong antagonistic spring and the weight of the moving parts, sufficient inertia is created to prevent the breech from opening prematurely.

The Revelli.—On explosion, the barrel with sleeve a (see fig. 7) recoils, and the gases, acting through the cartridge head, impart a rearward movement to the breech block b. At this stage, the breech block and sleeve are locked together by a claw c, on a rotating wedge with axis d. The rearward movement of the breech block causes the wedge to rotate to the rear. In so doing, the claw, which passes through a slot in the sleeve, bears against the latter at the shoulder e, and helps to force the sleeve and barrel rearward. After

a and b have moved about 4 mm., the claw is entirely disengaged from the breech block, which continues to the rear under its own momentum. The wedge in rotating compresses a strong spring, so the tip of the claw bears against the under side of the breech block, and is prevented from regaining its forward position. Hence the sleeve cannot do so until the recess in the breech block returns to within 4 mm. of its forward position.

The long arm of the wedge is that which engages with the secondary sear introduced for " mechanical safety " and referred to in the description of the gun. (H. R. A.)

MACHINERY: *see* AUTOMATIC MACHINERY; TEXTILE MACHINERY.

MACHINE TOOLS (*see* 27.21).—The sixteen years between 1910 and 1926 changed the character of machine tool equipment in many respects. For while the outward appearance may have retained the same general outline, there have been many developments in details that greatly affect productive capacity. Among these details are the use of heat treated alloy steels in spindles and gears, anti-friction bearings in many places, including the main spindle in a few instances, and the placing of the driving motor in the base of the machine itself. Add to these the growing use of individual motor drives, the speeding up of the machines and the tendency toward automatic or semi-automatic feeds, and the changes are very noticeable.

Mass production has been aided by the increasing use of more accurate gauges and better inspection methods. The new visual or projection methods of inspecting screw threads and other contours has enabled interchangeable work to be secured more rapidly. The use of optical methods has also made it much easier to obtain extreme accuracy whenever necessary.

Lathes.—There have been few changes in cutting tools since the advent of the tools suggested by the late Frederick W. Taylor although there is a tendency to use tools with greater top rake. Both A. L. De Leuuw and Dr. Hans Klopstock have advocated changes in tools shapes that, as shown by experiments, make a much higher cutting speed possible. The machines themselves have undergone distinct changes largely by the use of alloy steel shafts and gears, more and more ball or roller bearings and the introduction of automatic stops that put the lathe into the semi-automatic class. The use of multiple tools had also increased to a large extent.

The hand turret or capstan lathe has received much attention, both in making it more convenient to operate and in the methods of tooling. The tools have been simplified so as to enable a comparatively few standard tools to be utilised for a large variety of work, thus making the capstan lathe a more universal machine and materially reducing the cost of tools required for average work. Self-closing chucks, operated both by air and electric motor, are growing in favor where the work warrants. More attention is being paid to the proper lubrication of lathes as well as of other machines. Geared heads are run in oil and in some cases an oil pump forces oil to the main bearings, or to reservoirs, from which it is led to different bearings by suitable pipes. Convenience of operation has also been studied and much lost time eliminated in that way.

Boring and turning machines of the vertical type have advanced in design and in productive capacity. Continuous operation machines are more in evidence so as to avoid idle time while the work is being put in position. This is secured in the station type machine where the work indexes under the cutting tools, one station being left blank for loading the work. In other machines the work table continues feeding but there is sufficient time for the operator to remove the finished piece and replace it with a piece to be machined, before the tools feed into the work; or the feed can be tripped and again thrown in when the operator is ready. One of these, by the same maker as the Mult-au-matic, is called the Continu-matic. This is shown on the plate. There are now several machines built along these general lines.

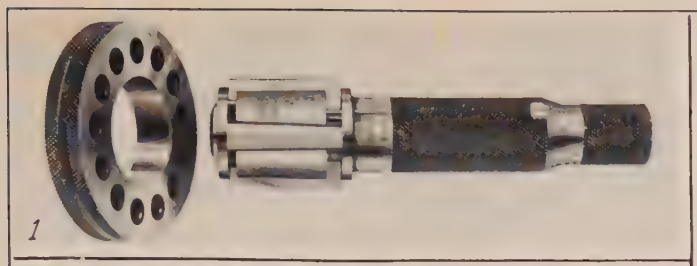
Drilling and boring machines have been developed to a considerable extent by the demands of the automobile industry. These developments include the special multi-way, multi-spindle machines that drill a large number of holes in from three to five sides of a cylinder block, at one feeding of the drills. The number of holes drilled at once is limited only by the ability to get the spindles close enough together and by the power of the machine. Drilling machines are also made in the station type and many are semi-automatic in their action. In other cases a number of spindles are mounted in a row and work is passed from one to the other. The drills themselves have been improved to such an extent that higher speeds and more powerful motors are now necessary to secure maximum production.

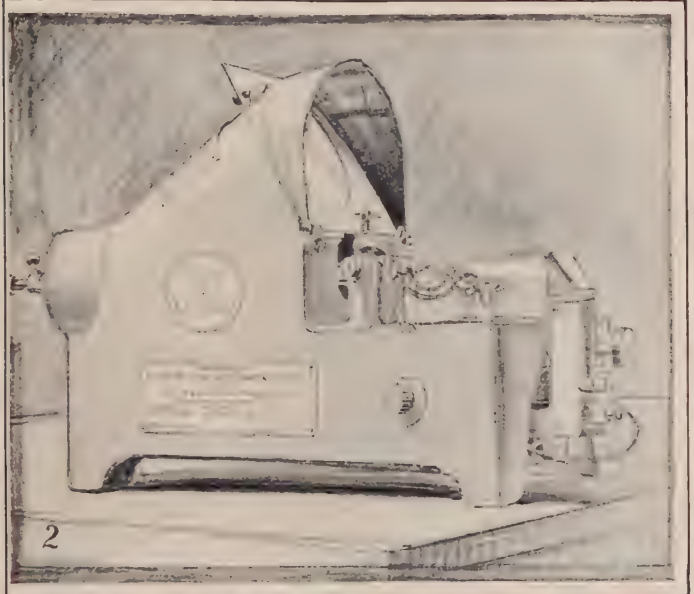
Milling Machines.—While there have been but one or two really new types of milling machines put on the market, the changes in design and capacity have been very marked. Machines are being built heavier and more rigid and the controls are being centralised for the convenience of the operator. Rapid power traverse is universal to save the time and labour of moving the tables or knees by hand. Anti-friction bearings have been largely used in the gear boxes and for thrusts, and now roller bearings are being applied to the main spindle in a few cases. Automatic feeds and stops are being largely used to increase the production and every endeavour is being made to make the cutting action continuous wherever possible. A development along this line is to hold the work on a revolving table that carries it past the milling cutters and allows a new piece to be put in place while the machine is running. These revolving tables are made both vertical and horizontal. With the table in a vertical position and horizontal milling spindles each side of the table, both ends of the piece can be milled at the same time. In one machine of this type the work is held firmly in place by a chain so arranged that the work runs under it before the milling cutters begin working and releases it after the work has passed the cutters. This is a very simple device but one which saves much time and greatly reduces the cost of clamping the work to the table.

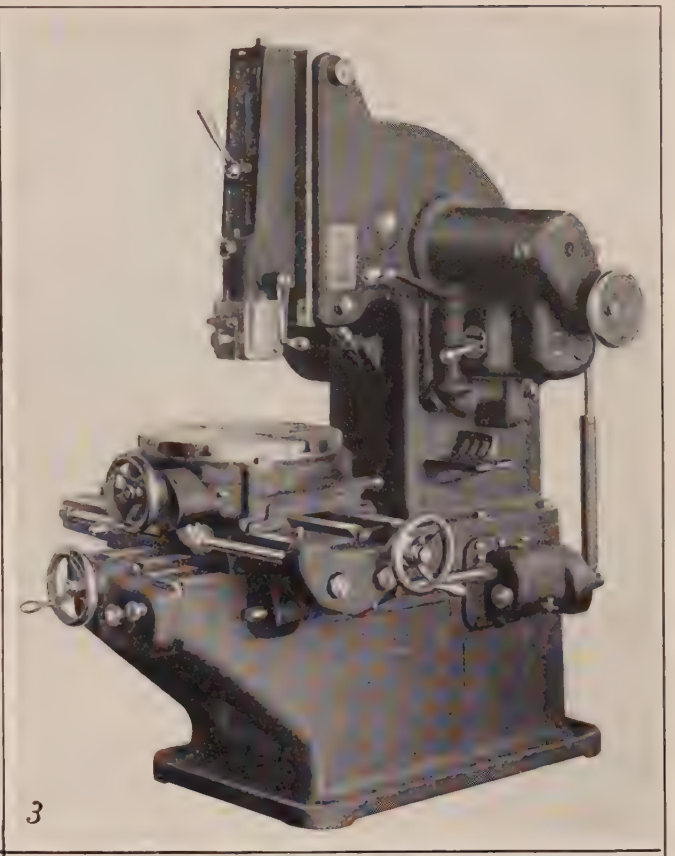
The planer type of milling machine is being used more and more in railway shop work on connecting rods and in similar work. We are also learning that a milling machine is only as good as its cutter, and that the designing and making of an efficient milling cutter is an engineering problem. The effect of this cutter development has been to double the feed per minute in many cases and to remove an unbelievable weight of metal per minute. For small pieces the tendency is to use the continuous milling machine rather than the planer type on account of the time lost in loading. On long work however it is still holding its own and the milling machine along the lines of the openside planer is being considered for a variety of large work, too large to go between the housings. Continuous lubrication and the use of motors in the base are also now a part of the development of the modern milling machine. Machines of the knee type are being adapted to special manufacturing by the addition of one or more spindles in a special head, the extra spindles being driven from the main spindle. This head and the use of special fixtures, turns a standard milling machine into a single purpose machine that can be used on other work by the substitution of another spindle head.

Automatic profiling machines as shown have also been greatly developed by the addition of an electric contact device for the follower that makes it possible to use a master of wood or plaster or common building cement. This electric contact device controls the action of the profiling cutter, and though the touch of the follower is very light and delicate, the profiling cutter can take as heavy a cut as the machine or the work will stand. This type of machine not only secures extreme accuracy in the reproduction of any desired pattern but also effects a remarkable economy over the usual methods of making dies or profiling work of any kind.

Grinding Machines.—Grinding machines have probably been more startlingly developed than any other class of machine. Beginning with being practically a polishing machine that removed very small amounts of metal, we now have grinding machines that are driving the grinding wheel with a 75 H.P. motor, and removing metal at a rate that compares favourably with machines and cutting tools of other types. One type of grinding now finding favour is the in-feeding or " plunge-cut " type where a wheel is used that is wider than the length of the work and fed straight against the work instead of being traversed along its







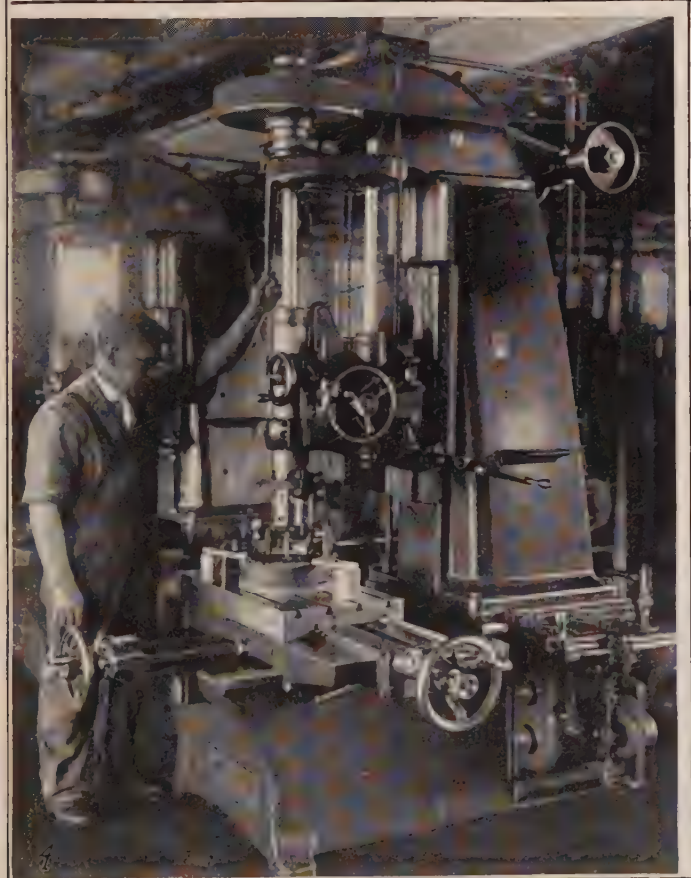
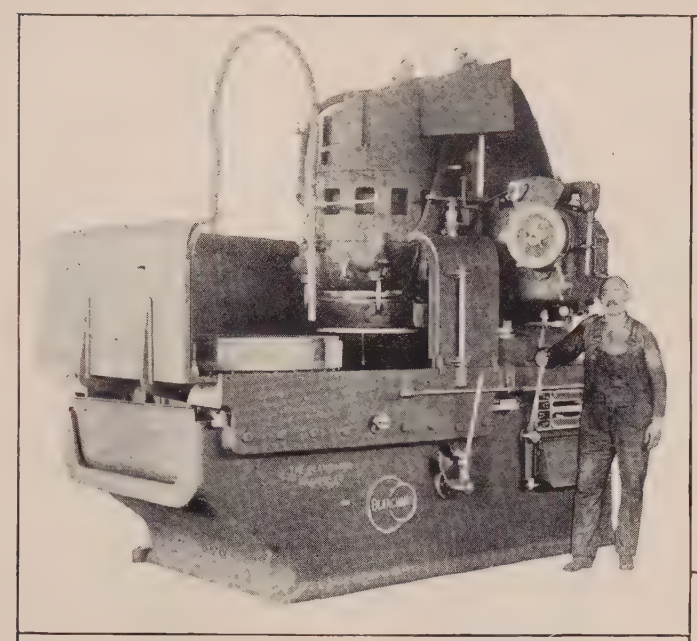
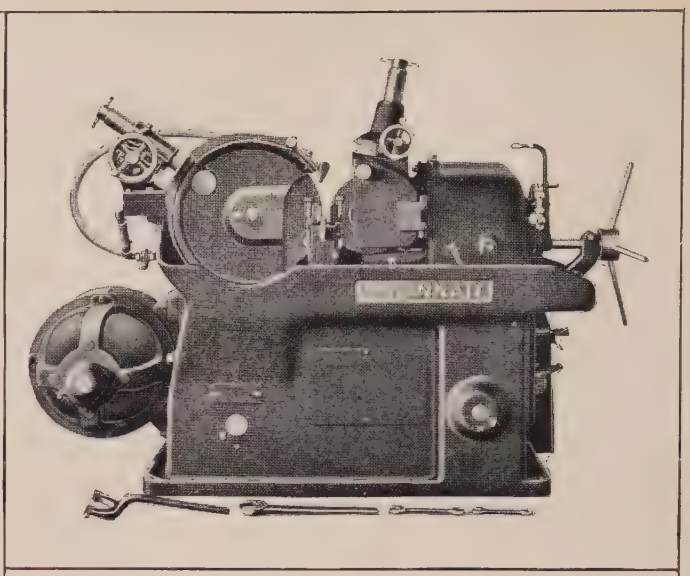
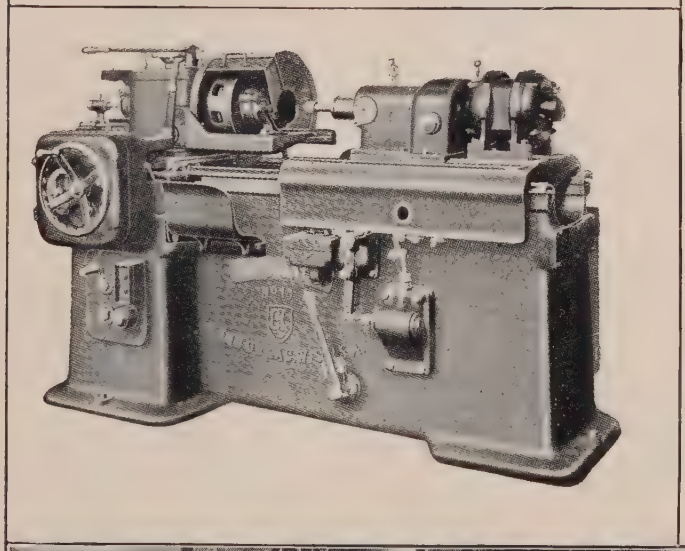


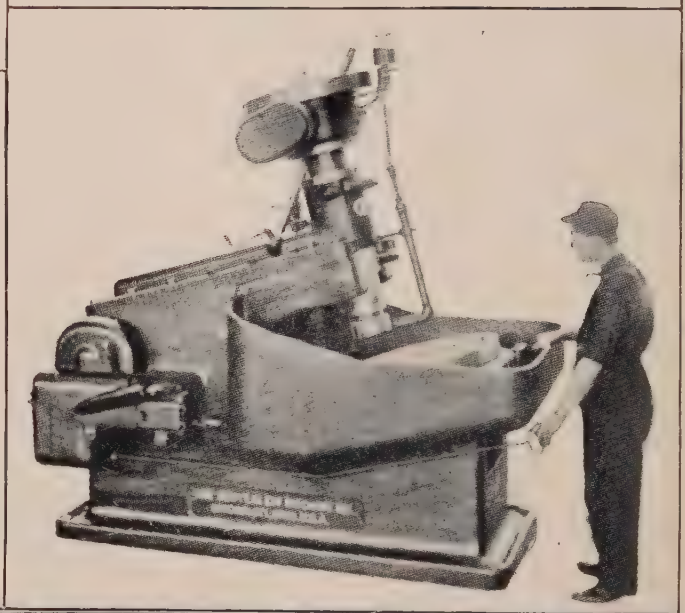
FIG. 1. Bath Internal Micrometer for rapidly verifying bores to .0001". FIG. 2. A beam of light is thrown on the screw which is to be examined. The shadow (enlarged by passing through a microscope) is reflected, from the back of the chamber, forward to the upper part of the instrument, where (if the screw is perfect) the shadow agrees with a translucent diagram mounted under the hood. The total magnification is 50 times. FIG. 3. Pratt & Whitney Vertical Shaper with inclinable ram. FIG. 4. Testing a Locating and Jig-boring machine, which locates centres to .0001". FIG. 5. 4-spindle Contin-U-Matic chucking and turning machine, producing a fly-wheel for each complete cycle of operations. There are four chucks which revolve intermittently around the standard.

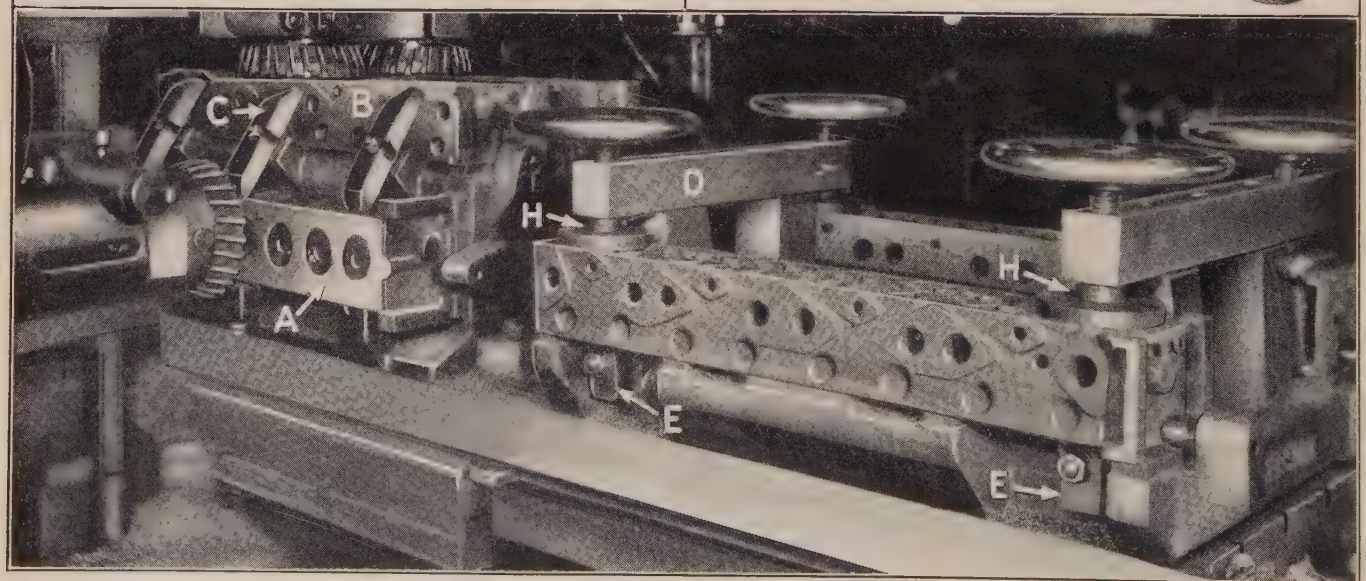
MACHINE TOOLS











UPPER LEFT. Grinding machine. Wheel 27x7x23″; magnetic chuck 48″ diam.; capacity for work 60″ diam. x16″ high. (Other sizes up to 84″ diam. x 16″ high.) UPPER RIGHT. Centreless Grinder. Capacity: standard work up to 3″ diam. x 10″ long; longer by attachments. LOWER LEFT. Internal Grinding Machine. LOWER RIGHT. Tilted Rotary Continuous Milling Machine. FOOT. Detail of machine for milling automobile cylinder heads. A is milling bottom of one head, B is milling top of another head, both held by chucks C. Then these rough-milled heads are placed in fixture D (held by clamps E and pads H) and the sides milled by same cutters as machine bottom of A.

(Courtesy of American Machinist)

length. The present limit seems to be a wheel 10 in. wide. The centreless grinding machine has also made great strides both as to the quantity of work produced and the accuracy obtainable. On such work as automobile piston pins which are fed through the machine in a continuous string, the diameter can be well within a half-thousandth, and with a high production. These pins are also remarkably round. It is also possible to grind shoulder work on the centreless but in that case the work cannot be fed through the machine but must be ground by revolving it in front of the wheel in a fixed position. Centreless grinding machines are being used on work up to eight or 10 in. in diameter.

Another development is in the application of automatic sizing mechanisms to cylindrical grinding, both internal and external, mostly the latter. These machines rough grind the holes at a rapid rate, then automatically reduce the feed as the hole approaches the finished size, and finally finish the hole with a light feed and stop when the hole is of the correct size. Here too the accuracy is well within a half-thousandth of an inch on commercial work.

Grinding machines are being used to remove metal to a greater extent than ever before not only on large and heavy surfacing work but in such work as the grinding of the threads in taps. Instead of merely finishing the thread of a taps that has been previously chased and hardened, some are now grinding the complete thread from the solid metal, and at a remarkably rapid rate. Hydraulic feed has been gaining in favour on several types of machines but has been applied to grinding machines to a greater extent than to any other. Some broaching machines are now hydraulically driven and the same type of feed has been used on boring and other machines. The idea has been lying dormant for a number of years but recent developments seem to have made it very successful in some of its applications.

Honing or lapping has gained in favour during the past few years to a remarkable extent. Honing as applied in automobile cylinder work, is in reality a method of grinding instead of what we formerly knew as lapping or honing. The hones have several strips or blocks of abrasive materials, turned on the outside to suit the bore of the cylinder. These are moved through the cylinder from end to end and revolved at the same time, so that it is really a grinding process with motion different from that of the grinding wheel. Some revolve the hones rapidly and traverse them slowly through the cylinder. Others reverse this, while some make both movements at about the same speed. In most cases the hones are used directly after a finish reaming operation and so eliminate the grinding operation. On a few of the higher priced cars however the honing is an additional operation that virtually polishes the surface and removes the " fuzz " left by the grinding wheel.

The use of magnetic chucks is being extended into new lines of work, but is confined largely to the grinding machine field. These are now made in many styles and shapes to suit individual conditions and are a great aid to production by reducing the time required for chucking any magnetic metal that can be held in this way, to a minimum.

Planing Machines.—Planing machines include shapers and slotters, which also embrace the special types built for gear cutting. All of these with the possible exception of slotters have been much improved, and the slotter has been developed as a tool room machine. The driving mechanism of planers has been vastly improved, which means better bearings, better gearing and improved lubrication of the whole machine. More convenient controls, rapid power traverse on all movements and more rigidity in the machine have added much to its cutting capacity and to the smoothness of the cuts that can be taken. This also applies to shapers, both for regular work and of the gear cutting type. Higher speeds are now possible than ever before and the work is also of better quality.

Broaching and Swaging Machines.—Both broaching and swaging machines continue to find new fields of usefulness. Where irregular surfaces are to be machined, or with internal surfaces that are hard to get at in any other way, the broach is found of great value, in many lines of industry. Broaches are in reality a series of cutting teeth, each cutting a very small amount as the broach is pushed or pulled through the work. The push broach seems to be growing in favour in some classes of work, presumably because of the lower first cost of the broaches and the corresponding lower loss when they break in service. Swaging machines have changed very little except to increase in size and in some cases to be used more on hot work than formerly. The accuracy of the work depends largely on the machine in which it is done and the way in which the machine is cared for and adjusted. Sewing machine needles, spinning frame spindles and much other work, including steel balls, hollow balls used in electrical pull chains and in jewelry, and many other parts, are manufactured by swaging.

The rapid development of machine tools during the last decade has made many first class machines of ten years ago entirely obsolete where low cost production is essential. In some cases machines of this highly productive nature become obsolete in two years, sometimes less. (F. H. C.)

MACKAY, CLARENCE HUNGERFORD (1874–), American capitalist, was born at San Francisco April 17 1874, being a son of John William Mackay (*see* 17.250). He received his education in Europe and at the age of 20 entered his father's office in New York. After his father's death in 1902 he succeeded to his large interests. He was elected president of the Mackay companies, organised in 1903, and owning all the capital stock of the Commercial Cable Co. and a majority of the stock of various cable, telegraph and telephone companies in the United States, Canada and Europe, including the Postal Telegraph Cable Company. In 1921 the Mackay companies operated some 350,000 m. of wires and 29,000 m. of cables, connecting with all parts of the civilised world. Acting under authority of a joint resolution of Congress of July 16 1918, President Wilson took over the wires as from Aug. 1 1918 and placed them under the control of Postmaster-General Burleson. Mr. Mackay opposed many of the Postmaster-General's policies on the ground that he was using War-time control to bring about government ownership of the wires. In Dec. Mackay was removed from control of the Commercial Cable Company. In March 1919 he was also removed from the presidency of the Postal Telegraph Cable Co., but was reinstated after the return of the wires to their private owners in 1919.

MacKAYE, PERCY (1875–), American poet and dramatist, son of Steele MacKaye, actor-dramatist, was born at New York City March 16 1875. He has lived chiefly in rural New England and in New York City. After graduating from Harvard in 1897, he travelled and studied abroad (1898–1900). By his varied imaginative works, he created new forms in native drama and literature and instigated national movements for community theatres, folk-plays and poetry. His outdoor choral masques, performed in stadium-theatres by thousands of actor-citizens, have drawn large audiences.

His many works include—in poetry: *Poems* (collected, 1916); *Dogtown Common* (1921)—plays: *The Canterbury Pilgrims* (1903); *Jeanne d'Arc* (1906); *Sappho and Phaon* (1907); *The Scarecrow* (1908); *Yankee Fantasies* (1901–12); *Washington* (1918); *This Fine-Pretty World* (1923)—operas: *The Immigrants* (1915)—masques: *Saint Louis* (10,000 citizen-actors, 1914); *Caliban* (Harvard Stadium, 1917)—essays: *The Civic Theatre* (1912)—folk-stories: *Tall Tales of the Kentucky Mountains* (1925)—biography: *Steele MacKaye, Genius of the Theatre* (1926).

MACKE, AUGUST (1887–1914), German painter, was born on Jan. 3 1887 at Meschede, Westphalia. His youth was spent in Cologne and Bonn, and he received his artistic training, from 1904, at the Düsseldorf Academy and later in Berlin with Louis Korinth. He was influenced particularly in his earlier work by the older Impressionists: Cezanne, Matisse, Renoir, Picasso; and the Cubists. During his student days he went to Paris, Holland and Italy for the purpose of study. The period of his independent creation embraces the years 1909–14. With Kandinski, Jawlenski and Marc, he was one of the most important representatives of the " Blauen Reiter," the group of painters from which Expressionism in Germany originated. His art combines the cherished tradition of French painting, its sense of the grace of

movement and atmosphere in landscape painting, with the cosmic sentiment of German art, without losing itself in the subtle and problematical. A journey to Tunis which he undertook in the spring of 1914 inspired some of his most beautiful pictures. He was killed in the World War at Perthes-les-Hurlus, Champagne, in Sept. 1914. See Walter Cohen, *August Macke* (Leipzig, 1922).

McKENNA, REGINALD (1863–), British politician and financier, was born in London July 6 1863, and educated at King's College. He went up to Trinity Hall, Cambridge, as a scholar and graduated as senior optime in 1885. He also gained distinction as an oarsman, rowing in the university boat race in 1887. He was called to the bar in that year, and in 1895 was elected Liberal member for North Monmouthshire. When his party returned to power in Dec. 1905, he became Financial Secretary to the Treasury. In 1907 he was promoted to the presidency of the Board of Education, but was no better able than his predecessor, Mr. Birrell, to draft a bill which would satisfy the Nonconformists and yet pass the House of Lords. His tenure of the office was brief, as, on Mr. Asquith's succeeding to the Premiership in the spring of 1908, he was transferred to the Admiralty.

He entered on his new duties at a time when the country was profoundly stirred by the rapid increase of the German fleet, and was in doubt whether the preparations of the Admiralty were on a sufficiently extensive scale. At the same time a large number of Liberals were disposed to belittle the danger and to call a halt to building schemes in the interest of peace and economy. Mr. McKenna, relying upon the advice of his First Sea Lord, Lord Fisher, resisted the section of the Cabinet represented by Mr. Lloyd George and Mr. Churchill, who took this last view; and, supported by the Prime Minister and Sir E. Grey, he persuaded his colleagues to begin the building of four battleships of the dreadnought type in 1909, and to ask for power, if necessary, to prepare for the construction of four more a year later. This programme disgusted the Radical economists, but did not altogether satisfy public opinion. The Conservatives and other friends of a big navy carried on an agitation to the slogan, " We want eight, and we won't wait "; and eventually in July Mr. McKenna announced that the second four dreadnoughts would definitely be ordered. The estimates of 1909 had shown an increase of nearly £3,000,000; those of 1910 showed a further increase of £5,500,000, mainly due to new construction. A still further increase of £3,750,000 in 1911 made it clear that Mr. McKenna and the Admiralty were in earnest in their determination to maintain " a fleet sufficient to hold the seas against any reasonably probable combination."

Work at the Exchequer.—From the Admiralty he went in the autumn of 1911 to the Home Office, and, as Home Secretary, had charge of the Welsh Disestablishment Bill. On the outbreak of the War, it was his duty—a duty on the whole satisfactorily accomplished—to safeguard the country against the machinations of spies. In the first Coalition Ministry in 1915 he was made Chancellor of the Exchequer, and a still more difficult task was imposed on him—to find the money to carry on the War. By a 4½% War Loan a subscription of nearly £600,000,000 was obtained. In the autumn he introduced a supplementary war budget, providing for over £100,000,000 by new taxation. Income tax was raised 40%, and the abatement and exemption limits lowered; the rates of supertax were seriously heightened; all the old duties on sugar, tea, tobacco, cocoa, coffee, motor spirit and patent medicines were almost doubled; the import of luxuries such as motor cars, cinema films, clocks and musical instruments was restrained by an *ad valorem* duty of 33⅓%; and an excess profits tax of 50% was imposed. Other methods of financing the War which he adopted were War Savings Certificates, which realised over £40,000,000 in their first year; 5% Exchequer bonds, replaced after a year for a short time by 6% Exchequer bonds: but for current expenses he relied mainly on the sale of Treasury bills. In his 1916 budget he raised taxation still further. Income tax was increased to 5s. in the £ and excess profits tax to 60%; there were further increases on sugar, cocoa and coffee; higher duties were imposed on motor vehicles; there were new taxes on amusements, railway tickets, matches and mineral waters.

Mr. McKenna went out of office with Mr. Asquith in Dec. 1916, and, along with other Liberal leaders who had refused to serve under Mr. Lloyd George, lost his seat at the general election of Dec. 1918. A year later he accepted the chairmanship of the London City and Midland (now the Midland) Bank, and speedily gained a position of authority in the city of London. At the same time he showed increasing detachment from party feeling, and was ready, as an anti-Socialist, to accept the Chancellorship of the Exchequer in Mr. Baldwin's first Ministry, had it been found possible to provide him a seat without a party contest. He married in 1908 Pamela, daughter of Sir Herbert Jekyll, and had two sons. (G. E. B.)

MACKENSEN, AUGUST VON (1849–), German soldier, was born in Hausleipnitz, Saxony, Dec. 6 1849. Educated at Torgau and the University of Halle, he was commissioned to the army in 1869. By 1903 he was commander of an infantry division; and in 1908 he was given command of the XVII. Army Corps. At the outbreak of the World War he was placed in charge of the IX. Army on the Eastern Front, where he conducted successful operations against the Russians at Kutno, Łódź and Łowicz. In April 1915 he became leader of the German forces in western Galicia and was largely responsible for the German break-through at Gorlice. On June 20 1915 he was made a field-marshal and in Aug. and Sept. of that year had further successes at Brest-Litovsk and Pińsk. In Oct. and Nov. 1916, as commander of the army sent against Serbia, he practically overran that country; and in 1916, with the composite army which invaded Rumania, he subjugated the Dobruja and by the middle of Jan. 1917 had to all intents and purposes occupied the country. He remained in Rumania till the Armistice; and on his retiring into Hungary he was interned by the French at Neusatz, where he was detained till the beginning of Dec. 1919.

MACKENZIE, EDWARD MONTAGUE COMPTON (1883–), British novelist, son of Edward Compton, was born at West Hartlepool Jan. 17 1883, and educated at St. Paul's School, London, and Magdalen College, Oxford. He saw a good deal of stage life before embarking on his literary career which began with *Poems* (1907) and a picturesque " costume " novel, *The Passionate Elopement* (1911). *Kensington Rhymes* and the novel *Carnival* followed in 1912, the long novel *Sinister Street*, characteristic of the quasi-autobiographical novels of childhood and youth which were then attracting some of the younger novelists. Mackenzie served with the Royal Naval Division at the Dardanelles, and held a staff appointment at Athens in 1916. After the War he lived on the Channel Island of Jethou. His work is characterised by a coloured and mellifluous style, picaresque action and humorous character study and, in some of his best work, a sympathetic portrayal of religious sensibility. This last, for instance, is to be seen in the trilogy *The Altar Steps* (1922), *The Parson's Progress* (1923) and *The Heavenly Ladder* (1924). *Guy and Pauline* (1915), *Sylvia Scarlett* (1918) and *Coral* (1925) were successful developments of the *Carnival* and *Sinister Street* milieu.

MACLEAN, SIR DONALD (1864–), British politician, the eldest son of John Maclean of Kilmoluag, Tiree, Scotland, was admitted a solicitor in 1887. After three unsuccessful contests, he entered the House of Commons in 1906 as Liberal member for Bath. He failed to hold his seat at the general election of Jan. 1910, but in Dec. of that year he was elected for Peebles and Selkirk, which he represented until 1918. He was member for Peebles and South Midlothian from 1918 to 1922, when he lost his seat. In the absence of Mr. Asquith, later Earl of Oxford and Asquith, from the House of Commons, he became chairman of the Parliamentary Liberal party, 1919–22, and after Mr Asquith was returned as member for Paisley in 1920, he continued to take an active part in debate. He unsuccessfully contested Kilmarnock in 1923 and East Cardiff in 1924. He was deputy chairman of committee, House of Commons, 1911–8, and chairman of the London Appeal Tribunal, 1916–8.

During the War he was chairman of the Enemy Debt Treasury Commission and of the House of Commons military appeal tribunal. He was sworn of the privy council in 1916, and created K.B.E. in 1917.

MACLEOD, JOHN JAMES RICKARD (1876–), British physiologist, was born on Sept. 6 1876, near Dunkeld, Scotland, and was educated at Aberdeen Grammar School, Marischal College, Aberdeen, and Leipzig University. From 1899 to 1902 he was demonstrator in physiology and then lecturer in biochemistry at the London Hospital, holding also from 1901–3 the Mackinnon Research Scholarship of the Royal Society; and from 1903 to 1918 he was professor of physiology at the Western Reserve University, Cleveland, Ohio, subsequently becoming professor of physiology and director of the physiological laboratory in the University of Toronto in Canada. His most important work was on the nature of the control of the metabolism of carbohydrates in the animal body, and, together with Dr. Banting, with whom he shared the Nobel Prize for medicine in 1923, he achieved fame as one of the discoverers of insulin (*q.v.*) and of its value in the investigation and treatment of diabetes (*q.v.*), and also in connection with other problems of metabolism. He was elected F.R.S. in 1923, and received the Cameron Prize of Edinburgh University in the same year. He has become a member of many scientific societies and was president of the Royal Canadian Institute in 1925. (*See* PHYSIOLOGY.)

His publications include *Practical Physiology* (1903); *Recent Advances in Physiology*, edited by Leonard Hill (1905); *Diabetes, its Physiological Pathology* (1913); *Fundamentals of Physiology* (1916); *Physiology and Biochemistry in Modern Medicine*, 4th ed. (1922); and numerous papers on insulin, etc., published in *The Journal of Physiology* and *The American Journal of Physiology*.

M'NEILL, RONALD JOHN (1861–), British politician, was born April 3 1861, the son of an Ulster landowner, Edmund M'Neill, and was educated at Harrow and Christ Church, Oxford. He became a barrister, but found a career in journalism and from 1901 to 1904 was editor of *The St. James's Gazette*, afterwards assisting Mr. Hugh Chisholm in the preparation of the 11th edition of *The Encyclopædia Britannica*. Having made several unsuccessful attempts to enter Parliament, he was, in 1911, returned as Conservative M.P. for a division of Kent. As a politician he was for some years associated with Sir Edward Carson and the more strenuous opponents of Home Rule. When Mr. Baldwin formed his first ministry in 1922, Mr. M'Neill was appointed Under-secretary for Foreign Affairs; he held that office until early in 1924 and returned to it in Nov. of the same year again under Mr. Baldwin. In 1925 he was made financial secretary to the Treasury.

MacVEAGH, WAYNE (1833–1917), American lawyer and diplomatist (*see* 17.269), died in Washington, D.C., Jan 11 1917.

MADAGASCAR (*see* 17.270) has an area of about 228,000 sq. m., and a population (1911) of 3,153,511; (1921) of 3,272,301. In 1921 Europeans—nine-tenths French—numbered 19,359, Asiatics 8,135. Tananarivo (Antananarivo), the capital, had 58,459 inhabitants. The Comoro Islands (*see* 6.794) were annexed to Madagascar in 1914. They had (1921) 109,860 inhabitants.

History.—French policy in Madagascar since the appointment of M. Picquié as governor-general in 1910 has been directed not only to material development and to attracting French settlers to the island but also to the training of the natives to ways and outlook essentially French. The former dominant race, the Hova, who had adopted Protestant forms of Christianity and had the largest number of educated persons, was deprived of all trace of political ascendancy, and special attention was paid to the Sakavala, the Betsimasakara and other tribes. Nowhere, however, was a purely native rule under tribal chieftains allowed. At the same time, large numbers of natives were employed in the French administration and the few Malagasy who became thoroughly assimilated were given French citizenship (there were about 150 native French citizens in 1924).

Notwithstanding these measures, the growth of a sense of Malagasy nationality could be discerned. Among the educated natives dislike of French rule continued strong for many years after the conquest of the island in 1896. Their discontent culminated during the World War in the formation of an anti-French secret society, whose members included a large proportion of the native officials. The existence of the society which, it was alleged, plotted the simultaneous "removal" of the Europeans by means of poison was discovered early in 1916. The society was rigorously suppressed and hundreds of Malagasy were condemned to hard labour in the Comoro Islands. The death of Ranavalona III., the last Queen of Madagascar, in exile in 1917, was a blow to Hova aspirations. Gradually, conditions in the island improved. Gradually, too, a better class of European official was sent out. The number of French functionaries was, however, large and was a drain on the scanty colonial revenue.

Malagasy troops were employed in considerable numbers in France during the World War and subsequently in Morocco and in Syria. They formed, however, inferior fighting material and the influence of the returned soldiers on their countrymen was not good. Other disturbing factors were the spread of alcoholism and of malaria and pulmonary disease among the people, leading to a marked decrease in the number of Hova and other races.

A brighter prospect was, however, shown in the marked attention paid by the French to education, and largely by this means the party among the natives attached to the French connection was built up. Primary schools were established in the villages, education was made compulsory between the ages of 8 and 14, and in all schools the children had to learn French. Nearly 100,000 children were attending school in 1925. The primary schools were supplemented by excellent regional schools—where lads were trained to become officials—and at Tananarivo and other towns there were means for higher education, including medical and agricultural schools. Another method by which the class of natives supporting the administration was increased was the lavish grant of decorations, including the Dragon of Annam, the Star of Anjouan and the Étoile Noire, as well as grades of Honneurs (12 classes), and medals such as the *mérite agricole*, the *mérite indigène* and *la médaille du travail*.

M. Marcel Olivier, who became governor-general in 1924, adopted a policy of decentralisation of the administration—greater local autonomy and the employment of more natives and in more responsible posts. While there was no form of popular Government economic and financial delegations existed and the plan of the administration was laid before them. The programme for 1925 laid special stress on the need to increase means of education, promote public health and to guide the natives, who after 30 years of French rule were taking larger views of life—and incidentally dressing largely in European fashion—upon the right road. Relations between the Protestant missionaries and the administration, after a period of strain, had reached a generally satisfactory position, and a larger share of the work was undertaken by French Evangelical societies. The Protestant missions had to meet, however, increasing and sustained efforts by the French Roman Catholic missions.

Economic Conditions.—Development of the natural resources of the island, if somewhat slow, was real. The chief products are rice, coffee, manioc, cattle and graphite. Cultivation is mainly by Malagasy; the number of French settlers on the land is small. In 1924 white colonists were cultivating 150,000 hectares; natives 1,110,000 hectares. Although as the result of a protective tariff the great bulk of trade is with France, about one-seventh is with Great Britain and much British capital is invested in the island. A feature of the commerce is that exports exceed imports both in quantity and value. In 1910 the exports amounted to 80,000,000 tons and imports to 61,000,000 tons; in 1924 exports were 302,000,000 tons and imports 90,000,000. As to value, the difference in the exchange rates of the franc and the increased cost of commodities prevent exact comparisons. The figures show the external trade (imports and exports) at 78,875,000 frs. in 1910 and 646,605,000 frs. in 1924.

Means of communication were greatly improved by harbour works and the building of roads and railways. By 1925 there were 1,500 m. of first-class roads and 540 m. of railway. The

chief railway (240 m. long), connecting the port of Tamatave with Tananarivo, was opened in 1918. From this railway a branch line goes northward, and from Tananarivo a railway (107 m. long) opened in 1923 runs south to Antsirabé. There is a road but no railway to Majunga, the chief port on the west coast. Canals have been made and irrigation works carried out. Public buildings are handsome and solid, built with an eye to future developments.

Revenue is derived mainly from customs and a poll tax; expenditure was largely on the civil service. The budget of 1913, the last normal year before the World War, balanced at 32,000,000 frs.; in 1924 the budget was balanced at 100,000,000 frs.; in effect, taxation and receipts had not increased. It was then realised that if economic progress was not to be checked, a revision of taxation was essential.

BIBLIOGRAPHY.—The standard work on the island is the *Histoire physique, naturelle et politique de Madagascar* (1875, etc.), in many quarto volumes by Alfred Grandidier (1836–1921) founded on his exploration of Madagascar in 1865–70 and subsequent researches. Besides this great work, of which the latest volume appeared in 1917, Grandidier edited a *Collection des ouvrages anciens concernant Madagascar* (1903, etc.), of which vol. 9 was published in 1920; see also James Sibree, *A Naturalist in Madagascar* (1915) and *Fifty Years in Madagascar* (1924); G. Grandidier, *Le Myre de Vilers, Duchesne, Galliéni. Quarante années de l'histoire de Madagascar, 1880–1920* (1923); Jean Lefranc, "La Prosperité et les Besoins de Madagascar," in *Renseignements Coloniaux* (Dec. 1925); *Guide-Annuaire de Madagascar et Dépendances.* (F. R. C.)

MADRAS, India (*see* 17.291), capital of the Madras Presidency, and the third largest city of India, had a population of 526,911 in 1921, very largely Hindu. Madras is rapidly growing; the suburbs are extending, and many of the gardens in the city itself have been divided to provide further building sites. Work was in progress on a drainage system in 1924, and new waterworks have much improved the health of the city. There are large industries (12 mills employing 19,000 hands in 1924). The municipality was reorganised in 1919; there are 50 councillors, 41 elected and five appointed by Government, under an annually elected president. A fine council chamber has been erected behind the Government secretariat. Proposals for the improvement of the port, including a new quay, were made in 1924. The present harbour accommodates 15 vessels drawing up to 30 feet. The harbour works act as a breakwater, and since they were built the foreshore has considerably extended.

MADRAS, UNIVERSITY OF (*see* 27.775).—Since 1912 a small teaching staff has been attached to the university, and by an Act passed in 1923 the reorganisation of the university as a teaching and residential university was authorised. It still exercises control over the quality of the teaching in its constituent and affiliated colleges. In 1923 it received Rs. 45,200 under the will of Sir William Meyer, G.C.S.I. Fifty-three institutions are affiliated to it and recognised in degree courses in the faculties of arts and science, education, law, medicine, engineering, agriculture and Oriental learning.

MADRID (*see* 17.292), with a population of 813,991 in 1923, is the capital of Spain and the largest city. Old Madrid is disappearing, and many of the alleys east of the Palace have been pulled down, whilst a number of massive and pretentious buildings have recently been erected. A cathedral is being built on the site of an old church in the Calle de Baileu, and an Anglican church was consecrated in 1925. A large bull ring and stadium have been opened and an underground railway, the first in Spain, was finished in 1924. Owing to violent speeches in criticism of the Government made there, the Athenaeum Club was closed in 1924 and handed over to the production assembly, a newly formed economic body. In 1925 the Rockefeller Institute gave £85,000 for the establishment of an institute of physics and chemistry. It was decided in 1925 to remove the Hippodrome racecourse to allow of extending a housing scheme and the Paseo de la Castellana. The cost of living in Madrid is notably high.

MAETERLINCK, MAURICE (1862–), Belgian essayist and dramatist (*see* 17.298), presents a marked contrast in his later work published during the 20th century, after he settled in France, to his earlier works, published before he left Belgium. Several of his pre-War essays, collected in *The Buried Temple* (1902), *The Double Garden* (1909), *Life and Flowers* (1907), and more particularly his book on *Death* (1912), are inspired by a reaction against his early mystic and fatalistic tendencies. The same contrast applies to the spirit of such plays as *Monna Vanna* (1909) and *Mary Magdalene* (1909), in which the action is concentrated in a few important scenes, more according to the Racinian than to the Shakespearian method.

The keen interest displayed by Maeterlinck in Shakespearian drama is nevertheless shown in his essay on King Lear, *Life and Flowers*, and in the translation of Macbeth (1910), written for a special performance given in the Abbey of Sainte Wandrille. *The Blue Bird* (1910), produced in 1911, still increased the popularity of the Belgian writer in English-speaking countries. It was followed by *The Betrothal* (1919), produced in London in 1921. From the technical point of view, these fairy plays mark a return to the poet's early symbolism. During the War Maeterlinck wrote a war play dealing with the German occupation of Belgium: *The Burgomaster of Stilemonde* (1920) produced in London by Sir J. Martin Harvey. *The Miracle of St. Anthony* and *Mountain Paths* appeared in 1919, and two more plays in a modern setting, *The Cloud that Lifted* and *The Power of the Dead*, in 1923. Most of the works of Maurice Maeterlinck have been translated into English by A. Teixeira de Mattos. After the latter's death Bernard Miall and F. M. Atkinson undertook this work.

MAGAZINES: *see* NEWSPAPERS; PERIODICALS.

MAGIC: *see* ANTHROPOLOGY; CONJURING.

MAGNESIUM: *see* ELECTRO-METALLURGY.

MAGNETISM (*see* 17.321). This subject may be studied further in the articles CRYSTALLOGRAPHY, SPECTROSCOPY and TERRESTRIAL MAGNETISM.

Theories of Ferromagnetism.—Langevin's theory of paramagnetism has been extended by Weiss[1] to ferromagnetism by the introduction of a hypothetical molecular field H_2 proportional to the intensity of magnetisation I. This hypothetical force is not necessarily magnetic. The relation between I and the external field H_1 is determined by the equations

$$I/I_0 = \frac{\cosh a}{\sinh a} - \frac{1}{a} \qquad (1)$$

$$a = \frac{MH}{RT}, \quad H = H_1 + H_2, \quad H_2 = \lambda I, \quad I_0 = NM \qquad (2)$$

where M is the moment of a magnetic atom, R the gas constant, T the absolute temperature, λ a constant specific for the substance, N the number of atoms per unit volume and I_0 the maximum possible intensity of magnetisation when all the magnetic atoms point in the same direction. These equations require that in the absence of an external field ($H_1 = 0$) in general the intensity of magnetisation I will not be zero, but will have a definite value given by eliminating a between the equations (1) and

$$I/I_0 = \frac{RT}{\lambda M I_0} a \qquad (3)$$

and solving for I. This gives a single *intensity of permanent magnetisation* which is stable, but disappears, and with it the ferromagnetism, at a definite temperature, the *critical temperature*, given by $T_0 = \lambda M I_0 / 3R$. If by means of this equation $R/\lambda M$ is eliminated from (3) and the value of a thus obtained substituted in (1) the resulting equation is of the form

$$I/I_0 = f(T/T_0) \qquad (4)$$

where the function f is a purely algebraical function of the variable T/T_0 the same for all substances. Thus if the intensity I of permanent magnetisation is expressed as a fraction of the maximum possible intensity of magnetisation I_0, and at the same time the absolute temperature T is expressed as a fraction of the critical temperature T_0, the theory leads to a characteristic equation for the intensity of permanent magnetisation (analogous to the equation of state for a gas) which is identical for all ferromagnetic substances. In the neighbourhood of the critical temperature

$$(T - T_0) I = \frac{H_1 T_0}{\lambda} \qquad (5)$$

[1] P. Weiss, *Journal de Physique*, vol. 6, p. 661 (1907).

where I is the actual intensity of magnetisation in an external field H_1, so that if H_1 is kept constant the I, T diagram will be a rectangular hyperbola. Curie's measurements with iron afford an approximate confirmation of (5).

An alternative theory of ferromagnetism has been put forward by K. Honda and J. Okubo.[1] This theory is largely a mathematical working out of the older ideas of Ewing, and is developed by the authors with a special view to the examples of iron, cobalt and nickel, metals which are known to consist of a mass of cubical crystals. In the natural stable configuration the axes of the elementary magnets are aligned parallel to the axes of the cubic crystals. The actual magnetisation is determined by the displacements under the influence of the external field and of the fields due to the neighbouring magnets. To account for temperature effects some spinning of the elements has to be invoked. The theory is made to give a good account of hysteresis and a number of other phenomena, but the thermal side of it appears rather forced.

Honda[2] states that the investigation of the binary alloys forming a solid solution with each other shows that an alloy of a paramagnetic with a ferromagnetic metal can be obtained which has a susceptibility of any value lying between those of the two metals. Hence the two classes cannot be sharply distinguished by the magnitude of the susceptibility, but each class is an extreme member of a series of which the intermediate members can merge continuously into each other. In high fields the disparity between the intensities of magnetisation of manganese and iron is very much less than in fields of the order required to produce saturation in the iron.

Ewing[3] has recently changed his model to meet some objections applicable to the older form.

Ferromagnetic Crystals.—The magnetic properties of crystals are of fundamental importance, because metals such as iron consist of a mass of interpenetrating crystals. Individual crystals of pyrrhotine,[4] magnetite[5] and iron[6] have been investigated. Pyrrhotine (Fe_7S_8) is a hexagonal crystal. It is very difficult to magnetise along the hexagonal axis. Of the two perpendicular axes one is called the axis of easy magnetisation: the properties in the direction of the other are similar to those along the hexagonal axis, but the difficulty of magnetisation is not so great. The curve of magnetisation (I, H curve) along the easy axis is remarkably simple. If a correction is made for the demagnetising force and some little allowance for the material irregularities which are almost inevitable in most minerals the diagram reduces to a rectangle. If the specimen is unmagnetised at first it remains unmagnetised till the value $H_c = 15{\cdot}4$ of the coercive field is reached, when the intensity of magnetisation suddenly jumps to the saturation value $I_s = 47$ gauss, at which it stays for all values of H between $-15{\cdot}4$ and $+\infty$. At $H = -15{\cdot}4$ the magnetisation suddenly reverses and stays at -47 gauss for values of H between $-\infty$ and $+15{\cdot}4$. The constancy of the intensity of magnetisation is actually verified by the experiments directly without any corrections over a range of H from about 700 to 11,000. If the direction of H does not lie along one of the axes the direction of I no longer coincides with it. The intensity of permanent magnetisation has been found to agree with the equation of state (4) above for magnetite from $-79°$ C. to $+587°$ C., at which temperature the ferromagnetism disappears (T_0). Other substances show a fair correspondence with this requirement, but the agreement is not precise. The value of the molecular field deduced by Webster from measurements with single crystals of iron is not only very small compared with the values obtained for pyrrhotine, but is much less than one-thousandth part of the values which have been got by other methods for iron in bulk. This discrepancy would seem to call for serious investigation.

[1] K. Honda and J. Okubo, *Phys. Rev.*, vol. 10, p. 705 (1917).
[2] K. Honda in Sir R. Glazebrook's *Dictionary of Applied Physics*, vol. 2, p. 519 (1922).
[3] J. A. Ewing, *Roy. Soc. Proc.*, A, vol. 100, p. 449 (1922).
[4] P. Weiss, *Journal de Physique*, vol. 4, p. 469, p. 829 (1905).
[5] P. Weiss, *Journal de Physique*, vol. 6, p. 667 (1907).
[6] Webster, *Roy. Soc. Proc.*, A, vol. 107, p. 496 (1925).

Magnetisation in Iron, Steel, etc., a Discontinuous Process.[7]—If the induced currents used to measure the change of induction are highly magnified by amplifiers, and sufficiently rapid detectors, such as oscillographs or telephones, employed, the I, H curve is found to consist of a succession of vertical and horizontal lines like steps. This is apparently due to the sudden magnetisation of successive elements of the material. These may be of considerable size, but it is doubtful if they are single crystals.

Paramagnetism.—Curie's law

$$kT = I_0^2/3R = C \text{ (Curie's const.)} \qquad (6)$$

where k is the susceptibility, has numerous exceptions. Some of these are doubtless due to the universally present diamagnetism, to change of molecular aggregation and the like. In the case of paramagnetic solids the law requires a general amendment, Kamerlingh Onnes and his collaborators having shown that at temperatures down to about 80°K it should be replaced by

$$k(T+\Delta) = C \qquad (7)$$

where Δ is a specific constant for each substance. Equation (7) is sometimes known as Weiss's law. This law breaks down at the very lowest temperatures, the deviations shown by different substances becoming very complicated and individual in character.[8]

Gyromagnetic Effects.—In 1907 O. W. Richardson[9] showed that a delicately suspended rod should spin about the axis of magnetisation owing to the turning of the electron orbits during the act of magnetisation, and calculated the magnitude of the effects to be expected. If U_z and M_z are respectively angular momentum and magnetic moment per unit volume generated for any axis O_z, N,n numbers of electrons per unit volume, M,m masses of electrons and A,a the respective mean areal velocities about the axis O (capital letters referring to positive and small letters to negative electrons), then

$$U_z = 2(N\,M\,A + n\,m\,a) \qquad (8)$$

and

$$M_z = N\,E\,A + n\,e\,a \qquad (9)$$

If the positive parts of the atom are stationary the ratio U_z/M_z reduces to $2m/e$, and in any event it should be independent of the strength of the field. A search made at the time did not succeed in satisfactorily separating the effect from parasitic disturbances. It was first clearly established experimentally by Einstein and de Haas[10] in 1915, and has since been carefully measured by a number of experimenters[11] for iron, cobalt, nickel, Heusler alloys and magnetite. Meanwhile, in 1914, S. J. Barnett[12] had established the existence of a converse effect, *viz.*, the development of a magnetic field along the axis of revolution of a body when made to spin in a field-free space. The intrinsic magnetic field which would give rise to an equivalent magnetisation is calculated as

$$H = 2\frac{m}{e}\omega \qquad (10)$$

when only negative electron orbits are considered, ω being the angular velocity. The experiments show that both U_z/M_z and H/ω are very close to m/e and not equal to $2m/e$. This implies that the motions of the positively charged parts of the atom must be considered. If twice as many quanta of angular momentum are assigned to the electrons as to the nucleus this so-called *gyromagnetic anomaly* is accounted for.[13]

A third gyromagnetic effect, viz., a magnetic intensity produced by a revolving perpendicular magnetic field, is anticipated, but has not yet been established experimentally.[14]

[7] H. Backhausen, *Phys. Zeits.*, vol. 20, p. 401 (1919); B. Van der Pol, *Proc. Acad. Amst.*, vol. 23, p. 637 (1921), p. 980 (1922); E. P. T. Tyndall, *Phys. Rev.*, vol. 24, p. 439 (1924).
[8] L. C. Jackson, *Phil. Trans. R. S.*, A., vol. 224, p. 1 (1924). This paper reports important additions to our knowledge of paramagnetic crystals.
[9] O. W. Richardson *Phys. Rev.*, (1), vol. 26, p. 248 (1908).
[10] A. Einstein and W. J. de Haas, *Berichte der Deutsch. Physik. Ges.*, vol. 17, p. 152 (1915); de Haas, *ibid.*, vol. 18, p. 423 (1918).
[11] *Cf.* Chattock and Bates, *Phil. Trans.*, A, vol. 223, p. 257 (1922); Sucksmith, *Roy. Soc. Proc.*, A, vol. 108, p. 638 (1925).
[12] *Phys. Rev.*, (1), vol. 6, p. 239 (1916); *Proc. Amer. Acad. Arts and Sciences*, vol. 60, p. 125 (1925).
[13] O. W. Richardson, *Roy. Soc. Proc.*, A, vol. 102, p. 538 (1922).
[14] J. W. Fisher, *Roy. Soc. Proc.*, A, vol. 109, p. 7 (1925).

The Magneton and Space Quantisation.—As a result of his observations of discontinuous changes in the apparent value of the Curie constant for magnetite, and for other reasons, Weiss[1] put forward the view that the magnetism of para- and ferromagnetic substances arose from a definite atom of magnetism. This *Weiss magneton* had a magnetic moment of $1{\cdot}85\times10^{-21}$ gauss×cm. The experimental evidence for the reality of this fundamental unit is very unconvincing. There is, however, according to the quantum theory (*q.v.*) a kind of fundamental unit of magnetic moment: the angular momentum of the electron orbits is limited to integral multiples of $h/2\pi$, h being Planck's constant, and we have seen above that the magnetic moment of such an orbit is proportional to its angular momentum. The value of this unit of magnetic moment, the "Bohr magneton" is $eh/4\pi m = 9{\cdot}23\times10^{-21}$ gauss×cm. Magnetic moment, however, is a vector quantity, so that the effect of compounding a number of such moments is more than a matter of mere addition. Thus no magnetic atom in the simple sense is to be anticipated. There should, however, be a tendency to certain discrete values owing to space quantisation.[2] In general if there is an axis of symmetry in the structure of the substance, or if such an axis is supplied by an external field, the quantum conditions require not only that the angular momenta about the polar axes of the orbits, but also their components about the axis of symmetry, should be integral multiples of $h/2\pi$. This double limitation restricts the orientation of the orbits to $m+1$ distinct planes where $mh/2\pi$ is the total angular momentum. The numbers of Weiss magnetons per atom have usually been deduced from the Curie constant C by the relation $C=\frac{n^2M^2}{R}\overline{\cos^2\theta}$ where M is the molar magneton (1123·5 gauss), R the molar gas constant, and θ the angle between the polar axis and the field, the average of $\cos^2\theta$ being taken on the assumption of equal probability for any direction. If, however, the averaging is confined to the discrete values just referred to, the number of Weiss magnetons which should correspond to the successive integral values of m from 0 to 6 are 0, 8·6, 14·1, 19·2, 24·4, 29·4, 34·4. There can be little doubt that the more reliable experimental values have a strong tendency to settle down at these numbers, and a plausible account can be given of such deviations as seem well established.[3] Gerlach and Stern[4] have shown that a fine beam of atoms when passed through a very inhomogeneous and powerful magnetic field is split into two in the case of Cu, Ag, and Au, into at least three in the case of Ni, and there is no effect in the case of Sn, Pb, and Fe. The splitting in the case of Cu, Ag, and Au, corresponds (the accuracy for Ag is about 10%) to a magnetic moment of $9{\cdot}23\times10^{-21}$. Thus this very important experiment establishes the reality at the same time both of space quantisation and the Bohr magneton. Some recently discovered changes with pressure in the susceptibility per unit mass of gases at low pressures are no doubt intimately connected with the phenomena discussed in this section.[5]

Magneto Optics.—Paschen and Back[6] have shown that in strong fields the complex Zeeman effects shown by multiple spectral lines in weak fields become simplified, the separations becoming integral multiples of the Lorentz-Larmor value. The change is a continuous function of the field strength. The magnetic response of multiplets as shown by their Zeeman effects is determined by their natural multiplicity, and there seems little doubt that this latter arises from the magnetic fields of the atoms. In an atom whose maximum permanent multiplicity is r and which is in an excited state such that its azimuthal quantum number is k, a good case can be made out that the maximum magnetic moment is equal to $(r+k-2)\frac{eh}{4\pi m}$. The magnetic moments so deduced show a reasonable agreement with those got from measurements of the paramagnetic susceptibilities of corresponding ions. Each starts from zero, rises to a maximum, and falls to zero again in traversing the successive elements in the period from K through Fe to Cu, and there are other resemblances. One interpretation of the spectroscopic data requires that the magnetic moment of the atomic core should be twice as large as that calculated from the angular momentum, an anomaly like that of the gyromagnetic anomaly already considered and capable of the same explanation.[7]

Permalloy.—H. D. Arnold and G. W. Elmen[8] describe a nickel-iron alloy containing 78·5% Ni, which has remarkable magnetic properties. The initial permeability is about 13,000, the area of the hysteresis loop is $\frac{1}{16}$ that for soft iron and the maximum permeability 87,000 for B about 5,000. The saturation intensity of magnetisation is comparable with that for iron, and the alloy approaches saturation in the earth's field.

See "Magnetic Measurements and Properties of Metals," in Sir R. Glazebrook, *Dictionary of Applied Physics*, vol. 2: *Electricity* (1922); P. L. Kapitza, "Production of High Magnetic Fields," *Roy. Soc. Proc.*, A, vol. 105 (1924); L. W. McKeehan, "Ferromagnetism," *Jour. Franklin Inst.* (May and June 1924). (O. W. R.)

MAGNETISM, TERRESTRIAL (*see* 17.353c).—Further developments occurring in various directions since 1909 in the study of terrestrial magnetism are dealt with below.

Instruments.—The intercomparison of the magnetic instruments of different countries has a recognised importance. While much was done before the World War by the Carnegie Institution of Washington, the comparisons between adjacent countries, which are specially desirable, have not been numerous. A difficulty increasingly realised is the uncertainty whether any magnetometer, even if never moved, can be considered invariable to the degree of accuracy usually aimed at, viz., 0·1′ in declination (D) and 1γ (0·00001 CGS unit) in horizontal force (H).

Trouble arises more particularly as regards the collimator magnet's moment of inertia and the "distribution constants" appearing in the deflection formula $2mr^{-3}(1+Pr^{-2}+Qr^{-4})$. The use of a coil and an electrical current promises increased accuracy in the measurement of H, and coil magnetometers have been constructed in several countries, but the accuracy actually attained requires further investigation. A coil instrument for the direct measurement of vertical force (V) would be of great value in high latitudes.

Surveys.—Observational work on land and sea has gone on continuously under the auspices of the Carnegie Institution of Washington, and many results have been published. Amongst recent surveys or resurveys which have been completed, there may be mentioned those of Belgium, the British Is., Japan and New Zealand. There have also been numerous field observations in Canada, France, Germany, India, the Scandinavian countries, Spain, the United States of America, and in a number of more restricted areas.

Eclipse Phenomena.—Special observations during solar eclipses have been made at many places on a number of occasions, more especially by the Carnegie Institution of Washington, and a good many results have been published in *Terrestrial Magnetism*. No consensus of opinion, however, has yet been reached, beyond the fact that any systematic effect is certainly small. To demonstrate a small systematic effect would require unusually quiet conditions over a period of days including the eclipse.

Sudden Commencements.—Another inquiry depending on co-operation has been into the simultaneity of the so-called "sudden commencements" (S.Cs.) of magnetic storms. It has been suggested by S. Chapman and L. Rodés that the S.C. might be associated with the engulfing of the earth in a jet or cloud of ions emanating from the sun. If the ionic jet rotated with the sun, as Chapman suggests, its time to engulf the earth would be about 30 seconds. If the ionic cloud were stationary, the process would take some $6\frac{1}{2}$ minutes. It seems fairly clear from the several independent investigations which have been made that the difference in the times of S.Cs., if any, is a question of seconds, not of minutes.

Characterisation of Days.—Since 1906, an international scheme has been in operation with its headquarters at De Bilt, Nether-

[1] P. Weiss, *Le Radium*, vol. 8, p. 301 (1911).
[2] *Cf.* A. Sommerfeld, *Atomic Structure and Spectral Lines*, Eng. trans. of 3rd ed. (1923).
[3] *Cf.* E. C. Stoner, *Phil. Mag.*, vol. 49, p. 1289 (1925).
[4] W. Gerlach and O. Stern, *Ann. der Physik*, vol. 74, p. 673 (1924); vol. 76, p. 163 (1925).
[5] A. Glaser, *Ann. der Physik.*, vol. 75, p. 459 (1925).
[6] F. Paschen and E. Back, *Ann. der Physik*, vol. 39, p. 897 (1912); vol. 40, p. 960 (1913).
[7] *Cf.* A. Sommerfeld, *op. cit.*, p. 384; *Zeits. für Physik*, vol. 19, p. 221 (1923); *Ann. der Physik*, vol. 73, p. 209 (1924); Lande, *Zeits. für Physik*, vol. 15, p. 189, vol. 19, p. 112 (1923); E. C. Stoner, *loc. cit.*; J. W. Fisher, *loc. cit.*
[8] H. D. Arnold and G. W. Elmen, *Jour. Franklin Inst.*, vol. 195, p. 621 (1923).

lands. Each co-operating station assigns to every day a " character " figure 0, 1 or 2, according as the day is quiet, moderately disturbed or highly disturbed. The arithmetic means of the figures so assigned are given in the annual De Bilt lists, so that each day has an international character figure varying from 0·0 to 2·0. Intercomparison of the character figures assigned at different stations has confirmed the view that in ordinary latitudes disturbance is seldom if ever confined to one area.

The De Bilt character figures discriminate on the whole very satisfactorily between the days of the same month or season. But there is a natural tendency in the standard represented by 1 or 2 to vary according as the season is more or less quiet. To remove this difficulty, F. Bidlingmaier suggested the use of " magnetic activity " defined as the mean value throughout the day of $\frac{1}{8}\pi(\alpha^2+\beta^2+\gamma^2)$, where α, β, γ represent the departures of the three rectangular magnetic components from their normal values. " Activity " in this sense exists and may be considerable on quiet days. Apart from the difficulty of assigning normal values, the amount of labour entailed in the calculation of " activity " in the absence of some special mechanical means seems prohibitive. Various alternatives have been proposed, including the daily ranges of one or all of the magnetic elements, the squares of the daily or hourly ranges, the variation from day to day in the mean daily value of *H*, and the number of intersections by the magnetic curve of a series of lines, parallel to the base line. In low latitudes disturbance is largely confined to *H*, and the character of the day may be fairly diagnosed on the *H* curve alone, but this is far from the case in high latitudes.

Twenty-seven-day Interval.—The existence of the De Bilt daily characters has enabled the reality of a 27-day interval in magnetic disturbance to be investigated without any possible prejudice. The phenomenon has been found to exist for quiet as well as for disturbed conditions. A day which follows a conspicuously disturbed (or quiet) day after an interval of from 26 to 28 days has decidedly more than the average chance of being itself a disturbed (or quiet) day.

Diurnal Variation.—The primary object of the international character scheme was the selection for each month of five quiet days (commencing at Greenwich midnight) from which diurnal inequalities of the magnetic elements should be calculated, either additional to or in place of those derived from all days. Of late years five international disturbed days a month have also been selected at De Bilt, so that diurnal inequalities may be calculated from them as well. It has been found that in high latitudes the diurnal inequality is extremely sensitive to disturbance. This is illustrated by the vector diagrams (*see* 17.366 and 367) for the horizontal plane in fig. 1. They are for the equinoctial season of 1912 at the two Antarctic stations Cape Evans (77°38′ south, 166°24′ east) and Cape Denison (67°0′ south, 14°40′ east). The curves have been smoothed by the assumption that they are true ellipses, with axes in and perpendicular to the geographical meridian. The hypothesis is certainly not much in error, and it prevents the eye from being distracted by the irregularities inevitable in unsmoothed vector diagrams based on a comparatively few days. Starting from the centre in each case, the successive curves represent groups of days having for their mean international character figures 0·5, 0·15, 0·35, 0·65 and 1·15. The curves are described in the direction of the arrows, *i.e.*, anticlockwise.

Magnetic Poles.—Cape Evans and Cape Denison are on opposite sides of the south magnetic pole. Its position is not exactly known, somewhat conflicting results having been obtained by the different Antarctic expeditions. According to E. N. Webb in the discussion of the results of the expedition led by Sir Douglas Mawson, the approximate position for the epoch 1912 was 71°·2 south, 150°·7 east. This is considerably to the northeast of the positions assigned by the " Southern Cross " and " Discovery " expeditions (*see* 17.384). But all the expeditions agree in placing the south magnetic pole near the direct line from Cape Denison to Cape Evans. Accepting this as a fact, it may be shown that a change of 4·5γ in the horizontal force vector is roughly equivalent to a shift of 1 km. in the position of the pole.

On this basis the curves of fig. 1 constitute independent estimates made at the two stations of the daily track of the south magnetic pole, on days of different international character, according to the kilometre scale supplied. The subject has also been investigated for the north magnetic pole for the epoch 1904 by A. Graarud and N. Russeltvedt, using the observations of Amundsen's expedition. The principal base station, occupied by a magnetograph, Gjöahavn, had a dip of 89°17′, and in fixing the position of the pole use was made of four other stations with dips varying from 89°34′ to 89°52′. Thus the position found for the north magnetic pole in 1904, viz., 70°30′ north, 95°30′ west, cannot be much in error. This position differs by only 25′ of latitude and 1°16′ of longitude from that assigned in 1831 by James Ross (17.384), so there is no suggestion of rapid secular change.

On this basis Graarud and Russeltvedt calculated that a change of 3·2γ in the horizontal force vector answers to a shift of 1 km. in the position of the pole. The curve they give for its daily motion on the average day of 1904 is approximately elliptical, with minor and major axes respectively in and perpendicular to the geographical meridian. The extreme range from east to west is about 22 km., and that from north to south 13 kilometers. The curve, in short, is very similar to the Cape Denison curve for character 1·15, though slightly more elliptical. It is described, however, in the clockwise direction, as is natural for the northern hemisphere. The differences in sunspot frequencies, 42·0 in 1904 as against 3·6 in 1912, would naturally lead to a considerably larger amplitude in the earlier epoch.

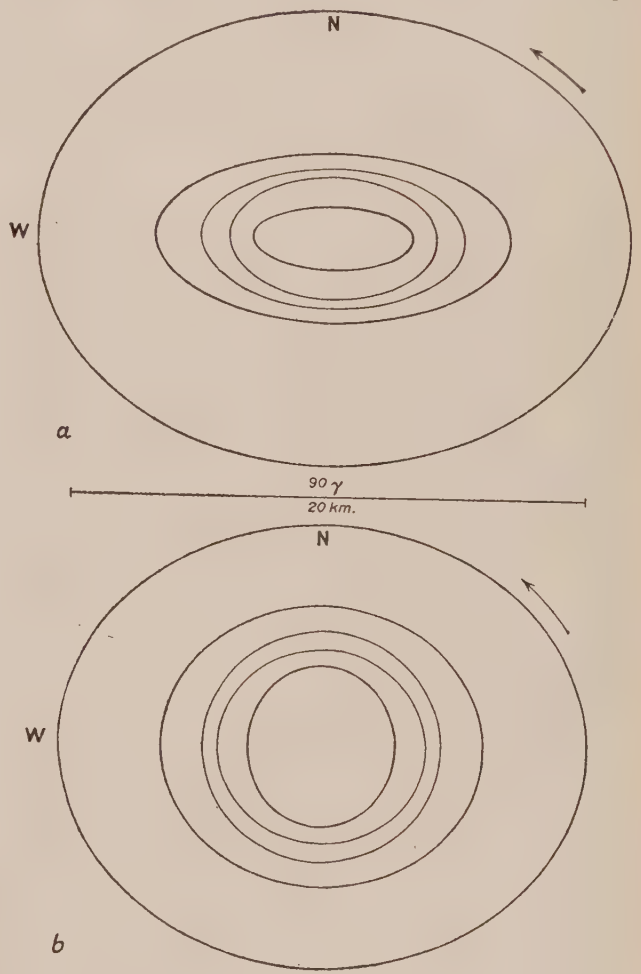


FIG. 1.—Vector Diagrams: (a) Cape Denison; (b) Cape Evans.

Variations of Disturbance with Latitude.—A comparison of the disturbances recorded in 1911–2 at the Scott Expedition's Antarctic station with those at observatories extending from Mauritius to Sitka, Alaska, showed a marked tendency for disturbance to be simultaneously great in high northern and southern latitudes, and to be less at intermediate stations, whether north or south of the equator. Again, comparison of auroras with magnetic character figures got out for individual hours, as well as for individual days, shows that an intimate relation exists between aurora and magnetic disturbance. While long accepted as true of large magnetic storms and aurora in countries where both phenomena are rare, this seems also true in the case of bright

aurora in high latitudes. In the case of faint non-fluctuating aurora, magnetic conditions seem often practically unaffected. Faint aurora, in fact, seems the rule rather than the exception in high latitudes under conditions favourable to its visibility.

Theory of the Regular Diurnal Variation.—The derivation of the diurnal variation from a potential has been further considered. Assuming the derivation possible, the constants occurring in the potential have been calculated by W. van Bemmelen, S. Chapman, F. Bidlingmaier and J. Bartels. A. van Vleuten, who has examined the hypothesis critically, especially as applicable to quiet-day phenomena, has, however, concluded that the balance of evidence is against it. A difficulty in the way of any general theory of the diurnal variation is the varied influence of disturbance. This influence not merely differs at different places, but is not the same for the different elements. It also varies with the season of the year, and is not the same at the same season of different years.

General Theory.—These various phenomena—the synchronous occurrence of magnetic disturbance in different parts of the earth, its special development in high latitudes, the enhancement of the regular diurnal variation during disturbance, the association of disturbance with aurora, and the 27-day interval—all accord *in a general way* with the theory pretty generally held that magnetic disturbance and aurora are both due to the emission from the sun of some species of electrical radiation. The nature of this radiation, whether β or α rays, has been discussed more especially by Kr. Birkeland, C. Störmer and L. Vegard. Difficulties, especially the scattering to be expected from the mutual repulsion of ions, if all of one sign, have been discussed by A. Schuster, S. Chapman and F. A. Lindemann.

When approaching the earth, ions of either sign would naturally spiral round the lines of magnetic force, and so be concentrated in high latitudes. But for ordinary α or β rays the approach to the magnetic poles should be closer than auroral phenomena suggest. To explain the occurrence of aurora in comparatively low latitudes, Störmer has suggested the existence of a ring of ions in the magnetic equator, but no proof of its existence has been advanced. The presence of ions would naturally increase the electrical conductivity, thus enhancing the amplitude of the regular diurnal variation of the magnetic elements, supposing that due (as is generally believed) to electrical currents in the upper atmosphere. The fact that disturbance enhances the diurnal inequality relatively more in winter than in summer would follow naturally from the very probable hypothesis that ordinary solar radiation itself increases the conductivity of the atmosphere. In high latitudes we may suppose that in winter the electrical currents associated with aurora play the part which in summer is largely played by direct solar radiation.

In the simplified mathematical theory of aurora and magnetic disturbance developed by C. Störmer, the earth is treated as magnetised as it would be if only the first order Gaussian harmonic existed. Everything is then symmetrical round the axis of the first harmonic, whose north end according to J. C. Adams was in 1880 at 78° 24′ north and 68° 4′ west, but moving west through about 0°·1 per annum.

In a theory of magnetic storms, S. Chapman also assumes symmetry round an axis, regarded as magnetic latitude 90°. He has derived mean results from 40 storms recorded at 12 stations arranged in five groups according to magnetic latitude. Confining himself to storms having an S. C., he regards the "general storm" phenomena, *i.e.*, the phenomena not dependent on local time, as determined by the "storm time," or time elapsed since the S. C. The phenomena varying with local time, he regards as composed of the ordinary diurnal variation + a "local storm variation," determined like the general storm phenomena by the magnetic latitude. He discusses the electrical current systems supposed to "flow in more or less horizontal strata in the upper atmosphere" to which the magnetic changes he has arrived at may be ultimately ascribed. "The external currents will of course be accompanied by corresponding induced currents within the earth which will modify their effects." Taking what he considered an average storm, Chapman calculated that it called for the expenditure of energy at the rate of about 2×10^{18} ergs per second for 15 hours.

To many minds, theoretical researches of this kind are fascinating, but deductions from them, until confirmed by direct observation, are just as hypothetical as the theories themselves. Magnetic phenomena are much less simple than theories such as Störmer's and Chapman's suggest. The complete Gaussian analysis indicates in reality a considerable departure from symmetry round an axis. High latitudes, moreover, were practically unrepresented in the data used for calculating the Gaussian constants, while the asymmetry in the positions of the two magnetic poles suggests that the results of the analysis may depart most from truth in the very regions where aurora and magnetic storms are most developed. The individual aurora or magnetic storm shows no approach to symmetry round a magnetic axis. The magnetic disturbance on a given occasion is of very different amplitude at stations having the same magnetic latitude. Even when there is a recognisable S. C. the sequence of events at a given station varies much on different occasions.

In low latitudes the S. C. is a change mainly in *H*, almost invariably a rise. In higher latitudes it is usually oscillatory, and may be large in all the elements. The duration of the enhanced value in *H* following the S. C. is sometimes a few minutes, sometimes several hours. Following the enhancement there is generally a pronounced fall, bringing *H* well below its normal value. But the recovery from this depression may set in after a few hours and proceed almost uninterruptedly, a return to comparatively quiet conditions occurring within 12 hours, or there may be a succession of irregular movements, highly disturbed conditions lasting for one or two days. The superposition following "storm time" of unsorted disturbance curves may give us a storm such as never existed. Comparison of magnetic curves from Kew, Stoneyhurst, Eskdalemuir and Lerwick has shown that while the amplitude of magnetic disturbance in the British Is. almost invariably increases with magnetic latitude, the rate of increase differs widely on different occasions. On special occasions there may be very large rapid movements in Lerwick, which are hardly represented in the south of England. The average intensity even of magnetic disturbance must be largely determined by other things than the magnetic latitude, as defined by Chapman. Agincourt (Toronto) and Kew are of nearly the same "magnetic latitude," but disturbance, at least in 1911–2, was almost invariably much larger at Agincourt than at Kew.

Chapman's estimate of the energy of a magnetic storm is certainly much less improbable than the enormously higher estimate made in 1892 by Lord Kelvin on the hypothesis of direct magnetic action between the sun and the earth, but it depends fundamentally on several assumptions, the degree of probability of which is at present entirely a matter of opinion.

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(C. CH.)

MAHAFFY, SIR JOHN PENTLAND (1839–1919), Irish classical scholar (*see* 17.394), became vice-provost of Trinity College, Dublin, in 1913 and provost in 1914. In recognition of the services of the college during the World War, he was in 1918 made a G.B.E. From 1911 to 1916 he was president of the Royal Irish Academy. He died April 30 1919.

MAHAN, ALFRED THAYER (1840–1914), American naval officer and historian (*see* 17.394), died in Washington, D.C., Dec. 1 1914. His later works included *Naval Strategy Compared and Contrasted with the Principles of Military Operations on Land*

(1911); *Armaments and Arbitration* (1912) and *The Major Operations of the Navies in the War of American Independence* (1913).

See C. Carlisle Taylor, *The Life of Admiral Mahan* (1921).

MAH-JONGG.—This is a Chinese game, for four players, which was introduced into Europe and America about 1923. The game is played with a number of pieces known as tiles. There are 144 tiles in all, comprising four "flowers," four "seasons," four white, four red and four green "dragons"; four each of north south, east and west "winds"; and three "suits," namely "characters," "bamboos" and "circles." Each suit consists of 36 tiles, made up of four lots numbered one to nine inclusive.

Each player plays independently, and the procedure is briefly as follows: The tiles are arranged in pairs face downwards in four sides of a square, each side, or wall, containing 17 pairs. The eight extra tiles are left in the middle of the table to be taken up by any player who draws a "flower" or a "season." The bank is allotted by a throw of dice, and the highest throw fixes also the point at which the wall shall be opened. Each player is allotted a wind, the banker taking the east wind. Each player, starting with the banker and working anti-clockwise, draws four tiles at a time from the wall till each has drawn 12, then the banker draws one extra tile. Each player's object is to make a complete hand of twos, threes, or fours of a kind, *e.g.*, three sixes of "characters" and sequences; or four, five and six of "bamboos."

The actual play commences when the banker discards a tile, placing it face upwards on the table. Each player, playing in order clockwise, then draws a tile from the wall and discards one from his hand. Should he draw a "flower" or a "season" he exposes it and draws one of the eight extra tiles from the centre of the table. If a player discards a tile of which another player already has two, such other player may cry "pung" and take the discarded tile, at once exposing the three tiles on the table. The players on the left of the discarder, by crying "chow," may similarly take a discard to complete a sequence of three. A pung or a chow does not affect the order of drawing, nor does it count as a draw. A player punging a tile takes it in preference to a player wishing to chow it. Finally, a player requiring a discarded tile to make his hand complete cries mah-jongg, and takes the tile in preference to all other claimants. A player can go mah-jongg either by claiming a discard, or by drawing a tile in the ordinary way, but such tile must complete his hand without further discarding on his part. The hand finishes as soon as one player goes mah-jongg.

The scoring is somewhat complicated, and various conditions in a hand entitle the player to double his score. The mah-jongg hand is paid in full by all the others except the banker, who pays him double. If he is himself the banker, he is paid double by all. The other players pay differences to each other, the banker paying or being paid double as the case may be. The bank passes anti-clockwise for the following hand, unless the banker went mah-jongg, when it remains with him.

MAHLER, GUSTAV (1860–1911), Austrian composer and conductor, was born at Kalischt, Bohemia, July 7 1860. From 1885 onwards he conducted in Prague, Budapest, Hamburg and London, becoming director of the Vienna Opera in 1897. By unremitting zeal and tireless enthusiasm he brought the Viennese opera to a high state of perfection, but the strenuous work which he exacted from all earned him the name of "the tyrant" and made him many enemies, and in 1907 he was obliged to resign his post. He immediately received the offer of a conductorship in America, which he visited for three seasons, returning to Vienna in 1911, where he died on May 18. Mahler reflected to some extent in his works the classical tradition inherited from Schubert and Bruckner. In addition to his songs and chamber music, he wrote no fewer than nine symphonies, planned on a gigantic scale for an orchestra nearly doubled in strength. These lengthy works, though rarely performed, have nevertheless had a certain vogue in Holland, chiefly owing to the zeal of the eminent conductor Mengelberg. See R. Specht, *Gustav Mahler*, etc. (1913); P. Stefan, *Gustav Mahler, a Study of his Personality and Work* (1913); G. Adler, *Gustav Mahler* (1916); P. Bekker, *Gustav Mahler's Sinfonien* (1921).

MAHOMMED V. (MEHMED) (1844–1918), Sultan of Turkey, was born at Topqāpu Nov. 3 1844, a younger son of the Sultan 'Abdul Mejid (1823–1861). He led a quiet and retiring life, and suffered at times considerably from the jealousy and suspicion of his elder brother, the Sultan 'Abdul Hamid II. On the deposition of 'Abdul Hamid he was invested as caliph (May 10 1909). He was, for the most part, merely a tool in the hands of the committee of union and progress and, though he was supposed to dislike the pro-German policy of Enver Pasha, he was unable to take any effective steps to oppose him. He died at Yildiz July 3 1918, and was succeeded by his brother Vahid-ed-Din (b. 1861) as MAHOMMED VI., the latter resigned in Nov. 1922 and died at San Remo May 15 1926.

MAHOMMEDANISM (*see* 17.399).—Of all the great faiths that have been accepted by large masses of the human race, Islam is one of the most historical. For the details of the life of the Founder the reader is referred to the article MAHOMET. The faith he preached is Islam, *i.e.*, resignation, submission to an Almighty Will. It teaches abstinence from drink, personal cleanliness, and abhorrence of evil, and, above all, the value of human life. The world is a well-ordered creation, regulated and guided by a Supreme Intelligence overshadowing the universe, since "Everything is pledged to its own time." Yet the human will is free to work for its own salvation. The sympathy of Mahomet was universal, and he invoked the mercy of the Creator "on all living beings." He pronounced the saving of one human life to be tantamount to the saving of humanity.

His social conception was essentially constructive, not disintegrating. In his most exalted mood the Teacher never overlooked the sanctity of family life. To him the service of humanity was the highest act of devotion. His call to the Faithful was not to forsake those to whom they owed a duty; but in the performance of that duty to earn merit and reward. Monasticism was disapproved of as contrary to nature. Children were a trust from God, to be brought up in tenderness and affection; parents were to be respected and loved. The circle of duty embraced in its fold "kindred and neighbours, and the lowly and poor."

The Koran.—The Koran has, on mistaken analogy, been sometimes called the Mahommedan Bible. The Old Testament is a record of ancient Israelite traditions which have, in one form or another, become the common property of the three Semitic faiths that now rule over the consciences of masses of mankind. All these traditions have passed through numbers of hands and bear evident traces of revision and editing. The synoptic Gospels, which form the outstanding feature of the New Testament, were not compiled, at least in the shape in which they have come down, until long after the events they purport to record.

The Koran, as a human document, stands on a totally different footing. As such it is *sui generis*. It is a record of the outpourings of one single human heart to whom the Soul of the Universe had spoken, and it has escaped revision. It prescribes religious duties in precise terms. Since men owe gratitude to the Creator for His manifold blessings, he should be glorified daily at stated times, so that there may be no neglect in the performance of His Worship. Five times a day devotions are offered to the Lord of Creation. Man must approach Him in purity of heart and body; and the practice of the Prophet has consecrated the mode of physical lustration and the cleansing of the heart.

Abstinence was also made a part of the religious law. Every able-bodied man or woman is required to abstain from food and drink from sunrise to sunset for one lunar month. The only exceptions to this rule are students and soldiers engaged in defence of their religion or country, and invalids male and female. Charity was incorporated as a part of religion and every person possessed of a sufficiency was required to give a certain part of his income for the support of the indigent.

Social Regulations.—The status of women was raised beyond any known in contemporaneous history. Far from degrading women, the legislation of Mahomet raised her in the social scale. "Paradise," it was declared, "is at the feet of the mother." In

his last sermon the Prophet enjoined his followers thus:—" Ye people, ye have rights over your wives and they have rights over you. Treat your wives with kindness and love. Verily you have taken them on the security of God."

The unrestrained polygamy of pagan times was drastically cut down; and the number of wives was limited to four and subjected to a condition which rendered it impossible under civilised conditions to practice polygamy without infraction of the rule. Owing to this condition in fairly-advanced Moslem communities polygamy has been much reduced.

Human chattelhood was forbidden; bondage was permitted only in the case of prisoners taken in " lawful " warfare in defence of religion; stringent rules were prescribed for the treatment of the unfortunate beings held in bondage; the child was not to be separated from its parents; no husband from his wife or one relative from another; and if a bondswoman bore a child to her master, she became at once a free woman and the child took the status of legitimate issue. The enfranchisement of people held in bond was an act of supreme merit with the Lord. Moslems were enjoined to " feed their slaves as they feed themselves, and clothe them with the stuff they wear."

The Sects of Islam

Islam, like Christianity, has been rent by schismatic strife and sectarian bitterness. The bulk of the Moslem population belong to the Sunni persuasion. Shiahs are found chiefly in Persia, but also in India. The Sunnis and the Shiahs differ greatly in their religious conceptions and doctrinal practices, and the difference extends from doctrines into the region of law, *e.g.*, the Shiah law of succession does not recognise agnacy, and daughters' children are not excluded by an uncle's son. Again, while the Sunni is enjoined to offer the prescribed prayers " congregationally " in a mosque, the Shiah may offer his orisons individually in the privacy of his house.

The principal divisions of the Sunni sect are mainly legal, according as the interpretations of the Hanafite, the Shafiite, the Maliki or the Hanbalite school are followed. Among the Shiahs, also, great jurists flourished who, deriving their inspiration from the medinite school, were liberal in their conceptions.

Wahhabiism.—Conformity was maintained in the Sunni community until the middle of the 18th century, when there arose a man in Central Arabia, named 'Abdul Wahhab, who revived the Khariji cult in all its pristine Calvinistic bigotry. He welded the Arab tribes into a composite force and established his authority from the shores of the Persian Gulf to the Red Sea. The Wahhabis, as his followers have ever since been called, captured Mecca and Medīna, from which they were driven out by the forces of Ibrahim Pasha, the son of Mehemed Ali, the founder of the present dynasty which rules over Egypt.

Ibn Sa'ud, the present chief of the Wahhabis of Nejd, emulated the achievements of his forbears by capturing again the Holy Cities from the hands of King Husain. In 1912 he had begun the formation of the new organisation of the Wahhabis under the name of Ikhwan or " brethren," and established colonies of them in various parts of Arabia, with the design that the settlers should sink their tribal rivalries in a communal religious life.

Senusis.—A religious movement closely connected with Wahhabiism was that of the Senusis, but though its teachings were practically identical, its organisation followed the usual lines of religious orders in the Mahommedan world. Founded in 1837, this order has achieved an immense expansion not only over the whole of North Africa from Egypt to Morocco and far to the south, but also in Mesopotamia and the Malay Archipelago. The order has been zealous in proselytising and has made many converts to Islam. Its activities were for a number of years a source of anxiety to the French as they appeared to be directed against the extension of European influence in Africa, and it took up arms against the Italians after the occupation of Tripoli in 1911, but in recent years has entered into friendly relations with them.

Shiahism.—Shiahism had no such auxiliary as Sunnism possessed in the form of organised political power to prevent its being rent with heresies, and consequently it has been distracted by constant schisms. Some owed their origin to dynastic rivalry; others to survivals of earlier cults in Western Asia.

Imamis.—The followers of the twelve Imams of the House of the Prophet (Ahl-ul-Bait) are commonly called Imamis. Ismail, the founder of the Safavid dynasty, made this branch of Shiahism the state religion of Persia, which character it has retained ever since. The Shiahs in India are also chiefly Imamis.

Zaidis.—The Zaidis are the followers of Zaid, a grandson of Husain, the martyr of Kerbalā. They differ from the general body of the Shiahs regarding the title of Abu Bakr, Omar and Othman to the Caliphate, and agree with the Sunnis on this point. The Zaidis are still found in the Yemen and North West Africa. The Zaidi Imam, Yahya, has recently consolidated his authority in Northern Yemen and is reported to be a ruler of great capacity.

Ismailis.—The Ismailis derive their name from Ismail, the eldest son of the Imam Ja'far as-Sadik, who pre-deceased his father. They hold that on the death of the Imam the religious headship devolved on Ismail's son Mohammed, whom they call al-Maktum (the " unrevealed " Imam), and not on his uncle Ja'far's second son, Musa al-Kazim, as believed by other Shiahs. Al-Maktum was, according to the Ismailis, succeeded by Ja'far al-Musaddak whose son, Mohammed al-Habib, was the last of the " unrevealed " Imams. The Ismailis achieved political importance with the foundation of the Fatimid dynasty in North Africa in 909 and after the conquest of Egypt in 969 the Fatimids ruled over North Africa and Egypt for two centuries. In the realm of thought one of the most remarkable manifestations of Ismaili speculation is found in the treatises of the Ikhwan us-Safa (the Brethren of Purity), a society of rationalists towards the close of the 10th century; they taught that individual souls are part of the world soul, to which they return after the death of the body. Through various stages of emanation the whole universe proceeds from God, and the re-union of the soul with God is effected through the reversal of this process and the purification of the soul from all grosser elements by asceticism, spiritual exercises and philosophy.

Assassins and Druses.—Two sects more permanent and more highly organised, the Assassins and the Druses, still survive as offshoots of the Ismaili movement. The Assassins in 1090 established themselves in the fortress of Alamut, in the north of Persia, and later in a number of other strongholds in that country and in Syria, and thence carried on an active propaganda, and their devoted followers did not hesitate at the risk of their own lives to use the dagger to remove political opponents. Their political independence was brought to an end by the Mongols, who destroyed most of their castles in the 13th century; but this sect still survives in a very altered form under the headship of H.H. the Aga Khan, whose followers in India number more than 127,000, in addition to adherents scattered throughout Syria, Persia, Central Asia and East Africa. His followers in India are known as Khojas and a large number of them are descended from Hindu converts and still adhere, in most important particulars, to the Hindu rules of succession.

A still more heterodox offshoot of the Ismaili sect is the community of the Druses, living in the Lebanon and the Anti-Lebanon and in the mountains of Hauran. They hold that God becomes incarnate in man in every age, and that Hakim, the sixth Caliph of the Fatimid dynasty in Egypt (996–1020), was the last incarnation of God; they believe that Hakim did not die and that he is only absent from human sight and will one day manifest himself again.

Babis and Bahais.—Another outgrowth from Shiahism was the Babi, followed by the Bahai movement, but in their latitudinarianism they have so far diverged from any orthodox form of Islam, that it is very doubtful whether they can properly be reckoned among Mahommedan movements. The Bahais have carried on an active propaganda in America and in certain parts of Europe, and have drifted further and further from the Islamic source from which they originally sprang.

The Ahmadiyya Sect.—In the year 1879 the founder of a new religious movement, named Mirza Ghulam Ahmad, began to

preach in the village of Qadian in the province of the Punjab, India. He claimed to be not only the promised Mahdi but also the promised Messiah—personages generally held to be distinct in ordinary Mahommedan theology. Another modification he introduced into Islamic doctrine had reference to the death of Jesus; the commonly-accepted belief maintains that Jesus was taken by God alive into heaven, while a phantom was crucified in his place; in oppositon to this he declared that Jesus was actually crucified, but was taken down from the cross while still alive by his disciples, was healed of his wounds and afterwards made his way into Kashmīr, where he finally died, his tomb being still in existence in the city of Srīnagar. Having thus removed the ground for any expectation of the second coming of Jesus from heaven to earth, he explained that he himself was the Messiah, not as being an incarnation of Jesus (for he rejected the doctrine of transmigration), but as having come in the likeness of Jesus—being Jesus for this generation just as John the Baptist was Elijah, because he came in the spirit and power of Elijah.

In proof that he had come in the spirit and power of Jesus, Mirza Ghulam Ahmad adduced the likeness of his own character and personality to that of Jesus, his gentleness of spirit, the peaceful character of his teaching, his miracles and the appropriateness of his teaching to the need of the age. In harmony with this pacific claim, he expounded the doctrine of Jihad (usually interpreted as meaning war against unbelievers) as a striving after righteousness. Mirza Ghulam Ahmad died in 1908, and a few years after his death his followers split into two parties, one having its headquarters in Qadian, and the other in Lahore. Both these sections of the community succeeded in enlisting the services of devoted, self-sacrificing men, who are unceasingly active as propagandists, controversialists and pamphleteers. They control an extensive missionary activity, not only in India, West Africa, Mauritius and Java (where their efforts are mainly directed towards persuading their co-religionists to join the Ahmadiyya sect), but also in Berlin, Chicago and London. Their missionaries have devoted special efforts to winning European converts and have achieved a considerable measure of success. In their literature they give such a presentation of Islam as they consider calculated to attract persons who have received an education on modern lines, and thus not only attract non-Moslems and rebut the attacks made on Islam by Christian controversialists, but win back to the faith Moslems who have come under agnostic or rationalist influences.

Modern Literature.—Indeed it has been characteristic of much of the theological literature of the Mahommedan world for the last few decades, to adopt an apologetic tone and to shake off those special features which have exposed it to hostile criticism; thus polygamy, slavery and intolerance are declared to receive no sanction from the Koran, as rightly interpreted; in Islam the reconciliation of religion and science is effected, and the demands of the modern spirit of enlightenment are satisfied. Of such modernist literature there has been a considerable output, especially in Egypt and India; it naturally appeals most to those readers who have come under European influences, and excites considerable opposition among more conservative orthodox circles, who remain loyal to the traditional schools of thought (as enumerated above) and resent the rejection of traditional, mediaeval theology by the modern thinkers. The older sects continue to flourish, and the new thought has not yet attempted to organise itself on sectarian lines and has thus remained largely a matter of individual opinion.

This lack of sectarian development is possibly in great measure due to the absorbing attraction that political problems during recent years have exercised upon the Mahommedan world. Anxiety as to the fate of Turkey after the Armistice, the withdrawal of the Holy Cities from the control of the Caliph and the occupation of Jerusalem by unbelievers, the separation of the Sultanate from the Caliphate (in 1922) and the abolition of the Caliphate altogether (in 1924) were circumstances that profoundly stirred the minds of pious Moslems all the world over and did not create an atmosphere favourable to the calm consideration of purely dogmatic problems. Moreover in many Mahommedan countries some form of nationalism obscured the larger vision of a united Islamic world; in Turkey it took the extreme form of Pan-Turanianism, or Pan-Turkism, which aimed at the union of all sections of the Turkish race in one vast confederacy and sought to purge the national life from all foreign admixture, in language, literature and political institutions; in India nationalist feeling prompted the Hindu-Moslem Entente and gave birth to the oft-repeated sentiment, "I am an Indian first, and a Moslem afterwards"; among the Mahommedan populations of Russia the formation of Soviet Socialist Republics has evoked nationalistic movements which have temporarily thrust purely religious interests into the background; Bolshevik propaganda has also met with a response among the Mahommedans of Java.

But Islam is so closely bound up with every aspect of the life of a Mahommedan people that even a purely nationalist political movement may react strongly on the religious life. This has been notably the case in Turkey, where the Government, besides abolishing the Caliphate, has confiscated the religious endowments and suppressed the religious orders; polygamy has practically been made illegal; the date of Ramadan has been fixed in accordance with astronomical science instead of being made dependent on reports that the moon has been seen (as has been the immemorial custom in the Islamic world); and the discontinuance of the wearing of the veil by women and the adoption of hats by men, are typical of a changed attitude towards the established usages of Mahommedan society. The breach with the past has been nowhere so violent as in Turkey, but throughout the whole Mahommedan world there are indications of a changed attitude towards religious questions. The old orthodoxy still holds the allegiance of the masses, as well as many of the educated, but others, especially those whose education has brought them under European influences, are seeking a re-statement of their religion, more in harmony with their general outlook upon life. To those that seek a solution in the realisation of some nationalist ideal, there remains little save a sentimental attachment to Islam, while they deprive it of any control over law and social organisation; the reformers, on the other hand, claim for the precepts of Islam control over all the relations of human life, but seek to restore it to its primitive simplicity, believing that thus it can be brought into harmony with modern thought and modern conditions.

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MAINE (*see* 17.434).—The population of the state in 1920 was 768,014, in 1910 742,371, an increase of only 3·5%, as compared with 14·9% for the United States in the same period and 6·9% for Maine in the previous decade. There was a significant increase in urban population. The proportion living in places of 2,500 or more was 33·5% in 1900, 35·3% in 1910, and 39% in 1920. In 1910 the rural population was 480,123; in 1920, 468,445. The only one of the 16 counties showing a marked increase in rural population was Aroostook, which is one of the richest farming regions of New England.

The principal cities of the state, with their population of 1920 and 1910 and rate of increase, were as follows:—

City	1920	1910	Increase per cent
Portland	69,272	58,571	18·3
Lewiston	31,791	26,247	21·1
Bangor	25,978	24,803	4·7
Biddeford	18,008	17,079	5·4
Auburn	16,985	15,064	12·8
Bath	14,731	9,396	56·8
Augusta	14,114	13,211	6·8
Waterville	13,351	11,458	16·5

Agriculture.—In Maine there were in 1920, 48,227 farms, valued with equipment at $250,000,000. Although the number of farms has decreased since 1910, the value of farm land has greatly increased; and in certain fields such as poultry there have been

gains. The poultry co-operative marketing is being successfully conducted; and in other branches of agriculture newer methods of marketing are making up for decreased acreage. Maine's potato crop in 1924 totalled 41,475,000 bushels. Fifty-five per cent of all certified seed potatoes in the United States was grown in Maine in 1924. Figures for that year show 305 bu. of potatoes per ac.; 42 bu. of corn; 26 bu. of wheat; 37 bu. of oats. One of the chief agricultural industries is the production of sweet corn for canning. In 1924, 38,030 tons of corn were cut. Lately canned green peas are coming into equal popularity. In Washington county blueberry production is one of the staple industries. Maine's annual blueberry crop is valued at a million dollars. Hay still leads other crops: 1,432,000 tons in 1924 as against 1,326,289 tons in 1919. Maine has a very low percentage of mortgaged farms; in 1924, 67·5% were free from mortgage indebtedness as against the national average of 52%. Ninety-six per cent of Maine farms are owned by men who operate them. It is estimated that about one-third of the people living in Maine are engaged in, or are supported by, agriculture. But over one-half of the foodstuffs come from outside the borders of the state—a situation that has led to efforts encouraging the use of markets and the development in Maine of agricultural independence.

Forestry and Lumber.—During the past few years much attention has been given to afforestation. Nearly three-fourths the area of the state, 15,000,000 ac., is forest land. Very recently attention has been called to the abundance of hard wood in the Maine forests, a fact that had been overlooked in the unparalleled consumption of pulp wood. The total stand of timber, spruce and fir is estimated at 25,500,000,000 ft.; pine, 5,060,000,000 ft.; cedar, 2,780,000,000 ft.; hemlock, 880,000,000 ft.; hardwoods, 5,000,000,000 feet. The annual cut of lumber is approximately 1,000,000,000 feet. Figured on the basis of population Maine's forest lands amounted in 1925 to 19·5 ac. *per capita*, a ratio exceeding those of all other states east of the Rockies, except Florida.

Shipbuilding and Fisheries.—The shipbuilding industry was stimulated during the World War to a remarkable activity, which, however, subsided in the years immediately following. Bath, the chief shipbuilding city, attained, during the height of this boom, to a population of 15,000.

Manufactures.—In total value of products, paper and wood pulp manufacturing ranks first among Maine industries; cotton goods are second; boots and shoes third; and woollen goods fourth, followed by lumber and timber products. Maine leads all the states in the production of wood pulp; and Old Town leads the country in the manufacture of canoes. There is still much undeveloped water-power; the U.S. Geological Survey credits Maine rivers with a potential maximum of 1,300,000 electrical horsepower, of which 700,000 is undeveloped. The state still refuses to allow the exportation out of the state of water-power; but there are indications that this policy does not meet with as much popular support as it did a few years ago.

Administration and Finance.—Since 1910 there have been adopted 13 amendments to the state constitution, the total number of amendments numbering 47 in 1925. Of amendments adopted since 1920 the two most important provided for a bond issue of $3,000,000 for a bonus to Maine soldiers and sailors in the World War, and for voting by mail. Maine is fast becoming the summer playground of the country. It has been conservatively estimated that nearly a million tourists visit Maine annually; and the summer visitors furnish an important element in the business life of the state. There are 165 summer camps for boys and girls, with an attendance exceeding 7,500. The recreational advantages of the state were emphasised in 1925 by Gov. Brewster in his inaugural address; and an elaborate programme of publicity, based upon the examples of California and Florida, was undertaken under the auspices of the state and with funds provided in part by appropriations granted by the state.

Education.—During the decade 1915–25 much progress was made, particularly in the rural schools. A well-arranged programme providing for school buildings of modern construction was being carried out in cities and towns; and in rural communities the old-fashioned type of isolated, single school buildings was giving way to consolidated buildings, transportation being furnished to pupils from remote homes. In 1925 the total enrolment of pupils was 163,106, as against 154,604 in 1920; 132,853 were enrolled in the elementary schools, and 30,253 in the high schools and academies. Of the farm population of high-school ages, 49·3% was enrolled in high schools, as compared with 42·3% of the non-farm population. Maine claims to have the highest percentage in the country of farm boys and girls attending high schools. The state dept. of education also put into operation a well-devised plan for the gradual elimination of illiteracy through evening schools and adult classes. There were about 1,400 students in the six normal schools, and about 3,300 students in the state university and Bates, Bowdoin and Colby colleges.

History.—In 1911, for the first time since the Civil War, Maine had a Democratic governor, Frederick W. Plaisted, and two Democratic senators, Charles F. Johnson, of Waterville, and Obadiah Gardner, of Rockland. In 1912 Woodrow Wilson won the electoral vote of Maine by reason of the split in the Republican ranks. But in 1916 the split was healed and Maine in every election thereafter ran true to form as a Republican state. The consolidation of various newspapers with other changes in ownership left the minority party practically with no press. The chief contests consequently were in the primaries for the Republican nominations. In 1924 the choice for governor between Frank Farrington, of Augusta, and Ralph O. Brewster, of Portland, was so close that for some weeks the result was in doubt, a recount held by the governor and council finally giving the nomination to the latter. In view of Federal legislation on prohibition and woman suffrage it is interesting to recall that in Sept. 1911 the state of Neal Dow voted to retain the prohibitory amendment to the constitution by the extraordinarily close vote of 60,853 to 60,095; and in Sept. 1917, in a referendum, woman suffrage was overwhelmingly defeated, 38,858 voting "No" and 20,604 voting "Yes." In 1924 the Ku Klux Klan was a very active factor in politics and one of the most discussed issues in the state campaign. The agitation, however, largely subsided following the election of Brewster as Governor in Sept. 1924.

Governors since 1911: Frederick W. Plaisted (Dem.), 1911; William T. Haines (Rep.), 1913; Oakley C. Curtis (Dem.), 1915; Carl E. Milliken (Rep.), 1917; Frederic H. Parkhurst (Rep.), 1921; Percival P. Baxter (acting) (Rep.), 1921–3, elected 1923–5; Ralph O. Brewster (Rep.), 1925– . (K. C. M. S.)

MAIRONIS, (1862–), Lithuanian poet, whose real name was Jonas Maciulas, was born in 1862 at Pasandvaris, in the Kaunas (Kovno) district. After leaving the Kaunas high school, Maironis continued his studies at the University of Kiev and the Kaunas seminary. On graduating from the latter, he entered the St. Petersburg (Leningrad) theological academy, where he took the M. A. degree. He was for 15 years a professor in the academy and received his D.D. for a scholarly work entitled *De Justitia et Jure*. In 1909 he was appointed rector of the Kaunas seminary. He became in 1922 a professor and deacon of the theological faculty of the Kaunas University which he helped to found, and in 1923 was appointed professor.

Maironis began to write at an early age. His prose, *History of Lithuania*, went into four editions. As a poet he excels alike in dramatic, epic and lyrical composition. His *Song of Spring*, a collection of songs, elegies, sonnets, ballads and satires also ran into several editions. Many of his songs have been set to music and are sung all over Lithuania. His famous poem *Young Lithuania* describes the national re-birth; *Our Sufferings* is a poem descriptive of the Lithuanian national ripening and conquest of independence; his *Magdalen of Raseiniai* castigates the national vices, while his Polish poem *Znad Biruty* appeals to the Polonised Lithuanian nobility. His dramatic works include *Where is Salvation? The Death of Kestutis*, and *Vytautas with the Crusaders*, the two last being historical plays of the 14th century. Maironis also translated the Rigveda into Lithuanian.

MALARIA (*see* 17.461).—Malaria had long been recognised as a disease of world-wide incidence and the cause of a higher sickness and death-rate than any other disease. The finding of malarial parasites in the blood cell by Laveran at Constantine in 1880, the demonstration of the life cycles of the quartan and tertian species of parasite by Golgi in 1885, and of the subtertian fever species by Marchiafava and Celli, and the discovery that the disease is transmitted through the agency of mosquitoes first from bird to bird by Ronald Ross in India 1897–9, and later from man to man, in conjunction with the investigations and teachings of Patrick Manson and other pioneers, were important factors in a great stimulus to the study of tropical diseases, both of men and of animals in general, and the whole of tropical sanitation was powerfully affected.

Parasites.—Malaria is due to small protozoa or animal parasites which pass an asexual stage in man, living and developing in the red blood cells, dividing into young forms or fresh broods in two or three days' time and producing some male and female forms (gametocytes), which are drawn with the blood into the stomach of the female mosquito, and there conjugate and complete a sexual cycle. An oöcyst forms from the female gamete and in this a swarm of young sporozoites develop and, becoming free in the body cavity, pass to the salivary glands, whence they are injected at the bite of the mosquito and begin again the asexual stage in man.

The Parasites.—Malaria parasites are of three species: *Plasmodium falciparum, P. vivax* and *P. malariae*, the causal organisms of "subtertian," tertian and quartan fevers respectively. Following the teaching of Laveran, a small body of workers believed that there was but one species, a theory of unity, and on the other hand certain investigators, because of minute differences between examples of the same species, concluded there were even further species and gave names to them. However, as Professor Marchoux pointed out in a thorough review of the question at the First International Malaria Congress held at Rome in Oct. 1924, experimental research generally tended to support the idea of plurality and existence of the three species above named. This was supported by the difference and practically constant periods of evolution of each, the transmission of the same species to healthy subjects, the specificity of culture of the parasites of each of the three species *in vitro,* and by epidemiological studies.

Symptomology.—In malaria symptomology nothing of fundamental importance has been discovered in recent years. There has been advance on our knowledge of the cause and treatment of Blackwater Fever or Haemoglobinuria, the serious nature of which has called forth many investigations, especially in the particular and heavily infected regions where it occurs. Some investigators hold that this condition may arise not only in infections with *P. falciparum*, but occasionally with *P. vivax* and exceptionally with *P. malariae*. The association of an unknown virus with the malarial parasite has been considered as the cause. J. Thomson's work in Rhodesia in 1923–4 gave strong evidence in favour of *P. falciparum* as the causal organism of all local cases and possibly elsewhere. He showed that *P. falciparum* can almost always be found in the blood; and that cases had been living in a district heavily infected by *P. falciparum*. He found one case after five months and another after 40 years' residence; he noted its occurrence only in people who had had attacks of malaria, though possibly unrecognised as such at the time, and had taken their quinine inadequately in amount and over an insufficient period of time. A similar observation was made in the cases which developed Blackwater Fever on their way home, or after they had left an endemic area even for some time. The finding of the other species of parasite, both of which tend more to chronicity and are readily found in the blood stream, may when present be, in Thomson's view, but an indication of a mixed infection.

Diagnosis.—In the diagnosis of malaria in endemic localities the estimate of inhabitants infected is based on the percentage rate of an enlarged spleen or of a positive blood finding amongst a proportion of the population. For the latter, the examinations of a thick and a thin film of blood are made. In the absence of the parasite an estimate of the relative number of large mononuclear (endothelial) cells to other white cells in the blood may be made in certain cases, but the evidence obtained is not conclusive. An increase above the basic figure of 15% endothelial cells of the total white cells was taken by Stevens and Christopher as indicative of actual or recent malaria in Europeans living in the tropics. Blood cell counts made at some time prior and subsequent to the finding of the malarial parasite did not show the presence of a constant relative increase of endothelial cells, nor was this a constant factor in latent malaria, even when the clinical diagnosis was obvious and the most reliable factor, an enlarged spleen, present. With regard to the finding of the parasite in the blood in these cases of "latent malaria in England" it must be remembered that but a small drop is taken and that parasites are not easily found except at the period of a relapse. The clinical signs of latent malaria most commonly found are, in order of frequency, an enlarged spleen, anaemia, functional disorders of the heart and enlargement of the liver. The tendency to chronicity and febrile relapses in malarial infections is very marked.

Distribution.—Malaria is a world-wide disease with endemic foci in all countries. It is most prevalent and extremely common in the tropics with the native population and high infection rate, constant heat, moisture and water for the breeding of the anopheline mosquito and requisite temperature for the development of the sexual stage of the parasite therein. As the poles are approached, the foci of endemicity gradually become less. For the development of the parasite in the mosquito an adequate temperature is necessary. On an average the three forms, *P. malariae, P. vivax* and *P. falciparum*, take 14, 11 and 6 days, respectively, the time varying with the temperature. In subtropical countries, malarial outbreaks follow the rainy seasons, when opportunities arise for the breeding of the mosquitoes. Norway and Sweden are examples of countries wherein anopheles are present but malaria absent.

In Great Britain malaria was formerly not very uncommon, but became rare until the return of many infected troops. Related to the presence of these carriers there were 235 indigenous cases in England in 1917, the number falling to four in 1924, thus corresponding with the cure of the malarial carriers. There exist in England three species of *Anophelinae* in which the parasites may develop and be transmitted from man to man, but with treatment of infected cases from abroad there is now practically an absence of the human carrier of the parasites, or at least of parasites with sufficiently numerous sexual forms in the blood, a minimum of 12 per cu. mm. of blood being considered necessary for development in the mosquito. Climatic conditions, particularly temperature and humidity, influence the endemic prevalence of malaria. A mean daily temperature exceeding 60° F. is necessary for its propagation for the full development of the parasite in the mosquito, *P. falciparum* requiring a very high temperature; *P. malariae* completing its cycle at a low one, and *P. vivax* over a wide range of low to high. This explains the seasonal incidence of the three types of malaria, the relatively high incidence of *P. falciparum*, the most malignant parasite, and the large number of infected inhabitants and high death-rate in the tropics and subtropics, and its rarity in indigenous cases in temperate climes, the presence of the endemic foci of *P. malariae* in the cooler hill country in the tropics and subtropics and the universal distribution of *P. vivax*.

Though *P. falciparum* is the most malignant and spreads most rapidly when anophelism is intense, because of its greater output of gametes in the blood, it does not tend to such chronicity in the absence of reinfection as do the other two forms. In the absence of reinfection *P. malariae*, by far the rarest form, is, however, the most resistant and *P. vivax* holds an intermediate place. Of 28,270 blood examinations made in England at one laboratory on cases of malaria contracted during the War, 777 were found positive, and of these *P. vivax* numbered 750, *P. falciparum* 14, *P. malariae* 4. There was a marked falling off as the time in England lengthened, and it was rare to find the parasite after the quarterly period of 12 to 15 months. Seven

cases were found after 30 months all with *P. vivax*, one in a double insection with *P. malariae* after 39 months, and one case after 51, and another after 59 months; *P. falciparum* was found after three months in a double infection with *P. vivax* at the 11th month, once alone at the 12th month, and once in a triple infection at the 14th month. The third of the four cases of *P. malariae* had also been home a long time, namely, 16 months. In none of this extensive series was the parasite ever found after five years at home. It is not uncommon to hear a person settled in a non-infective country for many years accusing a temporary febrile attack or period of lassitude as a return of malaria which he once contracted abroad. Proof of this seems wanting. Though malaria has been transferred directly from man to man, the parasites infecting man have not been made to infect any animal. Entomologists have furthered their investigations into the bionomics and classification of mosquitoes and the determination of the species of anopheles that carry malarial parasites.

S. P. James and Dale have recently reported that quinine, quinidine and cinchonine possessed the same curative properties for all forms of malaria, and without difference in their toxicity save for the greater cardiac depressant action of quinidine. Fletcher at Kuala Lumpur has made a careful series of observations on this point.

Prophylaxis and Treatment.—The treatment of malaria is intimately bound up with prophylaxis. Particular reference may, however, be made to the recent therapeutic use of horse serum in the treatment of that severe form of malaria, Blackwater Fever, wherein this serum appears to inhibit the action of an autohaemolysin and its destruction of red blood cells in the body.

Many clinicians strongly advocate in tropical regions intramuscular and intravenous injections of the bihydrochloride of quinine in serious cases, and injections do act quickly in severe, malignant, remittent and comatose cases, but in ordinary cases oral administration of the sulphate has been satisfactory. In acute attacks it must be borne in mind that 24 hours or more may elapse before the good effects of quinine become manifest.

The classical successes in the reduction of malaria at Ismailia, Hongkong, Havana and elsewhere have encouraged similar work in other localities, but there are few such examples as the long continued labours of Malcolm Watson in the Federated Malay States and the brilliant sanitary victory of General Gorgas and the Americans over both malaria and yellow fever at Panama. The work of Darling, Bass and others in southern United States and in the Islands must also be mentioned. The method of mosquito reduction against malaria, first suggested and tried under Ross in Freetown, Sierra Leone, in 1899, has not been followed as widely as anticipated, and local authorities too often dislike spending money on sanitation and hamper practical efforts of sanitarians by the attitude that it is better to prevent malaria by quinine or by the use of mosquito-nets, measures which are impractical in an uneducated native community. Local conditions must always determine the most suitable mode of prophylaxis, and it is important, as Étienne Sergent points out, to have several methods of control which may well be combined and include with specific measures an educational propaganda. Obviously there must be action to eliminate infection from all carriers of the parasite: in other words, to prevent the mosquito becoming infected, to destroy the species of anopheles in which the parasite may develop, and to prevent their biting and inoculating the parasite into the blood of man. Good results have attended well-applied efforts of this kind. Better health results and there are real economic returns for expenditure. The native must be looked after and enjoined to adopt some sanitary methods until he is taught to share in systematised efforts to protect and cure himself of malaria as of other endemic diseases.

Measures to rid carriers of the parasite are most difficult to put into practice. There is no settled or fixed dosage, or time of administration, of the specific remedy, quinine or other of the cinchona bark extracts. Acute attacks respond readily to quinine; each dose makes a reduction in the number of parasites, and this reduction occurs every day, until finally none of the parasites is left. Treatment must be continued for a long time. Empirically three months appear to be enough, but there are obstinate cases.

Standard Treatment.—For some years a standard line of treatment to procure disinfestation has been adopted by Bass in America and by Ronald Ross and his colleagues in Great Britain, and the former has been recently introduced by J. Thomson in Rhodesia. The two former vary slightly. Ross gives 30 grains of quinine daily during the attack and for three days after, followed by 10 grains daily, just before or after breakfast, for three months; Bass ceases after two months. Success has attended these standard treatments, and it is well for administrative purposes that a standard be adopted in each country. It will not cure all cases, but the exceptions appear rare and when detected can be specially treated. Stevens found arsenic, after initial doses of quinine, of great value in helping to eradicate the parasite. Together with quinine or other drug therapy, the important factor of building up and maintaining the general health, so as to assist the natural forces of the body to eliminate the malarial parasite, must not be forgotten.

Regarding the value of quinine prophylaxis amongst carriers, the results obtained at the malaria centres and camps during the War showed that any dosage under a total of 60 grains weekly proved insufficient for an adult male. Other salts of quinine, of hydrochloride and bihydrochloride, affect the digestion less and seem to be as satisfactory. The tannate has been much used in Italy, especially for prophylaxis among children. The daily small dose is more easily and therefore more certainly taken by patients (out of hospital) than larger occasional doses which cause some dyspepsia and headache and are therefore frequently postponed. Children can be given a larger proportion by body weight than adults, say, twice as much. Sir Ronald Ross has always felt that, to be effective, quinine should be continued in 10 grain doses daily for three months after a subject has left a malarial country.

Quinine prophylaxis has been of value on particular occasions, such as in tiding a body of troops over a critical period of fighting or passing through a heavily infected area, in that it has kept off attacks of malaria during that time. Bodies of troops in Salonika who were given quinine daily remained free as long as they were taking it, but went down with malaria as soon as they stopped it, showing they were infected in spite of it.

Not all people bear quinine continued over a long period well and they may show symptoms of quininism. Occasionally an individual is hypersensitive to quinine and may show symptoms even following an initial dose. On the first appearance of quininism the drug should be stopped for a time, or arsenical treatment substituted. In the hypersensitive case some begin with very small doses to desensitise the patient. Certain investigators in the tropics consider that it is more difficult to eliminate the parasite by quinine therapy in cases that have been taking quinine consistently and who have become infected in spite of it. The cost of quinine and of its supervised administration has frequently rendered quinine prophylaxis impracticable in certain endemic areas.

Quinine prophylaxis should be supported by measures to prevent mosquito bites as far as practicable. In endemic areas and where there are many carriers the infection rate of the mosquito may be very high and frequent reinfection may occur.

The second measure of prophylaxis, *i.e.*, the reduction of anopheline mosquitoes and the prevention of bites, has received more general application. This is difficult and costly, but it results in a lessened sickness and death-rate from malaria, and in profit from the expenditure incurred.

In subtropical regions or where mosquitoes hibernate in dark places in rooms of homes, cellars, stables, outhouses and such places, often attaching themselves to cobwebs, they should systematically be killed directly or by fumigation. The breeding place of the mosquitoes is any still water on which they lay their eggs, and to kill the larvae and pupal forms through which they pass in development is the object in view. Much can be done by the filling in of small pools, cattle foot-marks, draining of

marshes, clearing out of long grass and reeds from the sides of streams, the conversion of still to running water when in large masses, the clearing away of all cans and unnecessary water containers and the covering by gauze of cisterns and tanks and the like around the homes. A female mosquito lays about 250 eggs at one time and seven to 10 days bring them to maturity. The young aquatic forms may be destroyed by larvicides such as kerosene, waste oil, cresol or "paris green," which, when mixed with 100 parts of dust (1 c.c. of the mixture to 10 sq. metres of water) and blown on to the water, distributed by the winds or dropped from aeroplanes, kills the anopheline larva forms and does not injure the fish or the animals that drink therefrom. Valuable agents against larvae and pupae are the surface-feeding minnows, gambusia, stickleback and perch.

Anopheline mosquitoes do not attack until sunset, when one may remain as far as possible indoors in houses, bungalows and huts protected by close-mesh wire or netted windows and double doors; a bed or head net should cover any exposed part of the body during sleep. In the early evening the wearing of puttees by men and a paper lining under the stockings of women prevents bites on the legs. Coolie lines should be placed when possible a mile from the breeding places of the anopheles, though this does not mean that the mosquitoes cannot fly much farther. There is little danger to be anticipated from breeding places over a mile distant, if the mosquitoes have opportunities of feeding close at hand (*i.e.*, from other mammals), and if the intervening space be raised, wind-swept and clear of all shrubs and trees. The knowledge that the mosquito will attack man or animal in its thirst for blood has raised certain questions regarding the preservation of game, but up to the present no practical studies on any extensive scale have been made.

Use in Psychiatry.—Following the observation of Wagner Jauregg in Vienna in 1917, that certain chronic conditions showed improvement after malarial attacks, the therapeutic use of malaria in psychiatry has been extensively applied in many countries. Many cases of general paralysis have benefited, some sufficiently to be able to return to family and social life. Time must be given to determine the permanency or otherwise of the amelioration. Its use in other cases of cerebrospinal syphilis and also in such mental diseases as *dementia praecox*, confusional insanity and *encephalitis lethargica* is under consideration. The parasite used is the *P. vivax* and it appears more satisfactory to inoculate the patient by an experimentally infected mosquito than by infection with blood from a case of malaria. Thereby all risks of other infection are avoided, a wise precaution, especially in an endemic region where other species of the parasite occur. Infected cases are allowed to have 6 to 10 febrile attacks of malaria and are then given quinine which in these experimental cases readily cures the attacks.

War Malaria.—The following were the British War Office figures of the number of cases admitted to hospital in four of the fighting areas during the War: Mesopotamia: 1916, 680; 1917, 744; 1918, 10,202. Salonika: 1916, 31,059; 1917, 71,413; 1918, 59,087. East Africa: 1917, 58,236; 1918, 20,015. Egypt: 1916, 1,423; 1917, 8,480; 1918, 30,241.

Until the War spread to the eastern fronts British armies suffered little from tropical diseases. In the summer of 1916 an epidemic of malaria occurred among the troops on the Salonika front; and continued until the end of the War.

Following the outbreak of malaria at Salonika, Sir Alfred Keogh, the Director-General, Army Medical Services, early in 1917 appointed a special malaria hospital in each Command in the United Kingdom, for the express purpose of finding a permanent cure if possible, and of treating the thousands of men who were being returned home sick with malaria from the eastern fronts, Sir Ronald Ross being also appointed Consultant in Malaria at the War Office. The fact that moderate doses of quinine will control actual attacks within a few days was fully verified, and with very few exceptions. Almost every form of treatment that had ever been suggested—enormous doses of quinine reaching 100 grains *per diem;* smaller doses continued for three weeks or more; additional medication with arsenic and other drugs; continuous doses lasting for a month, and various kinds of interrupted dosage—all proved uncertain. Thirty grains of quinine, continued every day for three weeks, proved a failure. Intramuscular injections and even intravenous injections did no better. Men who were presumed to be cured relapsed again after returning to duty; a large proportion of those infected with malaria became almost useless for further service. Numerous nostrums advocated for malaria proved valueless, the only exceptions being one or two arsenical preparations, which, however, were *no better* than ordinary quinine.

Now, in all these attempts, treatment had seldom been continued for more than one month and rarely or never for more than two months—owing, of course, to military exigencies. It was decided to deal with the large numbers of discharged soldiers by a longer period of treatment. In 1918 two whole divisions, full of malaria, had been brought from Salonika to France and were there subjected to a longer course of treatment preparatory to their being sent again into the firing-line. The regiments arrived in an extremely bad condition, were all placed in camps in the Dieppe region, and the men were given 15 grains of quinine in solution once daily for a fortnight, followed by 10 grains of quinine in solution daily for 2½ months more. The course, designed and carried out by Col. J. Dalrymple, had marvellous results, almost the whole of the two divisions being found fit for the front at the end of the three months. About the same time large malaria concentration-camps were established in England, where cases were given similar treatment, but for shorter periods; and it was found generally that: (1) doses of less than 10 grains daily did not suffice to prevent relapses even while they were being taken; (2) doses of 10 grains daily did so suffice, except in about 6% of the cases, most of whom, however, relapsed during the first days of the treatment; (3) 15 grains a day reduced the relapses still further, but only to about 4 or 5%.

The long-continued treatment of malaria was now proved to be satisfactory, and was extended to pensioners also. In one London clinic alone nearly 30,000 pensioners have been treated in this way. The results have been admirable, and probably very few men who have taken the treatment properly have returned. But the 10 grains of quinine must be taken religiously every day, and it is well to associate this with or follow it by a course of arsenic. Quinidine replaced the quinine in a small number of these cases. Good food and care in building up the general health are important factors in overcoming malarial infections. Empirically, three months appear to be enough, but in obstinate cases four months might be better. There are rare individuals who are hypersensitive to quinine or who may be desensitised prior to the introduction of the standard dosage. Even long courses of treatment will not necessarily cure people who are subject to reinfection during treatment; and it is even possible that they are not so effective during the first six months or the first year of infection as they are later. The results described above were obtained among returned cases in Britain. Other salts of quinine besides the sulphate were tried. The hydrochloride and bihydrochloride affect the digestion less and seemed to be as satisfactory.

The prevention of malaria on the battle-front was always difficult and sometimes impossible. Mosquito-reduction in the face of enemy fire is impracticable; quinine prophylaxis was under such conditions disappointing; and the armies were obliged to fall back upon mosquito-nets and mosquito-proof tents and bivouac shelters—which were carefully designed by the British War Office. Better results were obtained at the bases of operations, especially in Palestine; and a very successful campaign of mosquito-reduction was carried out by Col. J. C. Robertson at Taranto in Southern Italy.

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(R. Ro.; W. B.-A.)

MALAY STATES, FEDERATED (*see* 17.478).—For over 16 years all matters of common interest to the Federation have been settled by the federal council, a body created in 1909 in accordance with the general wishes of the individual rulers. The council consists of the high commissioner (president), the chief secretary to the Government, the four ruling Sultans, the four British Residents, the legal and financial advisers and eight nominated unofficial members; it meets generally three times a year and all Federal legislation is passed by it.

Population.—The growth of the population is the measure of the States' prosperity. According to the census of 1921, the population was 1,324,890, having increased since 1911 by 27·7%; it is still rising rapidly, and was estimated at the end of June 1924 to be 1,418,455. There are approximately 510,000 Malays, 494,000 Chinese, 305,000 Indians and 5,700 Europeans. The increase among Malays, especially in Selangor, is largely due to the influx of foreign Malays who have settled in the coast districts to plant rubber; and the increase in the Indian population also synchronises with the development of the rubber industry. There are indications that the immigrant races, who have done so much to develop the resources of the Federated Malay States,

are ceasing to regard these States as a place of temporary sojourn and tend more and more to make them their permanent home.

Commerce and Industry.—An indication of the continued prosperity of the States is afforded by the fact that for the six years following the World War there was a considerable trade balance; and for the years 1919, 1923 and 1924, the estimated value of the exports, which consist chiefly of tin, rubber and copra, was well over twice that of the imports. The average value of the exports is over 200,000,000 dollars. The export of tin-ore reduced to a metallic basis and of block tin has averaged 40,000 tons, and the market for this commodity, as also for rubber, has been greatly assisted by the policy of withholding stocks against current prices. In the case of tin the holding or releasing of stocks was arranged by voluntary agreement between the Government, which held large stocks, and private holders.

Government assistance to rubber growers was given by the Export of Rubber (Restriction) Enactment, under which the percentage of release of stocks at the minimum duty rose or fell according to the ruling market price. By this means a fair price was obtained for growers, and many plantations were saved from the ruin that must have resulted from the premature tapping of trees. The Government continues to make a grant to the Rubber Growers' Association in connection with propaganda for new uses and markets for rubber. The establishment of a rubber research institute was approved in 1924, to be maintained by a special export duty on rubber. Important research work had been done, before this, on the deterioration of rubber in storage, which was found to be due mainly to surface oxidation, from which it is indicated that the slab form is preferable to the crêped form for storage. The mouldy rot disease (in Negri Sembilan) and the brown bast disease were further investigated. A Government experimental coconut plantation has been started. The commercial timbers of the country are in process of being scientifically investigated, and the distillation of native woods has also been made a subject of research.

Tin-mining continues to be the chief industry in Perak and Selangor and rubber the chief industry in Negri Sembilan and Pahang. Other ores produced are tungsten (wolfram and scheelite) and gold. The Raub gold mine in Pahang is the only gold mine now working in these States; but alluvial gold is recovered in various places. Coal also is produced, the tonnage averaging between 350,000 and 400,000 tons annually. Coconuts and rice are widely grown in Perak, Selangor and Negri Sembilan, in which last-mentioned state coffee is now but little grown, its place being taken by rubber. The timber industry is in process of development, and the whole question of the exploitation and conversion of timber is receiving the active consideration of the Government. Already there are some 5,000 sq. m. of forest reserves, and the areas are being extended.

Railways.—Communications in the Federated Malay States keep pace with the growing requirements of the tin and rubber industries. The total length of line now open to traffic under the Federated Malay States railway administration is over 1,000 miles. This includes the Johore state railway, which at Gemas branches into the west coast line to Prai and to the Siamese frontier; and the east coast line, which runs northward towards Tumpat. The Kelantan section is being extended southward to the east coast line to provide direct communication between Kelantan and Singapore. Through traffic, over the west coast line, with the Siamese state railways was opened in 1918, and between the Federated Malay States and Kelantan via the Siamese railway in 1921. The Johore causeway, which connects Singapore with the peninsula, was opened in 1924. The causeway carries two lines of rails and a roadway; its total length is 3,465 ft. and its average headway at low tide is 47 feet.

Education.—In 1919 important movements for the extension of education were set on foot, despite difficulties encountered in increasing the number of teachers and the improvement of the teaching standard. A temporary scholarship scheme for sending teachers to Hongkong University was set on foot, to serve until more training colleges were established and pending the opening of Raffles College, founded in Singapore. A Malay college is established at Kuala Kangsan; the Sultan Idris training colleges provide Malay vernacular teachers; and there are many Chinese and Tamil vernacular schools.

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MALAY STATES, NON-FEDERATED (*see* 17.482).—These are Johore (*see* 15.475; this form of the name, rather than Johor, has come into official and general use), Kelantan, Trengganu, Kedah and Perlis. The populations according to the census of 1921 were Johore, 282,234; Kelantan, 309,300; Trengganu, 153,765; Kedah, 338,558; Perlis, 40,087.

Malaria is severe except in Trengganu, and infant mortality high, but both this and the general death-rate have been reduced with improvements in sanitation and provisions for medical service introduced under British supervision. To this, and to the more settled conditions brought about under it, is attributed in large part the substantial increase of the population recorded in all the States; although, as in Trengganu about 1920, the benefits to the commercial classes were not immediately reflected in improved conditions for the peasantry.

By an agreement made in 1885, the Sultan of Johore placed his foreign affairs under British Govt. control and undertook, when required, to receive a British agent at his court. No such appointment, however, was made until 1910. In 1914 a subsidiary agreement was concluded whereby a General Adviser was appointed with powers similar to those exercised by British Residents in the Federated Malay States. The other States, Kelantan, Trengganu and Kedah, came under British protection in 1909 by virtue of a treaty signed at Bangkok in 1909 under which the Siamese Govt. transferred to the British Govt. all its rights over them. The officer administering the government of the Straits Settlements is the British High Commissioner for all protected States in the Malay Peninsula.

Johore.—Most of the interior of Johore is covered with jungle, but already over 800,000 ac. have been alienated, chiefly in small holdings, for cultivation. Rubber plantations occupy half this area and coconut crops about 90,000 acres. Other agricultural products are padi, betel nuts, African oil palms, tapioca, sago palm, gambia, pineapples, tuba and patchouli. The chief mineral resources are tin-ore and iron-ore. China-clay is worked, but, owing to impurities, has not been found suitable for use in the Bombay cotton-mills. Good forest country exists north of Labis, and timber production averages 20,000 tons a year. The export trade is of the average annual value of $50,000,000, of which rubber represents three-fifths, copra, tin-ore, preserved pineapples, areca nuts and gambia, the greater part of the remainder. The Johore State Railway from Kuala Gemas to Johore Bahru is now leased to the Federated Malay States. The total length of roads maintained by the Government is over 600 miles.

Kelantan.—The dominating physical feature of Kelantan is the flat plain of 1,000 sq. m., extending behind the low sandy coastline. This plain is densely populated, and closely cultivated with rice, coconut and fruit trees. Of the total population in 1921 286,363 were Malays, for the most part born in Kelantan. Chinese numbered about 12,000. The broken hilly country south of the plain is thinly populated, but it contains the bulk of the foreign-owned estates. The staple produce is rice, most of which is grown for domestic consumption. Rubber, coconuts and betel nuts come next in importance. Other notable industries are fishing and weaving; but there is no mining worth mention, though tin mining is likely to develop with increased transport facilities. Recent prospecting indicates the possibility of gold being found in payable quantities. The total volume of trade is valued at about $9,000,000, of which exports represent about $5,500,000. The chief exports are gums and resins (mainly Para

rubber), copra, dried bétel nuts, dry and salted fish, poultry and cattle, silk and cotton goods and dried hides.

Trengganu.—With the transfer to Great Britain of the Siamese suzerainty over the State of Trengganu in 1909, the sending of the triennial tribute of Bunga Mas (gold and silver filigree flowers) to the King of Siam ceased, and a British Agent with consular powers was appointed. In 1919, following the report of a commission of inquiry, the agent was replaced by a British Adviser, whose advice must be sought and followed in all matters of general administration and all questions other than those touching the Mahommedan religion. The soil and climate are suitable for the cultivation of Para rubber, coconuts, coffee and pepper; but the potentialities of the country lie in its mineral resources. Trengganu is the least opened up of the Unfederated States; but it is undoubtedly rich in minerals: tin (lode and alluvial) and wolfram are worked, and graphite, hematite, magnetite and monazite have been found. The total value of the trade of the State is about $9,000,000, of which exports represent nearly $5,500,000. The bulk of these, consisting of Para rubber, dried fish, tin-ore, and copra, go to Singapore. Agriculture employs over 48,000 people and fishing 9,000. About 95% of the population are Malays. Many of the Malay inhabitants show special commercial aptitude, and it is noteworthy that there are here instances, rare elsewhere, of Chinese trade financed by Malay capital.

The suzerainty of Kedah also passed to Great Britain in 1909 and the administration of the country was finally adjusted by a treaty signed at Singapore in 1923. The population in 1921 was 338,544, of whom 237,043 were Malays, 59,403 Chinese and 33,019 Indians. Only about 100 of the aborigines (Sakeis) are left, these being mostly located in the forest region of the Muda river. In North Kedah the people are mainly employed in cultivating rice, and in South Kedah, rubber, coconuts and tapioca. The estimated annual value of the exports is about $21,000,000, over 50% of which represents rubber. There are several good metalled roads communicating with Province Wellesley, Singgor and North Perak. The Federated Malay States railway administration has extended its service through Kedah into the independent and protected State of Perlis and trains have been running regularly since 1915. Bangkok and Singapore are now linked up by a connection through Perlis.

Perlis.—The principal industries in the small State of Perlis are rice cultivation and tin-mining. Most of the exports go to Penang, with which country there is regular and frequent steamer communication.

Survey and Land Settlement.—One of the principal reforms undertaken under British advice has been that in land settlement, the demarcation of property boundaries, and the issue of titles. To this end trigonometrical surveys have been undertaken. In Johore by 1925 a Settlement Act was in force in the districts of Muar and Batu, but not in other districts owing to the want of surveyors. In Kedah the survey is expected to be finished in 1927, and the Survey Department of that State has also supervised the work in Perlis. In Trengganu a settlement enactment was passed in 1924. Education has also received close attention. The new system in Johore, in which English is taught concurrently with Malay, promises success. The chief English school is that of Bukit Zohara at Johore Bahru. Education has also notably advanced in Kedah, where there are government English schools at Alor Star and Sungei Patani.

A notable inscription in Malay on a stone pillar, of date 1303, was discovered in 1923 near Kuala Trengganu. It has a strong admixture of Sanskrit and some of Arabic, and deals with certain phases of Islamic law. No example of this association of languages of earlier date than 1468 was previously known, and this inscription, which has been deposited in the Raffles Museum at Singapore, forms by far the earliest known record of the penetration of Mahommedanism into the Malay Peninsula.

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MALINES, Belgium (*see* 17.489), had a population of 60,429 in 1923. The town was bombarded three times during the World War, and much damage done. The old Palais de Justice, restored shortly before the War, the school of music and the picturesque houses round the Bailles de Fer were ruined, and the south side of the cathedral and the chimes badly damaged. The cathedral was in progress of restoration in 1926. The Cloth Hall, also restored before the War, is used as the town hall. In 1924 the conversations between the Archbishop of Malines, Cardinal Mercier, with some dignitaries of the Anglican Church about the cause of Christian Reunion brought Malines again into public notice.

MALLOCK, WILLIAM HURRELL (1849–1923), British author (*see* 17.492), died at Wincanton, Somerset, April 2 1923.

MALMÉDY: *see* EUPEN AND MALMÉDY.

MALTA (*see* 17.507).—The period 1910–25 comprises changes of paramount importance in Malta, of which the most important are consequent on the World War of 1914–8. The Maltese provided a garrison for Malta, many seamen and stokers for men-of-war and minesweepers, and labour battalions for Gallipoli and Salonika; and they did excellent service in the hospitals. These services contributed to the grant of responsible government, which was established by the constitution of 1921.

Constitution.—On June 12 1920 the governor, Lord Plumer, communicated the decision of the British Govt. to grant a form of self-government which provided for responsible control by the Maltese ministers of local affairs. The letters patent came into force on May 16 1921, and provided for the creation of a senate of 17 members, with a legislative assembly of 32, the latter elected by proportional representation and having control of its own ministers. Judges are to be appointed by the governor in council, and can only be removed by a joint address from both Houses of the Legislature. The police are under ministerial control. Each House makes its own standing orders and rules, and defines its privileges; such powers, however, are not to exceed those of the British House of Commons. Debates may be conducted in English, Italian or Maltese; but all official entries are to be in English or Italian. All persons are to enjoy full religious liberty, no person is to be subjected to any disability or exclusion from office on the grounds of religion. A covering despatch empowered the legislature at its first sitting to declare Roman Catholicism the state religion. English is declared the official language of the administration: Italian is to be the official language of record in the law courts. British subjects, not of Maltese birth, may claim to be tried in the English language.

By the new Letters Patent, power to make laws regarding reserved matters—including everything pertaining to defence, the control of foreign relations, coinage and external trade—remains in the hands of the governor and commander-in-chief, assisted by a nominated council consisting of the lieutenant governor and the legal adviser (as ex-officio members) with senior officers of the navy, army and air force.

Population and Emigration.—The civil population, including Gozo and Comino was estimated on Dec. 31 1924 at 223,088; according to the census of 1911 it was 219,311. The death-rate in 1924 was 23.22 per 1,000 as against an average of 22·57 during 1910. Economic conditions became critical after the cessation of the War. The number of unemployed was swollen in 1919 by the discharge of about 15,000 men by the naval and military establishments, whereupon organised emigration was necessarily resorted to in order to ensure a suitable outlet for Maltese labour. The number of emigrants in 1924 reached the total of 3,277. The distress prevailing among the poorer classes after the War caused the Government to continue the bread subsidy in 1920 and a grant in aid thereof amounting to £250,000 was made from Imperial funds. General want and discontent led to serious disorders and to loss of life by riots on June 7 1919.

Schools.—On Dec. 31 1924 the number of Government day schools was 597. There were 58 private schools with a total of 26,744 scholars. The estimated expenditure on all branches of education for the year 1925 to April 1 was £92,370, excluding buildings. The teaching of Italian in the infant schools and in the first and second year of the elementary schools was entirely abolished in 1923.

Finance and Trade.—The revenue for the year ending April 1 1925 was £773,015 and the expenditure was £757,966; as against, in 1910, revenue £436,200 and expenditure £458,012. The amount of British treasury currency notes in circulation on March 31 1925 has been estimated at £750,000.

The total number of acres under crops in 1924 was returned at 42,964. It is estimated that the agricultural produce of the islands could only support the present population for three months in the year; the balance of foodstuffs and necessaries has to be paid for by work done for the Imperial forces, for the dockyard and for visitors and tourists, and also by large remittances to relatives at home which are received from Maltese abroad; moreover interest from investments outside the islands, and accumulated capital furnish margins to adjust the adverse balance.

Trade (inclusive of goods by parcel post but exclusive of bullion and goods in transit) was as follows:—

	1914	1924
Imports	£2,510,934	£4,416,453
Exports	1,053,854	1,451,766

The exports in 1924 include £443,798 value of coal furnished to merchant ships. In 1924 the value of imports from the United Kingdom was £1,367,291. The number of British steamers calling (not including war vessels and transports) was 349, with the aggregate tonnage of 989,517, and of foreign vessels 411, tonnage 696,501.

Defence.—The increased importance of Malta as a naval base was developed considerably in 1925, producing a period of increased prosperity; a floating dock was installed in 1925 capable of lifting the largest ships. An aerodrome has been built at Hal Far, suitable for main line airways. The greater part of the fortifications has been made over for civil purposes, in view that the importance of aircraft has altered fundamentally the needs and methods of military defence.

Antiquities.—Palaeological investigations have been continuous and excavations at the cave of Ghar Dallam have yielded important results among which were the discovery of human teeth assigned to the Neanderthal period and remains of many species of animals. In the period of 1910–25 archaeology has been enriched by further excavations of neolithic temples, and by the announcement of Professor Keith that the collection of bones at Ghar Dallam are due to that locality having been adapted by the prehistoric inhabitants as a pitfall to catch elephants and other wild animals when Malta was part of an isthmus which connected Italy with Africa, and was in the neighbourhood of a fresh-water lake.

See M. H. Egan, *Notes on Malta* (1922); P. F. Bellanti, *Studies in Maltese History* (1924). (G. St.*)

MALVY, LOUIS JEAN (1875–), French politician, was born at Figeac Dec. 1 1875. In 1906 he entered the Chamber as a Socialist-Radical and was an under-secretary in the Monis and Caillaux cabinets (1911), Minister of Commerce and Postal Services under M. Doumergue (Dec. 1913) and minister of the interior in the Viviani Ministry (June 1914). He retained this post under M. Briand and M. Ribot. On July 22 1917 M. Clemenceau charged him with lax administration in dealing with defeatists and agitators, and he resigned on Aug. 31. In October M. Léon Daudet brought against him a general accusation of treason. A commission, appointed at M. Malvy's own suggestion, decided on behalf of the Chamber that the Senate, sitting as a high court, should pronounce judgment on all the stated charges. On Aug. 6 1918 the high court acquitted M. Malvy of the charge of treason, but found him guilty of culpable negligence in the performance of his duties as Minister of the Interior from 1914–7, and sentenced him to banishment for five years, which he passed in Spain. In 1924 he represented France at the Morocco negotiations which took place in Spain, and in Oct. of the same year became president of the finance commission of the Chamber. M. Malvy again became Minister of the Interior in the Cabinet formed by M. Briand in March 1926, but he resigned in the following April. (*See* FRANCE.)

MAN, EVOLUTION OF.—The late Sir E. B. Tylor, writing on the evolutionary theory of man's origin, made the following statement: "In one form or another such a theory of human descent has, in our time, become part of an accepted framework of zoology, if not as a demonstrable truth, at any rate as a working hypothesis which has no effective rival." When Sir Edward Tylor made this statement in 1910 he was in his 78th year; his memory could carry him back to a time when it was believed that man had come into the world as a special creation some 4,000 years before the birth of Christ and owed no kinship to other living things. He was 27 years of age when Darwin's *Origin of Species* was published in 1859; in 1865, two years after Huxley had issued his renowned treatise on *Man's Place in Nature*, he himself published a work which threw a new light on human history, *Researches into the Early History of Mankind and the Development of Civilization.* When Darwin's *Descent of Man* came out in 1871, Tylor's *Primitive Culture; Researches into the Development of Mythology, Philosophy, Religion, Art and Custom*, kept it company. By the end of the 19th century he had seen chair after chair in the universities of the world filled by men who were convinced that evolution was true; at his death in 1917, at the age of 85, he had seen another generation of inquirers grow up who, after applying Darwin's teaching to all departments of man's world—to his body, mind and culture—remained convinced that, as a working hypothesis, the doctrine of evolution had no rival.

Summary of the Evidence

Embryology.—No matter what aspect of man the student of to-day may select for study, the conviction that evolution (*q.v.*) is true is forced on him. If he investigates the development of the child in the womb he comes across a complicated series of appearances which can be explained only if Darwin's teaching is accepted.

Comparative Anatomy.—If he studies the structure of man's body he finds it framed on the mammalian plan, and if he compares it with that of anthropoid apes he finds the points of resemblance to be so numerous and so close that he cannot think that such a degree of resemblance could be a result of mere chance. If he inquires into the periods through which a newly born child passes to reach manhood or womanhood, he finds the animals which are most human in this respect are the great anthropoids—the gorilla, chimpanzee and orang. If he takes into consideration the diseases to which man is liable, he finds that human diseases are more readily communicated to the great anthropoids than to any other living animals. Particularly is he impressed by the fact that the blood of man and of the anthropoid apes, when tested against each other, react almost in the same way. To account for the presence of so many vestigial structures in man's anatomy, he feels impelled to suppose that man has come of an ancestry in which these vestiges were fully grown and useful. A child may be born with its body malformed; it may suffer from hare-lip, cleft-palate or many other kinds of deformity, including the presence of a tail; medical men cannot account for such malformations if they look on man as a special creation; they can give a rational explanation of their occurrence in man's body if they accept the teachings of evolution.

Palaeontology.—In recently formed strata of the earth fossil forms of man are found; those from the older strata are more ape-like than those from the newer. In still older strata are found fossil fragments of great anthropoids; in still more ancient, the remains of small anthropoids; deeper still in the earth's records no trace of anthropoid has yet been discovered. In these older strata occur fossil remains of small monkey-like primates. The geological records, so far as they are yet known, support Darwin's theory of man's origin; they are altogether against the belief that man appeared suddenly—a special act of creation.

Human Races.—More especially is the student of human races driven to Darwinism for an explanation of his many problems; even if he believed that man had appeared originally by an act of special creation he must formulate a theory of evolution in order to account for the divergent races now living.

Although in thought and deed man rises far above any member of the brute creation, yet students of his brain find that it is modelled, part for part, on exactly the same pattern as that of the anthropoid ape. Those who inquire into man's mental qualities, his emotions, his habits, his tendencies and his modes of thought, find much which can be explained only by supposing that he has ascended from a lower order.

For these reasons all present-day students who are applying themselves seriously to the unravelling of man's history accept the theory of evolution as a truth. This conviction has spread from professional circles into the public thought of our time and altered the outlook of a large section of the lay mind; yet there still remain numbers of the public of Europe and of America who, impressed by the great and real differences which separate the mentality of the lowest grades of mankind from that of the highest grade of ape, cannot believe that man has arisen from a lower form by any natural or evolutionary process. The State of Tennessee has passed a law forbidding, in state-supported schools, " the teaching that man has descended from a lower order of animals." In June 1925 Mr. Scopes, a school teacher, was prosecuted under this law, found guilty and fined $100. Since then certain other states have enacted similar laws.

Man's Genealogy

Darwin's Views.—Although there is a complete agreement among professional students that man is a member of that order of mammals to which Linnaeus gave the name " Primates " and that his lineage, when traced backwards, will be found to branch off from the primate tree, there is a sharp difference of opinion as to the exact point in the tree, and the approximate date in geological time, at which the human branch separates from those other main branches which represent the lineage of anthropoid apes and of monkeys. It is clear from statements made in

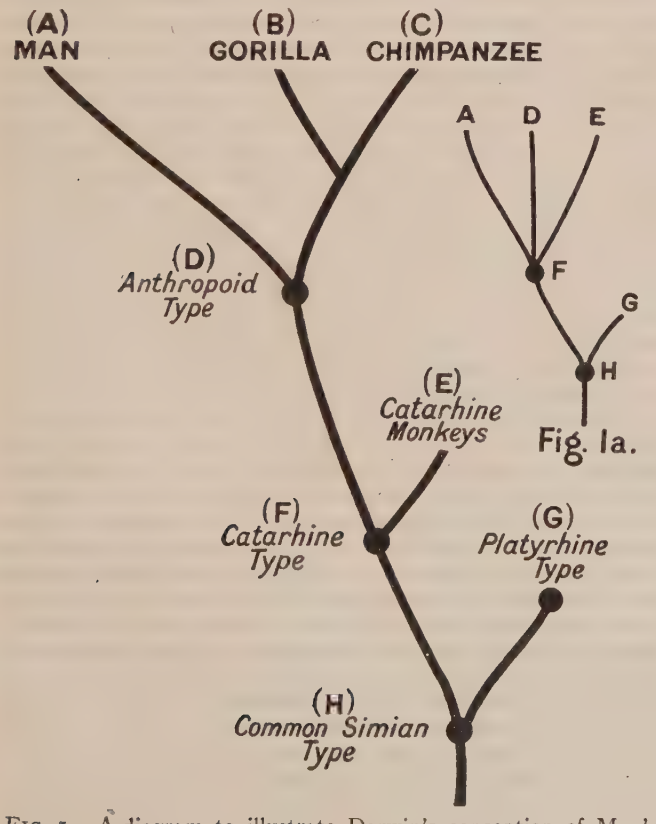

Fig. 1.—A diagram to illustrate Darwin's conception of Man's lineage.

Fig. 1a.—Another possible relationship, also mentioned by Darwin.

the *Descent of Man*, that Darwin regarded the gorilla and chimpanzee as more nearly akin to man than other living primates and, on the evidence available in 1871, thought it probable that man and the African anthropoids were co-descendants of a common anthropoid which had its habitat in Africa (fig. 1). He regarded the catarhine type of monkey—the type exemplified by the monkeys of the Old World—as representatives of a still older ancestral form. Darwin traced the common anthropoid stock, which gave birth not only to the ancestral lines of man, the gorilla and chimpanzee, but also to those of the orang and gibbon, back to a common catarhine type. This catarhine type, he presumed, was the offspring of a still older common simian or monkey-like type, one which existed in the Eocene period of the earth's history and gave origin not only to the catarhine monkeys of the Old World but also to the platyrhine monkeys

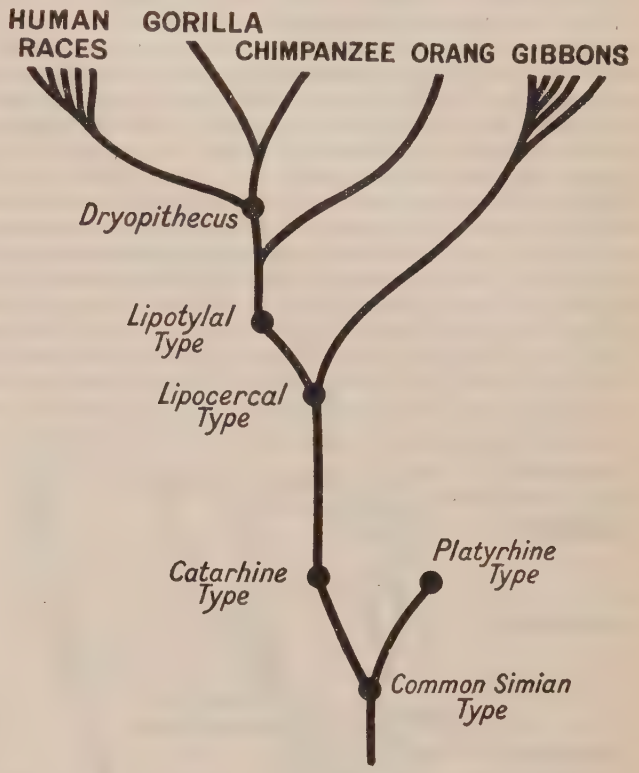

Fig. 2.—Haeckel's conception of Man's descent as illustrated by a phylogenetic tree, published in 1866.

of the New World. Thus man's history, as Darwin saw it, did not begin until after the ancestral type of anthropoid had been evolved; the appearance of an anthropoid type from a common catarhine ancestor and this from a common simian stock, represent prehuman stages in the evolution of the higher primates. It is noteworthy that Darwin's mind remained open as to the exact point at which the human stock branched off from the general primate tree; more than once in the *Descent of Man* he writes as if the human lineage might have come off, not from the anthropoid stem, but lower down in the primate tree, from that of the common catarhine stock (fig. 1a).

Haeckel's Views.—On no occasion did Darwin throw his conception of man's lineage into a diagrammatic form. The first to construct an evolutionary tree of man's descent was Ernst Haeckel; this appeared in his *Generelle Morphologie* published in 1866, five years before Darwin's *Descent of Man* was issued. This pedigree is still worthy of study (fig. 2). Haeckel perceived that the small form of anthropoid ape, the gibbon, was more primitive and earlier in point of evolution than the three living great anthropoid apes (orang, chimpanzee and gorilla) and supposed that in the evolution of the great anthropoids from the ancestral catarhine type there was interposed a small anthropoid stage to which he gave the name Lipocerca (λιπεῖν, to lack, κέρκος, tail). This small anthropoid stock (Lipocerca) gave origin, he supposed, to gibbons and to the ancestral stock of the great anthropoids—for which Haeckel proposed the name Lipotyla (λιπεῖν, to lack, τύλη, cushion)—anthropoids which, unlike the gibbons, were destitute of ischial callosities or natural cushions on which gib-

bons and Old World monkeys seat themselves. This cushionless anthropoid stock (Lipotyla) he regarded as ancestral to the various races of mankind. From the Lipotyla, which gave origin to man, there also branched off, at an early stage, the ancestry of the orang and, at a later, the common ancestry of the chimpanzee and gorilla. Thus Haeckel regarded the gorilla and chimpanzee as more nearly related to man than other living anthropoids. It is also remarkable that he placed the extinct Miocene form of anthropoid ape, known as Dryopithecus, on the line which led up to the gorilla and chimpanzee on the one hand and to human races on the other. Thus it will be seen that in Haeckel's opinion man was the descendant of an anthropoid ape.

Later, he introduced considerable modifications into this family tree. In the third edition of his *Evolution of Man* (English translation, 1879) he interpolated into man's ascent from an anthropoid to a human state an intermediate stage represented by *ape-like* men—beings who were manlike in form and in gait but lacked man's power of speech. To such hypothetical beings he gave the name *Pithecanthropi*.

Modern Views.—In 1892 Prof. E. Dubois discovered in the island of Java the fossil remains of a being which answered very well to this hypothetical stage, and named this fossil form of evolving man *Pithecanthropus erectus*. Haeckel presumed that his pithecanthropi had lived in the Pliocene period; Prof. Dubois is of opinion that his transitional form of man lived in Java towards the end of the Pliocene period. Discoveries made by Dr. G. E. Pilgrim of the Geological Survey of India and by members of that survey in the latter part of the 19th century have

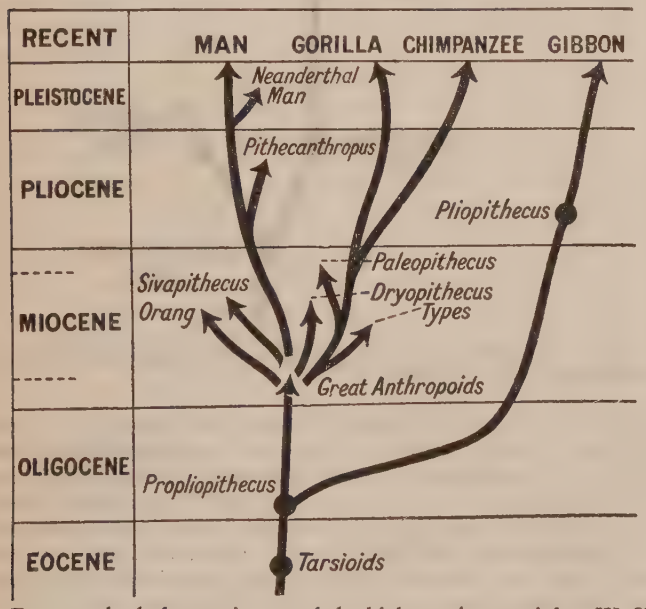

FIG. 3.—A phylogenetic tree of the higher primates (after W. K. Gregory, 1916).

proved that India, during the Miocene period and the earlier part of the Pliocene, was the home of great anthropoids of many and diverse kinds, several of them belonging to the type of Dryopithecus which Haeckel, at an early period, regarded as a possible ancestor to man. Others of these fossil Indian or Siwalik anthropoids show affinities to the orang, to the chimpanzee and to the gorilla, while still another—*Sivapithecus*—is regarded by Dr. Pilgrim as an early representative of the human family. Notwithstanding these revelations from India and taking all their bearings into consideration the majority of modern authorities (Dubois, W. K. Gregory, Elliot Smith, Keith), in constructing diagrams to illustrate the affinities and lines of descent for the higher primates, depict the human stem (fig. 3) as springing from the vicinity of the stem which gave rise to the gorilla and chimpanzee. The conception, first formulated by Haeckel, that a Miocene anthropoid of the type of Dryopithecus (fig. 3) may stand as a common ancestor to man and to the African anthropoids is still regarded as possible.

Doubts Raised by the Occurrence of Parallel Evolution.—There is a line of evidence, accumulating at the present moment, which tends to undermine the confidence of those who have drawn up phylogenetic trees of man's descent. All who have inquired into the evolution of horses and elephants, by the study of fossil forms found in widely separated regions of the world, have become impressed by the fact that horses and elephants in America have passed through evolutionary changes of the same kind and in the same order as have done their representatives in the Old World. This tendency for the descendants of a common ancestry to undergo *parallel* or even *converging* evolution, has been very fully expounded in the published works of Dr. Henry Fairfield Osborn (*Origin and Evolution of Life*, 1918). That parallel evolution has been potent in the order of mammals to which man is assigned there can be no doubt. The monkeys of the New World parted company from those of the Old early in the Eocene period; it is probable that at the time of their separation they had only reached the stage represented by the Tarsioids, a family of monkey-like primates, which has now only one living representative—the Tarsier (*Tarsius spectrum*) of Borneo and other islands of the Malay Archipelago. Although parted thus early, New and Old World monkeys have acquired corresponding structural modifications—modifications of a kind which we cannot regard as having been present in their common ancestor. The brain of the South American spider monkey (Ateles), that of the Old World monkeys of the semnopithek type, and that of the small anthropoid or gibbon, have many common characters which could not have been present in the brain of their Eocene ancestor.

We may legitimately infer, however, that a bias or tendency to produce similar or almost identical modifications was latent in the common ancestor. If parallel evolution has been at work in one section of the order of primates it may have been at work in another, and we must therefore keep in mind the possibility that man and the gorilla may have acquired their many and striking points of structural similarity independently. Cope (1882) and Hubrecht (1897) supposed that human lineage had parted from that of the anthropoids near the base of the primate phylum; if this were so man would have an independent pedigree of immense length. In more recent times Prof. F. Wood Jones (*The Problem of Man's Ancestry*, 1918) has put forward the theory that man, because of the number of primitive and generalised features of his structure, is to be traced back to an independent origin from a tarsioid ancestor. Such a view entails the need of supposing that the multitude of structural similarities shared by man and the great anthropoids must have been acquired by each independently—a supposition which is unacceptable to the majority of those who have made a special study of the higher primates living and extinct.

Klaatsch (*Die Stellung der Menschen im Naturganzen*, 1911), (*Evolution and Progress of Mankind*, 1923) made a larger demand on the powers of evolution to reach the same end by diverse routes. This voluminous author traced the origin of mankind to an anthropoid ancestry, but supposed that the ancient inhabitants of Europe—Neanderthal man, known only from his fossil remains, and the living Negro peoples of Africa had arisen from the same stock as the gorilla and chimpanzee, while Mongolian peoples and men of the modern European type had sprung from the same lineage as the orang. Klaatsch believed in the polygenetic origin of human races, whereas nearly all modern authorities hold a monogenetic theory of man's evolution. They cannot believe that black and white races, which although outwardly dissimilar are yet structurally so alike and freely capable of interbreeding, could have sprung from different branches of the primate tree. They rely on the axiom that likeness in structure means similarity of descent.

Man an Aberrant Primate.—In charting the family tree of the Higher Primates modern authorities differ as to the position which should be assigned to man. Prof. Eugène Dubois represents the human stem as the main and direct continuation of the trunk of the primate tree (*Nature*, vol. 53, p. 245, 1896); from this main trunk all the other members of the primate order

are made to come off as side branches. Man is given the central position of his order; he forms the apex of the primate tree. Prof. Elliot Smith (*Evolution of Man*, 1925) also gives the human family the central position as a direct continuation of the main primate stem. In reality man is the most aberrant member of his order; in brain and in the modifications of his lower limbs he has departed farther from the ancestral primate state, so far as we know that state by the study of fossil remains, than any member of the order; he has retained less of the structural organisation of the original primate than all the others. Apparently in the evolution of the higher primates there has been the same tendency as is to be noted in modern political parties—a tendency for an extreme wing to move ever further from the central group of conservatism. The human family represents the extreme wing in the order of primates; *Tarsius*, greatly modified as it is, retains the essentials of the central or conservative group.

Man's Zoological Position

Zoologists classify animals into families, sub-families, genera and species, according to their degrees of structural likeness; they presume, although fully aware that parallel evolution can and does take place, that two animals, such as the gorilla and chimpanzee, which are so similar in the structural details of their bodies, owe that similarity to their descent from a common ancestry. Darwin urged rightly that in settling the zoological relationship of one group of animals to another, more weight must be attached to the points wherein they agree than to those in which they differ.

Huxley's Views.—In the masterly analysis of man's structural relationships given by Huxley in *Man's Place in Nature* (1863), more stress was laid on the anatomical differences which separate man from the gorilla than on the points wherein they agree. Huxley held that differences of a like kind and of an equal degree separated the gorilla from any form of catarhine or platyrhine monkey a critic might choose for comparison. He held that if evolution could produce the structural gap which separates a monkey from the gorilla it could also bring about the abyss which divides the gorilla from man. Huxley's conclusions are still valid; indeed, the modern anatomist is convinced that the structural hiatus which lies between a baboon or any other form of monkey and the gorilla is much wider than that which lies between the gorilla or chimpanzee and man. When tested by modern methods, the blood of the chimpanzee shows a much closer affinity in its reactions to that of man than to that of any Old World monkey; the blood of monkeys of the New World, when submitted to the same tests, reveals a still more distant affinity (Prof. G. H. Nuttall, *Blood Immunity and Blood Relationship*, 1904). Huxley included in one family the great anthropoids (gorilla, chimpanzee and orang), the small anthropoids (siamang, gibbons), and the various genera of monkeys of the Old World; if we are to be guided by anatomical considerations we must give to each of these groups the rank of a family. The same rank—that of a primate family—must be given to the section which embraces all the various races and types of mankind, living and extinct. The various genera of New World monkeys make up a fifth family of primates.

The Primate Families.—Thus in that part of the living animal kingdom to which man belongs, there are five families—the human family, that of the great anthropoids, that of the small anthropoids, the family of catarhine or Old World monkeys and the family of platyrhine or New World monkeys. These families are separated by structural gaps of about equal magnitude. From the platyrhine monkeys upwards, these families form an ascending series in the sense that each succeeding family marks a further departure from the ancestral tarsioid type, the point of highest differentiation being reached in the human family.

Evidence of Man's Descent

Anatomical.—The members of these five families of primates have a common structural substratum—an inheritance from the ancestral stock from which they have all descended. Each family in the course of evolution has come by anatomical features which are peculiar to itself. A full analysis of the structural details of man's body shows that about 30% of them are peculiar to himself. The corresponding characters of the gorilla number 16%; the gibbon has about the same proportion of features peculiar to its own family (Keith, *Rivista di Antropologia*, vol. 20, p. 1, 1916). As examples of man's peculiar characters we may cite his nude skin, his projecting nose with well marked wings, the size of his brain, the strength of his thigh, the form of his leg, the shape of his foot.

Common Characters.—Further analysis reveals in man's body a series of characters which he shares with only two other living animals—namely, the gorilla and chimpanzee. These amount to nearly 9% of the total points selected for comparison, but if we include in this group features which man shares with the gorilla alone or with the chimpanzee alone, then man has in his body about 26% of characters which he shares with gorilla and chimpanzee or with gorilla alone or chimpanzee alone. Such characters, we presume, are derived from a common ancestor which gave birth to man and to the great anthropoids of Africa. As examples of characters common to the three we may cite the air chambers which branch off from the nasal cavity. These have the same arrangement and are of the same number in man, gorilla and chimpanzee. Another example is to be found in the small bones of the wrist. Of the higher primates, only in these three has the *os centrale* disappeared as a separate unit from the carpus; yet in a foetal stage this bone is present in all three; and as a separate element in adults of all the other higher primates.

Descending still lower in the strata of human anatomy we encounter a group of characters which man shares with the three great anthropoids. We may speak of man and these three as the giant primates, for compared with the earlier types they are giants, or we may apply to this group Haeckel's convenient name—*Lipotyla*. Man shares with the other giant primates 10% of similarities of structural detail; to this we may add 5% which he shares with the orang and with the orang only, characters which the chimpanzee and gorilla have apparently lost or perhaps never possessed. Going still lower in our analysis, we find over 8% of characters which are common to the gibbon as well as to the great anthropoids. With the gibbon man shares 8% of structural features which are not to be seen in the bodies of the great anthropoids. In this case, again, we have to suppose that man and the gibbon came by those characters long after they separated from a common ancestor, or that the great anthropoids have lost them in the course of evolution while man and the gibbon have retained them.

Lower in the scale of our analysis we come upon features in man's body which he has apparently retained from a catarhine ancestry; at least, to find their counterparts we have to go to the bodies of Old World monkeys. In man's body there are 5% of such catarhine features; in the gorilla's body such features are three times as numerous. It is remarkable that platyrhine characters, features to be seen in the bodies of the New World monkeys, should be as numerous as catarhine in man's body.

There is a small residue of anatomical details in human anatomy attributable to a still more distant past, a heritage from a tarsioid or lemuroid ancestry. From the details revealed by anatomical analysis it is plain that evolution has not proceeded in an orderly or simple manner in shaping the bodies of the higher primates; characters are curiously scattered. Yet to explain the distribution of characters in the various families we must suppose that man's ancestry is linked closely to that of the African anthropoids—the gorilla and chimpanzee. In some instances we obtain help in explaining the distribution of characters by calling in the aid of *collateral* or parallel evolution; in other cases Mendel's discoveries in heredity assist us; further, we see that the body of man and of ape is a great mosaic work of structural elements and that progressive changes may occur in one set of units while retrograde changes affect another set.

In recent years the formation of the human embryo in the womb, the complicated changes which transform the embryo into a foetus and the elaborate processes which produce the organs of the ripe child from embryonic rudiments, have been

studied by an ever-growing army of inquirers and by methods which show an ever-increasing precision. Embryologists find it necessary to assume that the law of evolution holds for man; unless they make this assumption they can offer no rational explanation of the complex changes which engage their attention. In its broad lines development pursues the same course in the human body as in that of all vertebrate animals. What Francis Balfour in 1885 saw taking place with diagrammatic clearness in the embryo of the dog-fish has given clues to the more complex and obscure processes now known to occur in the embryo of man.

The developing human egg, when it becomes established in the mother's womb, undergoes a series of elaborate and peculiar changes. The investigations carried out by the late Dr. Emil Selenka (*Menschenaffen. Studien über Entwickelung und Schädelbau*, 1898–1906) revealed the fact that only in the wombs of four other living mammals, the gorilla, chimpanzee, orang and gibbon, do the same changes take place. The process by which the placenta is formed, thus establishing a means of supplying the unborn child with nourishment, is exactly the same in man as in anthropoid apes. It is true that in *Tarsius* we see outlined the basal plan of placentation met with in the higher primates, but it is also true that in the placentation of the monkeys of the Old World and also in that of the New World we see a stage which leads on from the lower or tarsioid condition to the higher or anthropoid form. In the embryos of man and of the anthropoids an external jointed tail is produced in the fifth week of development; by the end of the eighth week it has shrivelled and become submerged, leaving a dimple at the point of the caudal region where it sinks below the surface. These are a few examples of some of the remarkable similarities which link the embryological history of man with that of the anthropoid apes.

Recapitulation, Interpolation, Adaptation.—When in the later decades of the 19th century anatomists applied themselves to unravelling the development of man's body, they expected it to recapitulate, in full detail, the various stages of his evolution. In this they have been disappointed, because in the growth of the embryo and of the foetus we see three different processes at work. We see recapitulation taking place; we also see new characters being interpolated from the time the embryo makes its first appearance until all the parts of a formed child are laid down; further we see at every stage the body of the embryo and of the foetus being adapted to a life within the womb. When gill-clefts appear in the neck of the human embryo towards the end of the first month of development we see a recapitulatory and very distant phase exemplified. When we look at the developing human foot, with the expectation of finding an anthropoid phase, we search in vain. The great toe is never a free and separate member in the human foot as it is in the adults of all other primates. There is a stage in the development of the feet of primates when all the digits diverge equally from the tarsal base; man and ape pass through this stage and man clings to it as it were, whereas all the other primates pass on to a final prehensile stage. Yet in the sole of the newly born child we see the same flexion lines as in that of the gorilla; we find the same muscles in the great toe of the human foot as in that of the gorilla; we find the joint at the base of man's great toe, especially in the foetus, moulded in the same form as the gorilla. We cannot explain these appearances unless we believe that the human foot has been evolved from one like that of the gorilla, more especially as the foot of the gorilla shows a curious blend of human and monkey-like features.

The human great toe does not recapitulate ancestral history; developmental changes which mould the great toe into the human pattern set in just when the simian ones are due; the human changes do not succeed but replace those that give the ape its prehensile foot. New changes have been intercalated in the evolutionary sequence. In a multitude of details the human embryo no longer recapitulates the series of changes gone through by its ancestors. It is true of every part of the human body; human characters begin to peer through its higher primate qualities before development is a month old.

Of the changes which affect the developing human body those which represent adaptations to life within the womb are the most important. The child draws its living from its mother's body; it is sheltered and kept warm; it has not to seek its living nor defend itself; such qualities need not be attained until the time of birth; until then nature is free to work out what experiments she will. It is a remarkable fact that many of man's distinguishing features are to be met with during foetal stages in the development of anthropoid apes. A stage which is transient in the foetal ape becomes permanent in man. We may take as an example the comparative hairlessness of man's body. A foetal chimpanzee, in the eighth month of development, resembles a human foetus of the same age; both have hair growing freely on their scalps, but the rest of their bodies, although provided with lanugo, appear to be nude. By birth the chimpanzee's body is covered with hair, but the human child retains the foetal state. Yet all known primates save man have their bodies thickly covered with hair; hairlessness is not an ancestral condition, but one made possible by the retention of the young in the shelter of the womb. The skin provides us with another example of foetal inheritance. In the fair or white stock of mankind the skin has become relatively free from pigment. In their earlier stages of foetal development apes are unpigmented; they darken as the time of birth approaches. White men have come by their colouring through the inheritance of a foetal condition, one which is certainly not ancestral.

Many examples might be cited of man coming by distinctive characters by retaining foetal states, but the following may be taken as representative. In all foetal primates the brain is relatively large and the jaws absolutely small; this is certainly not an ancestral state, for in all the older forms of primate the brain is small and the jaws large. Man is distinguished by the large size of his brain and the relatively small size of his teeth and jaws. How he compares with adults of great anthropoid apes may be seen from the following data. We may take the capacity of the cranial cavity to represent the size of brain and the area of the palate to represent the size of the jaws. In a well-grown adult European male we expect a cranial capacity of 1,500 c.c. and a palatal area of 25 sq. cm., there being 60 c.c. of brain space for every square centimetre of palate. The average male gorilla has a cranial capacity of 470 c.c., a palatal area of 72 sq. cm., that is, 5·8 c.c. of brain space for every square centimetre of palate. The corresponding figures for the average male orang are: 412 c.c., 62 sq. cm., giving a cranio-palatal ratio 6·6:1; in the average male chimpanzee the figures are: 390 c.c., 46 sq. cm., giving a ratio of 8·5:1. There is a wide gap between the European cranio-palatal ratio 60:1 and that of the chimpanzee, 8·5:1. We may fill the gap somewhat by citing a Tasmanian skull with a capacity of 1,350 cc., a palatal area of 36·7 sq. cm., and a ratio of 36·7:1.

We find a still nearer approach to the anthropoid condition in the fossil skull of Rhodesian man in which the cranial capacity is 1,300 cc., the palatal area 41 sq. cm., the cranio-palatal ratio 31·7:1. Even this ratio is far above that of the chimpanzee, 8·5:1; but if we take a suckling chimpanzee, in which the cranial capacity is 260 c.c. and the area of palate 13·6 sq. cm., we obtain a ratio 19:1, an approach to the human proportion. If we take a still earlier stage, such as may be observed in a chimpanzee foetus during the eighth month of development, we find a ratio which is human in its magnitude. Man has come by his small palate by retaining a foetal anthropoid condition, and this is true of all the parts of man's skull which are concerned in mastication. This tendency to foetal inheritance is not confined to the human branch of primates; in certain genera of New World monkeys, particularly in Chrysothrix and Cebus, we see in their small jaws and large heads the same law at work.

The belief that many of man's foetal characters do not reflect ancestral stages, but foreshadow the trend of future evolution, was held by several anatomists in Germany towards the end of the 19th century, particularly by Ranke. The law of foetal inheritance, so far as it relates to man, has been greatly extended during recent years in a series of papers by Prof. L. Bolk of

Amsterdam (*Proc. of the Roy. Acad. of Sc. of Amsterdam*, 1921–5). Embryological evidence, if it has failed to reveal the pithecoid states through which man has passed in his ascent, does provide conclusive evidence of his simian ancestry. In the development of his brain, for example, we see that the first fissures to appear are those which occur in the brains of the higher monkeys; the next are those which are found in the brains of the great anthropoids, and later still the secondary human sulci are formed; but never at any stage does the human brain correspond to that of monkey or of anthropoid. If embryology has failed to reveal the details of man's history, it has shown that the processes of evolution are at work on the foetal body; if the study of the foetus does not help us to decipher man's past, it does seem to provide a basis on which we may forecast the future of the human body. The brain of the gorilla, in the totality of its characters, is the most like that of man; these two are structural allies, yet evolution has moulded their bodies in opposite directions. During growth the gorilla replaces all its foetal characters by those of brutality and strength; in man the tendency has been to retain the delicate physique of the young and to shed those of a more brutal nature. Why the one fate overtook the gorilla and another fell to man remains an enigma.

Biological Evidence of Man's Evolution

Blood Tests.—Not only are the bodies of man and anthropoid apes fashioned on similar lines, but, as was demonstrated at the beginning of the present century, their living tissues give like reactions. In 1900 Dr. Hans Friedenthal injected a small amount of human blood into the veins of a chimpanzee; its vital qualities were so similar to those of the chimpanzee that no disturbance followed the operation. When an equal amount of the blood of a macaque monkey was injected into the veins of the chimpanzee there was a slight reaction; the corpuscles of the macaque's blood were destroyed and ejected by the kidneys. When the blood of an ox was used a violent reaction was produced, the foreign blood being destroyed and thrown out.

Prof. G. H. F. Nuttall, of Cambridge University, thereafter elaborated a more precise method of estimating blood-affinities, by which very small quantities of blood can be tested against specially prepared antisera. In 1904 appeared his classical work *Blood Immunity and Blood Relationship*, containing the results of tests carried out on three species of anthropoid ape, 28 species of Old World monkeys, and nine species from the New World. The blood of all these species was tested against a human antiserum. The blood of the anthropoids gave a full reaction—100%; that of the Old World monkeys gave a lesser reaction or precipitation, one equivalent to 92% of the full; that of the New World monkeys 78 per cent. At the time Prof. Nuttall was making these investigations in England, Dr. Uhlenhuth was carrying out independent inquiries in Germany, and reached corresponding conclusions as to degrees of affinity. The tests devised by Nuttall and by Uhlenhuth utilise the fluid or serum of the blood. Recently Drs. Landsteiner and Miller (*Jour. Experim. Med.*, vol. 42, p. 841, 1925) have utilised the corpuscular elements of the blood and find that they give more delicate reactions than those given by the serum. They devised tests which serve to distinguish the blood of the chimpanzee from that of man, but which failed to discriminate the blood of the white man from that of the negro.

Disease Reactions.—The reactions of living tissue are also tested by disease. Man is peculiarly susceptible to syphilis; the animals most akin to him in this respect are the great anthropoid apes. Monkeys are difficult to inoculate with syphilis, and when they suffer, take the disease in its mildest form. Anthropoid apes are almost as suceptible to typhoid fever as man is. When chimpanzees are kept in confinement they are liable to that modern disease of man—appendicitis. Anthropoids react to stimulants, sedatives and poisons in the same manner as human beings. The brains of the great anthropoid apes are smaller and are less convoluted than is the case in man, yet when the living cortex is stimulated by electrical methods, be it in man or anthropoid ape, the same reactions follow when corresponding convolutions are excited. Surgeons have found that observations made by experimental physiologists on the brains of anthropoid apes afford reliable guidance when they have to operate on the brain of man. Thus the evidence supplied by vital tests bears out the conclusions forced on anatomists by similarity of structure—namely, that great anthropoid apes, in an evolutionary sense, are near akin to man.

Evidence of Vestigial Structures

Nearly all the structures which have become greatly reduced or are mere vestiges in the body of man have undergone a similar fate in the bodies of the anthropoid apes. In them as in man the tail has disappeared, all save its basal part, which has sunk beneath the surface to form the coccyx. It is true that the vermiform appendix of man is smaller than that of any of the anthropoid apes, and that in half of the Europeans who reach the age of 70 its lumen has become closed, yet it is more than doubtful if this structure should be reckoned vestigial in the body of either man or anthropoid. The *palmaris longus*, the *plantaris*, the *pyramidalis*, muscles which are reduced or fibrous in man, are in the same state in anthropoid apes. Such evidence points to a common origin for anthropoids and man, but it throws no light on man's more immediate relationship to any member of the anthropoid group.

There are two muscular vestiges, however, which point to man's kinship to the African anthropoids. There is a muscle in the neck of monkeys which helps to lift the shoulder; it is called the *levator claviculae*. It has almost disappeared from man's body; it is met with only once in a hundred dissections. This muscle shows definite signs of reduction in the gorilla and chimpanzee, but not in the orang or gibbon. All monkeys have a strong muscle called the *latissimo-condyloideus*. When a monkey is climbing, and has seized a branch with its hand, it uses this muscle to pull the trunk upwards. It is a particularly strong muscle in the gibbon, well developed in the orang, somewhat reduced in the chimpanzee, partly fibrous in the gorilla, wholly fibrous in man, although in 5% of human bodies some muscle fibres may be detected. Lately Dr. A. H. Schultz, of the Carnegie Institution of Washington, has found a remarkable example of the persistence of a vestige in man's body (*Amer. Jour. Physic. Anthrop.*, vol. 7, p. 149, 1924). Lemurs, which branched off from the primate stem at a very distant geological period, have a tuft of touch vibrissae at the wrist. Monkeys were supposed to have lost these vibrissae; Dr. Schultz found them in foetal stages of monkeys both of the Old World and of the New. On examining the wrists of human foetuses in the second month of development he found a raised plaque at the spot where the touch vibrissae are situated in lemurs.

The Evidence of Fossil Remains

Pithecanthropus Erectus.—The discovery which throws most light on the evolutionary progress of man was made in Java during 1891–2 by Prof. Eugène Dubois, then a surgeon in the colonial military service, and later professor of geology in the University of Amsterdam. In a stratum which contained the fossil bones of many extinct species of animals he obtained five fragments of a strange kind of being, one which he regarded as a transitional form between man and ape—a real missing link. He named it *Pithecanthropus erectus*, and assigned it to a separate family of primates—one lying on the borderline between anthropoids and man. (*Pithecanthropus erectus, eine menschenaehnliche Uebergangsform aus Java*, 1894.) The five fossil fragments found were: a skull cap which outwardly had the form which might be expected in a giant form of gibbon, a left thigh bone and three teeth. The most distant of the fragments were twenty paces apart. Later he added a sixth fragment—part of a lower jaw found in another part of the island but in a stratum of the same geological age. The skull cap is flat, low and has great eyebrow ridges; its characters are more simian than human, yet when Prof. Dubois succeeded in obtaining a cast from the interior of the skull cap, that cast bore on it the convolutionary pattern of the brain of Pithecanthropus, and that

pattern proved to be altogether human. Pithecanthropus, the fossil man of Java, had a brain which was smaller, simpler and infinitely more primitive than that of the lowest living men.

By this discovery Prof. Dubois caught the human brain in the act of evolving. Certain cortical or convolutionary areas in man's brain are known to be concerned with sight, hearing and touch, and the reception of messages from other sense organs; a "motor" area is concerned in the initiation and control of voluntary movements. Between these primary areas of the cortex lie association areas which have to do with the memory and the interpretation of what is seen, heard or felt. The cortex of part of the frontal lobe—the prefrontal cortex—is concerned in the acquisition of skilled movements. These secondary or association areas of cortex, which lie between and separate the primary areas, are the basis of man's educability—his capacity to learn from experience. In the brain of Pithecanthropus the association areas are much less developed than in the brains of the lowest of living human races. Yet all the essentially human parts are represented. It is even possible that the owner of this brain was capable of speech.

A further study of the brain-cast has convinced Prof. Dubois that Pithecanthropus must be placed in the human family (*Proc. Roy. Acad. Sc. Amsterdam*, vol. 27, nos. 5, 6, 1924). The brain of this "fossil" man is now estimated to have had a volume of at least 900 c.c.; the largest-brained gorillas rarely rise above 600 c.c.; the lowest-brained of human beings occasionally falls below 1,000 cubic centimetres. Pithecanthropus in size of brain lies on the verge of humanity. His teeth, if large, are essentially human in form of crown and root; the socket for the canine, in the fragment of lower jaw, shows that this tooth was not massive and pointed as in anthropoid apes. The thigh bone is human altogether, and gives proof that Pithecanthropus walked as men do.

Pithecanthropus was assigned by Prof. Dubois, on reliable evidence, to a date late in the Pliocene period; others on weighing the evidence suppose that he lived early in the Pleistocene period. If we accept the duration of the Pleistocene as 250,000 years, and regard Pithecanthropus as representing the evolutionary stage reached by mankind at the beginning of this period, then we have to conclude that man's body had become adapted to its peculiar posture and gait before the end of the Pliocene period, and that the higher development of the brain took place in the ensuing Pleistocene period.

Eoanthropus.—The discovery which ranks next in importance to that of Pithecanthropus was made by Mr. Charles Dawson at Piltdown, Sussex, between the years 1911 and 1915. He found the greater part of the left half of a deeply mineralised human skull, also part of the right half; the right half of the lower jaw, damaged at certain parts but carrying the first and second molar teeth and the socket of the third molar or wisdom tooth. The lower jaw, on the region beneath the chin, had a bar of bone known as the "simian shelf," which until then had been regarded as a mark of the ape. Later a pointed upper canine tooth was added; its characters were simian rather than human. The stratum of gravel proved to have been laid down early in the Pleistocene period, and it is certain that the fossil fragments of this human skull were as old as the date of deposition. From the fossil fragments thus found, Sir Arthur Smith Woodward reconstructed an extinct genus of mankind, *Eoanthropus*, the dawn-man (*Quar. Jour. Geol. Soc.*, 1913–5). Subsequently (1915) in the deepest part of the gravel stratum there was found a remarkable bone implement hewn from the thigh bone of an extinct kind of elephant; in a neighbouring field two other fragments of a skull of the same kind came to light, and another molar tooth.

Some experts still doubt whether a lower jaw which resembles that of a chimpanzee in several respects should be assigned to a skull which is purely human in its characters. At first there were differences of opinion as to the size and characters of the brain of Eoanthropus. Amongst British authorities there is now agreement that the skull and jaw are parts of the same individual, and that the brain, as revealed by casts taken from the interior of the skull, is human in its size and in all its characters. If we divide living races into three classes according to the size of brain, the large-brained having a cranial capacity above 1,450 cu.c., the small-brained a capacity under 1,350 cu.c., then Eoanthropus certainly reached the upper limits of the small-brained class if not actually a member of the medium-brained group. The brain of Eoanthropus has risen many stages above that of Pithecanthropus; the bone implement affords evidence of manual skill and of inventive ability on the part of its owner. The eyebrow ridges of Pithecanthropus are shaped as in the gibbon, chimpanzee and gorilla; in Piltdown man they are fashioned nearer to the form seen in the skull of the orang. The discovery at Piltdown shows that at the beginning of the Pleistocene period a race of mankind had come by a brain that had reached a human estate, and that this race still retained certain definite simian characteristics in its jaws, teeth and face.

Neanderthal Man.—In 1857 while workmen were clearing out the Neanderthal cave near Düsseldorf, Germany, they found the vault of a fossilised skull and limb bones of a man who proved to be, in the light of further discoveries, a representative of an extinct species of man—*Homo neanderthalensis*. A fossil skull which was dug up at Gibraltar in 1848 is of the Neanderthal type. Fossil remains of the same kind have been found in Belgium (at Naulette, 1866, and at Spy, 1886), but the caves of France have proved the richest source of Neanderthal remains, particularly those in the valley of the Dordogne.

The evidence found at La Chapelle (1908), at La Ferrassie (1909), at Le Moustier (1908) and at La Quina (1911) made it quite clear that this extinct type of man, marked as he was by many simian traits of body, buried his dead with signs of respect. He worked flint implements with great skill, in the style or culture known as Mousterian. He was a hunter and lived in caves and rock shelters. His molar teeth were often shaped in a peculiar manner; his teeth have been found in cave deposits in Jersey (1911) and in Malta (1917). His remains have been found in Moravia (1906) and at Krapina in Croatia (1899–1906). His culture has been found in Italy and in England, but no trace of his body. Only once have fossil remains of Neanderthal man been found outside the limits of Europe, in a cave situated on the western shores of the Sea of Galilee (1925).

Neanderthal man appears to have been the sole occupant of Europe during the middle of the Pleistocene period—throughout the time in which the Mousterian culture prevailed in that continent. The date of this culture may be put down tentatively as extending from 40,000 B.C. to 20,000 B.C.; perhaps its duration was much longer. Remains of Neanderthal man rather more primitive in type, and found in strata older than the Mousterian strata of France, have been discovered at Taubach (1895) and at Ehringsdorf (1914), both of these sites being near Weimar, Germany. *The Heidelberg mandible* was found at a depth of 78 ft. in a sandpit at Mauer, ten miles to the east of Heidelberg, in 1907. The stratum in which it was found belongs to the deeper and older Pleistocene series; this fossil jaw thus represents a race which lived long before the men who practised the Mousterian culture. Yet so like is the mandible of Heidelberg man to that of Neanderthal man, in the majority of its characters, that we may safely regard him as an ancestral representative of the Neanderthal species. In Heidelberg man the canine tooth did not project above its neighbours as in Eoanthropus.

At one time it was believed that Neanderthal man represented an ancestral phase of modern man. Every bone of his body shows distinctive markings, many of these being of a simian nature. His eyebrow ridges were like those of the gorilla and chimpanzee; the roof of his skull was low like theirs, and yet in size of brain he equalled, if he did not surpass, modern Europeans. He had, however, certain specialisations of structure which modern or Neanthropic man does not possess. Besides, the archaeological evidence is now complete that he was replaced in Europe by the arrival of men of the modern kind—represented by people of the Cromagnon type. For these reasons Neanderthal man cannot be regarded as an ancestor of modern man. Neanderthal man and men of the modern type, however, have so much in common that they must be looked upon as descendants of a common ancestor.

Rhodesian Man.—The fossil remains of Rhodesian man which were discovered in the Broken Hill Mine, Northern Rhodesia, in the summer of 1921, also bear evidence to the truth of man's evolution. His fossil remains lay deep in a filled-up cave; he was probably alive in Africa when men of the Neanderthal type dominated Europe. His limb bones show that he was tall, quite 5 ft. 10 in. in height, and stoutly made, after the manner of modern man. His skull, which is complete save the lower jaw, possesses many primitive traits. His brain space was small (1,300 c.c.); in point of development the brain falls below that of Eoanthropus. The eyebrow ridges are extremely massive, and the face has features which recall those of the gorilla. Yet his teeth, although large, are human in every respect and were ravaged by caries. Rhodesian man might well stand as an ancestral type to modern man.

Cromagnon and Other Races.—The Cromagnon type of man and other forms which appear in Europe after the disappearance of Neanderthal man are fully developed men of the modern type; they differ from us only in robusticity of build and strength of jaw. The fossilised, capacious skull discovered at Boskop, Transvaal, in 1913, represents an extinct form of man of the Bushman type. The Talgai skull, derived from a Pleistocene deposit and described by Dr. S. A. Smith (*Phil. Trans.*, ser. B, vol. 208, p. 351, 1918), is of the same form as that of living Australian aborigines, but possesses additional primitive features. Prof. E. Dubois discovered a Pleistocene form of man at Wadjak, Java, one with a very large cranial capacity (*Proc. Roy. Acad. Sc. Amsterdam*, vol. 23, pt. 7, 1920). Such discoveries, although they bear out the truth of evolution, do not throw light on man's evolutionary pedigree.

Geological Evidence of Man's Antiquity

Artefacts in Pliocene Deposits.—If we accept Pithecanthropus as representative of man's estate towards the end of the Pliocene period, then we must infer that man had come by his posture and his gait before the close of the Pliocene period, and that his brain underwent its greatest expansion in the earlier part of the Pleistocene period; an inference which postulates a rapid rate for human evolution. In size of brain Pithecanthropus was approaching the human minimum. It is difficult to conceive him as a maker of tools, yet in geological deposits which were laid down in East Anglia during the Pliocene period Mr. Reid Moir has found flints which must have been shaped by beings which possessed skilled hands (*Pre-Palaeolithic Man*, 1921. *The Great Flint Implements of Cromer*, 1923). Such evidence indicates that other genera of the human family may have marched towards the human goal more rapidly than Pithecanthropus.

The Early Anthropoids.—If man is a descendant of a great anthropoid, and the great anthropoid of a small, then a knowledge of the geological levels at which these two forms occur should throw some light on the date of man's evolution.

The oldest trace of a small anthropoid so far discovered comes from strata of the Fayum, Egypt, laid down in the earlier part of the Oligocene period. The half of a lower jaw with its teeth is all that has been found of this small anthropoid, which was described by Von Schlosser in 1911. He named it *Propliopithecus*, and regarded it as an ancestral form of gibbon (W. K. Gregory, *The Evolution of the Human Dentition*, 1922).

No fossil remains of great anthropoid apes have been found in strata older than those of the Miocene period. Of Miocene great anthropoids, at least nine species have been discovered; one of them, *Sivapithecus*, known from fragments of jaws and teeth found in the Siwalik deposits of India, is regarded as a possible ancestor of man by Dr. G. E. Pilgrim, but a full consideration of the evidence leaves the expert unconvinced. In 1922 a tooth was found in Pliocene beds of Snake Creek Quarry, Nebraska, which has been attributed to an anthropoid ape with human leanings to which the name *Hesperopithecus* was given by Dr. Henry Fairfield Osborn. Unfortunately, the tooth was worn and its true characters hard to decipher; the fact, however, that such competent authorities as Dr. Osborn, Dr. W. K. Gregory and Dr. W. D. Matthew are convinced that a trace of a humanoid anthropoid has been found in America will secure consideration for Hesperopithecus.

Early in 1925 Prof. Raymond Dart announced the discovery of the fossil skull of a young anthropoid ape, found in a limestone quarry at Taungs, on the eastern border of the Bechuanaland Protectorate, near the Transvaal frontier (*Nature*, 1925, vol. 115, p. 195). The geological evidence goes to show that this anthropoid, which Prof. Dart named *Australopithecus*, cannot be older than the beginning of the Pleistocene period, which eliminates it from any place in the line of man's ancestry. Its anatomical characters place it in the same group of anthropoids as that to which the gorilla and chimpanzee belong. In some respects Australopithecus is more human than either of the two living African anthropoids.

Summary.—Thus, taking all lines of evidence into consideration, anatomical, biological, embryological and geological, we are led to the conclusion that man has been evolved from a lower form, and that human races, as we know them to-day, are the products of evolutionary processes. There remain great blanks in the line of evidence which links the origin of modern man to an extinct form of anthropoid ape. Between the highest kind of anthropoid and the lowest type of man, represented at present by Pithecanthropus, there remains a great gap; the transitional forms which fill this gap still remain to be discovered. Yet the evidence as it stands, imperfect as it is, points to man's departure from an anthropoid status early in the Miocene period, certainly 1,000,000 years ago, perhaps more; that in the Miocene and Pliocene periods his body and limbs became adapted to a plantigrade posture; that his brain underwent expansion in the Pliocene, and particularly in the earlier part of the Pleistocene period, and that as the brain reached a full human status the coarser outward appearances of the ape were shed. Of the vital processes which brought about these changes we are as yet ignorant, but it is manifest that in his evolutionary progress man has tended to acquire and preserve in adult years states which appear at first as transient conditions in foetal or infantile stages.

It is becoming clear that the machinery of evolution is that which regulates development and growth, and in these matters knowledge is growing. Experimental embryologists have proved that one group of developing cells can and does regulate the growth and behaviour of a neighbouring group. The theory of hormones has thrown a flood of light on the machinery of evolution (Prof. Chas. R. Stockard, *Publications of Cornell University Medical College*, 1924, vol. 10; Keith, *Supplement to Nature*, Aug. 18 1923). It has been proved that substances or hormones are carried by the circulation throughout the living body from a series of glands which include those of reproduction, the adrenal, the thyroid, the pituitary and pineal, and that the substances thus liberated in the body do control its vital reactions and its structural form.

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MANAGEMENT: *see* SCIENTIFIC MANAGEMENT.

MANCHESTER, England (*see* 17.544), has an area of 21,688 ac. (including areas incorporated in 1910 and 1913), and an esti-

mated population of 761,320. Since 1918 10 members have been returned to Parliament, and the city was brought entirely under one board of guardians in 1915 and one board of overseers in 1916. The birth-rate varied between 1·86 and 2·37 in 1921–5, and the death-rate between 1·36 and 1·44.

Housing and Improvements.—Several housing schemes, including a number of wide new roads, have been undertaken, the largest being at Blackley, Moston, Wilbraham Road, Anson and Gorton, but the house shortage was still acute in 1926, although more than 5,300 houses had been built by the municipality since 1919, besides those erected privately. The council aim at completing 10,000 more by 1930, and had under consideration the question of the purchase of a site of 4,500 ac. in rural Cheshire beyond and to the south of the city limits. In this area stand the Wythenshawe Hall and grounds (comprising 250 ac.), presented to the corporation for park purposes. A number of large parks and open spaces have been acquired, and include Cringle Fields, Burnage (54 ac.); Broadhurst Park, Moston (84 ac.); Fletchermoss Playing Fields, Didsbury (21 ac.); and Green Bank Fields, Levenshulme (24 ac.). New parks are planned for Withington (48 ac.) and Chorlton-cum-Hardy (37 ac.), which have grown rapidly since the World War.

New Buildings.—The Horsfall education museum, Ancoats Hall, has been transferred to the corporation; the old parsonage, Didsbury, was opened as a branch art gallery in 1923; and Platt Hall was handed over in 1925 as a branch art gallery and museum. A new art gallery, surrounded by a wide, open space, for which the design was approved in 1925, is to be built on the site of the old Royal Infirmary in Piccadilly. The infirmary has been moved to Oxford street, and several other hospitals have been built in its vicinity. A large Wesleyan hall and institute was opened in Peter street in 1910, the Y.M.C.A. building in 1911 and the Church House in Deansgate in the same year. The Exchange was extended and reconstructed in 1914–21; the historic Free Trade Hall in Peter street was bought by the corporation in 1921, and plans were made in 1925 for the extension of the town hall, to include the central library, then in temporary buildings on the Piccadilly site.

The new office being erected in King street in 1926 for the Ship Canal Co. will be the highest commercial building in the city. A textile institute, with its headquarters at St. Mary's Parsonage, was founded in 1910; and a British Cotton Industry Research Assn., with offices and laboratories at Didsbury, in 1919. Premises are to be built at Fallowfield for the grammar school. A radium institute, the first in the country exclusively for the use of radium in hospital treatment, was opened in Nelson street in 1921. A statue of King Edward VII. was unveiled in Whitworth Park in 1913, one of Abraham Lincoln in Platt Fields in 1919 and a large war memorial on the foundations of old St. Peter's church in 1924. Playing fields and a pavilion have been acquired at Stretford as a memorial to men of the Manchester Ship Canal Company.

Public Works.—Two additional pipe-lines have been laid from Thirlmere, and the North Cheshire Co.'s water undertaking was purchased in 1921. In 1925 a beginning was made with the large Haweswater scheme, to involve 84 m. of aqueducts, tunnels and pipes. It is hoped to finish the work by 1934. A new electric power station was opened at Barton in 1923, and in 1925 it was decided to double its capacity. Parliamentary powers were obtained in 1921 for the construction of a large gas-generating station at Partington, and the present stations in the city will eventually be used only for distributing. Parliamentary powers were also obtained, in 1911, for a comprehensive scheme to result in the whole drainage of Manchester being carried to works at Davyhulme. In 1925 the possibilities of an electric underground railway were under discussion.

Port Improvements.—In 1925 there were eight docks with a water area of 120 ac. and $5\frac{3}{4}$ m. of quays in the port. Trafford Wharf was rebuilt and re-equipped in 1924, and in 1925 the last five miles of the Ship Canal were being deepened to allow vessels drawing 28 ft. to come up to Ellesmere Port. Road and railway improvements were also in hand at Ellesmere Port, which is leased by the Ship Canal Co., more wharves are to be built, and the company have acquired 1,000 ac. of land for industrial development. The corporation have determined to undertake a comprehensive civic survey. When the survey has been completed, recommendations will be made as to future action in matters municipal, social, economic, housing, parks, recreation facilities, commerce, industry, communications, and transportation.

Though best known as the business and warehousing centre of the cotton industry, Manchester has also become a great manufacturing and distributing centre for chemicals and dyes, and is one of the chief ports for importing oil. Some of the greatest engineering workshops in the world are in the city or its immediate neighbourhood. Motor-cars and commercial vehicles are made, and rubber manufacture and the ready-made industry are extending. (O. J. R. H.)

MANCHESTER, VICTORIA UNIVERSITY OF (*see* 17.545).—The development of the University of Manchester during the 20th century, in common with that of the other English universities, has been greatly affected by the War. At the same time, valuable contributions both to the defence of the country and to knowledge were made, especially by the scientific, technological and medical staffs who were called upon to face problems raised by the War. The number of students, which had reached 1,691 in 1910, increased immediately after the conclusion of hostilities, and in 1920 was 2,900. It had in 1926 apparently stabilised itself at about 2,500. Perhaps the most significant feature of this increase was the continued growth of the number of women students—730 in 1926 as against 336 in 1910. The botanical and physical laboratories and the extensions of the museum and library, completed during the four years 1910–4, were followed by the erection of a building to house most of the departments of the faculty of arts (1919), while new accommodation was provided for the metallurgical department, and the medical school was internally reconstructed. The continued growth of the library, which contains over 200,000 volumes, led to further extension, and a bequest of Mr. Jesse Haworth made possible the erection of a new wing of the museum, to provide galleries for the exhibition of the valuable ethnographical collections made by the late Mr. Charles Heape and presented by him to the university in 1923.

Developments.—An appeal for funds in 1919 produced a sum of £250,000, and this made it possible to satisfy some of the needs rendered urgent by post-War conditions. New chairs have been instituted in Russian and Italian, in addition to a second chair of French. The lectureship in textile technology has been raised to the status of a professorship, and a similar development has taken place in psychology and in commerce and administration. A chair in English language has been instituted in addition to that in literature, and the second chair in law and the chair of comparative religion have been revived. The institution of a faculty of education in 1914, with a post-graduate degree of master in education, led to interesting researches in educational method and administration, and the faculty received a valuable addition by the endowment by Sir James E. Jones of a lectureship in the training of teachers of the deaf. The same donor also endowed a hall of residence primarily for the accommodation of women students preparing for the certificate instituted in that subject. A gift from the Carnegie United Kingdom trustees led to the establishment of a special library available for teachers and others interested in the education of the deaf.

The university athletic grounds have been extended. They now cover 28 ac. and possess a finely equipped pavilion. The facilities for the residence of the men students have been increased by the recognition of two more halls; while for women students three new halls have been recognised, and the existing Ashburne Hall has been extended to accommodate about 130 students. This extension, opened in 1925, includes a central block, providing a large hall, and beneath it a library in which have been placed the 8,000 volumes bequeathed by Lord Morley for the use of women students of the university. Closer

relations between the university and the local education authorities have been established. There are three county and eight municipal authorities contributing annual grants.

The resignation of Lord Morley as Chancellor of the University took place just before his death in 1923. The Earl of Crawford and Balcarres was elected as his successor. Sir Henry A. Miers, previously principal of the University of London, and appointed vice-chancellor of the University of Manchester in 1915, retired during 1926. Mr. W. H. Moberly, principal of University College, Exeter, was appointed to succeed him.

MANCHURIA (*see* 17.552).—In 1911 an agreement was concluded by the "Four Nations" consortium, to finance the development of Manchuria, but was blocked by Russia and Japan until their participation under conditions which secured to them continuance in their privileged position had been conceded. A treaty in 1911 and an agreement in 1916 further strengthened Russia's position in North Manchuria, while the formal annexation of Korea by Japan in 1910 placed the numerous Koreans in Manchuria under Japanese consular jurisdiction. By the beginning of 1911 the "peaceful penetration" of Manchuria and Eastern Inner Mongolia was proceeding steadily and under conditions generally similar to those which had characterised Russia's forward policy from 1898 to 1905.

In 1912 the railway from Changchun to Kirin was opened to traffic. In May 1915, by the terms of a new treaty concluded by China as the result of the Japanese ultimatum accompanying the "twenty-one demands," the lease of the South Manchurian Railway and of the Antung Mukden line was extended to 99 years (*i.e.*, to 2002 and 2007 respectively). By the same treaty Japanese subjects became entitled to lease land for trade, manufacturing and agricultural purposes, and to reside and travel freely in South Manchuria. By notes exchanged as the result of the same "twenty-one demands" China was to permit Japanese subjects to open more mines in South Manchuria. No foreign loans were to be made for the construction of railways in South Manchuria and Eastern Inner Mongolia without the preference being given to Japanese capitalists; preference was to be given Japanese in employing foreign advisers in South Manchuria; and other promises were made favouring the Japanese. In 1917 the whole of the railway system of Korea was linked up with the South Manchurian Railway and placed under its administration. Under these conditions the activities and influence of the railway rapidly became dominant factors in the economic life of Manchuria. In 1916 Japan and Russia agreed by treaty to support each other's rights and interests in the Far East.

In Dec. 1915 a loan agreement was signed between the Chinese and Japanese Govts. for the construction of a railway from Ssupingkai (120 m. north of Mukden) to Chengchiatun; this line was completed in Dec. 1917. In Oct. 1917 a revision of the Changchun-Kirin loan agreement was concluded between the Chinese Govt. and the South Manchurian Railway Company, the result being a loan of 6,500,000 yen for a term of 30 years, during which period the management of the line is vested in the South Manchurian Railway, on behalf of the Chinese Government. In 1918 there were agreements with Japanese interests for the development of mines and forestry and for the construction of four railways.

Russo-Japanese Rivalry.—The disorganisation of the central Government in China and the collapse of Russia after 1917 served to increase the economic, financial and political ascendancy of Japan in Manchuria. For example, after China's entrance into the World War, some of the loans made to Japanese by the Peking Govt. had as security properties and resources in Manchuria. As a result, however, of the negotiations initiated by the United States in July 1918 for the establishment of a four-Power consortium to co-operate in Chinese finance, and of the subsequent *pourparlers* between the British and Japanese Govts. on the same subject, the latter finally agreed (May 1920) —with some important reservations—to withdraw the claims, previously put forward by the Japanese bankers, to exclude from the scope of the Consortium "all the rights and options held by Japan in the regions of Manchuria and Mongolia where Japan has special interests." Japan's power in South Manchuria, however, continues to grow, but at the same time the Chinese have by no means given up control, for they continue to form the great majority of the population, and the provincial organisation and administration are actively maintained. The dominant Chinese figure in Manchuria has increasingly been Chang Tso-lin. General Chang, in 1924 still in middle life, had once been connected with a band of Hunghutze, or bandits, but he had been taken into the service of the Chinese Govt. and in 1911 he was military Governor of Fengtien. From then on, his power grew until by 1920 he was one of the major figures in the Chinese political situation, and Manchuria had become virtually a semi-independent principality under his control. Russian influence, moreover, did not disappear with the collapse of the old régime. For a time it was weakened, but with the establishment of regular diplomatic relations between the Soviet Govt. and China in 1924, Russian power, while by no means fully restored, was again increasing.

Despite an agitation in Japan, the Japanese Govt. has maintained its policy of strict neutrality in the civil war—a policy reiterated by Baron Shidehara, the Japanese Minister for Foreign Affairs, in the Diet in Jan. 1926. Some alarm seems to have been aroused in Moscow by a contract given in April or May of 1925 by Chang Tso-lin to the South Manchurian Railway Company for the construction of a line from Taonanfu in Inner Mongolia to Tsitsihar in northwest Manchuria on the ground that it invades the old Russian sphere of influence in North Manchuria. Rapid progress was made by the Japanese with this railway which was expected to be open for traffic as far as the Nonni river by Aug. 1926. The Soviet authorities are also reported to have protested against the strengthening of the Japanese forces in North Manchuria in 1925 as a violation of the spirit of the Japanese-Soviet Treaty of 1924. (*See* CHINA; CHINESE EASTERN RAILWAY.)

Trade Statistics.—The economic progress achieved in Manchuria had been very rapid since 1912. This might have been expected in regions with vast undeveloped resources and with an increasing, industrious population. Much of the expansion of its trade and industries must also be ascribed to the enterprise shown by the Japanese in the development of mines, forestry and agriculture, and in improving transport, communications and currency.

Figures show the rapid increase of South Manchuria's trade and reflect the effects of the Russian débâcle upon the commerce of the northern province. In 1916 the maritime customs receipts in the northern provinces were 21% of the total for Manchuria. In 1920 they were 12% of the total, and in 1922 17 per cent. In 1919 the total direct foreign trade of Manchuria was taels (Hongkong) 299,523,736 and in 1922 it was 285,861,094. Dairen (Dalny) now ranks second only to Shanghai in the list of China's maritime ports. In 1922, 56·5% of Manchuria's direct foreign trade passed through Dairen (Dalny). In 1908 the trade of Manchuria represented 11·5% of China's total; in 1918 the proportion had risen to 16·8%; in 1922 it was 17·5 per cent. Naturally the bulk of South Manchuria's foreign trade was with Japan. The anarchical conditions prevailing in Russia and Siberia after 1917 served to increase Japan's economic and financial influence in Northern Manchuria, the rouble note being replaced in many parts of the country by the yen notes of the Bank of Chosen, which in Jan. 1918 was given control of the treasury business of the Japanese Govt. in Manchuria. At the end of 1918 this bank had 18 branches operating in Manchuria (as against 10 in Korea), and notes in circulation to the amount of 30,000,000 yen. According to the statistics compiled by the South Manchurian Railway, the population of Manchuria in 1916 was 20,112,100. The post office estimate for 1922 was 22,083,434. (*See* CHINA.)

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MANDATE.—The mandate system is a term applied to the conditions set up by the Treaty of Versailles for the administration of the former overseas possessions of Germany and Turkey. Mandatory Powers are those Powers which were selected by the Supreme Council of the Allies to administer these territories under mandate. The system is a novel experiment in the relations

between a sovereign State and a country under its control, involving new departures in international law. It was created by Art. 22 of the Covenant of the League of Nations, which formed part of the Treaty of Versailles, and has thus gained the recognition of all States that are members of the League.

In its origin it was in the nature of a compromise. After the War the victorious Allies naturally wished to retain the German and Turkish colonies, in the conquest of which they had in most cases made great sacrifices. It was believed that these colonies had been subjected to misrule; pledges had been made to the native inhabitants, some of whom had taken part with the victors in the fighting, that they should not be handed over to the vengeance of their former masters; and finally, a misgiving existed lest, in case of rendition, Germany might use them as recruiting grounds for black armies, and their ports as bases for submarines in a future war. On the other hand the Allies had declared—more particularly in the pre-Armistice statement of Nov. 5 1918—that annexation of territory was not their aim in the War.

International control of some kind was the only alternative. Joint administration was condemned as impracticable and opposed to the interests of the people. Even as a condominium between two Powers only, it had given rise to friction in Egypt, Samoa and the New Hebrides. The only other course lay in the appointment of an individual Power in whom could be vested responsibility for the administration of each separate territory as an agent, or mandatory, of the League. For this course there were analogies in the delegation of quasi-sovereign powers to British and Dutch chartered companies and in the control of the Ionian Is. on behalf of the Powers by Great Britain in 1859. Individuals also had been appointed as mandatories of the Powers, as when King Leopold undertook control of the "International Free State of the Congo," or when Prince George of Greece was made Governor of Crete in 1898.

The main defect of these delegations of sovereignty was that they provided no machinery to ensure the due execution of the trust, and it is the distinctive feature of the mandate system that it attempts to remedy this defect. The League of Nations afforded just such a supervisory authority as was needed, and its supervision is exercised through the medium of a standing committee, known as the "Permanent Mandates Commission." The League had nothing to do with the assignment of the mandates or with their terms, or with the extent and boundaries of the territories. These were determined by the Supreme Council. The United States, not being a member of the League, was no party to this arrangement, and she insisted that as an Associated Power her consent was necessary. The mandates therefore were submitted to her, and approved on condition that "free and equal treatment in law and in fact was secured to the commerce of all nations." Where the mandate did not ensure this she negotiated separate treaties with the mandatory concerned.

Terms of the Mandates

The mandates were formed to give expression in detail to the principles embodied in Art. 22 of the Covenant (*q.v.*), and since that article prescribes that their character must vary with the varying conditions of each territory they were divided into three classes to correspond with the three paragraphs of that article.

Class A includes the former Turkish vilayets of "Iraq, Palestine and Syria whose independence "can be provisionally recognised, subject to the rendering of administrative advice and assistance until they are able to stand alone." The two former were assigned to Great Britain, the latter to France.

Class B comprises the ex-German Central African colonies—Togoland, Cameroons, Tanganyika and Ruanda—in which the mandatory is responsible for the administration and undertakes to promote the moral and material welfare of the people. Tanganyika, and a small part of the Cameroons and Togo fell to Great Britain, the major portions of the two latter being assigned to France, while Belgium became responsible for Ruanda.

Class C territories include those which "can best be administered under the laws of the mandatory as integral portions of its territories, subject to the safeguards in the interests of the indigenous population" which are laid down for Class B. They are South-West Africa, Samoa, New Guinea, the islands north of the equator in the West Pacific and the tiny island of Nauru. For these respectively the Union of South Africa, New Zealand, Australia, Japan and the British Empire accepted mandates.

In the case of Nauru, Great Britain, Australia and New Zealand had by agreement in July 1919 (before the issue of the mandate), jointly acquired control of the phosphate deposits, which constitute the sole value of the island, and they jointly undertook the execution of the mandate. Since, however, the British Empire has no single code of laws, the administration was assigned by the two others to Australia for five years.

The "safeguards in the interests of the indigenous population" to which reference is made are: (1) freedom of conscience and religion, subject only to the maintenance of public order and morals; (2) prohibition of abuses such as the arms and liquor traffic and the slave-trade; and (3) prevention of fortifications, naval and military bases, and the military training of natives except for police and the defence of the territory.

The mandates were conferred by the Supreme Council of the Allies, and after acceptance by each mandatory were submitted to the Council of the League, which was charged with the duty of seeing that their terms were in accord with the Covenant. They were finally approved by the United States. The A class could not be issued until the Treaty of Lausanne came into force (Aug. 1924). Meanwhile an Arab government had been set up in 'Iraq, and a treaty had been concluded by Great Britain with it. On Sept. 27 1925 the Council formally accepted the undertaking of the mandatory to see that the terms of this treaty (which embodied the obligations of the Covenant) were adhered to, and this undertaking was substituted for the mandate. These long delays were very prejudicial to the welfare of the people of Asia Minor. The territories were, however, administered in accordance with the terms of the Covenant or under draft mandates. These terms are explicit. The mandate is a "sacred trust of civilisation" to be assumed by nations who (*inter alia*) "by reason of their resources can best undertake this responsibility and are willing to accept it." The altruistic nature of this pledge was confirmed in a reply to a German protest. "The Mandatory Powers," said the Allies, "in so far as they may be appointed trustees by the League of Nations, will derive no benefit from such trusteeship."

A mandated territory differs from a protectorate in that the protecting Power in the latter obtains rights over the population and against other Powers, whereas a mandatory in its capacity as guardian assumes obligations both toward the population and the League. These thus acquire rights as against the mandatory.

League Control.—The system, it has been said, differs from such partial precedents as have been cited, in that it attempts to set up machinery by which the proper execution of the mandate may be assured. This consists in the unqualified right of supervision vested in the League which imposes upon each mandatory the obligation to submit an annual report on its administration.

The Permanent Mandates Commission examines these reports in the presence of an accredited representative. The commission consists of nine members of the following nationalities: Belgian, British, Dutch, French, Italian, Japanese, Portuguese, Spanish and Swedish—to which has recently been added an "additional member" (Swiss). The majority are nationals of non-mandatory states. They are selected "for personal merit and competence" as private individuals, and not as representatives of their respective nations. They are nominated by their governments, but approved and appointed by the Council of the League, and may not hold any office under their government. A representative of the International Labour Office attends the sessions, and takes part in any discussions relative to labour. This international composition negatives any suspicion of bias, and gives to the commission the aspect of an impartial tribunal of practical men, whose object it is to promote co-operation while fearlessly exposing any breach of the Covenant. Its functions are purely advisory to the Council.

A permanent secretariat, under a director, collects and circulates all documents of interest concerning mandates and conducts the routine business. The duties of the commission are not confined to the annual review of the reports of the

mandatories. It receives any petitions and memorials from inhabitants of the territories and others interested, and these, unless trivial or irrelevant, are forwarded to the mandatory concerned before examination by the commission, which also makes a special study of questions arising either in relation to the system or to the various problems of administration. Notes for guidance in preparing their reports are circulated to mandatories, dealing with such matters as slavery, labour, traffic in arms, liquor and drugs, liberty of conscience, the judicial system, military forces, economic equality, education, public health, land tenure, public finance and matters relating to general administration and the moral and material welfare of the people. The proceedings are conducted in French and English, and are generally held in private to facilitate freedom of discussion. Full minutes are printed, which, together with the memoranda on special subjects and all other pertinent papers, can be obtained from the League publication department, or from its agents in London and other European capitals. The Commission meets at least twice in the year at Geneva, and its procedure is governed by rules approved by the council.

The weak point in the system lies in the impossibility of independent verification of statements contained in the reports. This difficulty is inherent in the circumstances, for it would clearly be impossible either for the whole commission or any part of it to visit a mandated territory officially, and to sit in judgment on the policy of a Sovereign Power. Even an official visit for the purpose of acquiring information would be of doubtful wisdom, as tending to weaken the prestige of the mandatory and to afford opportunity for malcontents to manufacture grievances. For information not contained in the report, therefore, the commission must rely on those public bodies or individuals who interest themselves in the welfare of native races, and on such memorials and petitions as may be presented to it.

The sole means at its disposal—or at the disposal of the League—for compelling the proper execution of the mandate is the force of public opinion, though in case of deliberate violation of the mandate and of gross maladministration, the council could no doubt send a commission of enquiry, and in theory the legal possibility of revocation for failure on the part of the mandatory to fulfil its contract no doubt exists. In order to obtain more accurate information, the actual administrators now generally appear as the mandatory's representatives. Steps are also being taken to secure a wider distribution of the sessional papers of the commission, with a view to enlarging the orbit of well-informed public opinion and perhaps of exerting an influence on the standards of colonial administration.

Interpretation of Article 22.—The creation of the mandates system—though a task of enormous importance, involving issues new to international law and affecting the destinies of many millions of the human race and of property in every quarter of the globe worth many hundreds of millions sterling, was only one of the many preoccupations of the Versailles Conference. Owing to the circumstances of the moment many matters of less permanent and historic importance claimed an undue attention. Critical examination and practical experience have therefore detected many points which require elucidation or authoritative interpretation. In some particulars, for instance, the mandates do not strictly conform to the terms of Article 22. In the A mandates the treaty enjoins that "the wishes of the communities must be a principal consideration in the selection of the mandatory," and it is common knowledge that the communities concerned were never consulted. The paragraphs in Art. 22 on which the B and C mandates were framed do not contain any similar injunction, though explicit statements to the same effect had been made.

Military Service.—Again, the French mandates in West Africa —unlike the British mandates for portions of the same territories (Cameroons and Togo)—contain a clause to the effect that "troops thus raised" (*i.e.*, for purposes of local defence and police) "may in the event of general war be utilised to repel an attack, or for defence of the territory outside that subject to the mandate." It is difficult to reconcile this clause with the words of the Covenant. At the instance of the Mandates Commission the British Govt. was willing to go even further than the Covenant prescribes, and to agree to pledge itself not to enlist the natives of a mandated territory, even though they offered themselves for enlistment outside its frontiers—thus limiting its sovereign rights in adjacent territories not under mandate. The French Govt. has declared its willingness to accept the same restriction.

The original intention of the treaty would seem to have been to exclude all mandated territories and their inhabitants from participation in a general war; but the mandates for Palestine and Syria authorise the mandatory "to make use of the ports, railways and roads for the passage of its troops and of all materials, supplies and fuel," and local forces may be used for purposes other than defence. These countries thus automatically became involved in any war in which the mandatory may be engaged. It is not clear what is the position of the C mandates in this regard.

Liquor Traffic.—The Covenant enjoins the "prohibition of abuses such as the slave-trade, the arms traffic and the liquor traffic." Some have urged that these words mean the enforcement of total prohibition alike for natives and non-natives. The mandates, however, only prescribe a "strict *control* over the sale of spirituous liquors," and the St. Germain Convention (Sept. 1919), concluded soon after the Versailles Treaty by the same signatories, forbids the import of "trade spirits" only. Relying on these facts, others contend that the term "liquor traffic" is used in the Covenant in the technical sense in which it is usually employed in West Africa, and means the "importation of cheap, distilled liquors for sale or barter as an article of trade with the natives." The Mandates Commission has consequently asked the council for an authoritative definition of this and other ambiguous terms used in the Covenant.

In the matter of equal commercial opportunity for all nations, the Covenant itself failed to fulfil the expectations raised by the pre-Armistice declarations of the Allies. No obligation in this regard is imposed in the C mandates, while in the B class it is restricted to States which are members of the League.

Legal System.—The essential distinction between the B and C classes of mandates, in the terms of Art. 22, lay in the dictum that the latter "can best be administered under the laws of the mandatory, as integral portions of its territory," but the British and French mandates for Cameroons and Togo, and the Belgian mandate for Ruanda (all of the B class) contain a clause in identical terms.

Boundaries.—Yet another cause of practical difficulty is presented by the fact that in many cases the boundaries of the territories assigned under mandate were not defined, and it was apparently left to the individual mandatories to adjust them without reference to the League. In the case of 'Iraq this has led to an acute dispute with Turkey. In Palestine the boundaries of Trans-Jordania are still undefined. In Northern Syria the French, having, as it was understood, agreed to accept a mandate for Cilicia, abandoned it to Turkey without apparently any authority from the League to do so, and the frontiers are still indeterminate. So again in Ruanda, where an adjustment, involving the cession of a considerable area by Great Britain to Belgium, was effected and approved by the League. On the northern frontier of South-West Africa negotiations are in progress between the Union Govt. and the Portuguese.

Sovereignty.—Wider issues are raised by such questions as the nature and extent of sovereignty exercised by a mandatory and the international status of the inhabitants of a mandated territory. The former—which has been much debated by American publicists—is rather academic and juridical than of practical interest. It suffices for practical purposes that the mandatory has the absolute right to make and enforce laws, to raise troops, to set up tribunals, to appoint officials and to raise and spend revenues. Sovereignty was not ceded by the Treaty of Versailles to the League, but to the victorious Allies—indeed the highest court in South Africa has recorded the opinion that the territories were not ceded at all, but placed by Germany at the disposal of

the Allies, to be administered under mandate—a status new to international law.

The mandatory's powers are exercised " in its capacity as such." It has, for instance, been satisfactorily established by the Mandates Commission that such terms as " crown (or state) lands " and *domains d'état*, where they appear in local ordinances, refer only to lands which are the property of the mandatory as such, in other words, to the mandated territory, and that any action on the part of the mandatory which had for its object (or would ultimately involve) annexation—as for instance the acquisition of large monopolistic rights, or of essential public services—would be contrary to the spirit of the Covenant and the mandate.

Status of Natives.—The status of the indigenous inhabitants of a B or C mandate territory has on the other hand been the subject of special definition. Obviously, since the country is not annexed, they do not become the subjects of the mandatory. The formula was therefore adopted by the Council that " they should be designated by some form of descriptive title which will identify them as such," viz., as " persons administered or protected under mandate." This confers no juridical status, and no privilege of citizenship, but Art. 327 of the treaty stipulates that they should be entitled to the diplomatic protection of the mandatory when outside the mandated territory, and individuals may if they so desire become naturalised subjects of the mandatory. Since residents in a British Protectorate cannot acquire British nationality, and since a person " protected under mandate " could not be placed in a more favourable position in such a matter than a resident in a British Protectorate it was decided at an Imperial Conference that the power of granting certificates of imperial naturalisation should be extended to persons resident in certain named protectorates, and in mandated territories. Extradition treaties with France have similarly been extended, the natives being regarded for this purpose as " assimilated " to those of a colony.

The application to mandated territories of special conventions, entered into by a mandatory Power, has also been the subject of investigation and recommendation by the Mandates Commission, in order to ensure that " persons protected under mandate " shall not be in a less favourable position in regard to their persons and property and their economic interests than the inhabitants of a protectorate or colony.

Permanence of Mandates.—The revocation of a mandate for maladministration, though theoretically possible, is in practice unthinkable. Voluntary transfer or abandonment (with the sanction of the League) is hardly more conceivable. The terms of the Covenant therefore contemplate self-government as the natural fruition of the mandate—in the case of the A class at no distant date. The new state—as is proposed in the case of 'Iraq—would then take its place as a member of the League, or perhaps, as in the case of South-West Africa, would be federated with the mandatory.

Conclusion.—The mandate system enforces, for the first time in history, the principle of trusteeship, and of public responsibility to a supervising authority for the obligations laid down in the trust deed in regard to mandated territories. The annual report forms an effective means of inviting a popular verdict on the fulfilment of the trust, and this supervision constitutes a fundamental distinction from annexation, whatever the degree of assimilation to other possessions of the mandatory. The League exercises supervision but not control, for the ultimate authority to which the stewardship of the mandatory is submitted is the public opinion of the civilised world. The standards of the Covenant must obviously in the future be regarded as principles of general application. The mandate system is an international acknowledgment of the responsibility which the advantages of a superior intellectual culture and twenty centuries of Christian ethics no less than the physical superiority conferred by the monopoly of firearms impose upon those Powers which have accepted control of backward races. *See* LEAGUE OF NATIONS.

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(F. D. L.)

MANGANESE (*see* 17.569).—The principal use of manganese is in the manufacture of iron and steel, about 95% of the world's production of manganese ores, manganiferous iron-ores, and manganiferous zinc residuum being consumed in metallurgical processes. Its chief chemical uses are as a constituent of oxidising agents and colouring materials, and as a flux in the smelting of silver and lead ores. Salts of manganese are used as fertilisers and massive rhodonite as an ornamental stone. Manganese is also used for medical purposes. Ores of the metal are widely distributed, but deposits of commercial importance are known only in a few countries. The principal of these are Russia (Caucasus), the ore of which consists mainly of pyrolusite; India, Brazil and West Africa. Minor producers of the metal are Italy, Spain, the United States, Cuba and Japan; while deposits are also known in Germany, Greece, Egypt, Canada, Mexico, Colombia, Chile and Queensland.

For many years before the World War, Russia was the main producer, the figures for 1913 being 1,234,900 tons. The Russian industry suffered severely during and after the War, however, and the export figures in 1923 had fallen to 407,401 tons. These figures, however, represent a considerable advance on those of the years immediately preceding. The circumstances which acted so detrimentally to Russia imparted great impetus to the Brazilian manganese industry, the United States absorbing practically the whole of the much increased output of the South American States. In 1916 the United States obtained 80%, and in 1917 83%, of its manganese ore from Brazil. In the Morro de Mina mine, in the state of Minas Geraes, Brazil has what is probably the largest manganese mine in the world.

Production in India began in 1892, in the Madras Presidency, but in 1899 rich deposits were discovered in Central India and from this date the industry in India assumed importance. The India ore is more suitable for blast furnaces than the softer ores of the Caucasus, and, owing to more careful selection, is exported in more uniform quality. Its main constituent is psilomelane, with an important amount of braunite.

In the Gold Coast, West Africa, large deposits of manganese were discovered at Dagwin, near Taquah. Work was commenced here in 1916, and the first shipment of 174 tons made in the same year. In 1923 the production had risen to 139,634 tons. The Dagwin mineral generally is psilomelane, though pyrolusite is occasionally found. The average percentage of manganese plus iron is 55–56.

Production of Manganese by Principal Leading Countries.
Quantity (long tons)

Country	1913	1918	1923
India	815,047	517,953	695,055
Gold Coast	..	30,292[1]	139,634[1]
Russia and Georgia	1,234,900	150,000[2]	407,401
Italy	1,596	31,383	9,451
Austria	16,280	177	23,647
Brazil	120,335	387,066	232,041
Spain	21,247	76,465	28,175
United States	4,048	305,869	31,500[1]
Japan	17,755	56,109	4,926

[1] Shipments. [2] Georgia only.

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MANGIN, CHARLES EMMANUEL (1866–1925), French soldier, was born at Sarrebourg, Moselle, July 6 1866 of a military family, his father having been a general of division. One of his brothers was killed on active service at Tongking; while another, formerly a White Father but during the War a sergeant in the Senegalese Tirailleurs, died in the North African desert a few months after the Armistice. Mangin, himself, was not unworthy of his family history. He left the École Spéciale Militaire at Saint Cyr in 1888 for Africa, and with the exception of three years spent in Tongking, and 10 months in France, he remained for 26 years in different parts of Africa. In 1891 he became a lieutenant, in Nov. 1897 a captain, in Jan. 1900 the commander of a battalion, in Dec. 1905 lieutenant-colonel, and later, colonel. In Aug. 1913 he was promoted to the rank of general of brigade. His travels in Africa were extensive; he visited Dahomey, Senegal, the Sudan, the Congo, Morocco and Lake Chad. He was a member of Marchand's expedition and was one of the legendary company who were said to have marched "for three days without a halt." It was he who, at the head of 5,000 men, routed the bandit El'hiba and all his followers in the plain of Ben Guerir and so relieved Marrakesh. His considerable literary abilities, which he had rarely the leisure to exercise, were also devoted to Africa; and his book, *La Force Noire* (1910) brought home to Frenchmen the immeasurable resources of their empire.

When the World War broke out General Mangin was 48 years of age. At first in command of the 8th Brigade and, after April 9 1916, of the 5th Infantry Division, he threw the enemy back upon Douaumont, which he reached on May 22. Five months later, on Oct. 24, he hurled two divisions against the Germans and took Douaumont and Vaux. In 1917 he was in command of the V. Army, and in the following year at the time of the April offensive the Supreme Command imposed upon him the hard task of checking the German offensive directed against Compiègne. Eight fresh divisions were entrusted to him, and with these 60,000 men he checked von Hutter's advance at Noyon. Subsequently he was entrusted with the X. Army and was ordered, in conjunction with General Degoutte, to break in the German salient south of the Aisne. This he accomplished; the Chemin-des-Dames, the Château de Coucy and Laon were successfully re-occupied. At the time of the Armistice, he would have been the first to enter Metz at the head of his troops, in company with Marshal Pétain, had not an unfortunate accident at the last moment prevented this. For a year he commanded the Army of Occupation on the Rhine. In June 1921 he was sent as Ambassador Extraordinary to represent France at the celebrations of the centenary of Peruvian independence.

General Mangin held the Grand Cross of the Legion of Honour, was a member of the Supreme War Council, was Inspector General of the Colonial Forces, and presided over the Supreme Council for National Defence. But his life work was to develop to the maximum his country's African resources. He died on May 12 1925, and was buried with military honours in the Montparnasse Cemetery. Above his head stands a simple stone bearing this inscription: "Ici repose un soldat français." (M. Gu.)

MANIPULATIVE SURGERY.—The earliest practitioners of "bone-setting"—the old misnomer for what is now more correctly described as manipulative surgery—date back into very remote times, and Hippocrates, although not versed in a knowledge of structural anatomy, was the author of a treatise on dislocations which will bear comparison with many present-day publications on the subject. The history of the Roman Republic tells of successful practitioners of this ancient craft.

During the years when surgery was gradually being regularised and its seats of learning were being established, "bone-setters" were the only orthopaedic surgeons of those days, and the doctors apparently countenanced them as legitimate exponents of that section of therapeutics. The famous surgeon, William Cheselden, in the middle of the 18th century, who was a warden of "The Master Governors and Commonalty of the Art and Science of Surgeons of London" used to send cases to the bone-setters for treatment, and frankly admitted that he did so because he was not competent to treat them himself.

Hunter's Attitude.—The renowned surgeon, John Hunter, with great foresight and acumen, was amongst the first of eminent surgeons to realise the value of early movements in cases of sprains and joint injuries. He wrote: "Nothing can promote contraction of a joint as much as motion before the disease is removed, but when all inflammation is gone off . . . a little motion and frequently repeated is necessary to prevent healing taking place with the parts fixed in one position."

Paget's Advice.—The world of conservative surgery owes an unpayable debt of gratitude to Sir James Paget who, in his desire for the public weal and the true interests of science, wrote to *The British Medical Journal* in January 1867, urging his professional brethren to "learn what was good in the methods of the bone-setter, and eschew what was harmful." Paget stood on firm ground and spoke with unshakable certitude when he declared that "too long rest is by far the most frequent cause of delayed recovery after the injuries of joints, and not only to injured joints but to those that are kept at rest because parts near them have been injured." But notwithstanding the high position in the profession of this far-seeing practitioner, his exhortations passed almost unheeded and the tradition of rest persisted in spite of its frequently disastrous results.

Later, Dr. Wharton Hood, who had conceived the greatest admiration and respect for Robert Hutton, the bone-setter, and who recognised the false teaching of his profession in regard to many forms of joint injuries and derangements, made a thorough investigation of Hutton's methods, and after the bone-setter's death published a description of them in *The Lancet*. But Wharton Hood's motives were wrongly interpreted. He was accused of associating with a "quack," and prejudice once more dealt a heavy blow at the progress of science. But happily, the seed thus sown is to-day beginning to result in a harvest of delayed therapeutic methods which are of the greatest usefulness to crippled humanity, and the early pioneers who were so bitterly assailed and persecuted will find in posterity their full reward.

Types of Cases.—Flat-foot, with its distressing deformity and painful crippling of the patient, occupies a front place amongst those cases which yield most satisfactorily to skilled manipulative treatment. To commence to correct this abnormality in its early stages is important, though cases might be instanced of patients, even up to 60 years of age, making perfect recoveries. The time of puberty is the period at which the irregularity usually makes its appearance, and the progress of the trouble is usually rapid and the deformation very marked.

It is difficult to assign with certainty the predisposing factor in such cases, though heredity probably plays some part in its origin. As many as four members of one family have been known to suffer from the complaint. The hands of the operator—if sufficiently powerful—constitute a much more effective instrument for forcing the foot and ankle into their normal positions than the Thomas wrench which is largely used even now. Several corrections should be made at short intervals, followed immediately by certain exercises in place of the one or two adjustments which used to be considered sufficient. The encasement of the joint in plaster of Paris is secure immobilisation and rest in bed must on no account be recommended. The anatomical contour of the foot is palpably bettered even after the first manipulation, and each operation brings the patient nearer full recovery. Almost all cases of adhesive and acquired flat-foot should recover. Congenital cases are much less satisfactory, though even in these improvement can generally be looked for. The technique is difficult and should be taught by cinemato-

graphic pictures so slowly reproduced that students can follow each manipulation carefully.

The Shoulder Joint.—The habitual derangement of the shoulder joint—sometimes on the slightest provocation, such as sneezing, stretching or ordinary reaching—is a most troublesome affection and is usually attributed to a rent or tear in the capsule, brought about in the first instance by a severe wrench, although cases could be recorded where no history of accident can be remembered. The disability is probably more often caused by adhesive contracture of a section of the capsule with an accompanying exaggerated relaxation of the remaining portion which allows the dislocation to take place. Although surgeons frequently advise a surgical operation, certain manipulations bring about a condition of the capsule which will enable it to exercise normal control of the head of the bone followed by exercises designed to re-establish the surrounding weakened tissues. Out of a number of cases only 2 or 3 can be remembered as not having yielded satisfactorily to treatment—even after a repetition of the operation. The procedure, under an anaesthetic, is quite devoid of danger, and the after-effects are of brief duration and only slightly painful.

Subluxations and Dislocations.—The actual reductions of gross dislocations do not enter to any great extent into the purlieu of the manipulative surgeon. There is, however, a large number of conditions due to minor displacements which constitute an important branch of his work. Principal among these must be placed displacements and fracture-displacements of the semilunar cartilages of the knee-joint. This field is an enormous and most important one, for the number of persons of both sexes who sustain such injuries is legion. In original unreduced displacements, reduction must be carried out by appropriate manipulation at the earliest possible moment. In chronic or recurrent cases, manipulation is also very frequently effective in bringing about a cure of a very troublesome and disabling condition.

The brilliant results obtained in this type of case have been known for many years, but the underlying pathology has been a profound puzzle until it was recently shown:

(a) that by far the commonest type of injury of the internal semilunar cartilage is the complete longitudinal tear;
(b) that in this type of case, the outer portion of cartilage is nearly always found in the interior of the joint;
(c) that by appropriate manipulative technique this displaced fragment may be made to retrace its steps and come into apposition with the inner fragment;
(d) that when this has been effected, there is a good chance of repair occurring between the two fragments.

Cases with Adhesions.—These constitute another important class. It is essential first of all to make quite clear what we mean by the term "adhesion." It is probably known to most that an inflammatory process is usually accompanied by the exudation of lymph from the blood-vessels of the part. This lymph tends after a short while to become organised, *i.e.*, changed into connective tissue, or, as it is usually called, "fibrous tissue." Let us imagine, for example, that owing to a severe sprain of the knee the lining membrane of the joint has become inflamed. As a result there is an outpouring of this lymph by the blood-vessels of the membrane, and various folds and layers of this selfsame membrane tend to become adherent by this inflammatory exudate. When this has become converted into fibrous tissue, adhesions are actually present which may give rise to marked disability. It is characteristic of adhesions that, when pulled upon or stretched, severe pain usually results. Further adhesions give rise to a variable amount of limitation of some particular movement or movements of the joint, which is apt to be overlooked unless a most careful examination be made.

Swelling of the joint after exercise, muscular wasting, and a sensation of weakness and often an actual giving-way of the joint, are not infrequent characteristics of adhesions.

Danger of Rest for Joint Cases.—As previously stressed, the doctrine "rest inflamed structures" has been responsible for the formation of countless thousands of joints disabled by adhesions. However true the doctrine may be in certain other organs and structures of the body, and even this is debatable, in the case of a joint it is dangerous, for the function of a joint is movement and movement must always be instituted at the earliest possible moment in almost any inflammatory condition, except in those ultra-acute conditions where movement is impossible and in some cases of tubercular disease and of myositis ossificans. When a joint has become crippled owing to the presence of adhesions, how is the joint to be restored to its pristine health and vigour? The answer is manipulation.

It is obviously impossible, in a short article of this nature, to detail the various technical methods of manipulation that apply to the different joints. Anaesthesia, although not absolutely essential, is a valuable aid in many cases, owing to the complete muscular relaxation thereby attained. The cases that are attended with the greatest success are those in which the adhesions are slight and in which the subsequent reaction is negligible. In more marked cases much benefit often follows from a series of manipulations separated by short intervals.

Although particular emphasis has been laid on adhesion in connection with joints, it is most important to remember that this may occur in many other important situations, particularly in the vicinity of muscles, or in their sheaths, or between different groups of muscles. This may also occur in connection with tendons and their sheaths, and in fascial or connective-tissue structures.

Functional or Hysterical Cases.—These constitute an interesting and important group in which good results by manipulation are sometimes attained. It must be remembered that a functional case is primarily mental and this condition is particularly apt to occur after injury in a person of nervous temperament. Although there is no actual organic disease of the joint—at any rate in the early stages—yet it is extraordinary how a functional condition of a joint may simulate some organic disability of the same joint. Great experience and clinical acumen are often required to form a correct diagnosis of such types.

The great value of manipulation in these cases is that a vicious circle is thereby broken, and, although an anaesthetic is not absolutely essential, yet, if some such anaesthetic as gas or gas and oxygen be given, it has a powerful suggestive effect upon the patient. It is usually found that, as soon as the patient is under the influence of the anaesthetic, the joint, which previously was held awkwardly and stiffly, becomes relaxed. The surgeon places the joint in the position which was erstwhile impossible and retains it thus until the patient is fully conscious. The patient is then shown the increased mobility and encouraged immediately to move the joint through this increased range. Much subsequently depends upon the patient being surrounded by an atmosphere of cheerfulness and encouragement, and everyone with whom the patient comes in contact must endeavour to play his or her part in the cure and to assure the patient of its completeness and finality. A great responsibility thus devolves upon friends and relations that the good work of the manipulator may not be subsequently jeopardised by misplaced sympathy or injudicious advice.

It must be borne in mind that in cases of long standing, actual organic changes may occur in an hysterical contracture, and the contracture, which was previously due to muscular sprain, becomes fixed by scar tissue. It is therefore important that manipulation should not be delayed too long in these cases, especially as the mental state becomes more fixed and more difficult to treat with the passage of years.

Cases Relieved by Manipulation.—This large group includes a great many conditions due to disease rather than injury, the principal probably being the group of infections and intoxications usually known by the name "rheumatic," especially in its more chronic forms. Here again it is obvious that those cases in which only a slight degree of stiffness of a joint is present are much more satisfactory from the point of view of treatment than cases of marked stiffness or cases in which well-marked destruction of the joint surfaces has occurred. It is important also to wait until all signs of activity have subsided and furthermore to eradicate the cause wherever possible before having recourse to manipulative measures. In nearly all cases of strains and sprains

gentle manipulation at the earliest moment is recommended because the reparative processes of nature act most effectually when, as far as possible, no interference whatever with their functions is resorted to. (H. B.*)

MANITOBA (*see* 17.584), a province of the Dominion of Canada. By an Act of the Canadian Parliament passed in the session of 1911–2 the eastern boundary of Manitoba was extended north to lat. 60° N. and northeast to the point where the meridian of 89° W. intersects the southern shore of Hudson Bay. This gave the province possession of two ports on Hudson Bay—Fort Churchill and Port Nelson. The effect of the change was to increase the area of Manitoba to 251,832 sq. m., of which about 13,500 sq. m. are covered by lakes. The population of Manitoba in 1921 was 610,118 an increase of 32·23% over 1911. The rural population was 348,502 and the urban 261,616. The legislative assembly consists of 55 members with an executive council of the premier and six members. The province is represented in the Dominion Parliament by 17 members of the House of Commons and six senators. There is an excellent secondary and public school system. Higher education is provided by the University of Manitoba which has affiliated with it several church colleges and professional schools. The Manitoba Agricultural College, near Winnipeg, is supported by the province.

Production and Industry.—The following table shows the total yield in bushels of the principal field crops for 1910, the annual average 1922–4, and 1925:—

Crop	1910	Av. 1922–4	1925
Wheat	34,125,949	45,773,000	39,453,000
Oats	30,378,379	67,955,333	71,770,000
Barley	6,506,634	31,837,333	52,156,000
Rye	29,205	5,857,667	5,152,000
Flax	176,675	1,844,000	1,664,000

In 1925 the number of live stock amounted to: horses, 359,839 cattle, 720,745; sheep, 101,997; and swine, 298,507. Dairying became firmly established after 1915, and both production and export greatly increased. In 1924 the chief dairy products were creamery butter, 12,632,804 lb.; dairy butter, 9,285,464 lb.; cheese, 500,633 lb.; and milk over 200,000,000 gallons. Large quantities of fish are obtained from Lakes Winnipeg and Manitoba, principally whitefish, sturgeon, pike and pickerel. The annual value of the fisheries during the post-War period exceeded $1,000,000.

Copper ore occurs in the Pas district. Gold has been found in contiguous areas. A mottled limestone is quarried at Tyndall, east of Winnipeg, and is in wide demand as building stone. Gypsum deposits are mined northeast of Lake Manitoba. Portland cement is manufactured at Winnipeg and Babcock. The average annual production of minerals from 1919 to 1923 was valued at over $2,500,000. The province possesses extensive water power resources. The available power at ordinary minimum flow is estimated at about 3,250,000 horse-power. The turbine installation in 1925 was only 169,325 horse-power. The chief industries are meat-packing and flour milling. In 1922, 768 manufacturing establishments with a capital of $84,662,378 gave employment to 13,789 employees, who received $17,891,064 in salaries and wages, and utilised $54,619,248 worth of material in producing goods valued at $94,417,608.

Communications.—Railway mileage increased from 3,221 m. in 1910 to 4,521 m. in 1925. The transcontinental lines converge at Winnipeg. Branches have been constructed linking up these lines with the area west of Lake Winnipeg and with Hudson Bay. Direct lines south to Minneapolis and St. Paul give connection with the United States. Great progress was made in the construction of roads after the passing of the Manitoba Good Roads Act in 1914: 6,191 m. of roads had been authorised and $10,985,497 expended by the Government and municipalities between the passing of the Act and Aug. 31 1924. (*See* CANADA.) (D. A. Mac. G.)

MANIU, JULIUS (1873–), Rumanian politician, was born at Simlaul Sylvanie (Transylvania). He studied at the universities of Cluj, Vienna and Budapest, and was for many years professor of law at the theological academy in Blaj. At the age of 26 he joined the National Rumanian party of Transylvania. In spite of the bitter opposition of Count Stephen Tisza, Maniu was elected deputy and sat in the Parliament at Budapest from 1906 till 1910. When the World War broke out Maniu was sent to the front and in 1918 was fighting against Italy. When he realised that the collapse of the Central Empire was in sight, he went to Budapest, where a National Rumanian Council was formed, Maniu taking charge of military and foreign affairs. He then went to Vienna and organised the revolt of Hungarian regiments, composed of Rumanians of Transylvania, stationed in Vienna and Prague. On Dec. 1 1918 the Rumanian National Assembly at Alba-Iulia proclaimed the union of Transylvania and the Banat with Rumania and elected Maniu, president of the *Consiliul Dirigent* (local government) which took over administrative control throughout Transylvania. In 1919 Maniu was elected president of the National Rumanian party of Transylvania, which in 1925 coalesced with the Nationalist-Democratic party. Maniu became the chief of this new formation, which took the name of the National Rumanian party.

MANN, THOMAS (1875–), German poet and novelist, was born at Lübeck June 6 1875. At the age of 19 he went to Munich where he was at first employed in a fire insurance company, but wrote novels at the same time. He then abandoned his practical calling and attended lectures at Munich University in literature, history and the history of art. He visited Italy, and was afterwards, for a time, editor of *Simplizissimus*. His chief work, excellent in both style and construction, is the period novel, the plot of which is laid in Lübeck, *Buddenbrooks*, *Verfall einer Familie* (1903, Eng. trans. 1924). His other books include *Königliche Hoheit* (1915), *Der Zauberberg* (1925), and a number of shorter novels including *Der Tod in Venedig* (1912) and *Tonio Kröger* (1914). He also wrote one drama, *Fiorenza* (1906) and *Betrachtungen einer Unpolitischen* (1918), a declaration of Conservatism. See Fr. Leppmann, *Thomas Mann* (1916).

MANNING, WILLIAM THOMAS (1866–), American Protestant Episcopal divine, was born in Northampton, England, May 12 1866. He graduated at the University of the South, Sewanee, Tenn., and entered the ministry from the diocese of California, being ordained deacon 1889 and priest 1891. He became rector of Trinity Church, Redlands, Cal., 1892, and was appointed professor of theology in the University of the South, 1893. He became successively rector of St. John's, Lansdowne, Pa., 1896; rector of Christ Church, Nashville, Tenn., 1898; Vicar of St. Agnes's Chapel, Trinity Parish, New York City, 1903. In 1904 he was appointed assistant rector of Trinity Church, New York City, becoming rector in 1908. He was consecrated Bishop of New York May 11 1921. A constant advocate of Christian unity, he was prominent in promoting the World Conference on Faith and Order. In 1925 he inaugurated the public movement for the completion of the Cathedral of St. John the Divine, New York City.

MANOEL II., ex-King of Portugal (1889–), was born at Lisbon Nov. 15 1889, the younger son of Carlos I. by his wife Marie Amélie of Orleans. On the assassination of King Carlos and of the Crown Prince Luis, Duke of Braganza, Feb. 1 1908, Dom Manoel succeeded to the throne of Portugal, but he only retained it for a short time, as the revolution of Oct. 3 1910 forced him to flee the country (*see* PORTUGAL). He took refuge with his mother in England, and finally settled at Fulwell Park, Twickenham. On Sept. 4 1913 he married, at Sigmaringen, Princess Augusta Victoria of Hohenzollern, daughter of Prince Wilhelm of Hohenzollern. Dom Manoel supported the Portuguese Royalist risings of 1911 and 1912, and in the latter year met the pretender to the Portuguese throne, Dom Miguel, at Dover in order to concert a common plan of action. On the outbreak of the World War, however, he appealed to all classes of his former subjects to lay aside political feelings and unite against the Central Powers.

MANSFIELD, KATHERINE (1890–1923), British writer, was born at Wellington, New Zealand, the daughter of Sir H. Beauchamp, and spent most of her girlhood in New Zealand. She published *In a German Pension* (1911), and in 1913 married John Middleton Murry, the critic, with whom she had been associated in the publication of a literary review, *Rhythm*. Her

brilliant talent for the short story form was displayed in a collection issued as *Bliss* (1920), and her acute critical powers in frequent contributions to *The Athenaeum*, then edited by her husband. This was followed by *The Garden Party* (1922), but a career of great promise, and small but perfect achievement, was cut short by death, after a long illness, at Fontainebleau Jan. 9 1923. Further stories, *The Doves' Nest*, appeared later in that year, also a volume of *Poems*, and in 1924, *Something Childish*, tales and fragments of minor interest.

MANSHIP, PAUL (1885–), American sculptor, was born at St. Paul, Minn., Dec. 25 1885. He studied at the St. Paul Institute of Art, the Pennsylvania Academy of Fine Arts at Philadelphia, and in New York City. In 1909 he went to Rome, having been awarded a scholarship at the American Academy there, and remained abroad three years. On his return to the United States his works quickly attracted attention by their individuality and his figures, exhibiting archaic traits skilfully coupled with intensely modern feeling, placed him in the front rank of American sculptors. In 1914 he was awarded the G. F. Widener Memorial Gold Medal at the Pennsylvania Academy of Fine Arts, obtaining also a gold medal at the San Francisco Exposition, 1915. He devoted himself chiefly to classical subjects, but executed two very striking portraits, "John D. Rockfeller" and "Miss Manship," the latter being a study of his daughter, aged three days, which is in the Metropolitan Museum of Art, New York City. Among his other chief works are the J. P. Morgan memorial in the Metropolitan Museum of Art; the "Infant Hercules" fountain in the courtyard of the American Academy at Rome; "Dancing Girl and Fauns" and "Indian and Prong-Horn Antelope" in the Art institute, Chicago; "Yawning," in the St. Paul Institute; and "Centaurs" and "Little Brother" (statuette) in the Detroit Museum of Art.

MAP (*see* 17.629).—Steady progress was made in all branches of map construction until the outbreak of the World War, when a type of map not hitherto in general use in warlike operations came into demand. With regard to normal topographical maps a useful landmark was the publication in 1908 by the U.S. Geological Survey of a book on *The Interpretation of Topographic Forms*. Three matters stand out as deserving of special attention—the revival and standardisation of the *International Map of the World;* the striking progress made in the few years immediately preceding the War with the mapping of the British Empire; and the great part which maps played, in all armies and in the fighting on all fronts, during the War, but especially on the Western Front. (*See* SURVEYING.)

International Map of the World.—The official title of this international undertaking is *Carte du Monde au Millionième*, and references to it will generally be found under this title. It owes its origin to the initiative of Prof. A. Penck, who put forward the project of a map of the world on a uniform scale at the Geographical Congress held at Berne in 1891. The scale proposed was one-millionth of nature, equivalent to 1 km. to 1 mm., or 15,178 m. to 1 inch. The scheme and the scale were accepted by the congress, and an international, but unofficial, committee was appointed for the purpose of prosecuting the idea. This committee reported to successive Geographical Congresses held in London in 1895, in Berlin in 1899 and in Washington in 1904, but not very much progress was made.

An important step was, however, taken at the Geographical Congress held at Geneva in 1908. At this congress the delegates of the United States made a proposal for the definite standardisation of the map and for the drawing-up of fixed rules to govern its production. The next step in its history is that the geographical section of the British General Staff took up the subject, and a promise was given at the Geneva Congress that, if possible, an official conference should be assembled to deal with the matter. This promise was carried into effect in the following year.

In Nov. 1909 an official conference assembled at the Foreign Office in London, on the invitation of the British Government. The countries represented were, in addition to Great Britain, Australia, Austria, Austria-Hungary, Hungary, Canada, France, Germany, Italy, Spain, Russia, the United States, *i.e.*, the British Empire and the other European and American Great Powers. The conference came to unanimous conclusions, and an account of it was published in a report issued by the British Government. The object of having an official, rather than a non-official or academic, conference was that experience had shown that without the support of the official map-making bodies, such as the great survey departments, little or nothing would be done in the way of actually producing the international sheets.

At the Geographical Congress at Rome in 1913 the scheme as formulated in London was accepted generally, but there was a feeling that a more comprehensive official conference was needed in order to put the matter before those countries not hitherto represented officially. Accordingly, after some correspondence between the British and French Governments, it was agreed that the latter should issue invitations to an official conference to be held in Paris in Dec. 1913. Thirty-four states sent representatives, and a very thorough examination was made of the London resolutions. In the main they were accepted, and the modifications made were not in matters of principle but of detail. The scheme had in fact got into a definite standard form, and the *Carte du Monde au Millionième* is now a world undertaking on lines accepted by practically all civilised countries.

The Paris Conference took an important step in approving of the establishment of a "*bureau permanent*," comprising a central office to be located at the headquarters of the Ordnance Survey at Southampton, with a branch office in London, at the Royal Geographical Society, where visitors to London can obtain all information with regard to the international map and its progress.

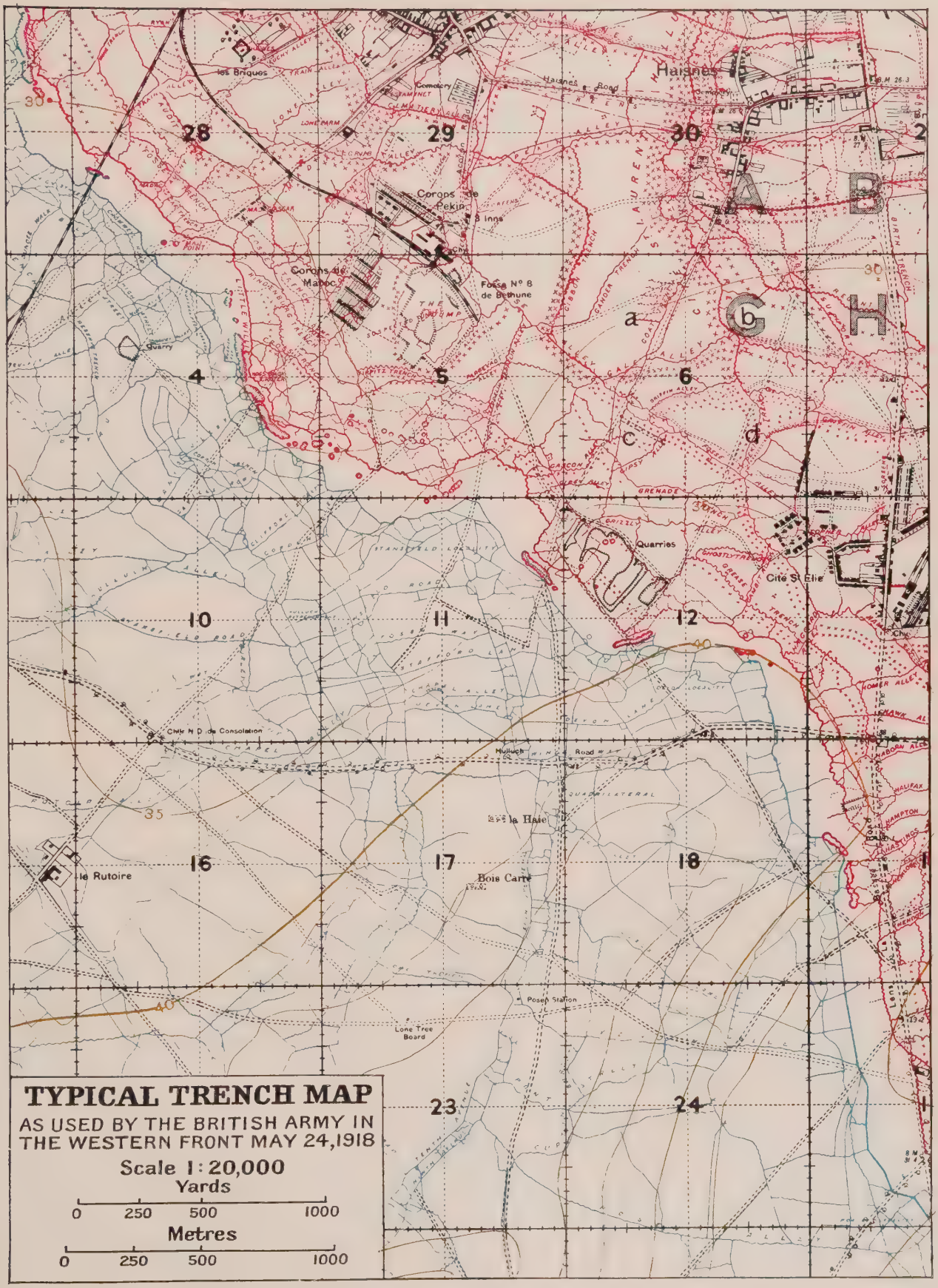
Maps for War Purposes.—The Conference came to an end on Dec. 18 1913, but the report was not published when War broke out early in Aug. 1914. The effect of the War on the scheme was twofold. First, it resulted in the immediate cessation of all work on the map so far as the belligerent countries were concerned; but in the second place it led to a demand for maps on, or about, the one-to-a-million scale, and so in England and France, particularly the former, much official cartography was carried out on the million scale, and a large series of maps was produced by the initiative of the General Staff.

This important series comprises 90 maps extending from the Persian Gulf to the Arctic Ocean, and from the western shores of Ireland to beyond the Caspian Sea. Its sheets were selected by the Peace Conference for use in determining the new European frontiers. It differs from the regular international series in small technical details. The international map, interrupted by the War, has since been taken up again and satisfactory progress has continued to be made.

The trench warfare of 1914–8 in France and Belgium created a demand for maps on a larger scale than had hitherto been in general use by great armies, and large scale maps became indispensable for the operations of trench warfare particularly in connection with the use of artillery. With regard to that portion of the line which passed through northeast France, the 1:80,000 map, the best then available, was enlarged to 1:20,000 which made an unreliable map. Bit by bit, these enlargements were corrected and eventually all the maps of the Western Front were redrawn from special surveys, air photographs and revised cadastral manuscripts, the chief scale in use being 1:20,000. The map showed the enemy's trench system in detail, and all the maps were provided with a system of "squares," or co-ordinates, which enabled any point to be defined within a few metres. The use of "squares," or co-ordinates, is typical of modern military maps. An example of a typical trench map of the Western Front on the scale of 1:20,000 is shown on the plate.[1]

[1] 1. The large rectangles on the map lettered A, B, C, etc., are divided into squares, 1000 yd. side, which are numbered 1, 2, 3, etc. Each of these squares is subdivided into four minor squares of 500 yd. side. These minor squares are considered as letters a, b, c, d (see square No. 6 in each rectangle). A point may be thus described as lying within square B.6, M.5, b, etc.

2. To locate a point within a small square, consider the sides divided into tenths and define the point by taking so many tenths



TYPICAL TRENCH MAP

AS USED BY THE BRITISH ARMY IN THE WESTERN FRONT MAY 24,1918

Scale 1:20,000

Yards

0 250 500 1000

Metres

0 250 500 1000

Progress of Cartography.—Modern topographical maps increasingly use colour. The old black, engraved maps were beautiful as specimens of engraving, but were never very easy to read, and in no case did they convey so much, or such accurate, information as do the modern topographical maps printed in five or six colours. But it is doubtful how long the modern coloured map will last; the paper is not nearly so durable as that which is used for the printing of copper-engraved maps, and the colours are in some cases none too permanent. These remarks apply with special force to the "layered" maps; changes in the tones of the layers will greatly alter their character.

Topographical Maps.—In Great Britain the new popular edition of the ordnance map on the scale of one inch to one mile is in colours with contours at 50 ft. intervals. It is completed for England and Wales and is one of the best topographical maps in existence. The new quarter-inch ordnance map, in layer form, is completed for Great Britain. An excellent map of Roman Britain has been published by the Ordnance Survey. In Canada an important series of topographical maps on the scale of one inch to one mile is being published by the Dept. of Militia and Defence. These maps have been in progress since 1907. About 90 sheets have been issued covering an area of about 40,000 sq. m. in the provinces of Ontario and Quebec. The only complete series of topographical maps of the Union of South Africa are those of the Orange Free State; these are on the scale of 1:125,000, or about half an inch to one mile. They were painted by the geographical section of the General Staff. There has been a marked improvement in the character of the topographical maps of India. Up-to-date methods of colour printing have been adopted with success. India, also, has produced the largest block of sheets yet published of the regular series of the international map.

Ceylon is gradually being covered by an admirable series of one-inch maps in colour. The new one-inch map of the Federated Malay States is a very satisfactory production. The mapping of Kenya and Uganda, which has made good progress, was stopped by the War and has not been resumed. Work is being carried on in the Gold Coast and Nigeria and in the Sudan.

The admirable and well-known series of maps of the U.S. Geological Survey continues to be issued. The production of the elaborate French 1:50,000 series in colour was completely stopped during the War; it is now being published in a simpler form. The Italians are mapping Tripoli and Italian Somaliland on the 1:100,000 and 1:50,000 scales, and the map of Italy on the 1:100,000 with brown contours and vertical hachures is a clear and useful map. The map of Spain on the 1:100,000 scale in colours, published by the Spanish General Staff, is in progress. There is an excellent series of maps of Denmark on the 1:400,000 scale, published in colours by the Danish General Staff, and some fine maps have been issued by Norway. A good start is being made with the mapping of Poland.

BIBLIOGRAPHY.—For examples and criticism of various kinds of topographical maps, see A. R. Hinks, *Maps and Survey* (Cambridge, 1923); C. F. Close, *Text Book of Topographical and Geographical Surveying* (Stationery Office, London, 1925); see also R. D. Salisbury and W. W. Atwood (U.S. Geological Survey), *The Interpretation of Topographic Maps* (Washington, 1908). (C. F. CL.)

MARC, FRANZ (1880–1916), German painter, was born at Munich July 4 1880, the son of the painter, Wilhelm Marc; his mother was of French extraction. He studied at the academy in Munich under Hackl and W. von Dietz. For the first seven years of his career as a painter he showed little originality. The decisive impulse came only when he got into touch with the group of painters including Kandinski, Jawlenski and Macke who founded the "Blue Knight" (*Blauer Reiter*) in 1911. One of his most famous pictures entitled "Tierschicksale" (Destinies of Beasts) is characteristic of his whole work, which is singularly compact, not merely in choice of motive, but also in pictorial composition. A certain leaning towards metaphysics, towards abstraction from the world of reality, gives many of his pictures a problematic character. He also wrote a series of articles pleading the cause of the new painting. Marc was killed near Verdun on March 4 1916.

MARCH, FRANCIS ANDREW (1825–1911), American philologist (*see* 17.688), died in Easton, Pa., Sept. 9 1911.

MARCH, PEYTON CONWAY (1864–), American soldier, was born at Easton, Pa., Dec. 27 1864. He graduated from Lafayette College in 1884 and four years later from the U.S. Military Academy. He graduated from the artillery school in 1898, and on the outbreak of the Spanish-American War went to the Philippines, remaining there three years and rising to the grade of lieutenant-colonel of volunteers. After honourable discharge from the volunteers in 1901 he was appointed captain of artillery in the regular army. From 1903 to 1907 he was a member of the general staff and in 1904, during the Russo-Japanese War, was with the Japanese Army in Manchuria as observer. He was promoted major in 1907, lieutenant-colonel in 1912 and colonel in 1916. Soon after America's entrance into the World War in 1917 he was made a brigadier-general, U.S.A., and later major-general of the national army and in Sept. 1917, major-general of the regular army. In 1917 he was with the A.E.F. in France in charge of the American artillery forces. In March 1918 he was appointed acting chief-of-staff, and the following May chief-of-staff with the rank of general. On June 30 1920 his rank reverted to that of major-general, and at his own request he was retired from active service Nov. 1 1921. As chief-of-staff of the army, he reorganised the War Dept., consolidated the regular army, National Guard and national army divisions into a single army—the U.S. Army; and initiated and carried into execution a programme which landed in France, by the time of the Armistice, 2,000,000 men.

MARCHAND, JEAN (1883–), French painter, was born in Paris Nov. 22 1883. He studied at first with Bonnat and Merson (1902–6), after which he deserted conventional teaching, and exhibited for the first time at the Salon des Indépendants in 1908. He visited Russia and England on several occasions. Though Marchand came under the influence of cubism between 1910 and 1912, his work in general was not greatly affected by it. His human forms are treated with power and discretion, while his landscapes and still life are tinged with an intense melancholy. Exhibitions of his work were held at the Carfax Gallery, London, in 1915 and 1919. Among Marchand's pictures may be mentioned "Les Gueux" (1906); "Le Départ" (1910); "Suzanne au Bain" (1911); "Trois Baigneuses" (1912); "Le Carafe" (1913); "La Gardienne du Foyer" (1914); "Nocturne" (1915); "Le Soir" (1919).

MARCHAND, JEAN BAPTISTE (1863–), French general and African explorer, was born at Thoissey (Ain) on Nov. 22

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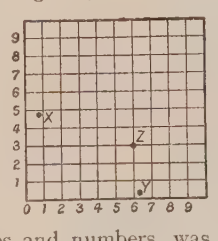
from W. to E. along southern side, and so many from S. to N. along western side, the S.W. corner always being taken as the origin, and the distance along the southern side being always given by the first figure. Thus the point Z would be 63; *i.e.*, six divisions east and three divisions north from origin.

3. When more accurate definition is wanted (on the 1:20,000 or 1:10,000 scale) use exactly the same method, but divide sides into 100 parts and use four figures instead of two. Thus 0847 denotes 08 parts east and 47 parts north of origin (see point X). Point Y is 6303.

4. Use 0 but not 10; use either two or four figures; do not use fractions ($8\frac{1}{2}$, $4\frac{1}{2}$, etc.).



The system of reference by squares shown on the map and described above was used throughout the War by the British armies on the Western Front. Although clear and simple in practice it was not ideal for gunnery purposes. For this reason it was decided shortly before the Armistice to supersede it by another and more universally useful system.

Colours.—The topography was represented in three colours. The detail including towns, houses, railways, roads, woods and grid lines and numbers, was printed in grey, water in blue and contours in brown.

Military details such as trenches, battery positions, mine craters, obstacles, etc., were shown in blue (British) and red (German). British trenches were not shown *in extenso*, but only for such distance from the front line as might be assumed to be already well surveyed by the enemy.

Conventional Signs.—The signs used for objects of military nature changed considerably during the War as the result of alteration of types of defensive and offensive works.

1863. After four years' service in the ranks, he was, in 1887, appointed a sub-lieutenant. In 1889 he was on active service in Senegal, was twice wounded, and made a chevalier of the Legion of Honour. In 1898 he carried out his historic occupation of Fashoda (*see* 1.341), and for this he was promoted to commander in the Legion of Honour, having been previously raised to the grade of officer. In 1900 he became lieutenant-colonel, and was made colonel two years later. Shortly after the outbreak of the World War he was appointed to command the Colonial Brigade of the XIV. Corps, and in Feb. 1915 was promoted a temporary-general of brigade. In the following May he assumed command of the 10th (Colonial) Division. He was wounded in Sept. 1915, and was made a grand officer of the Legion of Honour. On March 25 1916 he was made a substantive-general of brigade. On April 4 1917 he was promoted general of division and confirmed as commander of the 10th Colonial Division. He retired from the army in 1919 and was given the grand cross of the Legion of Honour in the following year.

MARCONI, GUGLIELMO (1874–), Italian wireless telegraphy inventor, was born at Bologna on April 25 1874. His father, Giuseppe, was an Italian country gentleman who, in 1864, married Miss Annie Jameson, daughter of Mr. Andrew Jameson of Daphne Castle, County Wexford, Ireland. The issue of the marriage was two sons, of whom Guglielmo was the younger. He was educated privately at Bologna, Florence and Leghorn. As a boy he took a keen interest in physical and electrical science. In 1895 the idea became firmly rooted in his mind that a system of telegraphy through space could be provided by means of electric waves, the existence of which had been foreseen mathematically by Clerk Maxwell in 1864 and later investigated experimentally by Heinrich Hertz, Oliver Lodge, Righi and others. Interesting scientific experiments had been carried out in London and elsewhere with these electric waves, but Marconi was the first to devise the practical means by which they could be made to provide a new and revolutionary method of telegraphic communication.

In the early summer of 1895, Marconi conducted a number of experiments at his father's country house at Pontecchio, near Bologna. These experiments, made with crude and inefficient apparatus, soon began to give results which appeared to Marconi to be remarkable, communication being established in that year over distances in excess of a mile. The first considerable advance which he made was his discovery of the marked effect of the simultaneous use of elevated transmitting and receiving aerials connected to the ground through the generators (transmitters) and detectors (receivers) of electric waves. He discovered that by connecting one of the spheres of the spark-gap by means of a vertical wire to a metal plate buried in the earth, he was able to multiply many times the range of communication for a given amount of power.

In his receiver Marconi used the form of coherer, or sensitive detector, employing nickel and silver filings, connected to the earth and to an elevated conductor, in the same way as was done at the transmitting end, and provided with connections to a relay and other mechanical arrangements, which made it capable of receiving and recording the impulses of telegraphic signs transmitted through space from the sending station. In these early days, Marconi also discovered that the distance of communication increased very rapidly if the height above ground of the elevated aerials was increased. This fact was pointed out in his first patent and was also clearly described in a letter dated Nov. 14 1896 addressed by him to Mr. William Preece, afterwards Sir William Preece, engineer-in-chief of the British Post Office.

In 1896 Marconi came to England, and on June 2 of that year took out the first patent ever granted for wireless telegraphy based on the use of electric waves. He continued his experiments in London, and in the same year demonstrated his invention before officials of the Post Office and other representatives of British and Foreign Govt. departments. These demonstrations were first carried out on the roof of the General Post Office, St. Martin's-le-Grand, London. Later experiments for the Post Office were carried out on Salisbury Plain and across the Bristol Channel from Penarth to Brean Down, near Weston-super-Mare, ranges first of two, then of four, and afterwards of nine miles were obtained.

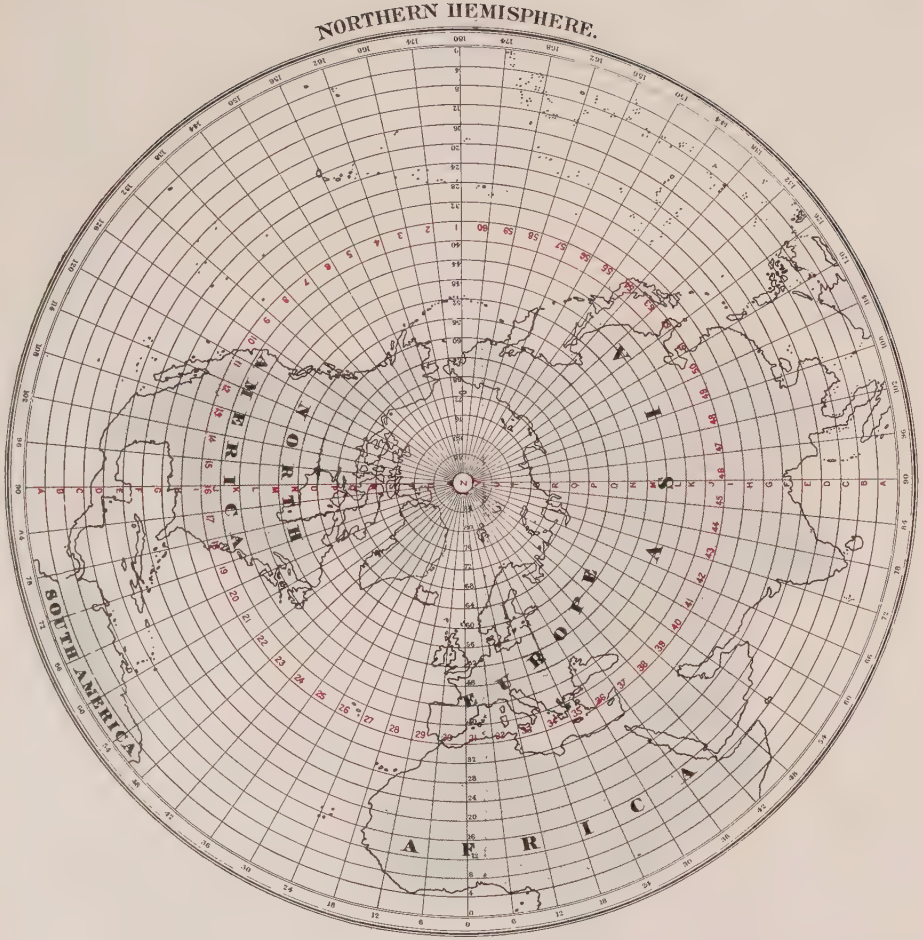
In June 1897, at the invitation of the Italian Govt., Marconi went to Spezia, where a land station was erected and communication with Italian warships was established up to a distance of 12 miles. He was then invited to demonstrate his apparatus in Rome, where successful tests were carried out in the presence of the late King Humbert and Queen Margherita. Other tests also took place at the Italian Chamber of Deputies.

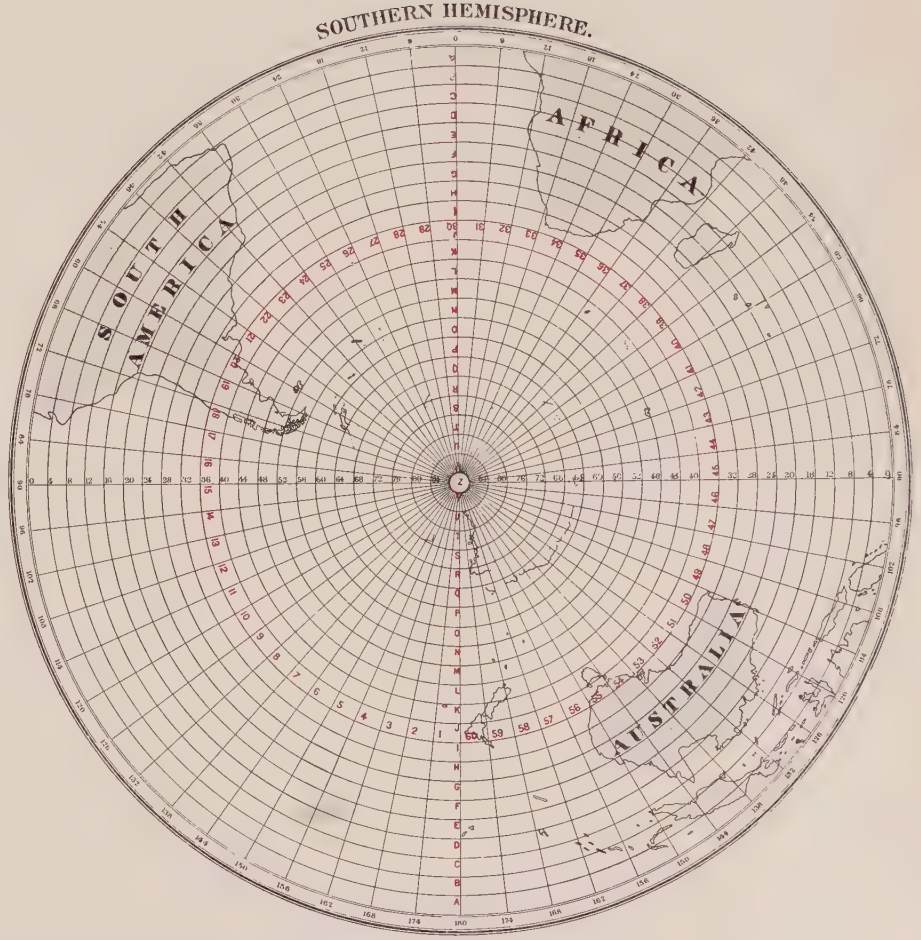
The time was now almost ripe for wireless telegraphy to be applied to commercial and utilitarian purposes, and in July 1897 a company was formed in London to acquire the Marconi patents in all countries except Italy. This company was called the Wireless Telegraph and Signal Company Limited, which in 1900 changed its name to that of Marconi's Wireless Telegraph Company Limited. For some time the company's efforts were confined to furthering Marconi's pioneer work. A number of interesting tests and demonstrations were undertaken round the coasts of the British Isles and abroad. Permanent stations were erected at Alum Bay in the Isle of Wight and at Bournemouth, this station being subsequently removed to Poole, 14 m. from Alum Bay.

Wireless telegraphy was first used for commercial purposes in 1898, when the Kingstown regatta races were reported for *The Dublin Express* by Marconi by means of wireless apparatus installed on a tug which followed the yachts in the Irish Sea. In the same year, during Cowes week, Marconi was called upon to establish wireless telegraphic communication between Osborne House in the Isle of Wight and the Royal Yacht "Osborne," to enable the late Queen Victoria to communicate with the Prince of Wales, later King Edward VII. In this year also wireless telegraphy was first employed as a means of communication between lightships and the shore by installations on the East Goodwin lightship and the South Foreland lighthouse, separated by a distance of about 12 miles. The utility of wireless in saving life at sea was demonstrated for the first time when, on March 3 1899, that lightship was run down by a steamer. The accident was at once reported by wireless to the South Foreland, enabling life-boats to be promptly sent to the assistance of the light vessel. In March 1898 Marconi established communication across the English Channel between England and France. During this year wireless was also first utilised in the naval manoeuvres for communication between warships over distances of 74 miles. The first military application of wireless took place during the South African War.

During this period numerous improvements embodied in patents taken out by Marconi were utilised. On April 26 1900 he applied for a patent for "tuned or syntonic telegraphy as well as multiplex telegraphy with a single aerial." The important novelty was the incorporation of tuned closed with tuned open circuits in both the transmitter and receiver. This patent, the number of which was 7777, became famous in the history of wireless, and its validity was upheld in the High Court by a decision of Mr. Justice Parker. The principles on which this patent was based were fully described in a lecture given by Marconi on "Syntonic Wireless Telegraphy" before the Society of Arts in May 1901.

In Oct. 1900 the erection of a long distance wireless telegraph station in Cornwall was commenced by Marconi and preliminary tests were carried out up to a distance of about 200 miles. On Dec. 12 1901 Marconi, on his first attempt, succeeded in transmitting and receiving signals across the Atlantic Ocean from Poldhu in Cornwall to St. John's, Newfoundland. This achievement completely confirmed Marconi's opinion that electric waves would not be stopped by the curvature of the earth and therefore could be made to travel any distance separating any two places on our planet, a view he had held for many years in the face of considerable opposition. The wireless conquest of the Atlantic may be regarded as the culminating point of Marconi's pioneer work.





INDEX DIAGRAM OF SHEETS FOR THE INTERNATIONAL MAP ON THE SCALE OF 1:1,000,000.

MAP

PLATE

In 1902 Marconi, during a voyage on the American liner S.S. "Philadelphia," received messages up to a distance of 700 miles by day and 2,000 miles by night, thus first discovering the now well-known fact that wireless signals can usually be received over much greater distances at night than during the hours of daylight. Marconi read a paper dealing with this phenomenon before the Royal Society on June 12 1902. At the time his conclusions were severely criticised and his results doubted, but later experience completely confirmed his observations. In 1902 Marconi designed and patented a practical form of magnetic detector based on the effect of electrical waves on iron or steel when subjected to a varying magnetic field. This magnetic receiver replaced the receivers up till then in use, and for over ten years remained the standard receiver on the great majority of sea-going vessels equipped with wireless.

In 1905 he took out his patents for the horizontal directional aerial, which marked an advance in the design of long distance stations. During the same year, in a lecture delivered before the Royal Institution, Marconi first pointed out that most probably wireless transmissions right round the world to places near the antipodes would be carried out with greater ease and at lesser expenditure of electrical energy than would be necessary to much nearer places. Later results fully confirmed the correctness of these views. In 1910 Marconi, assisted by Mr. H. J. Round, received signals and messages at Buenos Aires from Clifden (Ireland) over a distance of about 6,000 miles. In 1912 he devised a new method for generating continuous waves, commonly known as "the timed spark system." This system was employed for several years at many important long distance stations and by its means Marconi sent the first messages ever transmitted by wireless from England to Australia on Sept. 22 1918.

In 1916, during the World War, experiments were commenced by Marconi in Italy with very short waves, with the object of devising a directive, or beam system, of wireless telegraphy for war purposes. This was a principle on which he had also worked during his earliest experiments, but work on these lines had been put on one side in favour of the use of longer and longer waves combined with higher power. Later, in England, with the assistance of Mr. G. S. Franklin, important results were obtained by the use of 15-metre waves between London and Birmingham. The result of the tests with short waves carried out in 1916 and 1922 were fully described in public papers by Marconi and Franklin in 1922. (*See* WIRELESS TELEGRAPHY.)

These anticipations of Marconi were fully justified by the results obtained since that time with short waves by British and foreign experimenters. Marconi was the first to discover in Oct. 1924 that short waves of the order of 30 metres in length could be transmitted and received over the greatest distances during daylight. Short waves have proved themselves capable, even when used with a minimum of power, of carrying out communications by night as well as by day over any distance, even to the antipodes. Marconi demonstrated that short waves are much more amenable to control than long waves and they have the very great advantage over long waves that by the use of suitable reflectors, or by an efficient system of directive aerial, they can be directed in a beam as light waves are directed from a lighthouse or searchlight.

Marconi stated publicly that this possibility of focussing and directing short electric waves would soon be applied universally and that except for broadcasting and shipping purposes it would no longer be necessary to send out waves at random in every direction.

During the World War Marconi served in both the Italian army and navy. He also visited America as a member of the Italian war mission to the United States Government. In 1919 the King of Italy appointed him plenipotentiary delegate to the Peace Conference in Paris, and in that capacity he attended the meetings of that conference and signed on behalf of Italy the Peace Treaties with Austria and Bulgaria. He also attended in the same capacity the meetings of the commission on mandates held in Paris and in London, and in other ways rendered valuable services to the Allied cause.

The value of Marconi's work has been recognised by governments, universities and learned societies all over the world. Amongst the many scientific awards granted to him may be mentioned the Nobel Prize for physics in 1909, the Albert Medal of the Royal Society of Arts, the Franklin Medal and the John Fritz Medal awarded to him in the United States for the "invention of wireless telegraphy." In the same year he was nominated by the King of Italy to be a member of the Italian Senate.

Every great invention, when it has become established, has given rise to controversy as to who was the real inventor. Doubts have been expressed as to whether Marconi was in fact the inventor of wireless telegraphy. In the interests of historical truth, therefore, it is worth while to make the following quotation from the judgment given by Judge William K. Townsend of the United States Circuit Court of May 4 1905, in the action Marconi Wireless Telegraph Company of America versus De Forest Wireless Telegraph Company:—

> It would seem, therefore, to be a sufficient answer to the attempts to belittle Marconi's great invention that, with the whole scientific world awakened by the disclosures of Hertz in 1887 to the new and undeveloped possibilities of electric waves, nine years elapsed without a single practical or commercially successful result, and that Marconi was the first to describe and the first to achieve the transmission of definite and intelligible signals by means of the Hertzian waves.
>
> The exact contribution of Marconi to the art of spark telegraphy may be stated as follows: Maxwell and Crookes promulgated the theory of electrical oscillations by means of a disruptive discharge; Hertz produced these oscillations and described their characteristics. Lodge and Popoff devised apparatus limited to lecture or local experiments or to such impracticable purposes as the observation of thunder storms. Marconi discovered the possibility of making these disclosures available by transforming these oscillations into definite signals and, availing himself of the means then at hand, combined the abandoned and laboratory apparatus and by successive experiments reorganised and adapted and developed them into a complete system capable of commercially utilising his discovery.
>
> Other inventors, venturing forth on the sea of electrical movement, met the rising tide of the Hertzian waves and allowed them to roll by without appreciating that this new current was destined to carry onward the freight and traffic of the world commerce. They noted their manifestations, suspected their possibilities, disclosed their characteristics, and hesitated, fearing the breakers ahead, imagining barriers of impracticable channels and shifting sand bars. Marconi, daring to hoist his sail and explore the unknown current, first disclosed the new highway. (F. G. K.*)

MARGARINE (*see* 17.704) was first made from fresh beef fat freed from tissue and digested at a temperature of about 110° F. with the pepsin obtained from pigs' or sheep's stomachs, rendered alkaline by a dilute solution of sodium carbonate. The process of manufacture was improved from time to time, and before the end of the War the product, particularly vegetable margarine, was so like butter in texture, flavour and appearance that it was difficult to distinguish from the product it was made to imitate. Generally speaking, three types of margarine exist: (*a*) animal margarine, (*b*) vegetable margarine and (*c*) mixed margarine.

Varieties of Margarine.—Animal margarine has as a basis the material called *oleo oil* which is made by pressing *premier jus* by hydraulic presses, so as to separate the liquid oil (oleo oil) from the hard fat (stearine). *Premier jus*, as the name implies, is the first running of fat obtained by heating the fatty tissues of the caul and the kidneys of cattle at a temperature not exceeding 100° to 120° Fahrenheit. This fat is washed with brine and allowed to crystallise or "grain," and is pressed to obtain the oleo oil.

The fatty basis of vegetable margarine usually consists of a hard fat mixed with a liquid vegetable oil. The hard fat in this case is usually either about 25% of hardened (hydrogenated) oil, or 65 to 70% of cocoanut or palm-kernel oil. As liquid oils, cotton seed, arachis, soya bean and many others are used in accordance with the price and quality of the product desired. All these materials are subjected to a very drastic process of refinement and deodorisation. In the case of mixed animal and vegetable margarine the solid fat is either *premier jus* itself or *oleo stearine* (*i.e.*, the residue left after pressing premier jus).

Whichever type of fatty basis is used it is subjected to a process of incorporation with milk. Skimmed milk is generally used for the purpose, not so much for the sake of saving the cost as because it is more readily obtained, and has greater bacterial purity than whole milk. The skimmed milk, previously pasteurised, is placed in vats (ripening tanks), and is there inoculated with a pure culture of lactic acid-producing organisms—mainly *Bacillus acidi lactis* Leichmann—which coagulate souring milk.

The temperature is carefully controlled and, in a scientifically organised factory, the souring to the required extent is arranged to take place by a definite time. Great care is taken to keep the culture free from adventitious organisms which would produce undesirable flavours and impair the keeping properties of the finished product. Mould fungi are specially undesirable as they produce an unpleasant rancid flavour in the margarine, particularly when made with vegetable fats.

When the milk has reached the desired state of sourness, it is churned with the fat, with or without artificial colouring matter, in specially constructed jacketed churns fitted with beaters for finely incorporating the previously melted fat with the soured milk. This churning process has to be carried out with great skill, care being taken to maintain the correct temperature and to stop the churning at the exact point when the emulsion reaches its maximum thickness, as continued churning causes the mass to become thin again. Various types of emulsifiers other than churns are in use, some of which are very efficient. When the emulsion has reached the desired state, the product is then finished by either the wet or the dry process.

Wet Process.—In the wet process the emulsion is projected against a violent spray of iced water, which causes the emulsified fat to solidify in fine globules; the solidified mass which is produced subsequently floats on a tank of cooled water, from which it is removed and mechanically worked until the desired consistency is obtained. Salt and preservative, if any, are incorporated into the mass together with more colour. About 30% of milk is used in the wet process.

Dry Process.—The dry process is more economical, and little more than half the amount of milk is then required. In this process the emulsion from the churns is run in a gentle stream on to large rolls cooled inside with brine. The emulsion, as it solidifies on the surface of the rolls, is scraped off by knives and then worked on tables, kneaders and rolls, in the same manner as in the wet process.

Admixture with Butter.—Margarine, like butter, must not contain more than 16% of water. The admixture of butter with margarine to the extent of more than 10% of the former is prohibited. This regulation is still in force, though it seems originally to have been made to dispel the fear of the farmer that butter might be adulterated with small quantities of margarine to make such an excellent product that his trade might suffer, and that the public might be defrauded. Modern methods of analysis are able to determine the percentage of butter fat in margarine to within comparatively narrow limits, which was not the case when margarine was first invented.

Margarine usually contains 0·25% of boron preservative, except the type termed "fresh-roll," in which no preservative is used; at present up to 0·5% of boron preservative is permitted, but under new British regulations which will come into force in 1927 no preservatives will be permitted. The nutritive value of margarine has long been a subject of discussion. The chemical composition of butter is very similar to margarine, which actually gives the same number of calories or heat units as butter, and an average margarine is as digestible as an average butter. The average butter is characterised by considerable vitamin content, whereas margarine is practically devoid of any such characteristic. (See W. Clayton, *Margarine*, 1920.)

(E. R. B.*; R. G. P.)

MARGATE, England (*see* 17.704), with an area of 2,961 ac. (including 468 ac. of foreshore), had a population of 46,475 in 1921. Parts of Garlinge and Northdown were added to the borough in 1913. A town-planning scheme, providing for an industrial zone at the back of the town and restricting the number of houses to the acre elsewhere, has been put into operation. The town is very healthy, the death-rate being usually under 10 per 1,000. The municipality owns over eight miles of seafront, with promenades along almost the whole distance. A pavilion and winter garden have been erected in a hollow on Fort Green, and a pavilion on the jetty; the path along the cliffs to Kingsgate has been made into a wide promenade, with a new bridge at Palm Bay; a seawall and undercliff promenade have been built, and a large bathing pavilion is (1926) in course of erection. A wing for tuberculous ex-service men was opened at the Royal Sea-bathing Hospital in 1919, and a public library in 1923. The War Memorial is in front of Holy Trinity church. During the widening of the Minster-road in 1922 an Anglo-Saxon cemetery was discovered. During the World War 156 bombs were dropped on Margate and 44 shells were fired from the sea; considerable damage was done, but the casualties were few.

MARGHILOMAN, ALEXANDRE (1854–1925), Rumanian statesman, was born at Buzeu July 4 1854. He studied law and political science in Paris. In 1884 he was elected a deputy as a member of the Conservative party, of which he became leader in 1914. At the beginning of the World War, Marghiloman advocated Rumania's neutrality and when in 1916 Bratianu offered him a portfolio in his cabinet, Marghiloman refused on the ground that he could not assume the responsibility of an insufficient military preparation. He remained in Bucharest under the German occupation, where he organised the relief work for the population. He emphatically rejected the proposals of the German commander to form in Bucharest a government for the purpose of concluding a separate peace. In March, 1918, Marghiloman went to Jassy at the request of the King and formed a government which eventually signed the separate peace with the Central Powers. This treaty, however, was never ratified. When the War ended Marghiloman ceased to play any part in Rumanian politics and after his death in Buzeu, May 10 1925, the Conservative party ceased to exist, its members joining Gen. Averescu's (People's) party.

MARGUERITTE, PAUL (1860–1918), French novelist (*see* 17.706), died Dec. 30 1918 in Paris. His later works included *La Maison brûle* (1913) and *Jouir* (1918).

MARIE, Queen of Rumania (1875–), was born at Eastwell Park, Kent, Oct. 29 1875, the eldest daughter of Alfred, Duke of Edinburgh, second son of Queen Victoria. On Jan. 10 1893 she married Prince Ferdinand, afterwards King of Rumania. From this marriage six children were born: Prince Charles, who married Princess Helen of Greece, Princess Elizabeth, married to the ex-King George of Greece, Princess Marie, later Queen of Yugoslavia, the Princes Nicolas and Mircea (d. 1916) and Princess Ileana. The Queen was a Protestant, but the children, in accordance with the Rumanian constitution, were brought up in the Orthodox faith. Queen Marie took a great interest in the development of her adoptive country. Red Cross and charity organisations were formed at her initiative and, as a Red Cross nurse during the World War, she looked after the wounded in hospitals and ambulances up to the firing line. Queen Marie devoted much of her time to writing, and her published works include *The Lily of Life* (1913), *My Country* (1916), *Stealers of Light* (1916) and *Ilderim* (1925). Together with King Ferdinand, Queen Marie was crowned at Alba Julia Oct. 15 1922.

MARINE ENGINEERING (*see* 25.840c).—At the present time there are three distinct types of marine engines, and these may be grouped as follows: (1) steam-engines with coal-fired boilers; (2) steam-engines with oil-fired boilers; (3) internal-combustion engines, such as the Diesel or semi-Diesel type. Of course, groups (1) and (2) may be reciprocating steam-engines, turbines (geared or otherwise) or combined turbine and reciprocating. The three types are described below.

Reciprocating Marine Steam-engines.—To-day, all marine reciprocating steam-engines are stage expansion engines, that is, the steam expands in stages from the highest pressure cylinder, through the intermediate stages, and finally exhausts into the condenser. Modern stage-expansion engines may be grouped as

follows: *Compound.*—In this type there are two cylinders, the high pressure and the low pressure. Steam performs its function in the high pressure cylinder; from there it passes into the low pressure cylinder, completes its work on this cylinder and finally exhausts to the condenser. *Triple Expansion.*—In this engine, as its name implies, steam exerts its power in three stages before exhausting to the condenser. *Quadruple Expansion.*—In this type the steam is used four times before exhausting to the condenser, two intermediate cylinders being fitted.

No marked improvements have taken place in this type of prime mover, except as regards engine refinements, the general design remaining the same. The advent of the marine steam turbine and the marine internal-combustion engine certainly has led many shipbuilders to install one or the other of these types; but it is interesting to note that in some recent large steamers, notably the Peninsular and Oriental "Naldera" and "Narkunda," the carefully balanced triple-expansion engine has been installed. Experiments are being carried out to utilise steam at a much higher pressure than formerly, and excellent results are expected.

Combined Reciprocating Engines and Steam Turbines.—An excellent example of this arrangement is the White Star "Olympic." The arrangement has proved an economical one, and is as follows: Each wing propeller shaft is driven by a reciprocating engine, the low pressure cylinder of which exhausts into a Parsons low-pressure turbine driving the centre shaft; 21 double-ended cylindrical boilers supply the necessary steam.

Marine Steam Turbines.—(*See* TURBINES, STEAM.) The advantages of this prime mover which has led to its adoption during the past few years are as follows:—

(*a*) Fewer working parts, as no slide valves, piston and connecting rods are required.
(*b*) The steam is supplied direct from the boilers with no intervening loss.
(*c*) Considerably less danger of breakdown.
(*d*) Engines placed well down in vessel (a big asset in warships).
(*e*) Less expenditure of lubricating oil.
(*f*) No cylinder lubrication is necessary, and clean feed water is returned to the boilers.
(*g*) Absence of vibration, a big factor in warships and passenger steamers.
(*h*) Smaller attendance required than in the case of reciprocating engines.
(*i*) Superior governing, good parallel running and even turning movement.
(*k*) Priming, which would fracture the cylinder covers of a steam reciprocating engine, has no material effect on a turbine.
(*l*) Overloading (forcing the engines) can be indulged in within reasonable limits.
(*m*) More economical except at the lowest speeds.

The large-sized turbines are more economical in steam per horsepower developed than the best triple or quadruple expansion engine, as the turbine is able to take full advantage of the whole of the expansive energy of the steam. The two types in general use are the Parson combined impulse and reaction turbine, and the Brown Curtis impulse turbine. There are, naturally, many modifications of these types.

Geared Turbines.—These turbines are coming into favour more and more. The chief trouble with the marine turbine arose with the propeller. It is necessary that a turbine for maximum efficiency should run at a high rate of revolution, whilst for maximum propeller efficiency, much lower rates of revolution are necessary. The solution for this was by the introduction of some form of gearing between the turbine and the propeller. Several forms of reduction gearing are being experimented with, such as the electrical, hydraulic and mechanical. Mechanical gearing appears at present to show advantages over the other forms—an efficiency of over 98% being obtained in the case of single reduction, and over 97% with double reduction. There is practically no limit to the ratio of reduction. Double reduction gearing finds favour for the following reasons: (*a*) the type permits larger ratio between revolutions of turbines and propellers without excessive size of gear wheels—higher revolution of turbines permits, for the same power, smaller turbines, and increase in the number of turbines for the same power further reduces the size of each unit; (*b*) high revolutions or greater blade speed are possible, resulting in a nearer approach to the point where the blade speed in relation to steam speed gives maximum economy; (*c*) a small turbine permits of a pivot thrust block being used, as the dummy can be omitted, and all unbalanced load taken by the block; (*d*) small turbines have small rotors and can thus be made of a much more robust construction; (*e*) variations in temperature for any single turbine are kept moderate, and these turbines are therefore suitable for use with superheated steam; (*f*) the parts being smaller, the turbines can be more easily overhauled, repaired or renewed. America favours the electric drive for her navy and mercantile marine.

Marine Internal Combustion Engines.—One of the principal reasons which has led to the adoption of the internal combustion engine for marine propulsion is the thermal efficiency of this prime mover. Compared with a steam engine (reciprocating), and coal-fired boilers, we find: Diesel 40% to 45% thermal efficiency, according to size; steam engine 20% to 25%. As regards running, the fuel bill is about half that for an oil-fired boiler ship fitted with geared turbines; very great saving of space occupied by the machinery; reduction of personnel.

Against these advantages we have the greater initial cost; complication of parts; a greater number of spare parts have to be carried; it is probable that the repair and upkeep bill will exceed that for steam units. Before a big reduction can be made in initial and upkeep costs, all parts must be standardised; and the engines should be built in combinations of various numbers of cylinders for various powers and revolutions. For a given power the Diesel compares unfavourably as regards weight with the steam turbines and oil-fired boiler combination, and the head-room is greatly limited (this, especially from a naval point of view, is a marked disadvantage). The possibilities of this prime mover are endless; but up to the present the Diesel has not been installed in the largest ocean-going liners or cross-channel mail packets. There is no doubt, however, when a speed of, say, 25 knots can be reached, combined with a reliable and simple design of engine, we shall see the mammoth type of internal combustion ship breaking the Atlantic records. The largest ship up to the present with Diesel engines installed has a length of 600 ft. and a breadth of 72 ft.; and another Diesel-engined vessel of 20,000 tons is under construction. The present types work on the two-stroke or on the four-stroke principle; but many competent authorities affirm that the marine oil engine of the future will be a double acting two-stroke with port scavenging—this design giving an engine of low initial cost and simple construction. The solid (or mechanical) injection of the fuel is likely to be generally adopted in preference to the air injection system, owing to the reduction in first cost that is obtained by its use. Experiments are now being carried out with geared Diesel engines, and these will be watched with interest.

Marine Boilers.—It is only within the last few years, comparatively, that the water-tube boiler has been seriously considered as a rival to the cylindrical, or water-tank, boiler. The experience gained after many years with the cylindrical marine boiler proved it to be undoubtedly a good, safe, easily understood generator and also comparatively easy to clean. This type may be said to be the principal boiler of the mercantile marine. For naval purposes, of course, there can be no question as to which type is suitable; but even with such highly trained engine-room ratings as the British Navy possesses the advent of the water-tube boiler was not looked upon at all with favour. Although water-tube boilers are being fitted in increasing numbers in the mercantile marine, their many advantages do not appear to be recognised to the extent they should be, this being due in part to the high initial cost and also to the fact that the fuel consumption is inferior to that of the cylindrical type. However, the outstanding features of the water-tube boiler (*i.e.*, they are much lighter and give greater horsepower for the same space) should further recommend them. The modern trend is toward much higher working pressures, higher temperatures and the more efficient burning of the fuel and generation of the steam in the boiler. There is no reason why pressures of 700 lb. or 800 lb.

per sq. in. should not be reached. Superheating of the steam, air preheating, increase in boiler feed water temperature and careful analysis of the funnel gases are all receiving due attention, as are also the best means to adopt to ensure the cleanliness of the internal surfaces and tubes, and thus prevent or retard corrosion. Zinc slab protection is, to a certain extent, being superseded by electrolytic protection. In this system electrolytic conductivity is produced in the boiler water by a current of electricity from a source outside the boiler to metallic anodes insulated from the boiler shell, the current being regulated at will.

Oil Burning in Marine Boilers.—Within the last few years oil fuel burning has made rapid strides, and but for the question of cost would be much more generally adopted. As an example of saving in boiler-room staff, after the Cunarder "Aquitania" was converted to burn oil, her firemen were reduced to 42 as against 320 when coal-burning. The advantages of oil fuel are: superior evaporative power per weight of fuel carried, giving increased radius of action—1 lb. of oil with a heat value of 19,000 B.T.U. will evaporate 15 lb. of water to and at 212° F., and 1 lb. of coal with a heat value of 14,500 B.T.U. will evaporate 10 lb. of water to and at 212° F.; ease of shipping into bunkers and putting into fires; less stokehold staff and bunker space required; absence of coal dust and ashes; no necessity to open furnace doors with consequent loss; proper regulation of combustion; capability of forcing the boiler. Against those advantages we have: uncertainty of obtaining supplies; complications of piping and machinery; possible leakage; special appliances are required for burning; liquid and solid impurities found in the oil; widespread contamination of water-ways.

Liquid fuel is atomised by one of three methods—steam, compressed air, pressure. The last method is generally adopted in modern marine practice due to the reliability and freedom from breakdown of pressure systems. The system as now adopted is very simple; oil is drawn from the bunkers and strained, which removes all solid impurities. The oil is delivered from the fuel pumps under pressure, an air vessel assisting in maintaining a steady supply. Next, the oil passes through cold filters and thence to the heaters. The heating process may form particles of carbon in the oil, which are removed by passing it through filters fitted on the delivery side of the heater. From these filters, called hot filters, the oil passes under pressure to the distribution boxes on the boiler front, and from there through the burners (where it is atomised) to the furnaces.

Marine Auxiliaries.—The great increase in the number of auxiliary engines now fitted in modern steamships necessitates as much attention as do the main propelling machinery. As regards design, the majority of auxiliaries follow accepted practice; but the following units call for special consideration.

Condensers.—The modern method is to insure high vacuum combined with reliability, and that the weight of the apparatus shall be as low as possible consistent with the work the condenser is called upon to perform. Separate air pumps are installed, one pumping out the feed water, and the other maintaining a high vacuum by pumping air from a cooler part of the condenser. Tube failure—through corrosion—is a frequent source of trouble, and the many experiments now being carried out with tube metal mixtures have not eliminated this.

Electrolytic protection has been adopted with good results. Metallic packing for the tubes, in place of the ordinary tape packing, has recently been introduced, and the results are excellent. In connection with modern condensers a system has been devised known as the "closed feed system." By this method the condensate is removed from the condenser and discharged to the boiler without exposure to the atmosphere; thus preventing air mixing with the feed water and causing boiler corrosion. Another method now coming into favour is the removal of the air in the feed water by mechanical de-aeration; and this method seems to possess advantages over the removal of the air by chemical means.

The Michell Thrust Block.—This block possesses marked advantages over the older form of multiblock. The device consists of one collar on the shaft, the thrust being taken by a series of pads capable of a slight rocking movement. The pads maintain a continuous flow of oil between the metal surfaces, which are thus kept apart by as many oil wedges as there are pads to produce them. This block is essential to the satisfactory working of gears now fitted in many modern ships.

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MARINES (*see* 17.719). *Great Britain.*—Marine forces in some instances constituted the whole or the main part of forces told off for coastal descents, *e.g.*, the British expedition to Ostend in 1914 and the Zeebrugge enterprise of 1918. In others they undertook emergency land operations for which no other military force was available, *e.g.*, in the case of the Royal Marine Bde. at Antwerp, 1914; or again, as in the case of the U.S. Marine Bde. in France, 1917–8; and the British 63rd (R.N.) Div., which included marine units, in the composition of a land army in continuous operations. In several instances the marines proper formed a soldier nucleus for formations of which the principal part was made up of sailors, as the British R.N. Div. and even more so the German Marine Corps. France used improvised battalions and brigades of sailors (Fusiliers Marins) in the same way, and a brigade of these under Rear-Adml. Ronarc'h won undying glory by its defence of Dixmude during the first battles of Ypres and the Yser.

The German Marine Corps was composed originally as a division partly of marines and partly of sailors, who were numerically far in excess of naval requirements. It took part in the siege of Antwerp and the advance through Flanders. When stabilisation came the division was raised to the strength of a corps, and the corps commander (Adml. Schroder) was made responsible for the Yser front, for coast defence between Nieuport and the Dutch frontier, and for purely naval operations based on the Belgian coast, having both submarines, surface craft and aircraft under his command for the purpose. Finally, the German corps formed a third mobile division which was sent to any point on the Western Front where reinforcements were needed.

The Royal Marines, 1914–8.—Just before the outbreak of the World War the total strength (all ranks) of the British Corps of Royal Marines was 18,000. During the War, however, the strength of the corps increased steadily, until at the end its numbers had been more than trebled, due to the formation of new units within corps. In 1914 the R.N. Div. was formed; various divisional units of Royal Marines were raised for service with it, such as engineers (transferred to the Royal Engineers in 1917), medical units and transport. The R.M. Submarine Miners (1917), the R.M. Labour Corps, the Home Service Labour Corps (1917) and the R. M. Engineers (1918) were raised. Special units were also provided separately and compositely by the R.M. Artillery and the R.M.L.I. at various times.

In all naval actions, and in naval patrol duties, the Royal Marine personnel took a part. In the early days of the War personnel of the corps served with the armoured cars operating from Dunkirk. Four battalions of the brigade took part in the defence of Antwerp. Details from two R.M.L.I. battalions were involved in the landing at Kum Kale and Sedd-el-Bahr (March 4 1915), and marine artillery siege guns were used at Dunkirk. The corps sent a battery to Egypt in 1916 for coast defence duties. Detachments served also in Cameroon, in the Persian Gulf and with Adml. Troubridge in Serbia, and formed the nucleus of the heavy batteries which were raised for service with Gen. Botha in South-west Africa and with Gen. Smuts in East Africa. The corps furnished gun crews for armed merchantmen and garrisons for naval bases as at Scapa, Cromarty and St. Helena, and for the coast defences at the North Foreland, in the West Indies and elsewhere. (X)

United States.—The United States Marine Corps is a separate military organisation under the administration of the Navy Dept., and as such it forms a part of the naval establishment of the country. It was founded on Nov. 10 1775 when a resolution of the First Continental Congress authorised the raising of two

battalions of marines to assist the continental navy in the defence of the colonies. In organisation, training and duties this force was modelled after the British marines of that date. From then to the present the marines have continued to serve as an integral part of the U.S. Navy, although under the authority of congressional enactment portions of the corps have been temporarily detached for service on shore with the U.S. Army.

The laws provide that marines may be assigned to the following duties: to garrison the different navy yards and naval stations within and beyond the continental limits of the United States; to furnish detachments to serve aboard the battleships and cruisers of the fleet where they form one of the gun divisions of the ship, perform military guard duties and act as a landing force from the fleet or squadrons as required; to act as expeditionary landing forces for service with the fleet to capture and defend such positions as may be required as temporary naval bases for the fleet; to furnish the first line of the mobile defences of naval stations and bases beyond the continental limits; and, when special conditions make it advisable, to be temporarily transferred for service with the army.

The marines have taken a conspicuous part in every war in which the United States has been engaged and have also seen much foreign service in the peace-time occupation of foreign countries for the protection of American citizens and property during revolutions and unsettled conditions, in furtherance of the diplomatic policies of the United States.

Before the Spanish-American War in 1898 the marine corps consisted of 75 officers and 2,000 enlisted men, but was increased thereafter, and at the entrance of the United States into the World War in 1917 it consisted of 511 officers and 13,124 enlisted men, and during that War a total of 31,824 marines were sent overseas for service with the A.E.F. The Fourth Brigade of Marines formed a part of the Second Division of the A.E.F., where they served in many campaigns and battles with conspicuous gallantry and gained many citations and decorations. The peace-time operations of organisations of the marine corps have included expeditions to China, Cuba, Nicaragua, Mexico and Panama, for the protection of American interests, and the recent occupations of Santo Domingo and Haiti to insure the peace and stability of these countries under treaty obligations between them and the United States. The mission of the marine corps under the stated naval policy of the United States is: "To support the fleet, or any part thereof, in the accomplishment of its mission." The emblem of the corps is a hemisphere with the map of the Americas thereon, superimposed upon a foul anchor and surmounted by an eagle with spread wings. The motto of the corps is "*Semper Fidelis.*" (D. W.*)

MARINESCU, GEORGE (1864–), Rumanian neurologist, was born at Bucharest Feb. 23 1864. He was educated at the faculty of medicine of Bucharest and then went to Paris where he worked under Dr. Charcot at the *Salpêtrière*, carrying out valuable researches on the histopathology of the nervous system. A year later he went to Frankfort and worked with Professor Weigert. He then continued his research work on nervous diseases in Berlin and Brussels. In the latter town he published his work on the treatment of epilepsy for which he obtained a prize from the *Académie Royale de Belgique*. In 1900 he was appointed Professor of neurology at the University of Bucharest. In the autumn of 1916 Professor Marinescu went to London where the Medical Research Committee made him a whole-time grant. At the L. C. C. Maudsley Hospital, Denmark Hill, in collaboration with Lt.-Col. F. W. Mott, F.R.S., he applied himself to an important series of researches upon the microscopic structure of nerve cells and their changes in different phases of activity or damage. He also took an important part in the investigation of the nervous system in some cases of *Encephalitis lethargica*.

MARINETTI, FILIPPO TOMASO (1878–), Italian writer, was born at Alexandria Dec. 22 1878, and studied in Paris, graduating at the Sorbonne; in 1899 he also graduated in law at the University of Genoa. He was the founder of the futurist movement, publishing the original futurist manifesto in the Paris *Figaro* on Feb. 20 1909. For a time he edited the international review *Poesia*, but his most characteristic work was *Mafarka le futuriste*, published in French in 1910. He also wrote for the stage *Le roi Bombance* (1905), a satirical tragedy, and other plays, and published a volume on the futurist theatre, *Teatro sintetico futuristo* (1916). In 1914 he wrote an extraordinary volume entitled *Zang-tumb-tuuum* on the Balkan war, and particularly on the siege of Adrianople. Other futurist essays are *Noi futuristi* (1917), *Manifesti del futurismo* (4 vol., 1920), *Democrazia futurista*. On the outbreak of the World War he was strongly in favour of Italian intervention, as he showed by his volume *Guerra sola igiene del mondo* (1915). *Otto amici in mia bomba* deals with war experiences; while in *Futurismo e fascismo* (1922) he expresses his support of the Fascist movement. Marinetti's futurism, though violent, exaggerated and sometimes ridiculous, is a quite genuine reaction against the excesses of the academic and hidebound tradition in literature and art.

MARKBY, SIR WILLIAM (1829–1914), Anglo-Indian jurist (*see* 17.730), died at Headington Hill, near Oxford, Oct. 15 1914.

MARKETING.—Marketing is essentially buying and selling. The central fact is the sale, but to secure sales the goods must often be assembled from the places where they were produced, graded when qualities differ, sorted when there are different varieties, moved to market and in many cases thence to the place of consumption.

I. IN THE UNITED STATES

Methods of Marketing.—The simplest form of marketing and the most primitive is the sale by the producer directly to the consumer. In the aggregate, sales made in this way even at present run into immense volume, although but a small part of the total of business. Modern business, the development of large cities, an increasing division of labour in industry, all tend to reduce this form of marketing. There is still a considerable amount of marketing of produce, particularly butter and eggs, direct from farmers to consumers, by parcel post and by direct sale. Again, certain specialities, complicated machines and machines requiring much attention and service after the first sale, usually are sold direct by manufacturers to consumers through the medium of speciality salesmen. The salesman is the representative of the producer in the marketing transaction. Again, if a retailing house does so large a business that it can advantageously engage in manufacturing some of the lines of goods it sells, it may combine production with distribution.

Most products of common use, such as foods, clothing, footwear, house furnishings, lumber, fuel and so on, are marketed through middlemen. The manufacturer of men's clothing or of shoes usually sells his product to retailers scattered over the country, who in turn sell to consumers. Manufactured food products, dry goods, drugs, hardware and house furnishings are generally sold first to wholesalers, who in turn sell to retailers.

Farmers' produce, fruits, vegetables, butter and eggs, are commonly marketed through local buyers, then to wholesalers or wholesale distributors, then to retailers and lastly to consumers.

Variations in Method.—Variations are introduced into marketing in many ways. The actual sale may be consummated through personal salesmanship either in the seller's place of business or in the buyer's. If the seller carries a line of goods he must have a store or shop, but even this may not keep him to one location. The old-time pedlar carried his store on his back. More recently grocery stores, meat shops, book and periodical shops and even dry goods and house furnishings have been put on wheels, on automobile trucks and sales routes laid out to be covered periodically, making sales direct to housewives and consumers. Again, the sales may be effected through retail institutions by mail. In the United States a gigantic business has been built up by a few large mail order houses which are really stores or shops selling retail to consumers. Some wholesale concerns selling only to retail dealers have developed enormous businesses founded on the mail order method of selling. In addition to these there is an unknown but certainly large amount of business transacted by ordinary retail and wholesale stores by mail, supplementing personal selling.

Wholesale Marketing

In the case of highly perishable goods, such as fruits, where no time may be lost in effecting sales in order that they may reach the consumer before spoiling, the auction system is used. Wholesale buyers and salesmen come together at a designated place at a set time and clear their transactions. The auction is a much more widely used mechanism of trade in England and in continental Europe, where large quantities of nearly all kinds of goods are thus sold, than it is in America, where the system is declining. In addition to its use in the marketing of perishable

goods it occurs, to a limited extent, particularly in lines of known standards or qualities, which are bought and sold in wholesale quantities at certain dates each year, as carpets, rugs, wool, furs and fruits. It is also a common method of marketing second-hand goods, works of art, antiques and even real estate.

Variation in marketing occurs through variation in ownership of the goods to be marketed. To illustrate: producers or local buyers usually sell outright to wholesalers all goods marketed through the wholesaler-retailer channel of distribution; but in highly perishable goods, such as fruits, dressed poultry, live poultry, etc., and also in cases where the value of the goods runs very high in proportion to the value of the service rendered by the wholesale middleman—as, for example, finished textiles, real estate, commercial paper and stocks and bonds—the wholesaler (or dealer who takes his place) frequently, if not usually, merely sells or buys as the agent of the owner and secures a commission or brokerage instead of a profit for his services. This arrangement in the case of perishable goods relieves the wholesale dealer of the risk from loss, and, in the case of costly goods, of the burden of financing the goods. Such wholesalers are known variously as commission dealers and brokers.

Function of Speculation.—While goods are being gathered together in wholesale quantities and made ready for distribution to the retail trade other factors in marketing frequently enter in, factors of a speculative nature. Standardised goods that are not readily perishable, such as grain, cotton, wool, silk, provisions, coffee, sugar and so on, are likely to be bought purely for speculative purposes. Thus a lot of grain or cotton may be bought and sold several times before being moved to consumption. It is but another step for these speculators to make their ventures in hope of gain on what they think future prices will be. Hence "selling futures" is a common occurrence on the great exchanges that deal in the commodities named.

Under this system grain may be bought and sold long before it has been harvested or grown, or even before it is planted. (*See* GRAIN TRADE.) A flour-miller may quite legitimately ensure his future supply of grain at a certain price by buying "futures." But a great deal of opposition has been aroused at various times by speculation in the necessities of life. It has been charged that dealing in futures enables powerful speculators to combine unjustly to secure success for their ventures, in some cases tending to hold prices down and in others tending to hold prices up. As a result both producers and consumers are suspicious of such traders. The consensus of opinion among those who have studied the course of speculation on exchanges seems, however, to be that if manipulation of prices and monopoly can be kept out of the market, and if the laws of supply and demand are allowed to operate freely, the effect of speculation, particularly of dealing in futures, has a healthful balancing effect on the market. Under such conditions purchase and sale of commodities for future delivery tend to discount and equilibrate all conditions of supply and demand, so that changes of price are made much more gradually than they would be if buying and selling of such commodities were confined solely to the stock offered each day. Dealing in futures is an essential function of marketing, but it needs careful regulation to prevent unfair practices.

Methods of Marketing.—If producers are many and small, and are located far apart, it is almost certain that their products will have to be assembled by a local buyer of some kind; whereas if the producers are able to turn out large quantities they may be able to deal with wholesalers direct.

If consumers use small quantities or small lots of any product at one time it is almost certain that they must purchase from retailers. But a large consumer would be able to buy more advantageously direct from the producer.

Some articles cannot be sold more than once or twice in a lifetime to a customer. If it also happens that such articles require much demonstration and explanation, then the producer is almost forced to sell direct to the consumer or have his sales made by special representatives or agents. Subscriptions to high-priced periodicals, adding machines, life insurance and real estate are illustrations of goods that need such specialised attention.

Time is a very important element in the marketing of perishable goods. There must be no delay, and little time can be given to the sale of any particular unit. An illustration of a perishable article is the daily paper, the weekly or monthly magazine. Timeliness is the essence of their value. This makes necessary a highly specialised marketing organisation to carry papers or magazines over the country and, in the case of magazines, to place them on sale everywhere at the same time. Such specialised handling calls for expense not incurred in goods not perishable.

A low-priced article with a small margin of gross profit to the seller cannot be sold in the same way as an article that offers a wide margin. In the former case the margin above costs of production could not permit the article to be sold direct or to be advertised and sold by itself by the mail-order method. It must take its way to the consumer through the channels of trade followed by thousands of similar articles.

Competition.—The competition in the sales field of any article might readily determine the channel of distribution that is taken. Certain manufacturers of soaps, perfumes and toilet goods have found it so difficult to place their products advantageously in drug stores and similar retail outlets because of the number of competing lines that they have found it advisable to sell, especially in country districts or small towns, direct to consumers by means of agents and canvassers working on a commission basis. A motor-car tire maker found it so difficult to break into the market through automobile dealers and garages that he sold his product to a mail-order house.

A new product must as a rule be sold through specialised marketing systems which may be abandoned after the public has begun to know the article.

THE COSTS OF MARKETING

Table I. contains figures compiled from actual records by the Harvard Bureau of Business Research, Harvard University.

TABLE I. *The Retailing of Shoes: A Comparison of Costs*
Net Sales 100 per cent

	Lowest	Highest	Usual
	%	%	%
Independent shoe stores:			
Low priced shoes	13·3	32·33	20·5
High priced shoes	23·43	32·85	28·8
Chain shoe stores	9·85	57·60	24·6
Department store:			
Shoe departments	19·0	33·4	23·5

It is clear that the statistics do not prove that in the case of shoes either chain stores or department stores can be conducted at less expense than independent stores. It is true that the lowest figure for chain stores is considerably lower than any other, but the chain stores also show the highest costs. The average costs of selling in chain stores seem to run a little higher than in independent low-priced shoe stores and in department stores.

Table II., showing cost of marketing,[1] is compiled and adapted from reports of the Harvard Bureau of Business Research, Northwestern University Bureau of Business Research, several national trades associations and personal studies.

Costs of selling through mail-order houses are not officially known. They are supposed to range from 18 to 30% of sales. But the knowledge of a general figure of this kind for a large mail-order house with many departments would be of little value even if correct. Costs of selling vary from department to department in mail-order houses just as in department stores. To be of value in a comparison of selling expenses, the figures should show the cost of selling shoes, for example, by mail. All things considered, the general costs of running a large mail-order house are probably somewhat lower than those for a large department store handling similar classes of goods.

The mail-order establishment need not be in a shopping district, so that the rent or investment represented by its size is comparatively small; the employees who fill orders do so more rapidly and for less pay than those who sell in a store; advertising is usually confined to the less expensive publications, and in the case of the largest houses the customers are much more numerous, running into millions. Costs in the shoe department of a mail-order house should run lower than in a department store or speciality shop because in the mail-order house there is no time and labour lost in fitting shoes.

[1] Costs of retailing in other lines of merchandise, so far as the figures are available, show about the same relationships. The example presented may be taken as typical.

TABLE II. *Marketing Costs*
Percentage on Sales

	Wholesale			Retail		
	Lowest	Highest	Usual	Lowest	Highest	Usual
	%	%	%	%	%	%
Automotive Equipment	16	26	23·5	15	29	24
Clothing	12	18	16	20	30	24
Drugs	12	20	15	23	33	28
Dry Goods	11	17	14	15	30	23
Electrical Supplies	10	20	14	20	31	26
Groceries	5	15	9	9	22	14
Hardware	13	21	18	11	32	23
Jewelry	15	20	18	24	40	32
Shoes	12	26	15	13	34	24
Furniture				20	35	25
General Merchandise				10	30	16
Department Stores				18	32	28
Chain Stores (Shoes)				10	57	24
Chain Stores (5 and 10c)				..	..	26
Chain Stores (Groceries)				..	..	16
Chain Stores (Drugs)				..	..	28

This saving is counterbalanced somewhat by the number of shoes which are probably returned. The lower costs of selling in the mail-order house, however, are offset in part at least by the costs of transportation and other expenses incidental to ordering by mail.

Economies in the Chain of Distribution.—A part of the competitive battle for trade among these various types of institutions consists in the utilisation of large buying power. Large chain store systems, mail-order houses and large department stores frequently purchase their goods direct from producers and secure the prices usually given wholesale purchasers. In some cases a part of these differences may be used in cutting the prices to consumers, but it would be a mistake to assume that the consumer gets all the benefit from purchases made at lower prices, or that this entire difference is gained for the dealers. Concerns that go direct to the producers, and thereby eliminate the wholesalers, as a rule incur practically all the usual expenses of wholesaling, such as interest on the investment in the larger stock of goods, storage risks, buying expense in dealing with numerous producers instead of a few wholesalers, extra record-keeping and, with chain stores, reshipments to their various stores throughout the country.

The only real saving which buying direct from producers insures is the eliminated profit of the wholesaler, with a possible reduction of the expense for salesmen whom wholesalers must employ. Competition in buying has forced the joint creation by small concerns of buying organisations which, united, represent as large a buying power as the chain or department stores. Co-operation in buying certain classes of goods has strong advantages both for dealers and consumers. Buying in group at one time may secure advantages, not only in price but also in transportation and handling, sufficient to cover the added expenses incurred in buying in quantity. Since 1920 there has been a rapid development in group buying by independent retailers of all kinds. The competition of chain-store systems wielding enormous buying-power advantages has forced independent dealers, both large and small, to associate for the purchase of many items, and in some cases for the joint ownership of full-sized wholesale houses.

Comparing the various methods of retailing as exemplified in the ordinary independent stores, the department stores and the mail-order house, from such facts as are available, it does not seem possible to assert positively that any one method presents decided general economic advantages over the rest. Each presents advantages in point of service, but the difference in service appears to be fully compensated in expense—that is, the public pays for what it gets and in proportion to what it gets.

So far as the public is concerned, it seems safe to say that there are large classes who prefer and who will always continue to prefer to trade in those retail establishments offering them the highest developments of service, the department stores and the independent speciality shops. Other large classes prefer and will probably always prefer to buy in stores offering less service and proportionally lower prices. Undoubtedly there are many who find their greatest satisfaction in purchasing in the stores of the self-service kind, where they may look about and pick up on their own initiative whatever they may wish to buy. Institutions are built to serve people in the way that they want to be served. There is room, therefore, in the retail trade for many types of stores. Speciality shops, department stores, chain stores and mail-order houses will all continue to exist as long as there are numbers of people who want the services each institution offers. It seems impossible to believe that any one type will monopolise the retail business or crowd out all the others.

Avoidable Waste.—The following statements outline briefly a few of the details of distribution which it seems certain must receive attention in order to secure more economical distribution. No doubt many more could be added. Poor roads greatly increase the costs of bringing the farmers' crops and produce to market, costs that must be added to the price that consumers eventually pay. Inadequate railway transportation is another element that makes a considerable addition to the costs. Car shortages at crop-moving time, cars unsuited to the products to be hauled, excessive delays in forwarding, at terminals, on the way and at transfer points, are common sources of expense.

Delay in transportation as a factor of expense in distribution has not been given the attention that it deserves. Poor location of terminals makes a great deal of expensive cartage necessary. Congestion of traffic in city thoroughfares is a growing cause of increased costs in distributing goods. Inadequate, inefficient, poorly located storage facilities cause huge losses. Inadequate, unauthoritative and inaccurate collection and dissemination of market information such as is needed by producers, distributors and consumers is responsible for great wastes. Through lack of such information business in many lines now passes constantly from glut to famine and back again. Poor packing of merchandise, inefficient loading, rough handling and uneconomical methods of handling are causes of waste and therefore of higher costs of distribution.

To refer more specifically to the activities of marketing through wholesalers and retailers, there is a startling loss of the wholesale salesman's time in finding customers, in making appointments, in fruitless interviews. The time of both salesmen and buyers is lost. Probably less than a sixth of a salesman's time, averaging salesmen of all classes, is actually employed in selling or even in displaying and describing merchandise. Anything that can be done to improve this deplorable economic condition will increase efficiency and decrease costs. No one can even begin to estimate the losses resulting from poorly trained salespeople who fail to sell and who waste the time of their purchasers through lack of knowledge of their goods, their customers' wants and their business, or through lack of ability to use their knowledge properly. Owing to lack of incentive most employees give but a fraction of their ability to their work.

Advertising.—Advertising is or should be an invaluable aid to marketing. In the list of expenses of distribution it occupies a prominent place. There is certainly room for improvement in its administration. Much study has been given in some organisations to such problems as the proper selection of mediums and the right use of the space taken. No doubt much greater progress can and will be made in the future in these directions, but the greatest loss in advertising seems to be in the lack of faith of the public in the advertising. If people gave more credence to advertising, much less of it would be needed to secure the same result. The remedy, of course, lies in the direction of raising the standards and shutting out the dishonest advertiser. (*See* ADVERTISING.)

Duplication.—Duplication in delivery organisations by retail stores is a source of economic waste. There are many who think that there are too many retail stores. Would goods be sold for

less if there were fewer? Probably not, because a large part of the competitive losses now occurring are borne by the dealers themselves in unpaid services. It may be argued that if their number were reduced the rentals for the locations that would be eliminated could be saved. This cannot be definitely checked by such experience as has been recorded in any public way. Concentration of retailing seems invariably to result in increasing rents. In fact, rents tend to increase faster than sales, so that the fewer the stores the higher the share of the landlord. More studies are needed to determine the exact effects of restriction of the number of stores on costs of distribution. There is further the fact that the store plant is unused for a large part of the time. Store hours are by custom and legislation steadily growing shorter. This means that the capital invested in stock and plant has fewer hours in which to produce.

Dishonesty.—Finally, there is undoubtedly an enormous loss due to unfairness and dishonesty, a loss that is now carried in large part if not wholly as an expense of distribution, being added to the price paid by the consumer. Failure to return containers lent by distributors seems a small item, but in such a business as milk distribution in large cities the loss to milk distributors due to non-return of empty bottles is enormous. Uncollectable debts and the cost of collecting delayed payments are important items in the expenses of distribution. Disregard of contracts in such matters as refusal of goods after placing orders, failure to deliver goods after orders are placed, abuse of the privilege to return goods, claims for adjustment and many other similar items make up large losses. Unfair competition, efforts made not to increase legitimate business but to impede or even to destroy competitors, commercial bribery, " graft " and the exercise of monopoly, all burden distribution expense far too much. A source of considerable loss is theft by employees, burglars and shoplifters. Some retail establishments count upon a fixed percentage on their sales representing losses due to this cause, a percentage that is added to the gross expenses which form part of the selling prices. Many of the losses of the distributive business, including theft, breakage, fire and so on, are covered by insurance, the cost of which is carried as an expense against the distributing process. Anything that can be done to reduce these losses will by that much reduce expenses of distribution and prices of goods.

Education in Marketing

The leaks and wastes enumerated above are certainly responsible for at least a quarter of the present costs of marketing. They may be responsible for a third or even more. Here, then, is a great field for reducing costs by improving present methods. The first general step towards such improvement is education. A beginning has been made. Before 1860 the apprenticeship system was general in England and to some extent in America, in retail, wholesale and importing houses. The apprenticeship system gradually decreased about the middle of the 19th century, and for years after no systematic training was provided for young people other than the haphazard effect of their experience. The first training of modern salesmen in America seems to have been by the subscription book houses that flourished during the 'seventies and 'eighties. Their canvassers or book agents were thoroughly drilled or schooled in the art of selling or in securing orders. During the 'nineties sales managers in speciality manufacturing concerns, notably the National Cash Register Co., of Dayton, O., began training their men in special schools held at the factory.

Training salespeople for retail stores seems to have begun in the 'nineties in such subjects as arithmetic, spelling and writing and, in 1905, in sales methods, under the auspices of the Women's Educational and Industrial Union in Boston. Educational service to salespeople and other workers is now commonly found in the better classes of both wholesale and retail stores. A beginning has been made also in education in distribution and marketing in American colleges and public schools. Several colleges offer courses in marketing, selling, sales management and advertising. Many high schools give similar but more elementary courses.

The main drawback to a rapid development of public education in marketing seems to be a shortage of teachers who can conduct such courses rather than lack of public interest. Such an organisation as the United States Chamber of Commerce in its relation to distribution is largely a clearing-house for information and educational ideas for its members. One of the notable things in the progress made in educational work for marketing is the growing conception of the relation of the sciences of psychology and sociology when practically applied to the problems of marketing.

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II. IN GREAT BRITAIN

Excepting the larger wholesale markets in England, situated in Liverpool, Mincing Lane, E.C., and elsewhere, which handle cotton, wheat and certain other imported products, it may be asserted that much variety, extremely haphazard methods and a considerable degree of inefficiency in organisation are the characteristics of the marketing process throughout the greater part of England, Scotland and Wales. For this unsatisfactory condition many reasons may be given, not the least important of which is the continued existence of market rights in the hands of private individuals or joint stock companies or their assignees enjoyed under royal charter, Act of Parliament, or surviving manorial rights.

Scarcely less important causes are the reluctance of the smaller British producers to form societies for co-operation in the sale of their output and the comparative ease with which, hitherto, a growing home market has absorbed an output which, especially in the case of certain perishable products, has increased less rapidly than the demand. Again, improvements in methods have not been necessary in the absence, until recently, of effective competition from abroad in respect of most of the less important commodities ordinarily handled in the provincial markets; while the inability of many existing markets to cope with an increase in the volume of business—an inability especially marked in some of the larger towns and arising mainly from the difficulty of reconciling numerous and conflicting vested interests—has rendered difficult any large-scale recasting of the marketing process throughout the country.

Location and Organisation of the Principal English Wholesale Food Markets: Fruit and Vegetables.—The smaller centres of population have traditional and established market places originally set apart for the sale of produce direct from the growers to the consumers. In the larger industrial towns these markets have grown in importance (but not in physical dimensions) with the growth of the towns themselves. Some have become retail markets whose continued existence it is not always easy to justify on economic grounds; but others have become wholesale markets, especially in areas where local production is insufficient or erratic and foreign imports are needed to ensure supplies, or again where transport facilities and favourable geographical situation have permitted the extension of their spheres of influence and caused them to become distributing centres for large areas. Many of these are well organised and are sensitive to price movements in other markets. Since, however, they draw a large proportion of

their supplies direct from the producer, and these supplies are liable to fluctuation, they require an additional and a more reliable source from which to supplement the local output and from which special lines and imported supplies may be obtained to balance demand.

This source they find in the central markets at important ports, and especially in the Covent Garden market in London, which has become a national distributing centre for fruit and vegetables. Privately owned by the Covent Garden Estates Company, Ltd., this market handles not only produce raised within carting distance of London, which is required for London consumption, but also main crop produce in general demand, part of which is regularly recodsigned to other distributing centres, and certain produce in limited demand or supply, such as glass-house produce which commands a high price and most of which is reconsigned to other markets. Much of this reconsignment business is economically indefensible; but it cannot be replaced entirely by direct consignment to provincial markets until the latter become more developed and price movements in them much less liable to be influenced by small alterations in supply and demand.

Meat and Fish.—Wholesale meat markets are generally owned and managed by local authorities, and exist only in those centres of population (not more than 20 in number) where the magnitude of possible trade justifies their establishment and where retailers are assured of adequate supply with wide range of quality and prices. In smaller towns the place of the municipally owned market is taken by wholesale butchers who purchase live stock, slaughter it and sell the meat to retail dealers; and in the City of Sheffield, where no meat market proper exists, the wholesalers sell at the slaughter-houses which they rent from the local authority. By far the largest and most important of wholesale meat markets proper is the London Central Market at Smithfield which in a single year handles between 400,000 and 500,000 tons, including 40% of the total imports of meat into the whole country. Unlike Covent Garden, it undertakes practically no reconsignment of produce to other wholesale markets; but its prices for both home and imported meat (although not officially issued under the imprimatur of the City of London Corporation, which is its owner and manager) are largely used as a basis for wholesale dealings in other parts of Great Britain.

In the foreign meat trade a network of depôts has been established by certain large distributing firms in all the principal cities and towns in the country. To them supplies of chilled or frozen meat are despatched from the ports of entry. They, therefore, serve as small markets from which retailers can secure supplies with ease and promptness. The prices charged are fixed with reference to Smithfield and are, therefore, fairly uniform throughout Great Britain; but local circumstances occasionally demand departure from strict uniformity.

Fish is handled at Hull, Grimsby, Fleetwood, Aberdeen and other ports, usually by Dutch auction, and is distributed by the wholesale purchasers to their stalls and to representatives in certain provincial fish markets (Birmingham, Glasgow, Liverpool, Manchester and others) and also to the very important Billingsgate market in London.

Cereals.—Wheat is usually sold by sample in the local corn-market nearest the producer's home. Certain of these small markets, however, attract a considerable quantity of grain from areas outside their immediate neighbourhood, and some of the largest dominate large tracts of country, frequently serving as depôts for the receipt of both home-produced and imported wheat and for its export to other consuming centres. The purchasers at these local markets include millers among their number; but sale outright to merchants and sale by merchants or agents on commission are not uncommon, the latter being, perhaps, the usual plan in Scotland. Producers' co-operative societies may also be employed, which may sell direct to millers, or more frequently to merchants whom the larger milling-firms find it more convenient to employ in their purchasing of home-grown wheat in bulk.

Barley when sold for malting and distilling is usually sold in the larger market-towns by merchants acting on a commission basis on behalf of the farmer. Oats are largely consumed on the farms of the growers, but direct sale by the producer to oatmeal millers is common. Merchants, however, frequently buy outright for sale to large consumers such as collieries and railway companies.

After wheat is milled it is usually sold direct to bakers, confectioners or other users, generally through travellers employed by the milling companies. Occasionally factors or wholesale dealers intervene, who purchase from millers for re-sale on their own account to small bakers in the more sparsely populated districts. Distribution by this method is uncommon, however, in the case of home-milled flour; although imported flour is nearly always handled by wholesale dealers of this kind.

At the next stage, that of baking, a few firms in several of the more important centres of population confine themselves to a purely wholesale trade. A fair number attempt to combine partial retail distribution with wholesale manufacture and usually possess retail shops where the bread is sold over the counter direct to the consumer or from which door to door delivery by van may be undertaken. The majority of baking firms, however, confine themselves strictly to retail trade, selling, in addition to bread, various forms of confectionery, such as cakes, sweets and biscuits, which may be either proprietary articles or manufactured by the bakers themselves; but certain difficulties, occasioned especially in the north of England by housewives buying bread at irregular intervals only, encourage distributors to cease manufacture themselves and to rely on wholesale baking firms entirely for the supplies which they need.

Poultry and Eggs.—Owing to the fact that British producers of poultry and eggs have no export trade to foreign markets, there is no obligation on them to conform to standardised methods in the disposal of their products. There is consequently great variety in the marketing of these commodities and the plan adopted by an individual producer depends partly on the scale upon which he is operating and partly on his situation relative to his market or his customers. Sale may take place (*a*) by private treaty in the producing area; (*b*) by auction in the producing area; (*c*) directly to distant distributors; (*d*) through commission salesmen in distant wholesale markets; (*e*) through co-operative societies. To the first of these classes may be assigned sales at local weekly markets of eggs and dressed poultry to local customers, sales by parcel post or rail direct to the consumer, sales from door to door often in conjunction with milk and vegetables, sale to local distributors in the nearest market town and sales at the farm. This latter plan is common throughout England and Wales, intermediaries known as higglers (also as cadgers and hagglers) going round in districts where the farms are scattered and distant from the larger consuming centres. The higgler calls at the farm with a vehicle once or twice a week, buys all the eggs and poultry available and pays cash without much regard to classification or to quality. He then resells privately or in open market to wholesale and retail distributors; but he may occasionally send consignments to wholesale markets for sale on commission.

The system of selling by local auction has been greatly extended in recent years. The Stirling live-stock mart is a good example, and the Kings Lynn market also is one that has lately made marked progress in this comparatively new development. For sale on commission the Smithfield and Leadenhall markets in London are utilised as well as the various wholesale markets in the provinces.

Costs of Distribution

The costs of distribution vary considerably with the nature of the commodity handled, the method adopted and the degree of efficiency in the market organisation available to the producer. In the case of cereals the fees paid by the farmers in the local corn-exchange are very small. Sixpence per day, one guinea per year, one penny on each occasion the market is entered, threepence per person entrance fee for sale by sample, are a few examples taken at random of the rentals and fees in actual operation at the present time. Cartage to the market or railway station is also the farmers' expense. This is reckoned at 1s. to 2s. 6d. per quarter of grain up to a distance of 8 to 10 miles. Merchants selling wheat on commission for growers are paid 9d. to 1s. per quarter or 2d. or 3d. per hundredweight. These figures are slightly higher in the cases of barley and oats. A rent ranging from 2 guineas to over 8 guineas per annum is charged to merchants who operate in the local exchanges and who require stands, desks or space on the market floor.

Fruit and Vegetables.—For fruit and vegetables the costs incurred in the complete marketing process are proportionally greater than in the case of cereals. Considerable expense arises in the preparation of produce for the market. Dressing potatoes for example costs 4s. to 5s. per ton. Cartage to railway station is estimated in Lincolnshire on the average to amount to 3s. to 4s. per ton. Railway charges are moderate and, on the whole, reasonable. In the distributive

market itself porterage charges and market tolls are an additional burden and then there are the payments to the commission salesman for his services.

It is the practice of the commission salesman to supply the receptacles or containers needed by the producer and generally to act on the latter's behalf once the produce is despatched from the farm. When a sale has been effected the salesman remits to the grower the amount realised less the charges for use of containers, for transport, porterage, market dues and also a commission on the selling price for service rendered. The latter is nominally about 7½%, but actually in cases investigated by the Linlithgow Committee an average of 10 or 12% was found.

In its further passage towards the consumer the produce may find its way direct to the retailer from the commission salesman, or it may be sold to a commission buyer acting for a distant wholesaler, who in turn resells to the local retailers from whom the consumer buys. These agents who buy on commission may act merely on behalf of principals who cannot attend the market in person, or may themselves buy on their own credit and assume full responsibility for the produce and for bad debts, charging up goods at cost price, adding porterage-out and a flat-rate charge to cover labelling, consigning and the clearing of empties. In the former case they receive a flat-rate per package, handled (2d. in Covent Garden). In the latter they charge 2½ to 7½% on the cost price.

It is calculated that the wholesalers on whose behalf they act make a net profit of about 2% on their sales to retailers, and that the latter obtain a net profit of over 6% on the cost of the goods or a little under 4% on turnover. The diversity, however, of retail services demanded by the consuming public and the wide range of costs entailed cannot but make for uneconomic distribution of these products; it would not be correct to state that the middlemen actually engaged in the marketing process make profits that are unduly large.

Meat.—In the meat trade the following estimates taken from the Linlithgow Report exhibit well the costs incurred and prices paid and received in the passage of beef from the English farmer to consumers in larger industrial centres.

	£	s.	d.
Farmer receives for one animal from dealer at local market	31	0	0
Farmer's expenses (tolls, etc.)	..	9	3
Farmer's net receipts	30	10	9
Dealer receives from wholesale butcher	32	10	0
Dealer's expenses (rail, tolls, feeding, etc.)	..	18	6
Dealer's net profit	..	11	6
Wholesale butcher receives from retailer	30	3	9
Wholesale butcher receives for hide and offals	3	10	6
Gross receipts of wholesale butcher	33	14	3
Expenses of wholesale butcher (slaughtering)	..	13	2
Wholesale butcher's gross profit	..	11	1
Retailer's receipts from consumers	36	9	10
Retailer's payment to wholesale butcher	30	3	9
Retailer's gross profit	6	6	1

The weight of meat sold in this instance was 690 pounds. The net price paid by consumer being £36 9s. 10d. and the receipt from offals being £3 10s. 6d. the difference between the net price received by the farmer and the total made by meat and offals is, therefore, the difference between £40 0s. 4d. and £30 10s. 9d., *i.e.*, £9 9s. 7d. The corresponding differences for Wiltshire bacon and for pork were £3 14s. 7d. and £1 16s. 6d. for weights of 140 and 148 lb. respectively.

The same Committee also collected figures showing the receipts from the sale of a forequarter of frozen beef weighing 187 lb. and costing £2 14s. 6½d. or 3½d. per pound. In this case £5 6s. 1½d. was realised, giving a gross profit of 48·6% on sales. In another case New Zealand lamb costing £1 17s. 4d. was retailed at £2 8s. 0d., leaving a gross profit of 22·2% on sales. When it is remembered that the expenses of the retailer in the case of frozen meat are substantially less than in the case of home-killed meat, owing to the absence of slaughtering and dressing costs, the very remunerative character of trade in foreign meat is readily perceived. Again, competition appears to be less active in the retail meat trade generally than it was before 1914, and this notwithstanding an increase in the number of establishments since that date. It would seem to be the case that butchers, having been encouraged to purchase collectively during the War period, still combine to keep down prices both of stock and meat; and further that retailers to a considerable extent agree on the prices consumers are required to pay and on the whole refrain from underselling one another in open competition.

In the distribution of bacon retailers usually purchase supplies of home-cured bacon direct from the factory; but in some cases they may buy from wholesale provision merchants. The margin obtained by the wholesaler is about 2½%. This is ample for the services he renders. The retailer's gross profit is more difficult to ascertain; for this trade is mainly undertaken by grocers who rarely separate it off from other departments of their business. It appears, however, that the profit on English bacon is from 10 to 14% of the sale price.

Poultry and Eggs.—In the selling of poultry and eggs at the local market, apart from the cost of conveying the produce to the place of sale, the vendor usually has to pay market tolls and, in the case of sales by auction, the auctioneer's fee. The average tolls charged (by the local authorities who usually own the markets) are ½d. to 2d. for poultry and from ¼d. per score to 6d. per 100 for eggs. Auction charges generally range from 5 to 7½% of the price realised and, consequently, are higher than those for selling livestock. This, no doubt, is because of the smaller value of the individual lots put up for sale. The higgler's profit in the districts where he flourishes is from 1d. to 2d. per doz. on eggs. This is not excessive; but his service, nevertheless, is not economical.

The dealer's business is more speculative, owing to the rapid fluctuations in prices from day to day and from market to market. His average profit of from 2d. to 4d. per doz. on eggs is, therefore, reasonable, especially as he provides boxes and pays transport charges. Commission salesmen's charge is 5% of the selling price, and wholesale dealers purchasing on their own account aim at a gross profit on eggs of about 2d. per doz. and of 2d. to 3d. per lb. on dead poultry. Probably it is in the retail section that profit margins in this trade are greatest and most open to question, 14% on eggs and 20 to 30% on poultry being the averages for the whole country. Producers complain that the difference between the prices they receive for poultry and those paid by the public has increased disproportionately in recent years. The gross margin formerly to cover profits and expenses of all intermediaries was roughly 1s. per bird. The current margin is about 6d. per lb., which is approximately 1s. 6d. to 2s. 6d. per bird.

Co-operative Marketing

The organisation of producers on a co-operative basis for the disposal of their produce and for the carrying out the processes involved in marketing is not a new development in Great Britain; but the progress made is insignificant compared with what has taken place elsewhere. Figures in the returns furnished to the Chief Registrar of Friendly Societies for the year ending March 31 1924, referring to societies operating only in England and Wales, establish the fact that roughly about 3½% of the total value of agricultural produce marketed in England and Wales was handled by co-operative marketing societies or co-operative societies with marketing branches. The following table which is taken from No. 1, of the Economic Series published in 1925 by the Ministry of Agriculture and Fisheries (Great Britain) sets out in detail the position for the 12 months beginning April 1 1923.

The following table shows the number and turnover of agricultural marketing societies and certain other societies handling agricultural produce as part of their general trading during the period 1923–4. The table excludes turnovers in grain, hay, potatoes, etc., of general trading societies.

Commodity Handled	Number of Societies	Turnover[2]
		£
Dairy produce	63	1,447,627
Eggs and poultry	43	349,262
Fruit and vegetables	18	301,932
Livestock[1]	9	375,128
Auction marts (livestock)	18	1,081,953
Slaughterhouses	11	415,270
Bacon factories	6	694,826[3]
Wool	13	200,000[4]
Total	181	4,865,998

[1] This entry covers societies selling livestock on behalf of members otherwise than through an auction mart owned or rented by the society.

[2] Turnover in respect of produce handled, and not necessarily total turnover of society.

[3] 1924 figures.

[4] Estimated value.

These 181 societies are widely distributed without any union or centralising agency which might secure joint action or otherwise look after common interests. Attempts, however, have been made from time to time to federate them or to institute an advisory body to assist them to sell advantageously. The most recent project of this kind was the establishment in 1918 of the Agricultural Wholesale Society with the object of buying and selling for such societies everything that is best bought or sold on wholesale lines. The capital of this new wholesale body, however, proved inadequate; and in consequence of a period of acute trade depression with insufficient resources and credit to enable it to surmount its difficulties it

went into liquidation in 1924. During its brief existence it seems to have done more bulk purchasing of agricultural implements and seeds than large scale marketing of produce; although it did set up a department to market eggs and established a meat section to help the co-operative slaughterhouses in their sales in Smithfield market. Its downfall involved the Agricultural Organisation Society in such difficulties that the latter body also succumbed a short time after.

Present Development.—The present trend is in the direction of the several groups of societies forming their own trading federations on a commodity basis and thus falling into line with the general course of development towards larger scale marketing and trade. One such central trading body is the English Farmers' Bacon Agency. Another, the British Egg Producers, which took over the business of an earlier body of the same kind, has hardly met with the success it deserves; but a regional trading federation in South Wales, called the South Wales Mutual Dairies, which is a selling agency for four large dairy societies in Carmarthenshire and Pembrokeshire, has had better fortune. There is also a rather undefined union of fruit and vegetable marketing co-operative societies of the counties of Worcester, Gloucester, Warwick and those adjoining, which is growing into a trading federation; but, on the whole, the association of co-operative marketing societies for joint action in the conduct of the sale of their produce is only very slightly developed in Great Britain.

Since 1900 many efforts have been made to establish trading relations between these agricultural producers' co-operative organisations and the industrial co-operative movement. The 1,300 retail consumers' societies of the latter are said, approximately, to feed one-third of the whole consuming population of Great Britain and are, therefore, in a position to offer an assured outlet for the produce of British farms. While some progress has been made in bringing the two organisations into closer relations it is obvious that the natural clash of interests between producers and consumers must always make price-fixing difficult. If this awkward point could be settled satisfactorily, much might be done to eliminate the control now exercised by the many middlemen in the marketing of agricultural produce. (*See* CO-OPERATION, AGRICULTURAL.)

THE FOOD COUNCIL

The general dissatisfaction with retail prices during the years succeeding the period of War-time Government control resulted in the appointment in 1922 of a departmental committee (the Linlithgow Committee) of the Ministry of Agriculture and Fisheries to inquire into the methods and costs of selling and distributing agricultural, horticultural and dairy produce in Great Britain and to consider how the disparity between the price received by the producer and that paid by the consumer could be diminished. This was followed by a Royal Commission on Food Prices in 1924 with terms of reference not very different. As a result of the first (and only) report of the latter body a Food Council was sent up to study current and future problems of wheat and meat supplies and to issue periodical reports. This Council is not endowed with any statutory powers. It seeks to work by focusing public opinion on whatever it judges to be unreasonable prices or unduly high profits; but it shirks definite price-fixing and thus avoids many problems that presented themselves during the period of Government control and to which no satisfactory solution ever was given.

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MARKHAM, SIR CLEMENTS ROBERT (1830–1916), British geographer (*see* 17.734), died in London Jan. 30 1916. The principal work of his later years was connected with the two Antarctic expeditions under Capt. R. F. Scott. An important history of Arctic and Antarctic exploration by Markham was completed posthumously by Dr. F. H. H. Guillemard and published in 1921 under the title of *The Lands of Silence*. A *Life*, written by his cousin, Adml. Sir A. H. Markham, was published in 1917.

MARNE, FIRST BATTLE OF THE, the series of actions fought in Sept. 1914, when the French and British Armies turned at bay between Paris and Verdun and defeated the Germans, driving them back to the Aisne.

The Germans had hoped to bring France to her knees in six weeks, but when four weeks had expired France and England were still keeping their opponent at arms' length. The Germans were indeed slightly ahead of their time table, but they had insufficient troops to carry out their grandiose plan. Antwerp and Maubeuge had necessitated a subtraction of strength and the invasion of East Prussia had led to the dispatch of two corps from the German right wing in France. Further, the rapid advance had led to considerable wastage and the comparative breakdown of wireless was hampering the invaders.

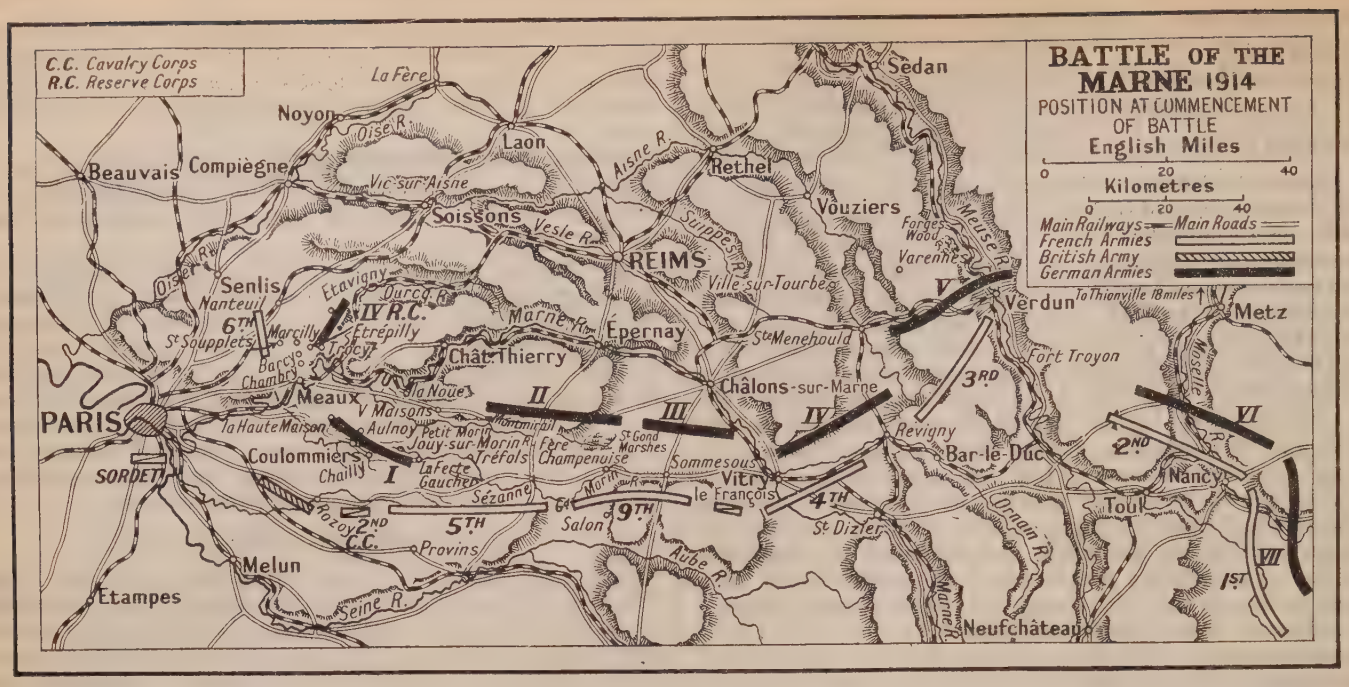
I. THE OPENING OPERATIONS

Advance on Paris.—The original plan had implied that if the French formed a great defensive flank resting on Paris, the capital was to be turned by forces pushed west and south of it; reserve divisions were to be dropped for the investment; and the five field armies, pivoting on Thionville, were to make a stupendous left wheel and to force the Allies against the Swiss frontier. By Aug. 28 this plan had begun to show signs of weakness. The German right wing was not strong enough and was too widely spread out. The II. Army was in comparative isolation and found itself committed to an advance against the great fortress of Paris.

This army was roughly handled by the French at the battle of Guise on Aug. 29 and its commander, Von Bülow, thereupon sent out urgent appeals to the I. and III. Armies on his right and left respectively to close in to his aid. These cries for help altered the whole course of the War. The commander of the I. Army was glad to switch off from the elusive British Army and decided to turn inwards. The hand of German supreme headquarters was now forced. They approved the scheme, although it meant giving up the advance on Paris. The new objective of the right wing was to be the flank of the French main forces opposite the II. Army. Envelopment was still held in view, but the net was to start its scoop east of Paris instead of west of it. Opposed to this wavering was the consistent policy of Joffre. An orderly retirement until he could gain the respite afforded by some topographical obstacle was his dominating thought. Here he proposed to reform and reorganise and then to assume the offensive at the earliest possible moment. The limits of the withdrawal were laid down as the territory immediately south of the rivers Seine, Aube and Ornain. A retirement so far would mean the isolation of Paris, but Joffre clearly realised that the fate of Paris would be decided in a battle fought, not under its walls, but in the open field.

Defence of Paris.—Paris was not undefended. It had, indeed, been proposed to declare it a *ville ouverte*, but the patriotism of its inhabitants decreed otherwise. The military governor was General Galliéni, who had under him four and a half divisions of *territorials*, some cavalry and field artillery, as well as 5,000 *fusiliers marins*. On Sept. 1 the newly formed VI. Army, some 60,000 strong, was placed under his command, and in addition he received Sordet's Cav. Corps, two reserve divisions and a particularly fine reinforcement in the shape of the 45th Div. from North Africa. Galliéni had therefore a respectable mobile force at his disposal, as well as garrison troops.

His first duty was the defence of the capital against which, so far as he knew, the German right wing was steadily advancing. The task was a difficult one, for the apathy and neglect of successive French governments had been reflected in the unreadiness of the fortress. By herculean efforts much was done in the limited time at his disposal, but Galliéni took a grave view of the situation. Then suddenly the whole situation changed. Up to the morning of Sept. 3 it seemed certain that the German right wing was advancing



on Paris with the Senlis-Paris road as the axis of movement; by the afternoon information, transmitted by aeroplanes and cavalry patrols, clearly showed that the German I. Army had switched off from Paris and was heading south-east towards the junction of the right of the British and the left of the French V. Army.

The situation in which Galliéni now found himself was one which demanded exceptional powers of decision. On the one hand there was the German I. Army making a flank march across the north-east of Paris, " trailing its coat " under the very eyes of the garrison, and providing a temptation almost impossible to resist. On the other hand there was the fact that Joffre had declared that he did not wish to undertake an offensive until he had got his army behind the Upper Seine and Aube. At 9 A.M. on the 4th Galliéni, anticipating the sanction of the commander-in-chief, directed the commander of the VI. Army to hold his troops in readiness for an advance against Von Kluck's exposed right flank. Next he communicated with Joffre and Sir John French. All three were equally desirous of assuming the offensive at the earliest possible moment and any divergence of opinion was only on matters of detail.

Joffre's Offensive.—Little reflection was necessary to convince Joffre that a chance not often met with in war was now vouchsafed him. He determined to assume the offensive from where he stood and shortly before midnight he issued his orders stating that advantage was to be taken of the situation of the German I. Army to concentrate against it the efforts of the Allied armies of the extreme left. All preparations were to be carried out on Sept. 5 and the attack was to be made on the 6th.

Disposition of the Forces.—At this moment the position of the Allied armies in France resembled a ribbon attached at its ends to Paris and Verdun and sagging slightly by its own weight in the centre. At Paris was the French VI. Army and other available troops. Next came the British Army. Then in succession the French V., IX., IV., and III. Armies, the right of the latter joining up with the mobile forces of Verdun. The initial orders included the VI., British, V. and IX. Armies only. The first was to cross the Ourcq and make for Château Thierry. The British were to be ready to attack in the direction of Montmirail. The V. Army was, generally speaking, to attack from south to north, its right protected by the IX. Army. During Sept. 5 supplementary orders were issued to the IV. and III. Armies, the general trend of which was that they were to attack inwards and thus to bring about a double envelopment of the German armies.

Facing the Allies were the five German armies to which had been entrusted the great turning movement pivoting on Thionville, numbered I. to V. from right to left. The French, British and German Armies thus enumerated were those immediately concerned in the operations now known as the battle of the Marne. Further to the southeast, between the fortress of Toul and the Swiss frontier, the German VI. and VII. Armies had been heavily engaged with the French I. and II. Armies since the middle of August.

During the evening of Sept. 4 a new directive was issued to the German Forces. By it the I. and II. Armies on the right were now to face west towards Paris. On the left the IV. and V. Armies, by a determined advance south-east, were to open a passage across the Moselle, in which region a lesser Sedan might yet take place. The III. Army in the centre was to push south ready to assist either wing as required. Thus Von Moltke was forced to abandon the hopes founded on the great massive wheel of five armies pivoting on Thionville and instead was compelled hurriedly to assign to his armies three divergent axes of march towards the west, south and south-east. In the new scheme it was Von Kluck's task to remain between the Oise and Marne. Instead of doing so he continued pushing on over the latter river. As the French VI. Army had been ordered to cross the Ourcq and to advance towards Château Thierry a collision between it and the flank guard of the German I. Army was now but a matter of hours. Almost exactly at noon on Sept. 5 a battalion of the French VI. Army came under heavy shell fire from the German flank guard. Some very heavy fighting ensued and by evening the French had made good a little ground, although at the expense of heavy casualties.

II. THE ACTUAL BATTLE

The battle proper may be considered as starting on Sept. 6. The French VI. Army moved out to the attack with both of its flanks protected by cavalry. By then Von Kluck had begun to comply with orders by withdrawing his troops across the Marne. The bulk of the day's fighting took place opposite the right wing of the French VI. Army and especially against the extreme right. It was soon evident to Gen. Maunoury, the French commander, that the German flank guard was being substantially reinforced. Von Kluck could, however, only reinforce his right flank at the expense of his front, and, in consequence, opposite the British there was a noticeable slackening in the advance of the German I. Army. Put briefly, the relative situation of that army had changed. What had been its right flank—consisting of the IV. Res. Corps and a cavalry division—was, by successive reinforcements, to become the front; while the original front, by a corresponding diminution, was transformed

into the left flank, and the army as a whole was to face west instead of south.

The hesitation observable in the German advance was soon followed by an unmistakable retrograde movement. The British lost no time in seizing the heights on the Grand Morin south of Coulommiers, from which German heavy guns had during the morning brought an effective fire to bear. Save for some fighting early in the morning about Rozoy—an action brought on by the Germans to cover their retreat—the British were not heavily engaged, though a few prisoners and machine-guns were taken. To the right of the British, the French V. Army, after a check early in the day, had made a substantial advance, the German I. Army was now in the position of having to fight desperately to hold off the converging attack of the French VI., the British, and the French V. Armies.

The fighting on the Ourcq on Sept. 7 was hard and bitter. Even at the risk of weakening himself elsewhere, even of causing a gap between himself and the II. Army, Von Kluck had to bring every available man to the fight. The effect of his action was that a gap, soon to yawn into a gulf of 30 m., was opened between the German I. and II. Armies. Into this gap the British and the left of the French V. Army were steadily pushing. In other words, Von Kluck found himself committed to an isolated action with his left and rear exposed. Unless he could hold off the British and the French V. Army sufficiently long to enable him to dispose of the French VI. Army he was defeated. But for his task he had neither the time nor the men.

After a day of hard fighting the French VI. Army had made some further progress, and its front ran generally from Chambray through Barcy and Marcilly to the high ground west of Etavigny. The British were now opposed merely by German cavalry reinforced by Jäger battalions and were enabled to push their line to La Haute Maison-Aulnoy-Chailly and Jouy sur Morin. The French V. Army likewise made good progress, reaching the line La Ferté Gaucher-Trefois. Further to the right the fighting had been severe, the left of Foch's IX. Army being heavily attacked and forced to call on the V. Army for help.

A somewhat disquieting feature of the day was the apparent intention of the Germans to make another effort to turn the Paris-Verdun line at Nancy and at Troyon, where a successful thrust would very seriously discount the French efforts on the Ourcq. Worse still, Maubeuge fell on Sept. 7, and the invaders not only gained another rail line of communication but had now another corps available for operations in the field. Against these drawbacks, however, could be set the fact that the gap between the German I. and II. Armies had considerably widened, and into it, the British Army and the left of the French V. Army were now advancing with speed.

Sept. 8 was remarkable for the violence of the German attacks along the Ourcq. Maunoury's plan was to attack with his right centre and left, while the VII. Corps in the centre was ordered to hold its line at all costs. That corps was heavily attacked early in the afternoon, and such was the severity of the fighting that a week later the streets of Etrepilly and Trocy were still blocked with the bodies of the slain. To the north the French outflanking movement was brought to a standstill, while even the superb gallantry of the Zouaves of the 45th Div. on the right centre failed to make any considerable impression on the enemy. During the afternoon Galliéni visited the Commander of the VI. Army at his headquarters at St. Soupplets and pointed out that the greater the resistance offered by the Germans on the Ourcq the less opposition would the British meet with in their advance. Nevertheless, Maunoury considered it advisable to make arrangements for a possible withdrawal on the following day. Meanwhile the British Army was discounting the efforts which Von Kluck was making on the Ourcq.

Sir John French decided that the best method of assisting the French VI. Army implied the speedy passage of the Petit Morin and Marne rivers, for after passing the latter the British army would be facing northwest and thus almost directly threatening the line of retreat of the German I. Army. Orders were accordingly issued for a general attack along the line of the Petit Morin, to begin early on Sept. 8. At first the march was undisturbed, but on reaching the Petit Morin it was soon realised that the German cavalry would not yield without a struggle, especially as the steep valley covered with small but thick woods distinctly favoured the defence. Some severe fighting ensued, but by evening the British had made good the Petit Morin and were on the line La Noue-Viels Maisons, where they joined up with the II. Cav. Corps of the French V. Army, the left corps of which extended to the southern outskirts of Montmirail.

Sept. 9 was to witness Von Kluck's last effort on the Ourcq. The French VI. Army, although it had been reinforced, was at the end of its strength and its left was pushed back. A superb effort, however, restored the day and then it was clear that Von Kluck had shot his bolt. During the day the British crossed the Marne and on its right the French V. Army seized Château Thierry. Thus on the extreme west of the great battle things had gone well for the Allies, and it is now time to turn to the doings in the centre of the field.

German supreme headquarters had ordered the I. and II. Armies to form front facing Paris, the former between Oise and Marne and the latter between Marne and Seine, Château Thierry to be the point of junction of the two armies. This order had at first been disregarded by Von Kluck, who had persisted in his passage over the Marne and in maintaining his position in front of the II. Army. Von Bülow, however, endeavoured to comply with the orders of his superiors, and did make an effort to wheel his army to the right with the object of taking up the line Château Thierry (exclusive)—Marigny-le-Grand. The net result of compliance with orders by one army commander and disregard of them by the other was that the right corps of the II. Army was squeezed out of the line by the left corps of the I. Army. In other words, the two armies were acting upon different plans; overlapping had arisen; and the confusion inevitable in such circumstances began to be revealed upon the evening of Sept. 5. This factor alone was bound to hamper the II. Army, and Von Bülow's task was not lightened by the subsequent conduct of his neighbour. When Von Kluck renounced his plunge southeast he did it with such thoroughness as to lead to the transfer of practically his whole strength to the Ourcq. On Sept. 7 he demanded back the III. and IX. Corps which he had lent Von Bülow but the day before. The withdrawal of these units to the Ourcq exposed Von Bülow's right flank; a great gap was thus opened between the II. and I. Armies and Von Kluck, who had, on Sept. 5, inconvenienced Von Bülow by his undue proximity, was now seriously embarrassing that commander by his aloofness.

III. THE GERMAN RETREAT

Retreat of Von Bülow.—Generally speaking, the task of the IX. Army under Foch for Sept. 6 was to support the advance of the V. Army with its left flank while maintaining a watching attitude along the rest of its front. Foch, however, found himself quite unable to carry out even the moderate programme he had drawn up. Von Bülow was endeavouring to wheel into position between Marne and Seine, and on his left the III. Army's orders were to push due south. As a result the French were attacked with considerable vigour all along the line for, although his right was becoming compromised, Von Bülow was able on the 7th to push on with his centre and left, the latter flank working in conjunction with the German III. Army. But owing to the determined resistance of the French IX. Army under Foch and to the assistance afforded him by the French V. Army on his left, the Germans made no great impression other than to deny the French IX. Army the possibility of making progress north and west. On the following day, Sept. 8, the Germans renewed the attack and a serious position developed for the right of the French IX. Army, which was forced to give ground. Foch refused, however, to be perturbed inasmuch as the news which came in of the course of the fighting east and west of him was reassuring.

On the 9th a sudden German attack told on the French left. Foch's reply was to move his reserve from his shattered left to join in a counter attack from his right, realising as he did that the danger of the German thrust was more apparent than real.

Reports as to the forcing of the line of the Marne by British troops during Sept. 9 forced Von Bülow to the conclusion that retreat was inevitable for Von Kluck, and that his own II. Army must fall back at once, if it were to avoid envelopment on its right flank. With the object of gaining time to get his long trains safely back over the Marne, the offensive by his left and centre was carried out with vigour during the morning, the French right being driven back to Salon; but early in the afternoon the German II. Army and the right of the III. Army were in full retreat, strong rear guards being left facing the French.

Verdun.—The fighting described up to the present, *i.e.*, that between the Ourcq and Fère-Champenoise, must not be allowed to overshadow the operations of the French armies between Vitry-le-François and Verdun. For nowhere on the whole front was the tenacity of the French III. and IV. Armies surpassed. It was towards the east that the Germans hoped to retrieve their failure elsewhere. Here they hoped to cut off Verdun from either side and to bring about a kind of minor Sedan in which the French I., II., III. and IV. Armies might be herded together and destroyed. The German VI. and VII. Armies were to advance eastwards across the Moselle; the IV., with its right passing through Vitry-le-François, was to bear down across Champagne, while the German Crown Prince with his V. Army was to proceed round the entrenched camp of Verdun. Fortunately for the French the Crown Prince based his advance upon a misconception. He assumed that Verdun would be left to its fate, whereas Sarrail commanding the French III. Army kept his right attached to it throughout and, further, on his own responsibility, ordered the fortress commander to use his troops to make an attack on the Crown Prince's communications.

German Retreat.—The attacks of the Germans brought the French into a serious position, especially the IV. Army of Langle de Cary. In fact, at one time there was a serious chance that its right might be rolled up. However, reinforcements from the extreme French right, that is to say the I. and II. Armies in the Vosges, restored the situation. Then, on Sept. 8, the III. Army was called upon to deal with a new peril. Fort Troyon was in serious difficulties and thus a very patent danger to the rear of the III. Army was suddenly revealed. The garrison, however, put up a stout resistance and the place was relieved by a French cavalry division from Toul on Sept. 10. The Germans renewed their attacks on the following day but they were without significance. From Verdun to Paris five German armies were in retreat. The great battle of the Marne had been fought and won.

It was not for several years after the battle that the world learnt how and why it was broken off by the Germans. The truth is that by Sept. 8 Von Moltke had completely lost his grip of the battle. In these circumstances a liaison officer, Lt. Col. Hentsch, was directed to visit the V., IV., III., II. and I. Armies in turn and to bring back a clear idea of the situation. Further, he was empowered to issue such orders as would close the gap between the I. and II. Armies should he find that retreat had set in upon the right wing. The critical point of his tour was his visit to the II. Army where he spent the night of Sept. 8–9.

Von Bülow was considerably disconcerted about the passage of the British over the Marne; he came to the conclusion that the retreat of the I. Army was inevitable, and that therefore his own II. Army must fall back if his right were not to be enveloped. Hentsch agreed and proceeded next day to the I. Army, where he interviewed Von Kluck's chief of staff. Although the latter considered that the I. Army could hold its own there was now no option but to order its retirement. Thus by the late afternoon of the 9th the whole right and right centre of the German Army was falling back. Supreme headquarters, in ignorance of the fact, were preparing for a continuance of the offensive but had to bow to the inevitable. During the 10th orders were issued for the retreat of the five armies behind the Aisne and Vesle. By the 16th the German front was thus traced out—the neighbourhood of Noyon, the plateaux south of Vic-sur-Aisne and Soissons, the tableland of Laon, the heights north and west of Reims north of Ville-sur-Tourbe, Varennes, and thence to the Meuse near Forges wood, north of Verdun.

Conclusions.—Thus tamely petered out the grandiose German plan, and thus ended the great and decisive battle of the Marne. Tactically indeed it was somewhat of a disappointment to the Allies. No part of the German host was annihilated or even immobilised for any length of time. The number of trophies and prisoners was inconsiderable. The Germans broke off the fight in their own time. No great pursuit, as had succeeded Jena, took place, and the Germans were able to retire, if not unscathed at any rate in fair order. From the strategic and moral aspects, however, the battle was of immense importance. It marked for the Allies the definite turn in the tide of defeat, while for the Germans it marked, no less, the collapse of the plan with which they had entered on the War and on which the Great General Staff had been prepared to hazard the fate of the Fatherland. That plan had aimed at securing a rapid decision in France with the bulk of the German armies, and the subsequent and immediate prosecution of a second campaign against the more slowly mobilising strength of Russia. But by Sept. 10 1914 the Germans had definitely acknowledged defeat in France. It is significant that the Battle of the Marne has been called by the Germans themselves *der Wendepunkt* (the turning point) of the War.

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MARNE, SECOND BATTLE OF THE.—The second battle of the Marne developed between July 15 and Aug. 4 1918. Beginning with the German offensive of July 15, which was broken on the Champagne front between that date and July 18, it was concluded by the victorious counter-offensive of the French armies of July 18–Aug. 4, extending from the Marne to the Aisne. This was the prelude to the general offensive of the Allied Armies and their uninterrupted march to the victory of Nov. 11. A typical "defensive-offensive" battle, it demonstrated at once the will of the French high command to impose its preconceived plan upon the enemy, and the rare faculty possessed by the French soldier of passing direct from parry to riposte with an energy and vigour that recent ordeals seemed only to have strengthened. (*See* also GERMAN OFFENSIVE.)

I. INTRODUCTION

Two months earlier, Gen. Foch, Commander-in-Chief of the Allied Armies, had decided to take the initiative at the first possible moment,[1] and, true to the principle that "to make war is to attack," was determined to give the enemy no further respite once he had gripped him. The opportunity he sought was given him by a mistake on the part of the German supreme command, which, having crowded its forces into the pocket of Château-Thierry, was now to find the position made worse by the resounding check to the offensive in Champagne.

German Plans.—The Allies had had information at the beginning of July of two German plans of offensive: one on the French front in Champagne, the other on the British front from Arras to Ypres. It remained to be seen which would be launched first, for the enemy had not the necessary reserves and material for the execution of the two simultaneously on such extended fronts. It soon became known that the attack in Champagne would precede that in Flanders and would take place about July 9 or 10. As it turned out, the check to the first offensive was to prevent the enemy from executing the second. The enemy's plan was known in detail: he was to attack on either side of Reims, the principal effort being entrusted to the I. and III. German Armies, moving on Châlons, while the VII. Army crossed the Marne in the direction of Dormans and rejoined the main attack in the region of Épernay.

Foch's Preparations.—Meanwhile Foch was preparing the severe riposte that he was about to inflict on the enemy. To meet the essential requirements of the expected defensive battle in Champagne and, at the same time, to make provision for the counter-offensive which Pétain was preparing in the Soissonnais,

[1] Order No. 3 of Foch, May 20.

he brought together between the Oise and the Argonne a reserve mass of 38 infantry divisions (29 French, four British and five American) and six French cavalry divisions. These strong reserves were to be augmented at an early date by the arrival of new American divisions, just in time for the critical moment when the adversary could only with difficulty maintain his forces. Thus, in the middle of July, the point was reached at which the balance between the forces became re-established and was about to turn in the Allies' favour. This was the moment chosen by Foch for taking the offensive.

Composition of French Army.—Before defining the part played by the French Armies in the second battle of the Marne, it may be as well to state that they comprised, at that time, 103 divisions, divided into three groups of armies under the command of Gen. Pétain, whose headquarters were at Provins.

TABLE I.

Reserve Group
Gen. Fayolle, at Noailles

	Commander	Head-quarters	Area
I. Army	Gen. Debeney	Conty	Amiens region.
III. Army	Gen. Humbert	Clermont	St. Just-en-Chaussée region.
X. Army	Gen. Mangin	Versigny	Villers-Cotterets region.
Centre Group *Gen. Maistre, at Sézanne*			
VI. Army	Gen. Degoutte	Trilport	Château-Thierry region.
V. Army	Gen. Berthelot	Montmort	Reims and the south.
IV. Army	Gen. Gouraud	St. Memmie	East of Reims.
IX. Army	Gen. de Mitry	..	Between VI. and V. Armies.
Eastern Group *Gen. de Castelnau, at Mirecourt*			
VIII. Army	Gen. Gérard	Flavigny	..
VII. Army	Gen. de Boissoudy	Lure	..

Degoutte with his VI. Army was later placed under the orders of Fayolle, in the reserve group of armies. De Mitry's IX. Army was brought in during the course of the battle.

These forces held 600 km.—this being about two-thirds of the total Allied front.

General Organisation of the Offensive.—The general-in-chief had, on July 12, stated the mission of the two groups of armies to be: "to reduce the pocket of Château-Thierry by means of two lateral thrusts towards the plateau situated north of Fère-en-Tardenois . . . . " so as to bring about the junction in this region of the two groups of armies, the tactical limits for which were clearly marked by the line Château-Thierry (for the Reserve group), Fère-en-Tardenois (for the Centre group). He had, as early as July 8, settled the means that would be at their disposal, defined the action they were to take, and ordered the preparation.

But the Centre group of armies, against whom the imminent attack would be directed, had still first to break this attack and in due course re-establish the continuity and security of its front; after which it would immediately proceed to the counter-offensive with all the means at its disposal, and Gen. Pétain exhorted "the command of every échelon to set themselves resolutely to act on the principle of simple, audacious and rapid methods of attack."

II. THE GERMAN OFFENSIVE IN CHAMPAGNE

From July 1 onward the French IV., V. and VI. Armies were on the alert and ready to receive the assault. The IV. Army (Gouraud), to the east of Reims, occupying a highly organised front, was to make a completely successful test of the new method of disposition in depth, ordered by Gen. Pétain. It had finally been decided to leave nothing along the line of outposts (constituted by the Monts de Champagne) but "islands" of resistance, which would be required to sacrifice themselves for the purpose of dissipating the enemy attack and keeping it under the well-controlled fire of the main position established in the rear. The moral preparation was on a level with the organisation of the defensive, and General Gouraud was able to address his men in such terms as these: "The bombardment will be terrible. You will stand it without flinching. The attack will be formidable, delivered in clouds of dust, smoke and gas . . . . but you will break it and it will be a great day. . . . " It was not possible to prescribe a rigorous application of the principle of defence in depth (as in the case of the IV. Army) for the V. and VI. Armies, as their defensive organisation was recent; it was to be feared that in their case the manoeuvre would develop under less favourable conditions.

On the 14th, at 8 P.M., a *coup de main* by the IV. French Corps brought in 27 prisoners, who, on being questioned, revealed the fact that the German attack was to be launched that night, the artillery preparation being timed for 12:10 A.M. But before it

began, the French counter-preparation and counter-battery fire opened on the whole of the enemy front. The enemy, though stupefied by the number of our batteries, carried on according to programme, and, between 4:15 and 5:30 A.M., the German infantry advanced to the attack on a 90 km. front, from Château-Thierry to Massiges (leaving out the Reims Salient). To the east of Reims, thanks to the steps taken by Gouraud, the attack suffered a complete reverse. The enemy infantry was broken up by French artillery fire and decimated by the machine-guns distributed along the outpost line before even reaching the main line of resistance, which, in spite of repeated assaults, they failed to break at a single point. To the west of Reims the situation was less favourable.

German Success at Dormans.—In front of the V. Army (Berthelot) the enemy made some progress between the Marne and the Ardre in the direction of Épernay, and the French Centre (V. French Corps and II. Italian) was thrown back on the second position along the line Pourcy-Belval-Reuil-sur-Marne. Lastly, the right of the VI. Army (Degoutte) was not able to stop the enemy from crossing the Marne on either side of Dormans, between Jaulgonne and Verneuil. The VII. German Army thus established a bridgehead south of the river, in front of the V. Army's left and the VI. Army's right; it also regained touch with the I. German Army on the slopes of the Montagne de Reims. On this side the situation was therefore serious, and Pétain decided to check the adversary's advance by reducing first of all the pocket which had just been formed. To this end he engaged, on the 16th, practically the whole of the Allied reserves intended for the defensive battle.

The French command was now confronted with a serious problem. It was still three days to the counter-offensive, which the Reserve group of armies had orders to carry out on July 18. The question was, whether to continue the preparations for this counter-offensive and risk losing the Montagne de Reims or to suspend preparations in order to parry the immediate blow. Foch decided to maintain his plan of offensive intact, and gave orders to proceed with the preparation. The general staff of the British XXII. Corps and the 51st and 62nd Divisions were already on the move; these divisions were to appear on the field of battle of the Centre group from the 19th onward. Following them on July 17th the British 15th and 34th Divisions were to march for the neighbourhood of Pont Sainte-Maxence and of Chantilly-Senlis respectively at Foch's disposal.

German Attack Checked.—The German attack had degenerated into local actions, disconnected and therefore useless, from July 16 onward. By vigorous counter-attacks the French had even recaptured some of the enemy's *points d'appui*, while our artillery and aircraft, by bombarding the Marne crossings, made it more and more precarious for him to obtain supplies. The only progress in the attack—to the southwest of Reims between the Vesle and the Marne, on July 16—remained fruitless, for it had cost the enemy too dear for him to repeat such sacrifices.

After two days of useless efforts, therefore, the German command stopped the costly " Friedensturm " operation, on which they had based their supreme hope, and on July 17 their army was on the defensive. The third grand offensive, which the enemy had carried out with even more powerful means than the two preceding ones (44 divisions on a front of 80 km.), had failed completely. On July 18 was to be launched the French counter-offensive, in which British and American divisions were to participate. Fortune had changed sides. The operations of the Centre group of armies for the clearance of the south bank of the Marne, the recapture of Château-Thierry and the disengaging of the Paris-Avricourt railway line, formed part of the general offensive action prescribed for the two groups of armies on July 12 and initiated by the Reserve group on the 18th, under conditions which will be dealt with later.

III. COUNTER-OFFENSIVE OF THE FRENCH

The French counter-offensive comprises two phases: (1) the first extends from July 18–28, and includes the victorious battles of Fayolle's main group of armies in the Soissonnais and on the Ourcq, and the closing stage of the defensive battle of Champagne and Reims during the same period, in which the Centre group under Gen. Maistre re-established its front and passed to the attack. This first phase, again, comprised three successive manoeuvres: the breaking of the enemy positions by the Reserve group of armies on July 18 and 19; the re-occupation of Château-Thierry and the south bank of the Marne by the Centre group of armies, in combination with the right of the Reserve group, on July 20 and 21; and the co-ordination by the general-in-chief of the main effort of the two groups of armies on both banks of the Ourcq in the general direction of Arcy-Sainte-Restitue and Fère-en-Tardenois on July 23 and 24. (2) The second phase, sometimes called the battle of Tardenois, extends from July 29 to Aug. 4, and includes the recapture of Soissons and the push towards the Vesle.

French Preparations for Attack.—We have seen that, acting upon Pétain's instructions of July 12, Fayolle prepared a counter-offensive for the 18th, which aimed at reducing the pocket of Château-Thierry. These preparations were continued with the utmost secrecy while the Centre group of armies (Gen. Maistre) were checking the last enemy offensive (July 15 and 16) and (from the 17th) arranging a counter-attack. In this connection it is interesting to take stock of the means which Maistre was to have at his disposal for passing direct from parry to riposte and those which Fayolle, for his part, was assembling in silence in the region of Villiers-Cotterets on the right flank of the enemy's Marne salient.

The counter-offensive of the Centre group was entrusted to two armies, the V. and the IX., the latter having been put into the front between the V. and VI. Armies. The V. Army (Berthelot), which had been so heavily attacked at Reims, had eight divisions in first line (including the Italian 3rd Div.), and one infantry and two cavalry divisions in second line. Three of its divisions, among them the Italian 8th Div., had been withdrawn for reconstruction. At the same time the British 51st and 62nd Divs. were now being held in reserve in the Vertus-Avize zone. The IX. Army (de Mitry) had five divisions, including the American 3rd Div. in first line, one division in second line, and two reserve divisions, including the American 28th Division. Two other divisions were in course of reconstruction. On the 17th the mission of the two armies was confirmed: they were to regain all the ground lost between Reims and the Marne and to clear the south bank of the river at the same time as the Reserve group of armies launched its attack. The reserve group operated with the X. and VI. Armies. The X. Army, under Gen. Mangin (battle headquarters at Bonneuil-en-Valois), who was responsible for the main attack, had 10 divisions in front line, including the American 1st and 2nd Divs., placed on the flanks of the Moroccan Div. in the centre of the army, and six divisions in second line and the II. Cavalry Corps, making a total of 16 infantry divisions and three cavalry divisions. In the rear of the army the British 15th and 34th Divs. were in reserve to the east of Pont Sainte-Maxence and Senlis. In addition, the army was given a large number of tanks and strong artillery reinforcements. The task which Mangin set before his troops was " to break through the enemy front between the Aisne and the Ourcq and push straight on in the direction of Fère-en-Tardenois in liaison with the offensive of the VI. Army."

On his right the VI. Army, commanded by Degoutte, whose own right was engaged in the defensive battle, had only seven divisions in front line—among them the American 4th and 26th Divs. (American I. Corps at la Ferté under Jouarre)—and one division in second line. The battle headquarters was at May-en-Multien. Degoutte was to attack with his own resources only, reinforced, however, by tanks. His orders were that " the main attack would take place between the Ourcq and the Rû d'Alland with the object of reaching the line Neuilly-Saint-Front—rounded hill of Breuil—and eventually of developing the attack in the direction of Coincy in liaison with the X. Army towards Brény-Armentières." He had further at his disposal the British 9th brigade of the Air Division, which was to " support his attacks."

Secrecy of Concentration.—The operations of the Reserve group of armies had been prepared with infinite precautions for maintaining secrecy—the essential factor in a surprise. The reinforcing divisions were only brought up to the front during the last two days, their movements being carried out by night, between July 14 and 16, the mounted elements marching and the unmounted carried by motor transport. No more rapid and complicated concentration had ever been carried out. Pétain had issued an order on the 17th stating the conditions of the counter-offensive for the following day, which concluded with these words: "The general-in-chief expects that the ardour and energy displayed by all will make July 18 a glorious day."

A violent storm which burst noisily during the night of the 17th–18th intensified the darkness and made movements in the woods very difficult; but it was favourable to secrecy and by 4 A.M. on the 18th the X. and VI. Armies were in position and ready to move without any sign of uneasiness being shown by the enemy. At the same hour the Centre group of armies was preparing to counter-attack. At 4:35, without a single preliminary round, the whole of the French artillery opened fire from the Aisne to the Marne, and 16 front line divisions dashed forward with the tanks, while all the air squadrons went up. In the X. Army the infantry and tanks advanced without an artillery preparation behind a rolling barrage, turning the enemy's strong defensive positions and quickly gaining a footing on the plateau northeast of the forest of Villers-Cotterets. In the VI. Army, on the contrary, the attacking divisions continued their artillery preparation against the enemy's defensive position for 1½ hours, and only attacked at 6:05.

The surprise was complete, and, along the whole front, the enemy lost practically all his advanced units and batteries. His resistance was only effective in two localities on the broken ground from Louâtre to the Buisson de Hautwison, at which point the XI. Army Corps, having no tanks, progressed only with difficulty and to the west of Neuilly-Saint-Front, where the II. Corps came under oblique fire from the heights of Chouy. Mangin received information of the first results achieved towards 8 o'clock, and exploited them without delay by the judicious use of his reserves. General Robillot's Cav. Corps had experienced extreme difficulty in debouching from the forest of Villers-Cotterets, which was encumbered with troops and baggage, and could as yet operate only with dismounted squadrons—the hour of the cavalry had not struck! On the first day the enemy lost 12,000 prisoners and 250 guns.

The battle raged through the night of July 18–19 and throughout the day of July 19. The two French armies substantially attained their objectives, even in the difficult region of Louâtre-Chouy-Neuilly-Saint-Front, where the XI. and II. Corps combined their attacks to subdue the enemy resistance. The artillery and air force were both definitely superior to those of the enemy. The artillery pushed its batteries forward and the bombing machines attacked the Marne crossings and the enemy concentrations at Oulchy-le-Château and Fère-en-Tardenois.

The Central Group Reinforced.—While Fayolle's group of armies had, by means of heavy pressure and exploitation of the surprise, penetrated deeply into the enemy's positions, the Centre group was preparing to clear the south bank of the Marne. But its units were exhausted by the resistance they had to put up against the German attacks of July 15–18, and in order to reinforce them with fresh troops the British XXII. Corps (51st and 62nd Divs.) was brought in to relieve the Italian Corps. Pétain took care to insist that it was not a question of a simple relief. "It will be carried out on the move—that is to say, it will take the form of a surprise attack, carried out with the co-operation of the French units on either side."

Foch defined the character that the battle was expected to take as follows: "The battle, when engaged, will be conducted with the utmost energy and without waste of time, in order to exploit the advantage gained by surprise." Nevertheless it was not until the 20th that the Centre group was able to push forward. On that day its IX. Army reached the south bank of the Marne, evacuated by the enemy during the night, while in the V. Army the British XXII. Corps was heavily engaged in the Courton wood, where it took several hundred prisoners.

The fighting continued to be very severe throughout July 21 and 22. On the two wings of the French disposition the enemy offered a stubborn resistance to the attacks of the X. and V. Armies which pressed on their flanks. It was evident that he wished to gain time for evacuating the material and troops that he had risked towards the Marne. At last, however, on July 21, at 7 A.M., the 39th Div. of the XXXVIII. Corps, attached to the VI. Army since that morning, reoccupied Château-Thierry. The American 3rd Div. crossed the Marne in its turn, to the east of the town, and entered the Barbillon wood. In the VI. Army the American I. Corps and the French VII. and II. Corps advanced on the plateau of Etrepilly and Latilly, and on the 22nd, at noon, the VI. Army re-established its communications by way of Château-Thierry. On the same evening elements belonging to the V. Army gained a footing north of the Marne, at Port à Binson and two battalions of the IX. Army crossed the river at Passy-sur-Marne.

Capture of Butte Chalmont.—From the 22nd onward the two groups of armies exercised continuous pressure upon the enemy, the Air Division co-operating in mass in the pursuit. But the whole interest of the battle was focussed, on July 25, on the heights dominating the Ourcq valley from the north—Orme du Grand Rozoy and Butte Chalmont. Once these heights were captured, the X. Army would be able to push on the Arcy-Sainte-Restitue and the VI. Army to move on Fère-en-Tardenois, skirting the wooded region on the north side, in conformity with the plan of the French high command. On July 25 the two divisions of the French XI. Corps took by assault Oulchy-la-Ville and Oulchy-le-Château and gained a footing on the west slopes of Butte Chalmont, thus depriving the enemy of all hope of re-establishing himself on the Ourcq. The two armies[1] lost no time in following up their success, as soon as they had concentrated all their available means and relieved those units which had been most severely tried. The VI. Army was indeed able to shorten its front and rearrange its disposition accordingly. A fresh division, the American 42nd, was also added to it.

Advance Checked at Fère-en-Tardenois.—The attacks went forward on the 27th. "Forward! . . . however tired the troops!" telegraphed Fayolle, and progress continued to be made on July 27 and 28 as follows: the VI. Army reached the Ourcq and gained a foothold in Fère-en-Tardenois; the V. Army reoccupied its positions of July 15, and the divisional cavalry pushed its patrols beyond the infantry's advanced guards. But from the 28th, at noon, the VI. and V. Armies met with a stubborn resistance and a barrage that was solidly established from Fère-en-Tardenois to Ville-en-Tardenois. The II. Corps was unable to debouch from Fère. The American I. Corps, which had advanced as far as Sergy, was violently counter-attacked there by a Guards Division. The village was taken and retaken four times and finally held by the American 42nd Div., though only at the cost of heavy losses.

The advanced guards of the V. Army could debouch neither on Villers-Agron nor on Ville-en-Tardenois. In the centre, therefore, the situation remained practically unchanged on July 29 and 30. On the two wings there was fierce fighting on the 28th, on the west towards Buzancy, where the British 15th Div. gained a footing in the village and was driven out again, but succeeded in holding the park of the château; and on the east, where the enemy made repeated counter-attacks and the Allies had to fight costly engagements in order to hold their recent gains. Only the right of the X. Army made definite progress. On the 28th the XI. Corps took Butte Chalmont, and on the 29th the XXX. and XI. Corps with the British 34th Div. occupied Grand Rozoy; but the divisions in line had reached the limit of their powers after several days of incessant fighting.

First Phase of French Offensive Complete.—The enemy had made heavy sacrifices to gain solid support for his flanks and cover his line of retreat towards the Vesle. The resistance that

[1] The IX. Army had been withdrawn from the front since the 25th. The III. Army Corps had joined the V. Army.

he offered everywhere made it clear that he was not to be underestimated but was capable of violent reactions, and it now became necessary to hasten his retreat by a direct action against the plateaux of the Tardenois. The first phase of the French counter-offensive was now at an end: the Marne valley and the Paris-Avricourt railway line had been completely cleared. This was the first of the " clearance " offensives laid down in the orders of July 24, which had been issued by Foch to the commanders-in-chief of the Allied armies. The second phase was now to begin, and Fayolle's appeal to the endurance of the troops was indeed timely, in view of the severe battles that lay before them without hope of respite before the winter.

The days of July 30 and 31 mark a pause in the progress of the French armies, which on July 29 received fresh instructions from Pétain for the combination of their attacks. The VI. Army, reinforced by the III. Corps and charged with the main action, was to " push vigorously, and without stopping, in the general direction of Fismes and Bazoches with its whole front, its left to establish itself in the region of Saponay so as to facilitate the debouching of the right wing of the X. Army towards Cramaille." The X. Army was to make every effort, by successive actions starting from its right (the south), to reach the line Bois d'Arcy, upper course of the Crise, and then by way of the Arcy-Sainte-Restitue plateau to work in the general direction of Braine. " The V. Army was to support the right wing of the VI. Army, making its effort in the direction of Romigny-Lagery-Crugny, along the heights on the south bank of the Ardre." It was to be kept in mind that the enemy, with his wings reinforced, might launch counter-attacks between the Oise and the Aisne or on the Reims salient. Considering the nature of the coming operations, it was not expected that the two cavalry corps would be used, and the commander-in-chief therefore withdrew them and moved them to the neighbourhood of Vitry-le-François and Beauvais in readiness for the two Franco-American and Franco-British offensives that were being prepared.

Redistribution of Troops.—Reliefs were effected within the armies. The VI. Army put considerable American forces into line: the 42nd and 32nd in the first line, the 4th and 28th in second line, while the 26th and 3rd were being reconstituted in the Marne valley.

In the X. Army, Mangin, convinced that he could obtain a decisive success in carrying the heights north-east of the Grand Rozoy, rested his troops on July 30 and 31 in view of this new effort. The V. Army withdrew the British XXII. Corps and replaced them by two French divisions. The VI. Army resumed its attacks on the 31st. The American 42nd Div. maintained its hold of Seringes-et-Nesles in spite of enemy counter-attacks, and the American 28th, 32nd and 4th Divs. entered Cierges and the Meunière wood. In this way the enemy's attention was drawn to the centre on the evening of the 31st, while the next morning (Aug. 1), at 4:45, the right of the X. Army attacked in its turn and, after severe fighting, occupied the whole crest that extends from L'Orme du Grand Rozoy to Saponay inclusive. On the same day the VI. Army, though it succeeded in capturing the Meunière wood, failed before Saponay on account of the extreme fatigue of its attack divisions. Its artillery gained a definite superiority of fire, however, and the air force reported numerous outbreaks of fire and explosions in the enemy's rear. Nevertheless an obstinate resistance was maintained throughout the night by the enemy.

German Retirement to the Vesle.—At dawn on Aug. 2 the three French armies found themselves facing a void. The enemy had fallen back on the Vesle, where he intended to establish himself firmly. The forward movement of the Allied divisions was preceded by advanced guards, which soon regained contact, and by evening the troops had reached the plateaux of Ambief, Mareuil-en-Dole, Dravegny and Lhery, reoccupying Soissons at 7 P.M. On the 3rd, the left of the X. Army reached the Aisne. Its right, together with the VI. and V. Armies, arrived in the immediate vicinity of the Vesle. Contact was established everywhere. All along the front the enemy artillery and machine-guns became very active. On Aug. 4 and 5 the Allied troops lined the banks of the Vesle, the American 32nd Div. entered Fismes and the advanced guards were even able to push some units north of the river at several points. But the enemy reacted vigorously, and in view of this well-organised resistance Foch had to consider whether to carry on operations beyond the Vesle or to remain on the south side for the time being.

It was obvious that a passage could only be forced by a set battle in great strength. At the moment, other Allied offensives were on the point of being launched in Picardy and Santerre in accordance with the plan made by Foch on July 24 in the midst of the battle of the Marne. It was desirable to reserve any available Allied troops to insure the success of this plan, which was of so varied a character that the enemy, surprised by the points against which attacks were directed, would not have time to parry them. It was for this reason that the order was given not to undertake any strong action north of the Vesle, but yet to keep the enemy under the impression that such an action was in preparation, particularly on the date chosen for the Franco-British offensive, which would thus have more chance of a surprise.

IV. RESULTS OF THE BATTLE

The second battle of the Marne was now over. After three weeks of bitter, vehement and uninterrupted fighting, in which the French armies exerted themselves at times up to the limit of human endurance, the following results had been achieved—of great importance materially and of incalculable moral value: The capture of 30,000 prisoners, over 500 guns, 200 trench mortars and 3,000 machine-guns; the shortening of the front by 45 km.; the restoration of the Paris-Châlons railway line and the removal of the threat against Paris. But above all, the enemy morale was shaken while that of the Allies was strengthened. Finally, the initiative of operations had passed to the side of the Allies, and, in addition, their numerical superiority was assured from that time onward by the arrival of the American forces and their inclusion in the battle, for the battle that was just finished marked the actual entry *en bloc* of American divisions in the offensive battle.

It was not, could not be, a surprise to any Frenchman—and still less to the enemy, who had had four years' experience of the British armies—to see the four British divisions which were fighting among the French divisions cover themselves with glory; but it was questionable whether the enemy had foreseen that the young American divisions, going into the attack with their organisation only just completed and their training still unfinished, would be able to make good both the one and the other by their energy, dash and courage, and by the fine confidence and disdain of danger which is to be looked for in so great a nation.

It was in the height of this struggle that Foch, relying presumably on the results already achieved, forestalled events to some extent in order to hasten them, and, calling together the commanders-in-chief of the Allied armies, issued to them his famous orders of July 24, of which it may be said that they covered the rest of the campaign and contained the germ of victory. Among the so-called " clearance " offensives that he designed in order to get possession of a base of departure for a general offensive, the one developed between the Marne and the Aisne had already done what he required of it. In fact, the action of the troops responded to the idea of the Chief with a rapidity which, so to say, emphasised the excellence of his plan and justified all hopes.

The battle whose scene was in the theatre of the Marne for the second time in less than four years thus marked a turn of the tide in favour of the Allies, and, by associating British, American and Italian forces with the glorious success of the French armies, formed an auspicious prelude to the general offensive. *See* VICTORY, ADVANCE TO.

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(E. R.)

MARRAKESH, or Morocco (*see* 17.753), the southern capital and largest town of Morocco, had a population of 139,874 in 1921, 1,956 being Europeans. A European town outside the old city, at the foot of the hills of Geliz and near the military camp, was founded in 1913, and has wide roads planted with trees; it is joined to old Morocco by the fine Avenue de la Koutoubia. There is also a new quarter, with shops and a public garden, in the city itself, and an hotel was opened in 1924. French and Franco-Arab schools have been started. The sub-division of Morocco is under a French military governor, who is in charge of the municipal services, and it has a French court, with right of appeal to the court of first instance at Casablanca. There are good roads to Mazagan, Mogador, Safi and Casablanca, where the trade of the city is handled; and one to Fez was in course of construction in 1925. There is connection by narrow-gauge railway with Casablanca and the rest of Morocco, and a standard-gauge line to Casablanca was under construction in 1926.

MARRIAGE LAWS (*see* 17.753).—It is obviously impossible here to do more than refer very briefly to the more important changes which have taken place in the marriage laws of civilised states since the last article on the subject was published.

I. THE BRITISH EMPIRE

Marriage Abroad.—The object of the Foreign Marriage Act 1892 was to provide that all marriages celebrated abroad—in British possessions outside the United Kingdom as well as in foreign countries—between parties one of whom at least is a British subject, before a "marriage officer" in the manner provided by the Act, should be as valid as if duly solemnised in the United Kingdom. Thus a marriage duly solemnised under the Act before a British Consul in France, although void by French law, was held valid in England (*Hay* v. *Northcote* [1900] 2 Ch. 262). But by the Foreign Marriages Order in Council 1913, where a marriage according to the local law of a foreign country would be valid by English law, the marriage officer must be satisfied (*a*) that both the parties are British; or (*b*) if only one is British, that the other is not a national of the country; or (*c*) if one of the parties is British and the other a national of the country, that sufficient facilities do not exist for the solemnisation of the marriage in the foreign country in accordance with the law of that country; or (*d*) if the man is British and the woman a national of the country, that no objection will be taken by the authorities of the country to the solemnisation of the marriage under the Foreign Marriage Act. From the decision of the marriage officer there is a right of appeal to the Secretary of State.

Further, if it appears to the marriage officer that the woman is British and the man an alien he must be satisfied (*a*) that the marriage will be recognised by the law of the country to which the alien belongs; or (*b*) that some other marriage ceremony, in addition to that under the Foreign Marriage Act, has taken place or is about to take place and that such other ceremony is recognised by the law of the alien's country; or (*c*) that the leave of the Secretary of State has been obtained. Measures have been passed to give effect to these provisions in the Bahamas, Gilbert and Ellice Islands, Gold Coast, Nigeria and Sierra Leone.

Recognition of Banns, etc.—The Marriage of British Subjects (Facilities) Act 1915 provides for the mutual recognition of certificates, publications of banns, or notices of marriage issued in the United Kingdom, and in any part of His Majesty's dominions outside the United Kingdom respectively, in the case of marriages intended to be solemnised in either, between British subjects resident in either respectively. These provisions may be applied to any part of the dominions where the law makes due provisions for the publication of banns, or notices for marriages between British subjects intended to be solemnised or contracted in the United Kingdom, and for the recognition of certificates for marriage. Reciprocal legislation in the dominions is a condition precedent to the issue of an order in council. Such legislation has been passed by the Bahamas, Barbados, Bermuda, British Solomon Islands, Cyprus, Gambia, Gibraltar, Gilbert and Ellice Islands, Gold Coast, Grenada, Hongkong, Mauritius, New Brunswick, New Zealand, Nigeria, St. Lucia, St. Vincent, Sierra Leone, Straits Settlements, Uganda and Victoria.

By the Marriage of British Subjects (Facilities) Amendment Act 1916, however, where the marriage is to be solemnised or contracted in the dominions, and no notice of the marriage under the law in force there is required, the Act of 1915 may be applied to that part of the dominions by order in council. By special statute any marriage celebrated abroad (either in British possessions or in foreign States) and being of doubtful validity may be validated here. There are many instances of this procedure, *e.g.*, the Marriages in Japan (Validity) Act 1912.

Deceased Wife's Sister, etc.—Marriage with a deceased wife's sister has been legalised in the Falkland Islands, Fiji, Jamaica and the Leeward Islands, and also, subject to the proviso that misconduct with the sister makes the marriage void, in Nigeria, St. Lucia, St. Vincent, Straits Settlements, Trinidad and Tobago; the Union of South Africa Act of 1920 legalises such marriages in Natal and the Transvaal, and the Marriage Decree 1915 in Zanzibar.

The Deceased Brother's Widow's Marriage Act 1921 legalises the marriage of a woman with her deceased husband's brother, including the half-blood. The same freedom is accorded in British Guiana, the Isle of Man, Jamaica, Leeward Islands, the Union of South Africa and Western Australia. Legitimation by subsequent marriage is allowed in New Brunswick and British Columbia.

Divorce.—The English divorce law has been modified by the Matrimonial Causes Act 1923 under which a husband's adultery committed since July 18 1923 entitles the wife to divorce without proof of other matrimonial offences.

In New Zealand the Divorce and Matrimonial Act 1908 has been amended by the Act of 1912, which reduces to seven years the period of detention in an asylum as a ground of divorce, while the Act of 1919 provides for the custody of children by the wife of a person of enemy origin. By the Marriage Amendment Act 1920 the allegation that persons are not lawfully married or that children are illegitimate is made a punishable offence on summary conviction by a fine of £100. The Act of 1920 extends the grounds for divorce to failure to comply with a decree for restitution of conjugal rights, and grants a divorce on a petition after three years from a degree of judicial separation or separation order or deed of arrangement or separation by mutual consent. Detention in an institution for insane persons, whether situate in New Zealand or in any other part of the British Dominions, is also a ground for divorce.

In Queensland, by the Act of 1923 lunacy for a period of five years is made a ground for divorce. The Tasmanian Marriage and Divorce Act 1919 enables a husband to petition on any of the following grounds: adultery, desertion for four years, habitual drunkenness and neglect during three years, imprisonment, violent assault, lunacy. The Victorian Marriage Act 1923 amends the Marriage Act 1915, the Marriage (Maintenance) Act 1919 and the Divorce (Insanity) Act 1919. The following are grounds for divorce: wilful desertion by either for three years, habitual drunkenness of husband with lack of maintenance of, or cruelty to, the wife, and habitual drunkenness and neglect of wife, imprisonment, violent assault, adultery of husband in the conjugal residence, or coupled with circumstances or conduct of aggravation, or of a repeated act of adultery, or lunacy, and adultery by the wife.

By the Divorce and Matrimonial Causes Act 1912 of Western Australia the grounds for divorce are adultery of the wife and adultery, sodomy or bestiality of the husband, desertion by either for five years, habitual drunkenness for four years of husband and lack of support of wife, and habitual drunkenness and neglect of wife for like period, imprisonment, violent assault and lunacy. By the Divorce Amendment Act 1919 incontinence by

either before marriage is added, provided the woman was pregnant at the time of the marriage. The Married Women's Protection Act 1922 repeals the Summary Jurisdiction (Married Women) Act 1896 and provides protection to a woman whose husband is guilty of cruelty to her or her children, adultery, desertion, wilful neglect to provide reasonable maintenance for her or her children. In Zanzibar a decree of 1912 regulates marriage. The Marriage (Scotland) Act 1916 provides for the joint application of the spouses for a warrant to register an irregular marriage.

II. OTHER COUNTRIES

Baltic States.—In Estonia, Latvia and Lithuania civil marriage is now compulsory.

Belgium.—Marriage between a brother-in-law and a sister-in-law, whether legitimate or illegitimate, is prohibited by the law of 1920, where the marriage which produced the relationship has been dissolved by divorce, but it is legal where the previous marriage has been dissolved by death.

Cuba.—The Spanish civil code 1889–99 has been amended by the Act of 1918, by which marriage is a civil contract, and is only legally effective if celebrated in accord with the code. Separation and divorce are established by the law of 1918. The grounds for divorce are adultery, prostituting the wife or children, grave injury by violence, words, or conviction for crime, grave crime against the wife or children, habitual drunkenness, confirmed gambling, desertion, failure of husband to maintain the home, contagious disease and mutual consent. A divorced husband is not freed from his obligations to his children.

France.—Marriage between a brother-in-law and sister-in-law, whether legitimate or illegitimate, is prohibited by the law of 1919, where the marriage which produced the relationship has been dissolved by divorce, but it is legal where the previous marriage has been dissolved by death.

Italy.—By the law of 1919 a wife may, without her husband's consent, make a gift *inter vivos*, alienate, or mortgage her real property, make a contract of loan, transfer or collect moneys, enter into a contract of guarantee, compound or appear in court with regard to these affairs, be a trader or accept a mandate.

Mexico.—By the Law of Family Relations 1917 marriage is a civil contract by which the spouses are bound by a dissoluble bond. Community of goods is abolished, subject to any settlement. The impediments to marriage are habitual drunkenness, impotence, syphilis, insanity, and any other chronic and incurable infirmity. The following are causes for divorce—adultery, attempt to prostitute the wife, or make the other commit a crime, or corrupt the children; contraction of syphilis, tuberculosis, incurable insanity or other chronic or incurable disease; unjustified desertion for six consecutive months; absence of husband for more than a year, coupled with the obligations inherent in marriage; ill-treatment; false accusation of crime; commission of crime; incorrigible drunkenness; mutual consent. Adultery of the husband is a sole ground for divorce only in certain circumstances. Upon divorce either spouse may remarry. The custody of the children is granted to the innocent spouse. All proceedings are *in camera* and on the intervention of the Attorney-General.

Norway.—By the law of 1909 a marriage may be dissolved where either spouse unknown to the other at the time of the marriage suffered from bodily defect, epilepsy, leprosy, venereal disease, mental disease, or the wife was pregnant by another man. If divorced, the woman may not remarry within 10 months from judgment or licence.

Portugal.—By decree of 1910 marriage is a civil contract and is evidenced by civil registration, and all contracts under the name of betrothal or engagement are void. Divorce may be granted for complete abandonment of the home for three years, or absence for four years or separation *de facto* during 10 consecutive years, lunacy, contagious disease, incurable disease, conviction of homicide.

Sweden.—Separation and divorce are regulated by the law of 1920. Grounds for the former are mutual consent, neglect, drunkenness or debauchery; for the latter judicial separation for one year, three years' separation, two years' absence, bigamy, adultery, venereal disease, plot against life of spouse or imprisonment.

Switzerland.—By the Swiss civil code, which came into force Jan. 1 1912, the marriage laws were made uniform throughout Switzerland. The legal status of women is raised almost to an equality with that of men. The marriageable age for women has been raised from 16 to 18 and that of men from 18 to 20, but for both sexes under 21 the consent of parents or guardians is necessary. Mentally diseased persons are incapable of marriage. The betrothal, for breach of which damages may be awarded, is followed after publication by a civil marriage. Grounds for divorce are adultery, plot against life of spouse, abuse, gross insult, crime, desertion, mental infirmity or ruin of marital relationship. The guilty spouse may not remarry within the period prescribed by the Court.

Judicial separation may be temporary or permanent. If it has lasted for three years either spouse may sue for divorce. The father of an illegitimate child may be compelled to contribute to its support until the age of 18 in proportion to his social position. The children of a marriage which is declared null are legitimate even when neither spouse contracted it in good faith.

Turkey.—The civil code of 1926 is an adaptation of the Swiss, and radically changes the legal status of women, who obtain *inter alia* equal rights with men in divorce.

United States.—The minimum age for marriage has been fixed at 15 in Missouri, 16 in Arizona, and 18 in Tennessee, whilst in Montana marriage between first cousins and persons either of whom is feeble-minded is forbidden. In North Dakota marriage with a degenerate (if a woman under 45, if a man of any age) is prohibited. New York has reduced the period within which a guilty spouse may not remarry from five to three years, and Tennessee has made a ground for divorce such cruel or inhuman treatment of the husband by the wife "as renders it unsafe or improper for him to cohabit with her."

III. DOMICILE AND MARRIAGE

Desertion.—The rule was laid down in *Mesurier* v. *Mesurier* (in 1895) A.C. 517 and affirmed in the House of Lords in *Lord Advocate* v. *Jaffrey* (1921, A.C. 146) that matrimonial status is governed by the law of the domicile of the parties. Thus the domicile for the time being of the spouses affords the only true test of jurisdiction to dissolve the marriage. This domicile is that of the husband. In *Att. Gen. for Alberta* v. *Cook* (1926, 42 T.L.R. 317) the Judicial Committee of the Privy Council declared that under British law a wife, even when judicially separated from her husband, still retains his domicile and cannot acquire a domicile of choice.

But in certain cases of desertion the wife has been permitted to sue in the domicile from which the desertion took place, and thus was not compelled to follow her husband to his new domicile: *Armytage* v. *Armytage* (1898 p. 178); *Ogden* v. *Ogden* (1908 p. 46); *Statathos* v. *Statathos* (1913 p. 46); *De Montaigu* v. *De Montaigu* (1913 p. 154). This undoubtedly is a departure from what has always been the rule of law and practice in Great Britain and Ireland—viz.: that the wife's domicile is the husband's domicile, whatever that may be. But, as Lord Cave said in *Lord Advocate* v. *Jaffrey*, there is no doubt authority for the proposition that "the husband will not be allowed to set up his own wrong as an argument for prejudicing his wife's rights." This proposition has been made statutory in some of the colonies. By the Victorian Marriage Act 1915 "a deserted wife who is domiciled in Victoria at the time of desertion shall be deemed for the purposes of this Act to have retained her Victorian domicile, notwithstanding that her husband may have since the desertion acquired a foreign domicile." The Western Australian Act of 1912 and the Tasmanian Act of 1919 are to the same effect.

India.—It was decided in *Keyes* v. *Keyes et Gray* (1921, p. 204) that the courts in India had no jurisdiction to grant divorce to parties not domiciled in India, though the marriage was celebrated and the parties were resident there. By the Indian Divorce (Validity) Act 1921 divorce may be granted where the proceedings were commenced before the Act. By the Indian Divorce Amendment Act 1926 relief is restricted to parties domiciled in India.

United States.—Throughout the United States matrimonial status is governed by the law of the domicile of the parties only up to a point. This point is reached when the wife separates from the husband for a just cause (*i.e.*, any act of his which would entitle her to a limited or absolute divorce) or where they agree in writing to live apart; the wife may acquire a separate domicile and may obtain a divorce in the State of her domicile. In a nullity suit, since there never was identity of domicile, the wife retains her own domicile. This rule obtains also in England.

Domicile and Validity.—The general rule that a marriage valid by the law of the place of celebration is valid everywhere is usually subject to the condition that it is also valid by the law of the nationality or domicile of the parties. In New York State the guilty spouse, if divorced, may not remarry during the lifetime of the other but it seems that by changing his or

her domicile he or she may remarry, and that by the general rule such marriage will be valid in New York. To prevent such a result, Massachusetts has passed an Act providing that if a person residing in or intending to reside in Massachusetts is disabled by the law of that State from marriage, and marries in another State, such marriage is void in Massachusetts. And if a person residing in another State is married in Massachusetts, such marriage is void if it would have been void in the State where such person is domiciled. Louisiana has also passed an Act providing that marriages contracted between persons, one or both of whom are domiciled in Louisiana and forbidden to marry in that State, shall be deemed to be invalid, even if valid elsewhere.

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MARS: *see* ASTRONOMY.

MARSEILLE (*see* 17.766) is the second largest city in France, with a population of 586,341 in 1921. Housing conditions were very bad, dwellings which were condemned before the World War being still inhabited in 1920, and manufacturers in consequence experienced considerable difficulty in procuring labour. There was an influx of workers during the War, when there was considerable industrial development, largely in the provision of foodstuffs and in metal manufacture. Part of the harbour became a British base, and many Indian, Australian and African troops passed through, together with refugees from Europe and the East; after the Armistice an American embarkation camp was established.

Before the War Marseille was extremely prosperous, but during it trade collapsed, and there was less military activity than in the western ports. A period of great difficulty in industry and shipping has since been faced. In 1923 the total of goods discharged at Rouen, where little was shipped, exceeded the total of discharges and shipments at Marseille, hitherto the leading French port. The figures in 1926 were still below those of pre-War years. During the War basins in the harbour were deepened, and a new one has since been taken in hand. A railway now runs along the coast for 60 km. as far as L'Estaque. Much work has been done on the Marseille-Rhône canal. A small port has been built at its opening into the Gulf of L'Estaque; land has been assigned for industrial development, and industrial suburbs are arising along the bank of the canal where, protected by embankments, it runs along the coast and reaches the Lave by a tunnel 7,000 metres long. It is hoped that improved navigation on the Rhône, and the extension of the port to include the lakes of Berre and Caronte, will bring a large influx of trade to Marseille.

MARSHALL, ALFRED (1842–1924), British economist (*see* 17.770). In 1890 he published his *Principles of Economics* which went through many editions and was translated into a large number of foreign languages. He retired from the chair of political economy at Cambridge in 1908 in order to devote himself to writing. His next volume, *Industry and Trade*, a realistic study of industrial organisation, appeared in 1919, and this was followed in 1923 by *Money, Credit and Commerce*. He died in Cambridge on July 13 1924.

Marshall may be said to have been in the lineal descent of the great English economists—Adam Smith, Ricardo and J. S. Mill. Like their chief works, his *Principles of Economics* has become a classic. It was distinguished by its profound and systematic methods of analysis, and introduced a number of new concepts of great importance to the science. Although many years elapsed between the publication of the *Principles of Economics* and that of his next two works, much that was most important in them, especially in regard to the theory of money, has been transmitted orally in his lectures at Cambridge, and has influenced thought both in England and in other countries. While Marshall never tried to found a school of economic doctrine, his genius for stimulating the minds of a long succession of pupils and the example of his methods of reasoning have had a profound effect upon the development of economics in England, the British Dominions and the United States. Further information on his life and writings and a detailed bibliography of his works are to be found in the *Memorials of Alfred Marshall*, edited by A. C. Pigou.

MARSHALL, THOMAS RILEY (1854–1925), American politician, was born at North Manchester, Ind., March 14 1854. He was educated at Wabash College (A.B. 1873; A.M. 1876) and was admitted to the bar in 1875. From 1876 to 1909 he practised law in Columbia City, Ind., and from 1909 to 1913 was governor of Indiana. He was nominated for vice-president on the ticket with Woodrow Wilson at the Democratic National Convention in 1912 and was elected. He was again nominated with President Wilson in 1916 and elected for the term 1917–21. For almost two years after the outbreak of the World War he urged strict neutrality, but in 1918 publicly expressed regret for this attitude. In 1919 he welcomed the King and Queen of Belgium on their visit to Washington during the illness of President Wilson. He was a strong advocate of the League of Nations, but did not favour woman suffrage. He served on the U.S. Coal Commission in 1922. He died in Washington, D.C., June 1 1925. His memoirs, *Recollections of Thomas R. Marshall*, were published posthumously in 1925.

MARX, WILHELM (1863–), German politician, was born at Cologne Jan. 15 1863. He entered the political branch of the Civil Service and became a judge. In 1899 he was elected to the Prussian Diet and in 1910 entered the German Reichstag, where he soon became prominent among the leaders of the Centre. He was elected president of the Centre party in 1921, and on Nov. 30 1923 succeeded Stresemann as chancellor of the Reich. In Aug. 1924 he took part in the Conference of London which determined the acceptance of the Dawes Plan (*see* GERMANY). In the autumn of 1924 Marx dissolved the Reichstag in the hope of getting a government majority, and after the elections retired from the post of chancellor. In Feb. 1925 he became Prussian Minister-President for a short period. After the death of Ebert he stood as candidate for the post of president of the Reich, but was defeated by Hindenburg. In Jan. 1926 he became Minister for Justice and Occupied Territories in the second Luther Cabinet and later in the same year succeeded Luther as Chancellor.

MARY (1867–), Queen Consort of England, daughter of the Duke of Teck and Mary Adelaide, daughter of Adolphus, Duke of Cambridge, seventh son of George III., was born at Kensington Palace May 26 1867, and was baptised as Victoria Mary Augusta Louise Olga Pauline Claudine Agnes. She was affianced in 1891 to Albert Edward, Duke of Clarence, eldest son of Edward VII., who died Jan. 14 1892. On July 3 1893 she married George, Duke of York, and when he succeeded to the Throne, on the death of Edward VII., was crowned with him in Westminster Abbey June 22 1911. Both as Princess of Wales and as Queen she took a prominent part in public life, showing special and well-informed interest in all that concerned the welfare of women and children. This was particularly notable at the outset of the World War, when the organisation of relief, as well as the promotion of the women's part in public service, claimed and received her constant attention. By the universal testimony of those who came into direct contact with her through those anxious years, no one showed a more practical appreciation of the problems to be solved than the Queen. In the first month of the War she inaugurated (Aug. 20) the "Queen's Work for Women Fund" to provide employment for as many as possible of the women thrown out of work by the outbreak of war. Over 70 special relief workrooms were opened, through which about 9,000 women passed before Feb. 1915; after that date, the need became less as the women were gradually absorbed into munition making and other industries. On Aug. 10 1914 the Queen also inaugurated "Queen Mary's Needlework Guild" for the purpose of "organising a collection of garments for those who will suffer on account of the War." On March 11 1921 the

Queen showed her sympathy with the higher education of women by visiting the women's colleges at Oxford and responding generously to their appeal for funds. The interest shown by the Queen in the work of the hospitals and the welfare of the nursing profession during the post-War years was especially signalised when she opened the new College of Nursing (the gift of Lord and Lady Cowdray) in London on May 31 1926, and in other ways. (*See* GEORGE V.)

MARYLAND (*see* 17.827).—The population in 1920 was 1,449,661, as compared with 1,295,346 in 1910, an increase of 11·9% as opposed to 9% in the previous decade. In 1920 the urban population (that is, residents of towns of 2,500 inhabitants or more) was 869,422, while the rural population was 580,239, or 60% urban instead of 50·8% in 1910. A part of this increase of urban population may be accounted for by the annexation of portions of Baltimore and Anne Arundel counties to Baltimore City in 1918 (*see* BALTIMORE), by which the population of Baltimore received more than the normal increase for the decade.

The population of those cities in Maryland having more than 11,000 inhabitants and the percentage of increase for the decade was as follows:—

	1920	1910	Increase Per Cent
Baltimore	733,826	558,485	31·4
Cumberland	29,837	21,829	36·6
Hagerstown	28,066	16,507	70·0
Annapolis	11,214	8,609	30·3
Frederick	11,066	10,411	6·3

The greatest percentage of increase was the 70% (11,559 in number) of Hagerstown, an important railway and manufacturing centre of the Cumberland valley.

Agriculture.—In 1910, 48,923 farms occupied 5,057,140 ac., or 79·5% of the total land area of Maryland, of which acreage 3,354,767, or 66·3%, were improved lands. The slow transition of the state from an agricultural to a manufacturing community is manifested in a comparison of these figures with those for 1920, in which year there were reported 47,908 farms, taking up 4,757,999 ac., or 74·8% of the total land area, and showing 3,136,728, or 65·9%, in improved lands. There were 1,015, or 2·1%, fewer farms in 1920 than in 1910, a decrease of 5·9% in total acreage and 6·5% in the acreage of improved land.

In the same period the value of all farm property in the state rose from $286,167,028 to $463,638,120; of the average value of a farm from $5,849 to $9,678. The total farm value in 1920 comprised $386,596,850 in lands and buildings, $28,970,020 in implements, and $48,071,250 in live stock. The average number of acres per farm decreased from 103·4 in 1910 to 99·3 in 1920. The average value per acre of all farm property in 1920 was $97.44, instead of $56.59 as in 1910, and of land alone was $54·62, instead of $32.32. Of the total number of farms, 41,699 were operated by white and 6,209 by coloured farmers, a decrease in the first class of 2%, in the second class of 2·6%.

Of domestic animals on farms in 1920, the total value was $43,784,464. The number of horses in 1924 on farms was estimated at 135,000; of mules 33,000; of milch cows 196,000; of other cattle 103,000; of sheep 96,000 and of swine 299,000. The total value of livestock had decreased to $33,686,000 in 1924, a decline due partly to a decrease in the number of horses and partly to smaller prices prevailing for some classes of animals. The total farm value of Maryland dairy products in 1919, exclusive of products consumed on the farm, was $13,407,526, as against $5,480,900 in 1909, an increase of 144·6%.

The total area in crops in 1923 was 1,934,000 ac., as opposed to 1,927,000 in 1909. The peak year was 1918, when the total area was 2,245,000 acres. The total value of field crops in 1923 was $67,560,000. The corn acreage of Maryland was 647,000 ac., in 1909 (value of crop $11,015,000), and in 1923 the acreage was 642,000, the production 25,231,000 bu., the value of the crop $20,689,000. The wheat acreage was 589,000 in 1909, 664,000 in 1919, 543,000 in 1923. In the last year 10,426,000 bu. were raised, worth about $1.00 a bushel. Hay was grown on 398,892 ac. in 1909; 662,939 in 1919; 400,000 in 1923. In the last year 420,000 tons were raised, which was about one-half less than in the preceding year. In 1923, 59,000 ac. were sown in oats, producing 1,758,000 bu. valued at $949,000. In barley 4,000 ac. were sown producing 132,000 bu.; 17,000 ac. in rye, producing 269,000 bu.; 9,000 ac. in buckwheat, producing 199,000 bu.; 49,000 ac. in Irish potatoes, producing 3,920,000 bu.; 9,000 ac. in sweet potatoes, producing 1,170,000 bu.; 24,000 ac. in tobacco, producing 19,008,000 lb., with a value of $4,182,000.

The apple crop in 1923 amounted to 2,300,000 bu., with a value of nearly $2,000,000; the peach crop 631,000 bu., with a value of $946,000; the pear crop 374,000 bu., worth about $1.00 a bushel. The tomato crop was very important in 1923; 44,230 ac. were devoted to the crop, which produced 243,300 tons, worth $3,708,000. Most of the tobacco raised is exported to France and other European countries. In 1923, 10,420 ac. devoted to strawberries produced 20,840,000 qt. and Maryland excelled all other states, except Tennessee, in the total number of carloads shipped. The wool crop for 1923 amounted to 467,000 pounds.

Minerals and Manufactures.—The value of the products of all mines and quarries in Maryland in 1909 was $5,782,045, and in 1919 $9,698,577, an increase of 67% in the decade. Of this amount, bituminous coal amounted to $8,195,667, or 84·5%. The production of granite amounted to $627,625; of slate, $652,142. In addition, considerable amounts of limestone, marble, clay, asbestos and iron ore were produced. The coal mining is in the western counties of Alleghany and Garrett. The iron-ore produced is used entirely in the manufacture of metallic paints. In 1919, 5,628 persons were employed in 126 mining industries.

The total value of Maryland manufactures in 1909 was $315,669,150, and in 1919 $873,944,774, a sum which placed the state 17th in the Union in value of manufactured goods. Of the amount named, $677,878,492 was the product of Baltimore plants alone. In the entire state, there were in 1919, 165,875 persons engaged in manufacturing industries and $619,606,983 invested in them. In the period 1914–9, the value of Maryland manufactures advanced 131·4%. The following table shows the value of the products of certain industries in 1914 and 1919:—

Products	1919	1914
Men's clothing	$72,589,000	$39,048,000
Copper, tin and sheet-iron products	40,636,000	25,491,000
Canning and preserving	30,566,000	18,029,000
Lumber and timber products	18,744,000	11,911,000
Foundry and machine products	31,581,000	10,659,000
Meat	43,228,000	17,100,000

By 1919 there had been added to this list: cars and general shop construction and repairs, for steam railways, $22,837,000; printing and publishing, $23,835,000; fertilisers, $37,014,000. Since 1914 there has been a large increase in the number of manufacturing establishments and in capital invested in manufactures in Baltimore, so that the 57% which in that year was the contribution of that city to the value of manufactures in the state, has been increased. Outside of Baltimore, the chief manufacturing centres are the western Maryland cities, Cumberland and Hagerstown.

Fisheries.—A decreased output in fishery products, resulting from a lack of regulation of the taking of oysters from the natural beds, having been recognised, the state created, in 1916, a conservation commission. This commission was replaced by a conservation dept. in 1922. In spite of the attempt of the state to increase the supply of oysters, in 1923 it had further diminished to 3,440,810 bu., as opposed to 4,967,433 bu. by April 15 1921, before the close of the season. In Feb. 1925 an exhaustive investigation proved the healthful condition of the Maryland oyster.

Communications.—Beginning with the passage of the "Shoemaker, or State Aid" Act in 1904, the state entered upon a programme of road construction, the prosecution of which has provided it with one of the best road systems of any state. In 1908 the state roads commission was created by the Legislature to construct all state roads and state-aided roads, and as the result of its activities there have been built of both classes 1,585 m. of

macadam, concrete and other surfaced roads on the foundations of the once privately owned turnpikes and the unmetalled connecting county roads.

Education and Religion.—The development of Johns Hopkins University is given in that article. The small colleges of the state, such as St. John's at Annapolis, and Western Maryland at Westminster, have been engaged in important and successful campaigns for the increase of their endowments. In 1920 the Legislature passed an Act merging the University of Maryland (Baltimore), with its schools of law and medicine, and the Maryland State College of Agriculture (College Park, Md.) under the name of the University of Maryland, and under the control of a board of regents. In secondary education, the further betterment of the school system throughout the state was provided for by the reorganisation of the state Board of Education by legislative enactment of 1916.

History.—A series of Acts passed since 1910 indicates a progressive quality in the administration of the state. These Acts created the Public Service Commission (1910), the state Industrial Accident Commission (1914), the Conservation Commission (1916), the state Board of Prison Control (1916), the state Tax Commission (1914), the state Roads Commission (1908) and the reorganisation of the state Board of Education (1916). In 1916 the budget system was adopted, and in 1920 a merit system for state employees was put in operation.

In 1922, largely through the efforts of Gov. Ritchie, the government of the state was reorganised so as to consolidate and rearrange the executive and administrative departments of the state under 19 divisions. A state purchasing agent now secures supplies for these state departments. Four great military establishments were located in Maryland during the World War; the Aberdeen Proving Grounds, the Edgewood Arsenal, Camp Meade and Camp Holabird. Because of their good location and convenience to Washington, these establishments have been retained for military purposes by the War Department.

Maryland was the sixth state to ratify the prohibition amendment, but never ratified the suffrage amendment. Recent governors have been: Austin L. Grothers (Dem.), 1908–12; Phillips Lee Goldsborough (Rep.), 1912–6; Emerson C. Harrington (Dem.), 1916–20; Albert C. Ritchie (Dem.), 1920–6. The latter was re-elected by a plurality of 40,400 votes in 1923. In 1924 Maryland decided to cast its electoral vote for Coolidge by a plurality of 14,350.

Of late, Maryland has usually been Republican on national issues, but Democratic at state elections. Through the efforts of Gov. Ritchie, a constitutional amendment was passed providing for the election of state officers at the same time as the election of national officers. This reduced the term of many state officers then elected, from four to three years, and provided for a three-year intermission in the meeting of the Legislature. Beginning with Jan. 1927 the Legislature will meet biennially again, and the members of the two Houses will be elected for four-year terms at the same time as the governor.

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(B. C. S.)

MASARYK, THOMAS GARRIGUE (1850–), first President of Czechoslovakia, was born on March 7 1850 in the Moravian border-town Hodonin. His father was a coachman employed on one of the Austrian Imperial estates, a native of Kopčany in Slovakia (Slovakia then being a part of Hungary); his mother came from a semi-Germanised Czech family of Hustopeč, in the Moravian plains. In his boyhood Masaryk was taught Czech and a smattering of German, and was educated at a Czech school in Čejkovice. His parents sent him for two years to the lower German Realschule of Hustopeč, with the intention of making him a teacher.

The object being abandoned, he became first a locksmith's apprentice in Vienna, then a blacksmith at Čejč. In 1865 his former schoolmaster induced his parents to resume their first idea of making him a teacher, and in that year Masaryk passed the entrance examination to the second grade of the "gymnasium," and began studying at Brno. He supported himself, as did many poor students, by tutoring. He developed a rebellious disposition, disagreed with some of the dogmas of the Roman Catholic Church and refused to go to confession. As a result he had to leave the gymnasium, and he continued his studies in Vienna, where he graduated first from the gymnasium with honours, then from the University, where in 1879 he became a lecturer in philosophy. He spent a year in Leipzig, where he met his future wife, Miss Charlotte Garrigue, daughter of the President of the Germania Insurance Co. of New York. In 1881 he published in German his first great sociological work, *Suicide as a Phenomenon of Modern Civilisation*. In 1882, when the University of Prague was divided into two parts, the one Czech, the other German, he was appointed to one of the Czech professorships. In 1885 he published his larger work on *Concrete Logic*, a study of the methods of classification of sciences, in which he attempted to work out a natural system of all knowledge.

In 1883 Masaryk founded a critical monthly review *The Athenaeum*, which soon sprang into prominence by becoming the battle ground on which the famous MSS. of Krláové Hradec and Zelená (Koeniginhof and Gruenberg) were attacked and proved to be forgeries, manufactured in the early 19th century by two well-meaning men, whose object was to provide text for the theory that in the Middle Ages there had been a high standard of literary culture in Bohemia. The authenticity of the MSS. had before been doubted by Slav philologists, but it was not until 1886, when Masaryk invited the great Czech philologist Gebauer to analyse the MSS. philologically, himself analysing them sociologically, that they were conclusively proved to be forgeries. The fight over the MSS. was the real beginning of the so-called "realist" revolution in Czech politics, literature and philosophy, the guiding principle of which was the application of the scientific method to letters and politics. While at Prague University Masaryk founded in 1893 a monthly review *Naše Doba* (Our Epoch). He became a member and instructor of the "Sokols." He started lecturing in Prague clubs and societies on unconventional subjects and published unpopular books. His sociological work led him to a study of Marxism, whose historical materialism he criticised in his great work *The Social Question* (1898, in Czech and in German).

Masaryk's political career started in the early 'eighties. In 1887 his friends founded a fortnightly paper *Čas* ("Time"), which two years later he took over and transformed into a political weekly. At that time the so-called Old Czech (Conservative) party was losing ground, and Masaryk, invited by the Young Czech (Liberal) party to be a candidate, was elected to Parliament in 1891. He soon resigned his seat in Parliament (1893) to devote himself to a crusade of moral education among the Czech people. He created for the Czechs what he called the philosophy of a small nation taking up the thesis of Palacky, the great Czech historian, who regarded the period of the Hussites and the Bohemian Brethren as the culminating point of Czech history, and drawing the moral that in the long traditional struggle between Slav and Teuton, which formed the main substance of Czech history, the Czech nation preserved itself by an intense love of culture and by a high standard of morality.

Although his opinions on nationalist questions were unpopular—an unpopularity which increased when in 1899 he fearlessly withstood a popular anti-Semitic superstition as manifested in the so-called "ritual murder trial" of a Jew named Hilsner—his ideas made a deep impression. They became the rallying cry of the younger generation not only of the Czechs, but of the Yugoslavs and other Slavs who flocked to Prague.

In 1900 his followers founded a political party which was officially named the "Progressive party," but which continued popularly to be known as the Realist party. The programme was founded on the principles enunciated in Masaryk's books. As a candidate of the Realist party he was re-elected to Parliament in

1907. In Parliament he soon began to criticise Austria's passive subjection to Germany and her own aggressive policy in the Balkans, especially as manifested in the annexation of Bosnia-Hercegovina. In the notorious "high treason" trial of Agram (1909), by which the Austrian Foreign Minister Count Aehrenthal tried to justify his annexation policy, and in the Friedjung trial (1909) which followed, Masaryk played a decisive part. He proved, on the basis of his private investigations, that the case for the Crown rested on documents forged at the Austro-Hungarian Legation in Belgrade. His fearless disclosures in the Austrian Reichsrat (May 1909) and in the Austro-Hungarian delegations (1910) forced the proceedings in the Agram trial to be quashed, compelled Friedjung to retract his accusations against the Serbs, and unmasked the methods of Austro-Hungarian diplomacy. Masaryk incurred the intense displeasure of the official and court circles in Vienna, but made a reputation abroad which proved useful to him during the War of 1914–8.

During the World War he developed his case against Austria-Hungary in detail, and at the end, in his work, *The New Europe*, characterised it as a corrupt, imperialist, militarist, pretentious and senseless relic of the Middle Ages. When the War broke out he was still a member of the Austrian Parliament. In Dec. 1914 he escaped from Austria, and in the following four years conducted a political and propagandist campaign in Switzerland, France, England, Italy, Russia and the United States on behalf of Czechoslovak liberation from Habsburg rule. He founded the propagandist journals *La Nation Tchèque*, which was edited in Paris by Ernest Denis, and *Československa Samostatnost* (Czechoslovak Independence), which was produced in the small town of Annemasse in Savoy, and he was one of the original Board of Dr. R. W. Seton-Watson's *The New Europe*, which was founded in London in 1916.

Masaryk's stand against Austria was publicly proclaimed in his Hus Anniversary speech made in Geneva in July 1915, and reaffirmed in his revolutionary manifesto, issued by him with the sanction of the Czech political leaders at home, on Nov. 14 1915. The signatories of that manifesto, who included representatives of Czech residents in France, Great Britain, America and Russia, formed a central revolutionary committee called the Czechoslovak National Council, of which Masaryk acted as President and Dr. E. Benes as Secretary. Finding his work in Switzerland hampered by enemy spies, he settled in London, where, at the invitation of Dr. Ronald Burrows, principal of King's College, he joined the staff of that college. Here he worked for two years combating, with the help of his friends, Mr. Wickham Steed and Dr. R. W. Seton-Watson, the German-Magyar propaganda, and familiarising Western opinion with Czechoslovak aspirations.

The Russian revolution of 1917 enabled him to go to Russia. Several thousand Czech soldiers—prisoners of war—had gone over to the Russians, and wanted to organise themselves into active military units. After some difficulty Masaryk induced the revolutionary Russian Govt. to agree to the formation and equipment of an independent Czechoslovak Army (92,000), whose exploits as they marched eastwards from Siberia to Vladivostok were one of the impressive later episodes of the War. He transferred some of them to the Western Front. He went to the United States in May 1918. The result was the Lansing declaration (May 29 1918) of sympathy with the cause of Czechoslovak and Yugoslav independence. The Allied Govts. associated themselves with that declaration on June 3 1919. The ice being thus broken, the Allied Powers and America recognised Masaryk's National Council as the *de facto* Government of the future Czechoslovak State. Masaryk was elected first President of the Czechoslovak Republic on Nov. 14 1918 and re-elected on May 27 1920. He had been sentenced to death *in contumaciam*, and in 1923 occurred the death of his wife, largely the result of the persecution to which the Government had subjected his family. For his work as President of the Republic during the years 1918 to 1926 *see* CZECHOSLOVAKIA.

Masaryk ranks equally high as a philosopher and as a statesman. His philosophical treatises were the result of his study of Czech history. His pronounced realism was a reaction both against the Teutonic idealism which developed moral speculation without reference to the practical affairs of life and against the Tolstoyan Slav philosophy of non-resistance to evil. Masaryk, as philosopher, stands for a unified conception of life, in which the spiritual and the religious take their place with the intellectual and the political as aspects of an integral whole. The following are the chief of his many philosophical, sociological and political works:—

O Hypnotismu, On Hypnotism (1880); *Sebevražda*, Suicide and Modern Civilisation (1881, also in German); *Theorie Pravděpodobnosti a Humeova Skepse*, the Theory of Probability and Hume's Scepticism (1882, German trans. 1884); *Blaise Pascal* (1883); *Theorie dežin dle zásad T. H. Buckle*, the Theory of History according to T. H. Buckle (1884); *Zakladové Konkretin Logiky*, Essay on Concrete Logic (1885, German trans. 1886); *Slavjanofilism I. S. Kirejevskeho* (1889); *Česká Otázka*, the Czech Question (1895); *Karel Havlíček* (1896); *Otázka sociální, filosofické a sociální základy marxismu*, The Philosophical and Sociological Foundation of Marxism (1898, also in German); *Jan Hus* (1899); *Rusko a Evropa*, Russia and Europe (1913, Eng. trans. *The Spirit of Russia*, 1919, 2 vol., 3rd vol. not yet finished); *The Problem of the Small Nations in the European crisis* (1916); *The New Europe* (1918, French trans. 1918. Czech 1919, German 1922); *Světová Revoluce* (1925, German trans. 1925, Eng. trans., *The World Revolution*, 1926).

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MASEFIELD, JOHN (1875–), British poet and novelist, was born in Liverpool and spent his early years in many countries and occupations, serving before the mast at sea, and earning a living as best he could in America. The activity of these years was reflected in his work from the first, as *Salt-Water Ballads* (1902) or *Ballads* (1903), in spite of their obviously Kiplingesque inspiration, show. His early novels, *Jim Davis* (1911), *Captain Margaret* (1908) and *Multitude and Solitude* (1909), had merit as tales of action and spirit, but it was in narrative poetry and drama that he found his natural expression. *The Everlasting Mercy* made something of a sensation in 1911; it was followed quickly by *The Widow in the Bye Street* (1912); *Dauber* (1913); and *The Daffodil Fields* (1913), all narrative poems in a key of stern realism. Meantime Masefield had made some successful experiments in drama, with *The Tragedy of Nan* (1909) and *Pompey the Great* (1910), the first allied in subject and setting to his long poems of village life, the second historical in theme. *Lollingdon Downs* (1917) included a noteworthy sonnet sequence, and *Reynard the Fox* (1919) proved one of the most successful of his verse narratives. Later work included *Collected Poems* (1923); *A King's Daughter*, a verse tragedy (1923); *Sard Harker*, a novel of adventure (1924); *The Trial of Jesus*, a play (1925); *Odtaa*, a novel (1926). He published some able prose War sketches in *Gallipoli* (1916) and *The Old Front Line* (1917).

MASON, MAX (1877–), American educationist and inventor, was born at Madison, Wis., Oct. 26 1877. He graduated from the University of Wisconsin in 1895, continuing his studies at the University of Göttingen (Ph.D., 1903). After being instructor in mathematics at the Massachusetts Institute of Technology 1903–4, he became assistant professor of mathematics at the Sheffield Scientific School, Yale University, in 1904. He was appointed professor of mathematical physics at the University of Wisconsin in 1908. He also lectured at Harvard University 1911–2. During the World War he was a member of the staff of the Naval Experimental Station, New London, Conn., and also on the submarine committee of the National Research Council 1917–8. He invented several devices for the detection of submarines. In Aug. 1925 he became president of the University of Chicago.

MASPERO, SIR GASTON CAMILLE CHARLES (1846–1916), French Egyptologist (*see* 17.848), died in Paris June 30 1916. During his second term of office as director-general of the service of antiquities at Cairo he was made K.C.M.G. (1909). He retired in 1914.

MASSACHUSETTS (*see* 17.850).—The population in 1920 was 3,852,356, an increase of 485,940 or 14.4% since 1910, as against

20% in the preceding decade. Nearly one-third of the state's inhabitants lived in metropolitan Boston. Less than 1·3% were negroes; 28% were foreign born, of whom 24·4% came from Canada. The average density of population in 1920 was 479·2 per sq. m., as against 418·8 in 1910. The urban population (in 169 places of more than 2,500) was 94·8% of the whole, as against 92·8% in 1910. According to a census taken by the state in 1925, the population was 4,144,205. The Census Bureau estimated the population as of July 1 1926 to be 4,197,288. The population of the 12 chief cities was:—

Cities	1925	1920	1910	Increase % 1920–5
Boston	781,529	748,060	670,585	4·5
Worcester	192,242	179,754	145,986	6·9
Springfield	142,224	129,614	88,926	9·7
New Bedford	120,494	121,217	96,652	–·5
Fall River	129,662	120,485	119,295	7·6
Lowell	110,542	112,759	106,294	–1·8
Cambridge	120,053	109,694	104,839	9·4
Lynn	103,147	99,148	89,336	4·0
Somerville	99,206	93,091	77,236	6·5
Lawrence	95,136	94,270	85,892	·9
Brockton	65,731	66,254	56,878	–·7
Holyoke	60,892	60,203	57,730	1·1

Agriculture.—The total number of farms in 1925 was 33,454 as compared with 32,001 in 1920 and 36,917 in 1910. Farm property in 1925 was valued at $293,405,059, including live stock valued at $21,758,276. The average acreage of farms is decreasing, being 70·8 in 1925 as against 77·9 in 1920, but the average value per acre is increasing, being $107.53 in 1925 as compared with $99.25 in 1920.

The principal crops were as follows, in bushels:—

Crops	1924	1919	1909
Corn (maize)	425,780	1,921,607	2,402,738
Oats	82,668	1,515,933	2,029,381
Buckwheat	11,847	23,238	32,926
Wheat	4,028	33,253	2,404
Potatoes	1,734,210	1,885,655	2,946,178
Tobacco (pounds)	14,058,156	14,282,589	9,549,306
Rye	9,947	46,261	59,183
Apples	3,006,120	3,187,211	2,550,259

Two-thirds of the cranberry yield of the United States in recent years was raised in the bogs along the southeast coast of the state. The live stock on farms in 1924 included 43,537 horses, 192,131 cattle (of which 145,631 were dairy cows) and 63,810 swine.

Mineral Products.—During the past 15 years there was a large increase in the production of building-stone, crushed rock for road and street-making, and sand. The value of marble, slate and stone work in 1923 was $11,285,444. The value of clay products of the state increased from $1,647,362 in 1908 to $4,238,354 in 1923, of which latter amount $3,045,638 was the value of common brick. The total value of mineral products in 1924 was $15,725,000 as compared with $12,411,708 in 1920 and $6,077,370 in 1910.

Manufactures.—Massachusetts, with a limited local market for its manufactured products, scanty resources in the form of raw materials, and a declining trans-Atlantic commerce, has added little to its railway and terminal facilities. Only four states are smaller in area: yet in 1921, only five states exceeded it in the value of its industrial output. Its advantage has lain in having a surplus of capital, in its unsurpassed supply of skilled labour and in the superior organisation of its factories. In its earlier development it utilised its local water-power, of which it had a liberal supply. Then it became largely dependent on coal for fuel, imported at increasingly high cost. In 1910 the total value of products of manufacturing establishments was $1,490,527,386; in 1921, $2,849,413,516; in 1923, $3,571,348,398. While the increase in value is largely to be accounted for by the increased prices, the state as a whole made commendable industrial progress. In textiles (cotton, worsteds and woollens), in boots and shoes, boot and shoe cut stock and findings, rubber footwear and in fine writing paper, Massachusetts in 1923 was the foremost state.

The following table deals with the chief manufacturing industries as ascertained by the census of 1923:—

Industry	No. of establishments	Average number of wage-earners	Wages	Value of products
Cotton goods	191	113,707	$115,080,841	$415,922,838
Boots and shoes	595	69,397	82,916,416	290,674,403
Worsted goods	83	45,806	51,833,609	258,035,615
Electrical machinery and supplies	130	26,350	34,482,705	117,575,926
Foundry and machine-shop products	533	24,660	36,267,289	114,929,133
Dyeing and finishing textiles	75	14,074	16,099,333	101,824,142
Woollen goods	103	19,036	24,356,203	94,100,430

The value of boots and shoes and cut stock in 1923 was 36% of the country's output, New York ranking second with 18·9%. In 1923 the textile industries employed 33% of the manufacturing wage-earners, the products being 28% of the total industrial output. Over two-fifths of this was in cotton goods and formed 22% of the output of the whole country, North Carolina being the next largest producer of cotton goods. The output of woollen and worsted goods in 1923 was about 30% of that of the whole country, Pennsylvania producing the next largest amount. The increase in value from 1900 to 1923 was 536%. The increase in the value of boots and shoes and cut stock for the same period was 154%. Boston and Worcester were the principal centres for foundry and machine-shop products. Other industrial products were: rubber goods, $84,098,920; tanned, curried and finished leather $71,098,478, in the manufacture of which Massachusetts was second among the states; paper and wood pulp, $93,641,621; printing and publishing, $117,436,792, of which $61,326,221 was the value of newspapers and periodicals; cordage, twine and jute goods, $28,477,768, in which the state was second only to New York; furniture, $34,691,239; jewellery, $30,436,712; and confectionery, $48,618,574, in both of which Massachusetts was third among the states.

The state is also noted for its fishing industry, the fleets visiting the Newfoundland Banks being important, with Gloucester and Boston as chief centres of the trade. The value of products in 1920 was $7,596,905. Cod were valued at $2,311,011; haddock, $2,655,303; mackerel, $748,682; and halibut, $518,598.

Education.—In 1925 the total number of pupils enrolled in the public schools was 713,926, the amount expended on education being $71,941,986. In 1910 the figures were 538,441 and $17,110,327 respectively. Several fundamental changes were made in the organisation of the educational enterprises of the state in 1919. Among the most important were: the consolidation into a new department of education of several related activities, the abolition of the Board of Education, and the creation of the Advisory Board of Education, consisting of six members and the Commissioner of Education, who is *ex officio* chairman. In vocational education rapid progress occurred in the period 1909-23 the number of schools in which vocations are taught increasing from six to 80, and the enrolment in vocational classes from 1,400 to 11,870.

Another significant development was in university extension. In the year ending Nov. 30 1923, 5,075 students were receiving instruction by correspondence. In the five years ending Aug. 1923, 27,658 were registered in adult immigrant classes and 27,313 in other extension classes. In 1911 the Teachers' Registration Bureau was established, a free agency which has proved very successful; three years later a retirement system was put into operation, with membership compulsory, and provision for retirement at 60 years of age under certain conditions or by

compulsion at 70. The Legislature of 1921 made several notable changes, among which are the following: Compulsory transportation from towns where there is no high school, with provisions for state reimbursement a provision compelling every town with a valuation of $1,000,000 or more to employ a school nurse, and the requirement of physical training in both elementary and high schools.

The state department may now grant the degree of Bachelor of Science in Education to any person completing a four-year course in a state normal school—one school giving it in the commercial course only, one in household arts, one in art and two in regular courses. Regular public-school teachers cannot be paid less than $750 a year. Reimbursements to small towns and cities are provided, with special arrangements for those of low valuation, enabling them to have good teachers. Civics and history are required to be taught in elementary and high schools, and since 1923, the Constitution of the United States. Pupils 14–16 years of age must have completed the requirements of the sixth grade before being certified for employment.

Finance.—The receipts of the state in 1909 were approximately $14,700,000, and those in 1923 approximately $41,000,000, or nearly three times as much. These figures represent receipts for revenue purposes only, and do not include receipts from the issue of bonds or notes. The payments in 1909 were about $17,100,000, and in 1923 about $42,507,914. These represent governmental cost and include no payments of money borrowed. In 1923 the funded debt of the state was $53,673,740, and the total debt $126,269,911.

Transportation.—There were 4,950 m. of steam railway in 1924 and 2,551 m. of electric street railway. Great attention has recently been given to the highways, and during 1924 nearly 149 m. of highway were constructed. The total length of state highways at the end of 1924 was 1,521 m.; and the amount spent on new roads in that year, about $2,000,000; repairs and maintenance, $4,798,000.

Banking.—The resources in 1923 of the national banks within the state were $1,227,367,000. There were 634 banking institutions and agents under state law, with resources of $2,488,606,935, divided as follows: 196 savings banks, $1,215,244,815; 105 trust companies, $1,076,114,436; 190 co-operative banks, $154,879,638; three savings and loan associations, $2,399,791; Massachusetts Hospital Life Insurance Co., $30,918,328; one foreign banking corporation, $1,838,749; 60 credit unions, $2,791,165; 77 steamship agents, receiving deposits of $3,187,506; one state bank, $1,132,507.

History.—During the years 1910–25 the most important laws enacted by the Legislature were the following: In 1912 a minimum-wage board was established with the right to determine wages of women and children. The inheritance law was amended so that only the real estate of a deceased non-resident is taxed, personal property taxes going to the state of residence. A law of 1913 provided for the establishment and maintenance of continuation schools and instruction for working children. A number of pure-food laws were enacted; also, a law providing for mothers' pensions. The election law was so amended that on application signed by 1,200 voters in any senatorial district, or by 200 voters in any representative district, asking for the submission to the voters of any question of instruction to Senators or Representatives, the Secretary of the Commonwealth shall determine if such a question is one of public policy, and, if so determined, he shall place such question on the official ballot to be used at the next state election. In 1914 a measure was passed submitting to the people a constitutional amendment giving suffrage to women, suffrage being finally granted June 25 1919. In 1916 the civil and criminal jurisdiction of district or municipal courts was extended so that their process runs throughout the state and makes them courts of superior and general jurisdiction. An income tax was enacted, and a law was passed to prevent misstatements in advertising. An Act forbidding the sale of narcotic drugs, except by prescriptions carefully regulated, was passed in 1917. Massachusetts on April 2 1918 ratified the Eighteenth (Prohibition) Federal Amendment, being the eleventh state to do this. That same year a budget system was adopted. The Legislature in 1919 made absentee voting possible for those in military or naval service and for others who made proper arrangements. It also passed a law making all Acts approved by the executive, unless subject to referendum, take effect 30 days after formal enactment. Emergency laws take effect upon passage. The permissible maximum amount of deposits in savings banks per person was raised to $4,000. Manufacturing corporations were enabled to provide for representation of their employees upon the board of directors if more than half the employees so decide by secret ballot. Industrial accident compensation was increased. The income tax was revised. An Act reorganising the executive and administrative functions of the state Government, approved July 23 1919, established new departments, consolidated the 100 odd departments under 20 heads, and a metropolitan district commission was authorised, with general supervision over the metropolitan area. The Legislature of 1920 passed a law providing for a state constabulary. Motion-pictures within the state were censored. Women were allowed to hold office. Suits were permitted by and against voluntary associations. Important "blue sky" legislation was enacted. In 1921 a law was passed making a scientific study of criminals mandatory on the courts in certain cases. Examination is required by the Dept. of Mental Diseases, and the results are admitted as evidence of the mental conditions of the accused. The opening on July 29 1914, of a canal across Cape Cod shortened by 70 m. the distance by water from New York to Boston.

The governors for the past 15 years were: Eugene M. Foss (Dem.), 1911–4; Davis I. Walsh (Dem.), 1914–6; Samuel W. McCall (Rep.), 1916–9; Calvin D. Coolidge (Rep.), 1919–20; Channing H. Cox (Rep.), 1920–4; A. T. Fuller (Rep.), 1924–.

(F. A. Cl.)

MASSENET, JULES ÉMILE FRÉDÉRIC (1842–1912), French composer (*see* 17.866), died in Paris Aug. 13 1912, having composed an opera, *Panurge*, just before his death.

MASSEY, WILLIAM FERGUSON (1856–1925), New Zealand statesman, was born at Limavady, Co. Derry, Ireland, on March 26 1856. His parents emigrated to New Zealand when he was six, and eight years later he joined them at Tamaki. After an elementary education, he went on the land, and 20 years later, as president of the Auckland Agricultural and Pastoral Society, began to play a prominent part in public life. He entered Parliament in 1894 as member for Waitemata, and in 1903 became leader of the Conservative Opposition to Mr. Seddon and Sir Joseph Ward. At first his following was small, but he gained ground to such an extent in the elections of 1911 that in the following year he was able to defeat the Mackenzie Ministry and form a Cabinet. Thereafter he played a dominating part in the Dominion's affairs. His strong personality, sterling honesty of purpose and administrative ability commanded universal respect, and during the World War, at the head of a strong Coalition Ministry, which included his lifelong opponent, Sir Joseph Ward, Mr. Massey led New Zealand with conspicuous ability and foresight. And, just as he had not hesitated to introduce conscription without reference to the people, so he had the courage, when peace came, to enforce unpopular economies. He was a member of the Imperial War Cabinet in 1917–8 and in 1919 was the representative of New Zealand at the Peace Conference in Paris. Shortly after the Imperial Conference of 1923 his health gave way and though he recovered sufficiently to carry on his work for a time, he died on May 10 1925.

MASSINGHAM, HENRY WILLIAM (1860–1924), British journalist, was born at Old Catton, Norfolk. Educated at Norwich Grammar School under Dr. Augustus Jessopp, he began to work for *The Eastern Daily Press* at the age of seventeen. In 1883 he came to London and for some time was on the staff of the National Press Agency. Five years later he became assistant editor of *The Star*, which he edited from July 1890 to Jan. 1891. In 1892 he joined the staff of *The Daily Chronicle* as literary editor, and was editor in chief from 1895 to 1899, when he resigned owing to his inability to support the war against

the Boers. He had made his mark as an influential champion of the Radical wing of the Liberal party and as the pioneer of literary criticism in the daily Press. After a brief connection with *The Manchester Guardian* and *The Speaker*, and a mission to South Africa in 1905 for *The Daily News*, he, in 1907, began a long association with *The Nation*, which he edited till the end of 1923. He was a severe critic of the World War and the Peace Treaty of 1919 and advocated co-operation between the Liberal and Labour parties. An early member of the Fabian Society, Massingham ultimately joined the Labour party, though on ethical, rather than economic, grounds, and his last journalistic work was done for *The New Statesman*. He died at Tintagel, Cornwall, on Aug. 28 1924. One of the best all-round journalists of his day, he was a trenchant writer on politics and a discerning critic of literature and the drama. He published in 1892 *The London Daily Press*, and contributed an introduction to the memorial edition of the works of Mark Rutherford 1923. *H. W. M. A Selection from the Writings of H. W. Massingham*, edited by H. J. Massingham (1925), contains highly appreciative estimates by G. Bernard Shaw and various eminent associates.

MASSON, LOUIS CLAUDE FRÉDÉRIC (1847–1923), French historian (*see* 17.870), died in Paris Feb. 19 1923.

MASS PRODUCTION.—The term mass production is used to describe the modern method by which great quantities of a single standardised commodity are manufactured. As commonly employed it is made to refer to the quantity produced, but its primary reference is to method. In several particulars the term is unsatisfactory. Mass production is not merely quantity production, for this may be had with none of the requisites of mass production. Nor is it merely machine production, which also may exist without any resemblance to mass production. Mass production is the focussing upon a manufacturing project of the principles of power, accuracy, economy, system, continuity and speed. The interpretation of these principles, through studies of operation and machine development and their co-ordination, is the conspicuous task of management. And the normal result is a productive organisation that delivers in quantities a useful commodity of standard material, workmanship and design at minimum cost. The necessary, precedent condition of mass production is a capacity, latent or developed, of *mass consumption*, the ability to absorb large production. The two go together, and in the latter may be traced the reasons for the former.

I. THE ORIGINS OF MASS PRODUCTION

In origin mass production is American and recent; its earliest notable appearance falls within the first decade of the 20th century. The mere massing of men and materials is a procedure as old as the pyramids. Basic industries, like weaving, domestic baking, house construction and wooden ship building, are carried on, with only superficial changes, much as they were in ancient Egypt. Cottage manufactures and handicrafts moulded the practices of industry until the invention of the steam-engine. With the coming of power machines the seat of industry was removed from the homes of the people and a new work centre, the factory, was established. Much harsh criticism has been uttered against "the factory system," but it is perhaps fair to say that its first effect was to emancipate the home from being a mere adjunct to the loom or bench, and its later effect was to provide the home with means to develop the dignified status which it has now attained.

The Factory System Giving Way.—The early factory system was uneconomical in all its aspects. Its beginning brought greater risk and loss of capital than had been known before, lower wages and more precarious outlook for the workers, and a decrease in quality with no compensating increase in the general supply of goods. More hours, more workers, more machines did not improve conditions; every increase did but enlarge the scale of fallacies built into business. Mere massing of men and tools was not enough; the profit motive, which dominated enterprise, was not enough. There remained the scientific motive which grew eventually into what is called mass production.

The new method came after the failure of the mercantile and financial emphasis in manufacture. The advent and progress of financial control of industry were marked by two developments, the corporation and the labour revolt. Artificial combination of industrial plants into vast corporations for financial purposes was the first movement toward *mass* in industry. It proceeded on the theory that complete financial control would automatically bring complete profit advantage. The theory ignored many vital principles of business and its fallacy became apparent, but not before serious social hostility had been incurred.

However, it was out of the social strife thus engendered that the idea began to emerge that possibly the difficulty lay in the neglect of scientific manufacturing principles. Industry was conceded to be necessary and useful; the service it rendered was regarded as of sufficient value to afford fair compensation for all engaged in it; it was therefore urged that the attention of management should be more directly focussed on the actual labour processes that were employed. This led to what was known early in the 20th century as the "efficiency movement" with its accompaniments of time-study and similar methods, although its roots were laid in the experiences of sound industrial observers as early as 1878. It cannot be said, however, that the efficiency experts did more than direct attention to the problem, by showing, in selected instances, how the then current methods were wasteful of men's earning power, and how their correction and improvement could lead to greater production, hence higher wages, and therefore a general betterment of labour relations. They emphasised a more intelligent management of methods than was then in use; they did not see that a wholly new method was possible which would simply abolish the problems of which the old method, under the most intelligent management, was inevitably prolific. For example they dealt with methods which enabled labourers whose task was to load 12½ tons of pig-iron a day, to load 47½ long tons a day for an increase in the day's pay from $1.15 to $1.85. They did not see that another and better method might be devised which would make it unnecessary for a working-man to carry 106,400 lb. of pig-iron to earn $1.85. Mass production was not in their view, but only the alleviation of the worst errors of competitive factory practice.

The Motor Industry Leads the Way.—To the motor industry is given the credit of bringing mass production to experimental success, and by general consent the Ford Motor Co. is regarded as having pioneered in the largest development of the method under a single management and for a single purpose. It may, therefore, simplify the history of mass production and the description of its principles if the experience of this company is taken as a basis. It has been already suggested that mass production is possible only through the ability of the public to absorb large quantities of the commodity thus produced. These commodities are necessarily limited to necessities and conveniences. The greatest development of mass production methods has occurred in the production of conveniences. The automobile represents a basic and continuous convenience-transportation.

Mass production begins, then, in the conception of a public need of which the public may not as yet be conscious and proceeds on the principle that use-convenience must be matched by price-convenience. Under this principle the element of service remains uppermost; profit and expansion are trusted to emerge as consequences. As to which precedes the other, consumption or production, experiences will differ. But granted that the vision of the public need is correct, and the commodity adapted to meet it, the impulse to increased production may come in anticipation of demand, or in response to demand, but the resulting consumption is always utilised to obtain such increase of quality, or such decrease of cost, or both, as shall secure still greater use-convenience and price-convenience. As these increase, consumption increases, making possible still greater production advantages, and so on to a fulfilment that is not yet in view.

The commodities that conduce to civilised living are thus far enjoyed by only a small fraction of the world's inhabitants. The experience of the Ford Motor Co. has been that mass production precedes mass consumption and makes it possible, by reducing costs and thus permitting both greater use-convenience and price-convenience. If the production is increased, costs can be reduced. If production is increased 500%, costs may be cut

50%, and this decrease in cost, with its accompanying decrease in selling price, will probably multiply by 10 the number of people who can conveniently buy the product. This is a conservative illustration of production serving as the cause of demand instead of the effect.

II. THE PRINCIPLES OF MASS PRODUCTION

As to shop detail, the keyword to mass production is simplicity. Three plain principles underlie it: (*a*) the planned orderly progression of the commodity through the shop; (*b*) the delivery of work instead of leaving it to the workman's initiative to find it; (*c*) an analysis of operations into their constituent parts. These are distinct but not separate steps; all are involved in the first one. To plan the progress of material from the initial manufacturing operation until its emergence as a finished product involves shop planning on a large scale and the manufacture and delivery of material, tools and parts at various points along the line. To do this successfully with a progressing piece of work means a careful breaking up of the work into its "operations" in sequence. All three fundamentals are involved in the original act of planning a moving line of production.

This system is practised, not only on the final assembly line, but throughout the various arts and trades involved in the completed product. The automobile assembly line offers an impressive spectacle of hundreds of parts being quickly put together into a going vehicle, but flowing into that are other assembly lines on which each of the hundreds of parts have been fashioned. It may be far down the final assembly line that the springs, for example, appear, and they may seem to be a negligible part of the whole operation. Formerly one artisan would cut, harden, bend and build a spring. To-day the making of one leaf of a spring is an operation of apparent complexity, yet is really the ultimate reduction to simplicity of operation.

A Typical Operation Described.—For its illustrative value let us trace the course of a spring leaf after it has progressed from iron ore through ingot, bloom and billet stages, and is rolled into strips. (1) Beginning as a strip of steel prepared by the steelmill, it is placed in a punch press for cutting and piercing. The workman puts the strip into press until it hits a stop, then trips the press. The cut-off and pierced piece falls on a belt conveyor which runs along the loading end of a series of heat-treating ovens. (2) A second workman takes the pieces from belt conveyor and places them on conveyor which passes through the furnace (in which temperature is automatically controlled); thence they are deposited at a certain temperature by this conveyor at the unloading end of the furnace. (3) The heated piece is lifted with tongs by a third operator and placed in a bending machine which gives the leaf its proper curve and plunges it in oil, the temperature of which is maintained at a definite degree by apparatus beyond the operator's control. (4) As the bending machine emerges from the oil bath, the same operator takes out the leaf and sets it aside to air-cool. (5) The leaf is then drawn by a fourth operator through molten nitrate kept at a regulated temperature. (6) A fifth workman inspects it.

As a set of springs on the Ford automobile requires on an average 17 leaves, and 25,000 springs are an average day's output, this operation must be visualised as employing a great battery of lines similar to the one briefly described. As all the leaves in a spring are of different length and curve, from the bottom or master leaf to the top leaf, this operation must be visualised as one of many carried on simultaneously by different batteries of machines, each battery working on its own special size. All of these lines, with their various machines and operations, are converging on the point where the leaves are assembled into springs. The leaf whose progress we are describing is the simplest one.

We now continue the operation. (7) A sixth workman removes the leaf from the conveyor which carries it from the molten nitrate, and inserts a bolt through this and the other leaves required in the spring. (8) A seventh workman puts the nut on the bolt and tightens it. (9) An eighth workman puts on the right and left hand clips and grinds off the burrs. (10) A ninth workman inspects it. (11) He hangs the spring on a conveyor. (12) The spring passes the tenth workman, who sprays it with paint, and the conveyor carries the spring above the ovens where it was originally heated, and the radiated heat "force dries" the paint. (13) The conveyor continues to the loading dock, where the eleventh workman removes it.

One workman under the old system could attend the leaf through all these phases, or even make a complete spring, but his production would be limited. Where large quantities of the same article are to be made, the simplest operation may involve the whole time of one man. A one-minute operation will require one man a full day of eight hours to accomplish it on 480 pieces. Now this simple part, a spring leaf, must be identical in strength, finish and curve with millions of others designed to fulfil the same purpose, and this becomes a complicated and delicate procedure requiring automatic machinery, the most accurate of measuring devices, pyrometer controls, "go" and "no go" gauges—in fact, the best facilities that can be provided by modern management. The leaf described, which is a minor matter when compared with the whole great process, becomes a major matter when considered by itself; it must have its own supply of material delivered in sufficient quantities at indicated places—for example, steel at 1; heat at 2; power and oil at 3; molten nitrate at 5; bolts at 7; nuts at 8; clips at 9; paint at 12. In this process the secrets of many arts and trades are employed.

The story of this minor part illustrates what is meant by orderly progression of the article through the shop. It goes to meet other parts of the motor-car which have come from other parts of the plant by similar processes. The story illustrates also what is meant by delivering the work to the workman: every workman's task is prepared for him by some other workman, and delivered to his hand. The third principle also is illustrated—the analysis of a single job into its constituent operations. The simplicity of the part here described should not be permitted to exclude from view the multitude of other operations, ranging from the heaviest forgings to the lightest manipulations in bench assembly of delicate electrical instruments. Some gauge inspections involve measurements to the ten-millionth part of an inch.

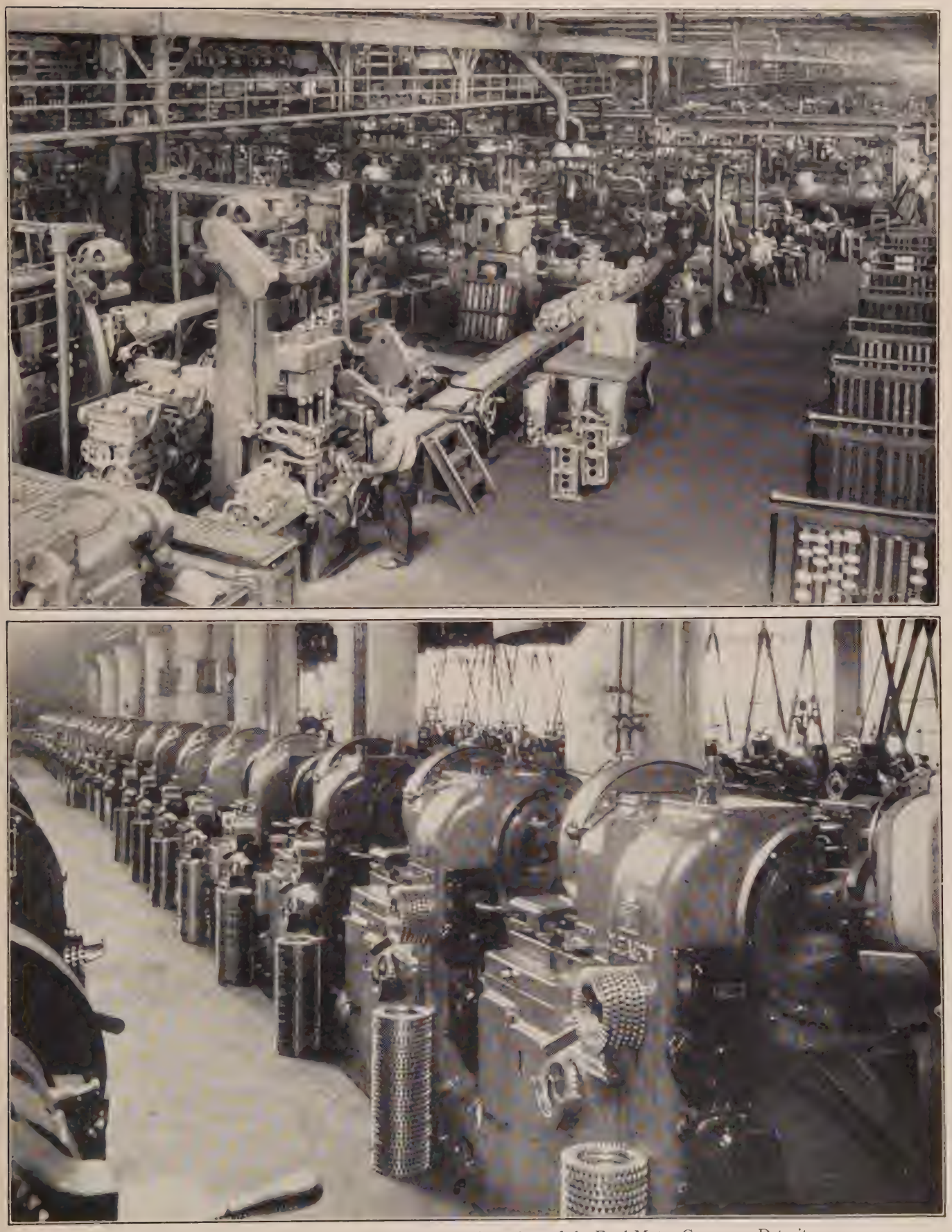
The economies arising from this method are obvious. The machinery is constantly in use. It would be economically impossible to maintain all this equipment for the service of men occupied in the entire operation of making springs. Presses, furnaces, bending machines, oil baths would be idle while the workman progressed from operation to operation. Under mass production it is the work that progresses from operation to operation. Use-convenience in the commodity would be lessened, while price-convenience would be destroyed. Economy in machine hours is, however, only one element; there is also economy in time and material and labour. Mass production justifies itself only by an economy whose benefits may be transmitted to the purchaser.

III. THE EFFECTS OF MASS PRODUCTION

But it is not the history and principle of mass production which provoke the widest discussions; the *effects* of it have been placed under scrutiny. What have been the effects of mass production on society?

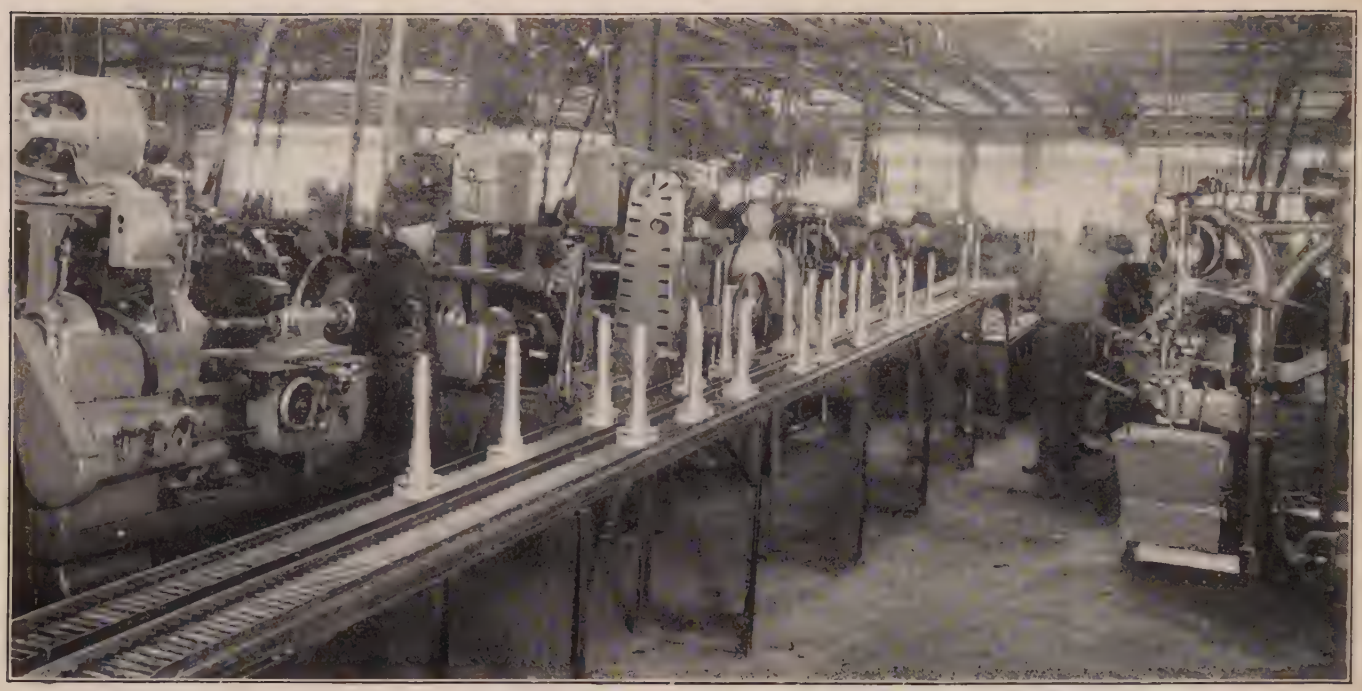
(1) Beginning with management, where unquestionably mass production methods take their rise, there is a notable increase in industrial control, as distinguished from financial control. The engineer's point of view has gained the ascendancy and this trend will undoubtedly continue until finance becomes the handmaid instead of the mistress of productive industry. Industrial control has been marked by a continuous refinement of standardisation, which means the instant adoption of the better method to the exclusion of the old, in the interests of production. Financial control was not, in its heyday, marked by a tendency to make costly changes in the interests of the product. The economy of scrapping the old equipment immediately upon the invention of the better equipment was not so well understood. It was engineering control, entrenched in mass production methods, that brought in this new readiness to advance. In this way management has been kept close to the shop and has reduced the office to a clearing house for the shop. Managers and men have been brought into closer contact and understanding. Manufacturing has been reduced to greater singleness of purpose.

(2) The effect of mass production on the product has been to give it the highest standard of quality ever attained in output of great quantities. Conditions of mass production require material of the best quality to pass successfully through the operations. The utmost accuracy must control all these operations. Every part must be produced to fit at once into the design for which it is made. In mass production there are no fitters. The presence of fitters indicates that the parts have been produced unfit for immediate placement in the design. In works of art and luxury this accuracy is achieved at the cost of careful handiwork. To introduce hand methods of obtaining accuracy into mass production would render mass production impossible with any reference to price-convenience. The standard quality of the product is guaranteed by the fact that machines are so constructed that a piece of work cannot go through them unless it exactly accords with specifications. If the work goes through the tools, it must be right. It will thus be seen that the burden of creation is on



ABOVE—A view of the machine shop at the Fordson plant of the Ford Motor Company, Detroit.
BELOW—A view of the ring gear department at the Highland Park plant of the Ford Motor Company, Detroit.

MASS PRODUCTION



ABOVE—One type of conveyor lines in the Highland Park plant of the Ford Motor Company, Detroit.
BELOW—Final assembly line in the Highland Park plant of the Ford Motor Company, Detroit.
Bodies and chassis having been completed separately, the body is dropped on the chassis as it advances. The chassis in the foreground is just about to receive the body which is seen, slung by chains from the overhead yoke, at the right.

management in designing and selecting the material which is to be produced by the multiple processes utilised in mass production.

(3) The effect of mass production on mechanical science has been to create a wide variety of single-purpose machines which not only group similar operations and perform them in quantity, but also reproduce skill of hand to a marvellous degree. It is not so much the discovery of new principles as the new combination and application of old ones that mark this development. Under mass production the industry of machine making has increased out of all comparison with its previous history, and the constant designing of new machines is a part of the productive work of every great manufacturing institution.

(4) The effect of mass production on employees has been variously appraised. Whether the modern corporation is the destruction or salvation of arts and crafts, whether it narrows or broadens opportunity, whether it assists or retards the personal development of the worker, must be determined by observable facts. A cardinal principle of mass production is that hard work, in the old physical sense of laborious burden-bearing, is wasteful. The physical load is lifted off men and placed on machines. The recurrent mental load is shifted from men in production to men in designing. As to the contention that machines thus become the masters of men, it may be said the machines have increased men's mastery of their environment, and that a generation which is ceaselessly scrapping its machines exhibits few indications of mechanical subjection.

The need for skilled artisans and creative genius is greater under mass production than without it. In entering the shops of the Ford Motor Co., for example, one passes through great departments of skilled mechanics who are not engaged in production, but in the construction and maintenance of the machinery of production. Details of from 5,000 to 10,000 highly skilled artisans at strategic points throughout the shops were not commonly witnessed in the days preceding mass production. It has been debated whether there is less or more skill as a consequence of mass production. The present writer's opinion is that there is more. The common work of the world has always been done by unskilled labour, but the common work of the world in modern times is not as common as it was formerly. In almost every field of labour more knowledge and responsibility are required than a generation or two ago.

Some Criticisms Answered.—Mass production has also been studied with reference to what has been called the monotony of repetitive work. This monotony does not exist as much in the shops as in the minds of theorists and bookish reformers. There is no form of work without its hardness; but needless hardship has no place in the modern industrial scheme. Mass production lightens work, but increases its repetitive quality. In this it is the opposite of the mediaeval ideal of craftsmanship where the artisan performed every operation, from the preparation of the material to its final form. It is doubtful, however, if the mass of mediaeval toil was as devoid of monotony as has sometimes been pictured, but it is absolutely certain that it was less satisfactory in its results to the worker. In well-managed modern factories the tendency to monotony is combatted by frequent changes of task.

The criticism of mass production as a means of reducing employment has long since been out of court. The experience of the Ford Motor Co. is that wherever the number of men has been reduced on manufacturing operations, more jobs have been created. A continuous programme of labour reduction has been paralleled by a continuous increase in employment. As to the effect of mass production on wages and the relations between managers and men, there is little need to speak. It is perhaps the most widely understood fact about mass production that it has resulted in higher wages than any other method of industry. The reason is at hand. The methods of mass production enable the worker to earn more and thus to have more. Moreover, the methods of mass production have thrown so much responsibility on the craftsmanship of management, that the old method of financial adjustment by reduction of wages has been abandoned by scientific manufacturers. A business that must finance by drafts out of the wage envelopes of its employees is not scientifically based. It is the problem of management so to organise production that it will pay the public, the workmen and the concern itself. Management that fails in any of these is poor management. Disturbed labour conditions, poor wages, uncertain profits indicate lapses in management. The craftsmanship of management absorbs the energies of many thousands of men who, without mass production methods, would have no creative opportunity. Here the modern method broadens instead of narrows individual opportunity.

(5) As to the effects of mass production on society, the increasing supply of human needs and the development of new standards of living are the elements to be estimated. The enlargement of leisure, the increase of human contacts, the extension of individual range, are all the result of mass production in various fields. (H. F.)

MASTERS, EDGAR LEE (1868–), American writer, was born at Garnett, Kan., Aug. 23 1868. At the age of 21 he entered Knox College, Galesburg, Ill., but left after one year to read law. He was admitted to the bar in 1891 and practised thereafter in Chicago, being for some years associated with Clarence S. Darrow. The book that first brought him public notice was *Spoon River Anthology* (1915), an extraordinary collection of epitaphs on members, in all walks of life, of a midwestern town. Within three years 50,000 copies were sold.

His other works include: *The New Star Chamber, and Other Essays* (1904); *Blood of the Prophets* (1905); *The Great Valley* (1916); *Toward the Gulf* (1918); *Starved Rock* (1919); *Domesday Book* (1920); *The Open Sea* (1921); besides several plays, *Maximilian* (1902); *Althea* (1907); *The Trifler* (1908); *The Locket* (1910); and *The Bread of Idleness* (1911).

MASURIAN LAKES, BATTLES OF THE.—The terrain of East Prussia is described in some detail under the heading TANNENBERG. It was the lake barrier which had proved the undoing of the Russians in their advance into East Prussia, and twice again was it to bring about their defeat when the Germans in their turn assumed the offensive. Jilinsky had failed to combine the action of his two armies, urging one forward to intercept what he thought to be a beaten enemy and dispatching the other on a subsidiary objective. The disaster to the II. Army had come to him as a crushing surprise, and in his fear that Rennenkampf would share the fate of Samsonov, he ordered the I. Army to halt and act on the defensive until fresh troops could be brought up from the centre of Russia. All chance of catching the Germans at a disadvantage during their temporary disorganisation after the fighting at Tannenberg was thus lost.

I. THE SUMMER BATTLE

Ludendorff was not long in deciding what was to be done after the destruction of Samsonov. Even before the fighting at Tannenberg was over, on Aug. 29 1914, he had commenced moving troops northwards to meet Rennenkampf. He was strongly urged to move southwards to the support of the sorely tried Austrians, but this would have meant leaving a strong and undefeated enemy directly in his rear, whilst attempting to traverse the selfsame desert area which had tried Samsonov so greatly. From the German point of view it was more important to free East Prussia from the invader at once, and the Austrians must therefore wait their turn.

Position before the Action.—All the German divisions had received their first reinforcements and were flushed with victory and full confidence in their leaders. Two fresh corps had arrived from the west. Rennenkampf did not appear to be on the move and was evidently commencing the blockade of Königsberg. Lötzen, the little fortress holding the main gap in the centre of the line of lakes, was still in German hands. Everything therefore seemed favourable for a German offensive.

Ludendorff's plan for his advance was in outline as follows: (1) Von der Goltz with 2½ divisions was to check any advance on the part of the Russian II. Army from Poland; (2) Von François with three divisions and a cavalry brigade was to move round the southern end of the lakes at Johannisburg with the primary object of turning Rennenkampf's left, and at the same time dealing with any Russian forces assembling to the south of the lakes; (3) Von Mackensen with two divisions and two cavalry divisions was to cross the Lötzen gap and join with Von François in the attack against Rennenkampf's left; (4) the main body of eight divisions was to move direct on the Insterburg gap; (5) the Königsberg garrison was to make a demonstration against the blockading troops.

Rennenkampf had commenced withdrawing on Aug. 30, and on Sept. 2 he issued orders for a position to be taken up for defensive action from the sea near Libau to Angerburg at the northern end of the lakes. This position offered many advantages from a defensive point of view, running as it did behind the rivers Deime, Alle and Omet, but it was too extensive for the force of 12 divisions which Rennenkampf had at his disposal, the distance from flank to flank being 60 miles. Moreover, the left flank was exposed to attacks coming from the Lötzen gap and the southern end of the lakes. But

it was chiefly in the manner in which he proceeded to occupy this position that he erred. He had no idea where the Germans were or what they had been doing in the interval since Tannenberg. He only had persistent rumours that the Germans were sending billeting parties to Königsberg. Instead of maintaining strong forces in front of his chosen position, in order to discover the enemy's intentions, Rennenkampf committed his troops at once to a linear defence of the line. He placed four of his divisions along the Deime on a front of 18 m., while keeping seven divisions to hold the remainder of his line of 42 miles. A single division was placed opposite the Lötzen gap to the east of the lakes.

It will thus be seen that from the very start of their manoeuvre the Germans had succeeded in out-generalling Rennenkampf. On the left of their line they were containing four Russian divisions with garrison troops, equivalent to about a division. In the centre they were opposing eight divisions to seven Russian divisions. On the right they were advancing with no less than five divisions and two cavalry divisions against a single Russian division.

German Attack.—Von der Goltz attacked and took Mława on Sept. 4, and thereafter kept in check any of the units of the Russian II. Army which attempted to advance. By the night of Sept. 5 Von François was approaching the southern end of the lakes. By the 6th he had taken Johannisburg and Nikolaiken, driving back the few Russian troops opposing him. By the 7th he was through the lakes and had captured Bialla and Arys. The Russian troops opposing him had been hurried up without proper artillery support and were dispersed in disorder. Eleven Russian battalions were thus dissipated without result. On the 8th Von François turned northwards against the Russian flank. Sept. 9 was to be a fateful day for the Germans. Von Mackensen had commenced his crossing at Lötzen during the 8th, but he could not enlarge the bridge-head. His troops attacked at 5 A.M., 12 noon and 8 P.M. on this day without success and that evening he reported no progress to Von François.

Von François' attack against Soltmahnen on the morning of the 9th came as a complete surprise to the left flank of the Russians opposing Von Mackensen. By noon the Russians were in hopeless rout, leaving 5,000 prisoners and 60 guns in the hands of Von François. The German enveloping movement had met with complete success. Rennenkampf's left flank division had been destroyed and about 8,000 men of the Russian X. Army concentrating about Augustówo and Osowiec had been placed out of action. The left flank of Rennenkampf's army now lay open to the attack of five German divisions. A second Tannenberg seemed more than probable.

Ludendorff had employed the 5th, 6th and 7th in bringing his eight divisions in line facing the Insterburg gap and, on the 8th, contact was gained with Rennenkampf's outposts. On the 9th, coinciding with Von François' attack, the Germans moved forward along the whole front. Little progress was made anywhere, and on the right the Russians made a determined counter-attack which completely held up the German advance. This check seems to have paralysed Ludendorff temporarily, for he ordered his right under Von François and Von Mackensen to hold fast and even to close in to the centre for fear of disaster. But Rennenkampf had taken fright at the menace to his left and had decided to withdraw. That night he ordered a general retreat. He had been just too quick for the Germans. When Ludendorff allowed his right to move forward again, nothing further than cutting off the streams of disorganised transport and breaking up the Russian rear-guards was possible. Rennenkampf had pushed his retreat with desperation. Two of his corps had covered 58 m. in 60 hours. By the 13th he was safe from annihilation, and by the 14th his exhausted troops had crossed the East Prussian frontier between the forest of Rominten and the river Niemen.

Results of the Battle.—Although the Russian I. Army had not been surrounded, it had suffered almost as much as the II. Army. Casualties since Sept. 6. had amounted to 125,000 men and 150 guns. Two corps had been destroyed and the whole army was out of action as a mobile force through lack of transport. The chief credit for this success must lie with Von François. In his march round the southern end of the lakes his men had covered 77 m. in the four critical days Sept. 6–9, and there had been severe fighting on two of those days. Had Ludendorff been quicker to realise that Rennenkampf's counter-attack on the 9th was made in order to disengage himself, and had his orders to Von François for the 10th and 11th not been so cautious, there can be no doubt that Rennenkampf's army would have been all but destroyed.

II. THE WINTER BATTLE

During their 28 days' invasion of East Prussia the Russians had lost some 310,000 men from the flower of their army and 650 guns. Their offensive had been completely defeated and they had been thrown on the defensive. It was not till late in the winter of 1914–5 that they began to show signs of activity once more. From the German point of view it was important to prevent another Russian invasion of East Prussia and it was therefore decided to upset by a strong offensive any Russian plans that were in existence.

German Dispositions.—In Jan. 1915 the German VIII. Army, under Von Below, was holding a line from the frontier south of Lake Spirding, along the line of lakes to Angerburg, and thence across the Insterburg gap between Insterburg and Gumbinnen to the river Memel. Some 100,000 Germans, for the most part of the Landwehr and Landsturm, were facing 200,000 men of the Russian X. Army under Siewers. To the south there were indications of a Russian XII. Army being assembled between Modlin (Nowo Georgiewisk) and Thorn (Toruń). Four fresh corps had been allotted for the offensive, making a total of some 250,000 men. In outline the German plan was as follows: (1) The X. Army (eight divisions and one cavalry division, under Von Eichhorn, was to envelop the Russian right, moving southwards from the Insterburg gap. (2) The right wing of the VIII. Army (three divisions), under Von Litzmann, was to envelop the Russian left by moving round the southern end of the lakes. (3) The remainder of the VIII. Army (four divisions) was to hold the enemy in the centre.

Orders for the advance were issued on Jan. 28. The attack in the south was to commence on Feb. 7, with a view to drawing the attention of the Russians to this quarter. The main attack was then to come from the north on the 8th. Conditions were very different from those of the advance in Sept. of the year before. The weather was bitterly cold and the whole country was deep in snow. Large numbers of sleighs had been collected and the scale of clothing and food greatly increased. The German administration left nothing undone which could be thought out beforehand.

German Line Advanced.—Von Litzmann's advance found the marshy country in front of Johannisburg almost impassable, and the attack of the 7th came to little. Many of the units had to force their way through blinding snow storms, and it was not till the 8th that the Russian positions on the Pisseck were reached and taken, and by the 9th the end of the lakes was passed. This diversion served its purpose well, for the attack of the German X. Army in the north came as a complete surprise to the Russians in their winter quarters, leisurely thinking of an advance in the spring. They were given no time in which to readjust their line, and reserves had to be thrown in piece-meal to save the situation. On the 10th, a determined stand was made by four Russian divisions on either side of Eydtkuhnen, but by evening their resistance had been broken. Everywhere the effect of the German heavy artillery was decisive. Despite the difficulty of bringing forward the heavy wheeled vehicles, which broke through the frozen crust of the ground, the Germans never failed to support their infantry at the decisive point. By the 12th, Von Below's army had reached a line stretching from the forest of Rominten to Ludwinow.

Meanwhile, the German centre had moved forward to keep in touch with the southern wing. Russian resistance in the south seemed to centre round the town of Lyck, and Litzmann was reinforced by a fourth division for its capture. From the 10th to the 13th the fighting round Lyck was desperate. Often the opposing sides could not distinguish each other in the blizzards which swept over them, and owing to the difficulty of ammunition supply the infantry were unsupported by artillery fire of any sort, and fierce hand to hand fighting ensued. Casualities on both sides were therefore heavy and the Russians also lost over 8,000 prisoners and 14 guns. By the night of the 13th the Russians had been forced from their positions and the town was in German hands.

Position after the Battle.—By the 14th, the German line ran from Rajgród in the south, through Suwalki, to Sztabinki in the north, in a semi-circle round Augustówo, at a distance of from 9 to 10 m., from the town. The wooded and close nature of the country made concerted attacks very difficult, but everywhere the superior individual training of the German soldier triumphed over the more ignorant Russian. The Russians fought with

desperation to maintain their positions and it was not till the 17th that Siewers finally gave the order to abandon Augustówo. He succeeded in escaping envelopment by abandoning most of his transport and ammunition columns and retiring in disorder on Grodno. By the 20th the Germans were no longer in touch with the retreating Russians.

In the winter battle the Russians lost 110,000 prisoners and 300 guns, and the X. Army, like the Russian I. and II. Armies, was placed *hors de combat* for several months as a mobile force. Their defeat was certainly greatly due to the superior leadership of the Germans, for they had been caught unawares in winter quarters, without proper protection and with an inferior intelligence service. Had the Germans been able to bring up the whole of their guns and ammunition on Feb. 14 they might have succeeded in surrounding Augustówo, but this the weather prevented them from achieving.

BIBLIOGRAPHY.—H. von Redern, *Winterschlacht in Masuren* (1918); P. von Hindenburg, *Out of my Life* (1920); E. Ludendorff, *My War Memories* (1922). (*See* also WORLD WAR: BIBLIOGRAPHY.)

(W. E. I.)

MATERIALS: *see* RAW MATERIALS.

MATERIALS, STRENGTH OF (*see* 25.1007; also CRYSTALLOGRAPHY; METALLOGRAPHY; METALLURGY; METALS, FATIGUE OF; TESTING MACHINERY).—The present article only attempts to describe some of the more important advances which have been made since 1910, and to indicate the trend of modern work.

Mathematical Analysis of Complex Stress Systems: Stresses in Ties.—In the Eleventh Edition it was stated that when a bar is subjected to a simple pull applied axially—that is to say, so that the resultant stress passes through the centre of gravity of every cross-section—the stress may be taken, under ordinary conditions, as (sensibly) uniformly distributed over any section not near a place where the form of the cross-section changes. The design of a tie of specified material to withstand a specified load is thus, as regards the greater part of its length, an easy matter; but it is essential that suitable forms of end attachment be devised, equally able to withstand the imposed load.

The most usual method of connection is by pins or rivets, inserted through the tie in such a way as to operate in virtue of their resistance to " shear "; and in consequence the problem of stress-distribution in the neighbourhood of holes has received much attention. C. E. Inglis[1] has obtained a mathematical solution appropriate to a single elliptical hole, and the special case of a circular hole has also been treated by K. Suyehiro.[2] The more difficult problem of stress-distribution in an " eye end " has been attacked by E. G. Coker[3] with the aid of transparent models of xylonite and the use of polarised light. Fairly complete information is thus available regarding the distribution of stress in tension members, so long as the elastic limit of the material is nowhere exceeded; but a problem of greater practical importance is to proportion the eye ends so that their *breaking load* (after ductility has operated to equalise the stresses) shall be equal to that of the main portion of the tie. This problem has been attacked experimentally by W. A. Scoble,[4] who has interpreted his results in terms of practical rules for design.

Strength of Straight Members in Compression (Struts).—Mention was made in 25.1022 of Euler's investigation of the collapsing load of an ideal strut, perfectly straight and uniform, and centrally loaded; also of a semi-empirical formula which has been proposed, to allow for the fact that a short strut may fail by simple crushing. Since 1910 considerable progress has been made in the theory of this and of allied problems. It was recognised by T. von Kármán[5] and (later, but independently) by R. V. Southwell[6] that crushing of the material is not the only alternative to collapse by buckling under stresses within the elastic limit, because plastic distortion may bring about conditions of instability under stresses which are far below the compressive strength of the material, and which Euler's analysis also would indicate to be perfectly safe. An interesting extension of mathematical theory was made by the authors cited, in a formula which modified Euler's result to allow for the new conditions; and the experimental work of A. Robertson[7] has shown that this formula agrees closely with actual results. The whole subject of strut failure, and advances in theory and experiment, have been reviewed by R. V. Southwell.[8]

Collapse of Tubes by External Pressure.—A similar possibility of collapse exists when a circular tube (such as the flue of a steam boiler) has to withstand fluid pressure imposed upon its *external* surface. Distortion of the circular cross-section into an oval form, whilst it involves an increase in the strain energy due to bending, also involves a decrease in the potential energy of the applied pressures; the circular form will thus be unstable when the pressures are sufficiently high.

This phenomenon was investigated experimentally by W. Fairbairn as early as 1858,[9] and has attracted much attention since; an extensive bibliography was compiled by G. Cook for the British Association in 1913.[10] Recent experiments by A. P. Carman,[11] R. T. Stewart,[12] and G. Cook[13] afford satisfactory confirmation of G. H. Bryan's theoretical formula for long tubes[14] and of a more general formula proposed by R. V. Southwell,[15] who investigated the influence of end constraints upon the resistance to collapse.

Other Problems of Elastic Stability.—The general theory of these problems of " elastic stability " has been developed by G. H. Bryan,[16] R. V. Southwell[17] and W. R. Dean.[18] Among other examples of the class may be noticed the collapse of thin tubular struts, in which instability makes its appearance by wrinkling of the tube wall, and of flat plating under forces which involve compression in its own plane. The strength of tubular struts acquires great practical importance in aircraft construction, and has received much attention both in theory and experiment; bibliographies relating to these two aspects may be found in papers by R. V. Southwell[19] and A. Robertson.[20] The stability of flat plating has importance for the design of deep plate girders, and has been studied from this aspect, theoretically by G. H. Bryan[21] and S. P. Timoshenko,[22] and experimentally by W. E. Lilly[23] and others; two special cases—the stability of a long flat strip under uniform shearing actions in its plane (theoretically treated by R. V. Southwell and S. W. Skan[24]) and of a circular disk under forces which tend to twist it in its plane (theoretically treated by W. R. Dean[25]) have recently been made the basis of a suitable " acceptance test " for the thin sheet steel used in the construction of metal aircraft.[26]

" Whirling " and Vibration of Shafting.—Elastic instability is also likely to occur in a long rotating shaft, because any curva-

[1] *Trans. Inst. Naval Arch.*, vol. lv, p. 219 (1913).
[2] *Engineering*, Sept. 1 1911. *Cf.* also A. Morley, *Strength of Materials* (Appendix).
[3] *Trans. Inst. Naval Arch.*, vol. lv, p. 207.
[4] *Trans. Inst. Naval Arch.*, vol. lix (1917).
[5] *Untersuchungen ueber Knickfestigkeit* (Dissertation: Berlin, 1909).
[6] *Engineering*, Aug. 23 1913.
[7] Inst. C.E., *Selected Engineering Papers*, No. 28 (1925).
[8] Aeronautical Research Committee, *R. and M.*, No. 918 (1924). *Cf.* also E. H. Salmon, *Columns* (Dissertation: Oxford Univ. Press, 1921).
[9] *Phil. Trans. Roy. Soc.*, vol. 148, p. 389.
[10] *Report of the Complex Stress Committee*, Brit. Assn. Report, 1913.
[11] *Univ. of Illinois Bulletin*, No. 17 (1906) and No. 99 (1917).
[12] *Trans. Am. Soc. Mech. Eng.*, vol. xxvii, p. 730 (1906).
[13] *Phil. Mag.*, July 1914 and Oct. 1925.
[14] *Proc. Camb. Phil. Soc.*, vol. vi, p. 287 (1888).
[15] *Phil. Trans. Roy. Soc.* (A), vol. 213, pp. 187–244 (1913), and *Phil. Mag.*, May 1913. *Cf.* also R. von Mises, *Zeits. d. Ver. deutscher Ing.* (1914).
[16] *Proc. Camb. Phil. Soc.*, vol. vi, p. 199 (1888).
[17] *Phil. Trans. Roy. Soc.* (A), vol. 213, pp. 187–244 (1913).
[18] *Proc. Roy. Soc.* (A), vol. 107, pp. 734–760 (1925).
[19] *Phil. Trans. Roy. Soc.* (A), vol. 213, pp. 187–244 (1913).
[20] *Loc. cit.*
[21] *Lond. Math. Soc. Proc.*, vol. 22, pp. 54–67 (1891) and vol. 25, pp. 141–150 (1894).
[22] *Der Eisenbau*, vol. 12, pp. 147–163 (1921). *Cf.* also S. P. Timoshenko and J. M. Lessells, *Applied Elasticity*, chap. 10 (1925).
[23] *Jour. Jun. Inst. Eng.*, vol. xviii, pp. 72–81 (1907); *Engineering*, Feb. 1 1907.
[24] *Proc. Roy. Soc.* (A), vol. 105, pp. 582–607 (1924).
[25] *Proc. Roy. Soc.* (A), vol. 106, pp. 268–284 (1924).
[26] Nat. Phys. Lab., *Annual Report* (1924).

ture of the axis will be intensified by centrifugal force, which may be sufficient to overcome the restoring effect of the flexural stresses. When this happens, the shaft is said to " whirl." The calculation of " whirling speeds " is evidently a matter of great practical importance (since it would be unsafe to allow a shaft to run at these speeds for any length of time), and various methods have been propounded.[27] Torsion or end thrust, acting upon the shaft, will combine with rotation to promote instability; a theoretical discussion of the problem, taking all three actions into account, has been given by R. V. Southwell and B. S. Gough.[28]

It can be shown that the whirling speeds of a shaft are identical with the frequencies of its free transverse vibrations in the absence of rotation; as the speed increases, these " natural frequencies " decrease, becoming zero at the whirling speeds. The difficult question of stability in the immediate neighbourhood of the whirling speeds has been examined by F. B. Pidduck.[29]

Other Problems of Vibration.—The influence of rotation upon the natural frequencies of free vibration has been examined in two other cases of practical importance: (1) the vibrations of a rotating rod (such as an airscrew blade) have been studied theoretically by R. V. Southwell and B. S. Gough,[30] and experimentally by A. Fage[31]; (2) the vibrations of a spinning disk (representative of the rotor of a steam turbine) have been investigated by H. Lamb and R. V. Southwell.[32]

A problem of greater complexity is presented by the vibrations of a railway bridge under the periodic forces imposed upon it by the " hammer-blow " (the effect of the eccentric weights employed to balance the reciprocating masses) of a locomotive as it passes. The period of these forces may synchronise with the natural period of the bridge, and considerable deflection is then produced; but account has to be taken of the fact that only a few blows are delivered during the transit, so that the problem is not one of " resonance " in the ordinary sense. A formal solution of the idealised problem (in which the bridge is taken to be a uniform girder, and a single travelling load is assumed) has been given by S. P. Timoshenko,[33] and an elaborate investigation of cases representative of practical conditions by C. E. Inglis.[34]

Approximate Methods of Stress Calculation.—A general tendency of the period now under review has been towards the development of approximate methods of solution for problems which cannot be treated by exact theory. The original impetus came from Lord Rayleigh, in relation to the calculation of natural frequencies of vibration;[35] but his methods have since been extended to a wide range of problems.[36]

" Experimental " methods of solution have also been developed, based on analogies obtaining between the equations of elasticity and those of other branches of physics. Thus the deflection of a membrane of uniform tension is governed by equations identical with those which define the distortion of cross-sections in a twisted prism; and this fact[37] has been utilised by G. I. Taylor and A. A. Griffith,[38] who have shown how to solve, by measurements made on a flat soap-bubble, Saint Venant's problem of torsion[39] for shapes of cross-section which are mathematically intractable.

Photo-elastic Methods.—Important advances in the solution of two-dimensional systems of stress have been made by the use of " photo-elastic " methods. Various transparent materials under the action of stress possess double refracting properties—that is, they split up plane polarised light into two rays. The interference obtained by the recombination of such rays produces colour bands which may be viewed on a screen or photographed; the colour varies according to the difference of the principal stresses, and the stress-difference at any place in the material may be estimated by matching it with the colour produced in a tension piece strained by a known and uniform stress. The sum of the principal stresses may be deduced from measurements of the lateral contraction of the specimen. By these methods, E. G. Coker, L. N. G. Filon, W. A. Scoble and A. R. Low have determined the distribution of stress in many cases intractable mathematically, which possess great practical importance.[40] The " stress-optical " properties of xylonite have been studied from this aspect by Coker and K. C. Chakko,[41] and the underlying principles of the method have been critically examined by Filon.[42]

Extension of Theory to Problems of Plastic Distortion.—Some general interest attaches to the formula, mentioned above, which extended Euler's analysis for elastic struts to cases in which elastic break-down precedes collapse, since this appears to be the earliest application of mathematical theory to material in the plastic state. The study of plastic distortion (*i.e.*, distortion which does not disappear when the load is removed), and its representation by mathematical equations, have attracted much attention among continental workers; reference may be made to the proceedings of a special conference on this subject, held at Prague in 1924.

Limitations of Mathematical Theory, as applied to the Elastic Failure and Fatigue of Metals.—Such methods of representation have this feature in common with the older theory of elasticity, that they presuppose the quality of *continuity* in the ideal material with which they deal. Employment of differential equations and the methods of the calculus are not strictly legitimate unless the properties of the material can be assumed to be unaffected by subdivision carried to any extent. Now the ordinary materials of construction are known, from microscopical examination, to be crystalline aggregates of great complexity; if subdivision were carried far enough, we should be left with fragments consisting of single crystals, and therefore having properties certainly aeolotropic, and probably non-elastic. Thus the classical theory of elasticity, as applied to actual materials, must be regarded merely as a method of statistical treatment, valid only to the extent that actual materials may be taken to be " statistically isotropic,"[43] and it would seem that the more recent extensions to the plastic state must have the same restricted interpretation. The foregoing considerations serve to explain why theory has given good results when applied to problems of elastic stability or of vibrations (where the result depends upon the general distortion of the whole body), but has not been so successful in its application to questions of elastic failure or fatigue. Suggested criteria of yielding under compound stress (such as those of Rankine, Saint Venant, Guest and Haigh)[44] which involve the principal stresses as calculated by the ordinary mathematical theory cannot be expected to provide an ultimate explanation of occurrences which must depend largely upon the actual microstructure of the material at the point considered.

Modern Tendencies in the Study of Elastic Failure and of Fatigue.—The outlook of earlier investigators, which tacitly presupposed a degree of continuity, in actual materials, comparable

[27] *Cf.* S. P. Timoshenko and J. M. Lessells, *op. cit.*, chap. xi; R. V. Southwell, *Phil. Mag.*, vol. xli, p. 419 (1921); S. Dunkerley, *Phil. Trans. Roy. Soc.* (A), vol. 185, p. 279 (1894).

[28] Report of the Complex Stress Committee, *Brit. Assn. Report*, 1921.

[29] *Proc. Lond. Math. Soc.*, vol. xviii, p. 393 (1920).

[30] Aeronautical Research Committee, *R. and M.*, No. 766.

[31] *Proc. Roy. Soc.* (A), vol. 107, pp. 457–469 (1925).

[32] *Ibid.*, vol. 99, pp. 272–280 (1921), and vol. 101, pp 133–153 (1922).

[33] *Phil. Mag.*, vol. xlii., p. 1018 (1922).

[34] *Proc. Inst. C.E.*, vol. ccxvii., p. 225 (1924).

[35] *Theory of Sound*, vol. I (1877).

[36] *Cf.* J. Prescott, *Applied Elasticity* (1924); and S. P. Timoshenko and J. M. Lessells, *op. cit.*

[37] The analogy was pointed out by L. Prandtl, *Phys. Zeitschr.*, Bd. 4 (1903). *Cf.* A. E. H. Love, *Mathematical Theory of Elasticity*, § 224.

[38] *Engineering*, vol. 104, pp. 655–699 (1917).

[39] *Cf.* A. E. H. Love, *op. cit.*, chap. 14.

[40] *Cf.* bibliographies by A. Morley, *Strength of Materials*, chap. 16; and by E. G. Coker, Reports of the Complex Stress Committee, *Brit. Assn. Reports*, 1921 and 1924.

[41] *Phil. Trans. Roy. Soc.* (A), vol. 221, pp. 139–162 (1920). *Report*, 1921.

[42] Report of the Complex Stress Committee, *Brit. Assn. Reports.*

[43] *Cf.* a paper by R. V. Southwell and H. J. Gough, *Phil. Mag.*, Jan. 1926.

[44] *Cf.* 25·1007 to 23 and B. P. Haigh, Reports of the Complex Stress Committee, *Brit. Assn. Reports*, 1919 and 1921.

with that of the ideal material of elastic theory, has been modified by increasing knowledge of the inner structure of metals, as revealed by microscopical study at the hands of Sorby, Ewing, Rosenhain, Humphrey, Beilby, Osmond and Arnold. In all the ordinary tests of material for engineering purposes, in the classical " stress-strain diagrams " of Eaton Hodgkinson and others, even in the notions of the " yield point " and of " ductility," we see a general tendency to analyse *resultant* effects, observed in a specimen of considerable size, as though these were due to *continuous* strains (the word is used in the mathematical sense) in a structureless material. Even in the work of Bauschinger, Muir and others, who investigated the phenomenon of " recovery " under prolonged rest or gentle heating, there is nothing which demands a mental picture of the inner mechanism by which the results are produced; and the extent to which the older ideas suffice for explaining the behaviour of materials from an engineering standpoint is shown by C. F. Jenkin's successful derivation of all the ordinary phenomena of low-speed tests from a conceptual " model " characterised merely by a resistance to distortion due in part to elastic resistance and in part to " solid friction."[45] But to explain the first occurrence of elastic failure, and the circumstances which attend the phenomena of fatigue and ultimate fracture, it is becoming increasingly evident that attention must be concentrated upon the actual structure of the crystalline aggregate.

Thus, A. A. Griffith[46] has been led, by discrepancies found to exist between theory and experiment in regard to stress-concentration in the neighbourhood of scratches and flaws, to propound a theory of rupture, for brittle materials, which takes account of the surface energy generated in the formation of cavities or cracks; and he has verified the consequences of his theory by producing fibres of fused silica exhibiting strength of a quite abnormal order. Attention is now concentrated upon ductile materials such as soft iron, copper and aluminium, which are aggregates of small crystals arranged, in general, with random orientation. The methods of X-ray analysis developed by W. H. and W. L. Bragg have provided a powerful means of investigating the structure of the individual crystal,[47] and the discovery, by H. C. Carpenter, C. F. Elam[48] and others, of methods whereby single crystals of aluminium and other metals can be produced in sizes such that they may be subjected to ordinary engineering tests, has led, at the hands of G. I. Taylor and C. F. Elam[49] and others to more exact understanding of the way in which such crystals distort under static or alternating loads.

The stress which a single crystal of aluminium can withstand without suffering permanent distortion is markedly low as compared with the strength of the crystalline aggregate, and it thus appears that we must look to the crystal boundaries (where the atoms presumably have a more random distribution, owing to the conflicting requirements of the adjoining crystal lattices) for an explanation of the relatively high resistance which the aggregate can oppose. This view is supported by the increased strength which accompanies a reduction in the size of individual crystals, under the influence of hardening processes such as heat treatment or " cold work." It is, of course, in agreement with the concept of the " amorphous phase " propounded by Ewing, Rosenhain and Beilby (*see* 25.1018); but it remains for further investigation, using the more powerful methods which are now available, to give precision to ideas which have proved so useful in the past, for correlating the manifold phenomena of plastic distortion and fatigue. Ultimately, of course, static straining and fatigue must be explained on some common basis (*see* METALS, FATIGUE OF).

Engineering Tests.—Rosenhain's theory of " lattice distortion," propounded in his May lecture to the Institute of Metals for 1923 as an explanation of the hardening effects of alloys, etc., exemplifies the new outlook which has been made possible by the discoveries since 1910; it is to microscopical, chemical and X-ray investigations that engineers are looking for a solution of the ultimate problems of fatigue. But understanding of the properties of materials is only one side of the problem of engineering design, and it is unlikely that the practical rule, that the working stress must be kept within the elastic limit, will lose its validity. The other side of the problem is stress-calculation, and stresses, in the crystalline aggregate, can only be determined in statistical fashion. So the older tests, on specimens large in comparison with the crystal structure, have not ceased to be useful, or reached the limit of their development.

A full account of experimental results will be found in R. G. Batson and J. H. Hyde's *Mechanical Testing* (1922). Considerable attention has been directed to the improvement of experimental technique and of the interpretation of results: thus W. E. Dalby[50] has introduced an improved type of specimen and a calibrated weigh-bar for the measurement of loads; A. Robertson and G. Cook,[51] by means of special apparatus designed to eliminate the effects of inertia in the testing machine, have shown that the observed inflection of " autographic " records at the " yield point " of ductile materials (*see* 25.1014) really masks a *reduction* of stress, which in some metals may be as great as one-third of the stress at which yield commences; T. E. Stanton and R. G. Batson[52] have done much to systematise the results of " impact tests "; B. P. Haigh[53] has developed an electrical machine whereby a sinusoidal wave of simple tension and compression may be impressed upon a specimen, and has conducted interesting investigations into the generation of heat during the progress of fatigue tests; W. S. Farren and G. I. Taylor[54] have made accurate determinations of the heat generated during plastic extension in a static test; C. F. Jenkin[55] has developed apparatus with which fatigue tests can be conducted at speeds up to 5,000 cycles per second.

It is impossible in this article to include any summary of experimental results. The reader is referred to a recently published treatise by H. J. Gough,[56] in which a very clear and exhaustive account may be found, covering all aspects of fatigue as developed up to the latter part of the year 1924. (R. V. S.)

MATERNITY AND INFANT WELFARE.—The period 1910–26 was marked by an increasing consciousness in all civilised countries of the importance of decreasing the heavy losses to the community due to the high death-rate among women at childbirth and among infants under one year of age. There is a considerable body of new legislation intended to supplement and assist welfare agencies and to provide definite state assistance.

I. THE UNITED KINGDOM

The Maternity and Child Welfare Act 1918 gives wide and comprehensive powers to local authorities for taking action designed to preserve maternal and infant life. The passing of this Act consolidated the work commenced in 1906 by the St. Marylebone Health Society. Like nearly every other movement to fight disease, modest experiments by groups of social workers pointed the way to larger state and municipal action.

In 1910 there were 90 infant welfare centres in Great Britain, and by 1914 the number had risen to 400. Owing to the great impetus given to this service during the War, and to the passing of the Maternity and Child Welfare Act in 1918, there were in 1925 no fewer than 1,363 infant welfare centres under the local authorities and 759 voluntary centres, as well as 133 maternity institutions recognised by the Ministry of Health.

Legislation.—The various enactments bearing on the subject are the Factory and Workshops Act of 1901, which endeavours directly to protect the woman who has recently given birth to a child; the Midwives Act of 1902, which laid the foundation of a safe and efficient system of practice by midwives; the Notification

[45] *Proc. Roy. Soc.* (A), vol. 103, pp. 121–138 (1923).
[46] *Phil. Trans. Roy. Soc.* (A), vol. 221, pp. 163–198 (1920).
[47] *See* articles CRYSTALLOGRAPHY.
[48] *See* METALLURGY.
[49] *Proc. Roy. Soc.* (A), vol. 102, pp. 643–667 (1923).
[50] *Phil. Trans. Roy. Soc.* (A), vol. 221, pp. 117–138 (1920).
[51] *Proc. Roy. Soc.* (A), vol. 88, pp. 462–471 (1913).
[52] *Proc. Inst. C. E.*, vol. 211, pp. 67–100 (1921).
[53] *Engineering*, Nov. 22 1912.
[54] *Proc. Roy. Soc.* (A), vol. 107, pp. 422–451 (1925).
[55] *Ibid.*, vol. 109, pp. 119–143 (1925).
[56] *The Fatigue of Metals* (1924).

of Births Act of 1907 and the extension of the Act in 1915, which Miss Margaret Llewelyn Davies described as " nothing less than a welcome by society to each of its newly-born citizens, and a signal of help and a message of hope to every mother in the land." Under this Act the father or doctor or midwife must notify the public health authority within 36 hours of the birth of a child. Advice and help, free of charge, are then given by a woman health visitor. The National Health Insurance Act provides a maternity benefit of 40s. for an insured woman or the wife of an insured man.

The Ministry of Health, formerly the Local Government Board, encouraged local authorities to extend and develop their maternity and child welfare services. In a circular letter to local authorities issued in 1914 the board stated that an estimate had been laid before Parliament for a grant to be distributed to local authorities and voluntary agencies in respect of institutions or other provision for maternity and child welfare, that more extended and systematic measures than had hitherto been generally adopted were necessary. Sir Arthur Newsholme, in a report on maternal mortality in connection with childbearing, published in 1915, stated that " the present report is intended to draw attention to this unnecessary mortality from childbearing, to stimulate further local inquiry on the subject and to encourage measures which will make the occurrence of illness and disability due to childbearing a much rarer event than at present." His successor, Sir George Newman, 10 years later (1924), in his preface to Dr. Janet Campbell's *Maternal Mortality*, referring to the fact that approximately 3,000 mothers had died each year at childbirth for the previous 10 years, stated: " That is a serious and largely an avoidable loss of life at the time of its highest capacity and in its most fruitful effort."

Administration.—The local authorities carrying out maternity and child welfare schemes are the county councils, county borough councils and the councils of certain of the larger county districts—as a general rule those having a population of more than 20,000. These are in the main the authorities which adopted the Notification of Births Act referred to above, under which some work for mothers and babies was already being done before the passing of the Act of 1918. The regulations under which a grant is payable by the Exchequer of 50% of the approved net expenditure of local authorities, set out the services which may and should be comprised in a maternity and child welfare scheme, and from them the scope and content of the services may readily be understood.

1. The salaries and expenses of inspectors of midwives and of health visitors and nurses engaged in maternity and child welfare work;
2. The provision of a midwife for necessitous women and for areas insufficiently supplied with this service;
3. The provision, for necessitous women, of a doctor for illness connected with pregnancy and for aid during the period of confinement;
4. The expenses of a centre, *i.e.*, an institution for providing medical supervision and advice for expectant and nursing mothers and for children under five years of age, and medical treatment at the centre for cases needing it;
5. Arrangements for instruction in the general hygiene of maternity and childhood;
6. Hospital treatment for complicated cases of confinement and for children under five years of age found to need in-patient treatment;
7. The cost of food certified as being necessary to expectant and nursing mothers and for children where the case is necessitous;
8. Expenses of crèches and day nurseries and of other arrangements for attending to the health of children under five years of age whose mothers go out to work;
9. Accommodation in convalescent homes for nursing mothers and for children;
10. The provision of homes and other arrangements for attending to the health of children under five years of age of widowed, deserted and unmarried mothers;
11. Experimental work in relation to maternity and child welfare work;
12. Contribution by a local authority to voluntary institutions.

Exchequer grants on the same scale are also paid to voluntary agencies which carry out certain services to the satisfaction of the Minister of Health.

The annual expenditure on maternity and child welfare services provided by local authorities is approximately £1,500,000, in addition to which exchequer grants are made to voluntary agencies. If to these figures is added the £1,500,000 paid in maternity benefit under the national health insurance scheme, a total of over £3,000,000 is spent each year on these services, without taking account of the total expenditure of the voluntary agencies, of other benefits paid from health insurance funds and of the voluntary hospital services.

Infant Mortality.—The services given at the centres by both lay and professional workers helped to secure the reduction of the infant mortality rate from 154 per 1,000 births in 1900 to 75 per 1,000 births in 1924. This gratifying result means that (calculated on the average infant mortality of 1901–10) there was in 1924 a further saving of 39,000 infant lives. " It also implies a better physical condition in children from one to five years of age, and a more enlightened understanding of personal and public hygiene " (Sir George Newman). While this saving of infant lives is all to the good, it is disturbing to find on an analysis of the statistics that the reduction in the infant mortality rate has occurred almost entirely subsequent to the first few weeks of life and that the death-rate of infants up to the age of four weeks has remained almost stationary, being 33 per 1,000 births in 1924 as against 40 per 1,000 births for the period 1906–10.

Maternal Mortality.—So, too, in the case of maternal mortality, notwithstanding that Sir Arthur Newsholme reported in 1915 that " 800 mothers die each year in England and Wales as the result of childbearing whose lives would be saved if the experience of the rest of England and Wales were as favourable as London," and that there would be a further saving of 1,100 lives of mothers secured annually in England and Wales if puerperal fever were to be eliminated " as it has been substantially from the experience of many lying-in hospitals." Dr. Janet Campbell, 10 years later, writes that " avoidable maternal deaths are a matter of everyday occurrence," and that " puerperal infection leads to more deaths and more injury than any other complication of childbearing."

It has been shown that the mortality rate of very young babies is nearly as high as it was early in the century. On examining the statistical returns of maternal mortality it is seen that while the death-rate of mothers at childbirth was 3·74 per 1,000 births for the period 1906–10, it was 3·70 per 1,000 births in 1924.

Here then is the problem. Improvements in general sanitation and public health services, a better education in public and personal hygiene, the maternity and child welfare services, the services provided under the National Health Insurance scheme, have had no visible effect upon the vital statistics relating to childbearing. Comparing the period 1906–10 with the year 1924—that is to say, the period prior to the establishment and development of maternity and child welfare services by the local authorities with the latest complete figures available—it is seen that taking the 1906–10 period as 100, the relative mortality rates for 1924 are:—

Maternal mortality	98·9%
Infants under four weeks	82·5
Infants from four weeks to one year	54·5

It seems perfectly clear that the saving of the lives of the mothers and very young babies is one and the same problem. " The unexpected loss of the mother is a tragedy to the family. It is not infrequently associated with the death of the infant for whom the maternal life has been sacrificed, and is often followed by the impaired health and nutrition of the remaining children" (Dr. Janet Campbell).

Disability Among Married Women.—It has been pointed out that the mortality returns " reveal only a part of the total damage and disability, and that an incalculable amount of unreported and often untreated injury and ill-health results from pregnancy and labour." Statistics relating to the comparative heavy incidence of sickness amongst married women were presented to the Royal Commission on National Health Insurance which reported in March 1926. In Appendix A to the report the Government actuary states:—

18. Another matter calling for attention, and in this case calling urgently, is the excess of the claims of married women over those of the unmarried.

At the important groups of ages, 20–25, 25–30 and 30–35, the married woman's rates of sickness are found to represent the following percentages of those of the unmarried class:

Ages	1921	1922	1923
	%	%	%
20–25	242	284	299
25–30	174	198	242
30–35	158	171	198

The majority report of the Royal Commission recommended the provision of improved maternity services "as and when funds are available to meet the cost." The minority report, however, declared that "the high maternal death-rate and the great amount of sickness amongst mothers clearly prove the need of reorganisation and extension of maternity work," and recommended that medical benefit under the Health Insurance scheme should include medical attention at confinement and should be extended to include the wives and dependants of insured men. The provision of more adequate services for women at childbirth is a matter of urgent necessity. "If a woman can rely upon securing the services of a careful up-to-date practitioner, or upon the attendance of a well-trained midwife who is able to obtain prompt and competent medical assistance in case of need, nearly all other conditions become of minor importance" (Dr. Janet Campbell).

Effect of Environment.—The development of antenatal services appears to afford the most likely solution to the problem. Regional distribution of the mortality does not point to industrial factors as being the chief causes of deaths. At the same time, it is not without significance that nine of the 10 county boroughs having the highest rates of maternal mortality in the four years 1919–22 were in Lancashire and Yorkshire, and seven of those nine towns, viz.: Halifax, Rochdale, Huddersfield, Bury, Oldham, Dewsbury and Blackburn, in the report of 1914–5 are among the county boroughs which exact "the heaviest toll of life from mothers in childbearing." Industrial areas can, however, be found with extremely low rates of mortality; the predominatingly working class district of West Ham actually had in 1919–22 the lowest rate of maternal mortality of all the county boroughs.

The same county borough had the lowest rate among the metropolitan boroughs in 1914. In the counties of Lancashire and Yorkshire it is the practice for a considerable proportion of married women to be employed in the textile mills, and it is difficult to resist the conclusion that the nature of their employment, together with the strain of managing the household and bearing large families, is in no small degree responsible for the unenviable position which the towns occupy and have occupied for so many years. The puerperal death-rate in Wales has always been higher than that in England, and, until recently, than in Scotland. That is probably due, not so much to any special cause peculiar to Wales, as to the fact that, broadly speaking, the whole country is either extremely rural or highly industrial. The services available in most rural areas leaving much to be desired, and the exceedingly hard life associated with the mining industry, must be factors contributing to the high maternal mortality rates disclosed.

An enlightened public opinion would encourage and, where necessary, compel the local authorities to provide the services considered by the experts to be essential. The medical profession has the knowledge; administrators, local and national, are capable of creating the administrative machinery; there is no lack of voluntary helpers; the provision of the necessary finance and the co-operation of the mothers are the two factors which depend upon education.

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II. THE UNITED STATES

The most important development in this field was the passage by Congress in 1921 of the Maternity and Infancy Act, popularly known as the Sheppard-Towner Act. This Act authorised an annual appropriation of $1,240,000 for a five-year period, of which a sum not to exceed $50,000 may be expended by the U.S. Children's Bureau for administrative purposes and for the investigation of maternal and infant mortality, the balance to be divided among the states accepting the Act as follows: $5,000 unmatched to each state, and an additional $5,000 to each state if matched; the balance to be allotted among the several states on the basis of population and granted if matched.

The national administration of the Act is lodged with the Children's Bureau of the U.S. Dept. of Labor; local administration in the states is in the child-hygiene or child-welfare division of the state agency of health or, where such a division does not exist, the agency designated by the state. In 1925, 43 states—all except Connecticut, Illinois, Kansas, Maine and Massachusetts—had accepted the benefits of the Act, and approximately $1,000,000 was being expended by the national Govt. in subsidies to the states. In 1924 the benefits of the Act were made available to the Territory of Hawaii, which has also accepted and matched the funds available.

Results of the Act.—The report for 1925 of the activities undertaken by the states under the terms of this Act shows continued progress as old activities have spread over a greater territory and new activities have been initiated. These have for their object: (1) better infant care through the teaching of mothers; (2) better care for mothers through education as to the need and value of skilled supervision during pregnancy, childbirth and the lying-in period; and (3) more widespread medical and nursing facilities so that adequate maternity and infancy supervision will be available to all who need it. Children's health centres or conferences and pre-natal or maternity centres or conferences are everywhere recognised as the best agencies for teaching the hygiene of maternity and infancy. An objective in most of the states is the state-wide establishment of permanent, locally supported centres. Demonstration conferences have been held and intensive pieces of work undertaken by the states when there was evidence of special need. In the main these activities have been for the benefit of rural communities and small towns.

State reports of the work during the fiscal year 1925 show 10,802 child-health conferences held by 43 states administering the Federal funds, with 278,016 infants and children of preschool age examined, and 622 children's health centres established through the efforts of the states. Since 1920 child-hygiene or child-welfare divisions or bureaux have been organised in the departments of health in 14 states, so that in all except one state (Colorado) these departments now have an organised agency promoting child health.

Ten states have been admitted to the United States birth-registration area since 1920. At present (1926) 33 states and the District of Columbia (all except Alabama, Arizona, Arkansas, Colorado, Georgia, Idaho, Louisiana, Missouri, Nevada, New Mexico, Oklahoma, South Dakota, Tennessee, Texas and West Virginia) are in the birth-registration area, comprising 75·9% of the total population of the United States. In 1915 the infant mortality rate for the birth-registration area was 100; in 1920, 86; and in 1924 (provisional figures), 72. A general reduction during the five years 1920–5 in the rates in both rural and urban areas is indicated.

On the face of the figures, maternal mortality from all causes appears to have been increasing in the United States. Analysis of the statistics shows that the certification of the causes of deaths has improved during the last 20 years. If allowance is made for the probable effect of this improvement in certification,

the mortality from puerperal septicaemia has fallen throughout the period instead of increasing up to 1911 and falling since that time, as the figures, if taken at their face value, would indicate, and the mortality from other puerperal causes has been approximately stationary. After allowances are made for the margin of errour in the statistics of the United States and of other countries, it seems probable that the rate in the United States is actually considerably higher than in most foreign countries. The maternal death-rate, per 1,000 live births in the birth-registration area of the United States, was 6·6 in 1924, with only five states having a rate below 6.

Great emphasis is being placed on pre-natal supervision by the state bureaux of maternal and infant hygiene, but the programme of work was only just getting under way in 1926. Reports of activities undertaken under the Maternity and Infancy Act show 3,781 pre-natal conferences with more than 36,000 women in attendance, and 65 permanent pre-natal centres established. More than 400 midwife classes were held in 20 states, with an enrolment of more than 10,600 midwives, of whom more than 8,000 completed a somewhat formal course of instruction. Most of these were negro midwives who had had little or no previous training. Women in isolated rural districts are being reached by "pre-natal letters" and itinerant conferences. More generally accessible hospital care during confinement is also receiving consideration.

In 1925, 22 states—Arkansas, Arizona, Colorado, Florida, Idaho, Iowa, Kansas, Kentucky, Louisiana, Massachusetts, Minnesota, Montana, Nebraska, Nevada, New Hampshire, New Jersey, North Carolina, Pennsylvania, Rhode Island, South Carolina, Utah, Virginia—and the District of Columbia have laws making medical inspection of schools mandatory, although in some of these states the examination is required only in case of infectious disease. In 8 states—Alabama, Connecticut, Georgia, Indiana, Maine, New York, West Virginia and Wyoming—it is mandatory for certain districts. Five states—Iowa, Kansas, South Dakota, Nevada and Utah—have laws specifically requiring examination of the teeth of school children; and in 12 other states and the District of Columbia it is included in the requirement of a complete examination. Thirty-three states—all except Arizona, Arkansas, Colorado, Florida, Kansas, Louisiana, Montana, Nebraska, New Hampshire, New Mexico, Oklahoma, South Dakota, Texas, Vermont, Wyoming and the District of Columbia—have laws with reference to physical education in elementary schools which are either mandatory or mandatory in effect. The teaching of health and health habits as distinguished from either medical inspection or physical education has greatly increased in recent years.

In 1923 two private national organisations, the American Child Hygiene Assn. and the Child Health Organisation of America, united to form the American Child Health Association. This association has made an important survey of child health in 86 cities having a population of from 40,000 to 70,000 and has supervised the demonstrations in child hygiene for The Commonwealth Fund and done general educational work in the field of child health.

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MATHEMATICS (*see* 17.878).—In the great *Principia Mathematica*, published in 1911, mathematics is rigorously deduced from a few primitive propositions of logic. Since then, not to speak of improvements of detail effected by Sheffer and Wicod, the *Principia* has been subjected to fundamental criticisms which have induced many workers to abandon altogether its line of approach.

I. MATHEMATICAL LOGIC

Theory of Types.—In attempting to provide a firm logical basis for the theories of infinite aggregates and irrational number developed during the 19th century by Cantor and Dedekind, the chief theoretical difficulty is to avoid the famous paradoxes of the theory of aggregates. These are direct contradictions which arise as a result of pursuing apparently ordinary and legitimate mathematical arguments. Such a state of things is intolerable, and shows that there must be something radically wrong with our fundamental ideas. Whitehead and Russell discovered that behind each contradiction lay a "vicious-circle fallacy," due to neglecting the fundamental principle that what involves the whole of a given totality cannot itself be a member of the totality. In order to avoid such fallacies they put forward their Theory of Types, which consisted of two rather different parts. The first part asserted that things were of different logical types, and that for any predicate there was only one type of subject, of which the predicate could significantly be predicated; applying it to a subject of any other type would give not falsehood but literally nonsense. According to this principle many of the paradoxes consist of sentences, which, though grammatically correct, are nevertheless strictly meaningless, and the contradictions are thus completely removed. But not all the paradoxes could be dealt with thus, and the others required the second part of the theory of types, which distinguished further different orders of predicates applicable to the same type of subject.

For instance, the quality of having all qualities of a certain sort cannot itself be a quality of that sort, or it would be involved in its own definition, but must be a quality of a higher order. So, in order to avoid vicious circles, we must never speak of all qualities generally, but only of all qualities of a certain order. If all statements of this kind are made precise as to the order of qualities involved, all the paradoxes which escape the first part of the theory of types in their turn disappear.

Axiom of Reducibility.—The theory of types is thus completely successful in avoiding the contradictions, but this is only half the problem. The arguments leading to contradiction must be invalidated, but this must be done without also invalidating the arguments used in accepted mathematics; and in this Whitehead and Russell failed, for the restrictions imposed by the second part of the theory of types upset an enormous part of ordinary analysis, and this catastrophe was only averted in *Principia* by the introduction of the axiom of reducibility. This axiom asserts that for any predicate of higher order there is a predicate of the lowest order having the same extension (*i.e.*, applying to the same subjects) as the one of higher order. This implies that any class defined as the extension of a higher order predicate will also be the extension of a lowest order predicate; so that thus the totality of classes, whose members are of a given type, can be obtained from the totality of lowest order predicates applicable to that type and will be a legitimate totality. In this way the theory of irrational numbers and the other parts of mathematics threatened by the theory of types can be saved, if we are prepared to accept the axiom of reducibility. But this axiom cannot possibly be regarded as self-evident, and there is really no reason whatever for supposing it to be true, so that anything which can only be proved by assuming it cannot be regarded as proved at all.

Intuitionist Views.—This point was especially emphasised by Weyl in *Das Kontinuum* (Leipzig, 1918) who went so far as to reject not merely as unproved, but as evidently unprovable, much of the general theory of real numbers, bounds, limits and continuous functions, to say nothing of more recent advances. He proposed to confine mathematics to the narrower body of truth, which could be proved not merely without the axiom of reducibility but without using higher order predicates at all. Since then Weyl has moved still further from the standpoint of *Principia Mathematica*, and in his latest work (*e.g.*, in *Mathematische Zeitschrift*, 1921) he appears as a follower of Brouwer, who is regarded as the leader of the "intuitionist" school.

The Excluded Middle.—Brouwer's principal thesis is his denial of the law of excluded middle, which may be illustrated by a case of the following kind. Suppose we wish to establish the existence of a number having a certain property; then we may argue thus: A certain condition, say p, must either be fulfilled or not; if p is true, we can make a construction which will give a number of the required kind; if p is false, we can also make a construction for

such a number, though a different construction from the previous one. So we shall conclude that in either case there exists a number having the required property. Such an argument would, according to Brouwer, be illegitimate, because if, as often happens, we could not tell whether p were true or false, we should not know how to set about actually constructing the number in question. It would be wrong, he thinks, to argue by the law of excluded middle that, because it could not be true in either case that all numbers have not got this property, there must be one number at least which has it.

This criticism, which is supported by several eminent authorities, would annihilate considerable portions of modern mathematics. There are, however, many thinkers to whom Brouwer's criticism seems to have no force whatsoever, and who are determined to find a theory of the foundations of mathematics which will not involve the rejection of any generally accepted parts of the subjects; and of their views we must now give some account.

Axiom Systems.—There are first Zermelo, Fränkel and others, who are working at the construction of axiom systems for the theory of aggregates; they propose to cease using the word class or aggregate in its ordinary sense, whatever that may be, but to mean by it anything satisfying certain axioms; these axioms will be constructed so as to permit the deduction of all the ordinary theory of aggregates, but avoid all the contradictions. But from a philosophical point of view this shirks the real problem, which is to clear from contradiction the notion of class and other allied notions which occur in mathematics, when, for instance, we speak of the class of prime numbers, as well as outside it.

Formalists.—The most prominent opponents of the intuitionists are, however, the formalists, of whom Hilbert (see especially *Mathematische Annalen*, 1922) is the leader. This school regards mathematics as consisting of meaningless symbols manipulated according to formal rules, thus reducing it to something of the nature of a game of chess. Such an account of mathematics is wholly inadequate; since if " two " and " three " were meaningless marks on paper there could be no difference in meaning between " two shillings " and " three shillings." But the formalist attitude, although hopeless philosophically, may be useful in dealing with particular questions, and the essential novelty of Hilbert's work consists not in his formalist theory, but in the propositions he has proved or hopes to prove about mathematical formulae. The chief of these propositions is that it is impossible to deduce a contradiction by permissible operations from the axioms of mathematics, including the law of excluded middle.

This demonstration is only required to convince the sceptics or intuitionists, who will not be satisfied with the simple argument that the axioms are true and that therefore no contradiction can be logically deduced from them. Hence it is essential not to use in the demonstration any principle which the sceptics doubt. This appears to be possible, since, owing to the finite nature of any piece of mathematical reasoning, in proving that it does not lead to contradiction we shall only have to employ the law of excluded middle for finite ranges, for which everyone admits its validity. The science on which Hilbert is now (1926) engaged, which takes for its subject matter the meaningless formulae of mathematics, he calls *metamathematics*, and believes it to be capable of establishing many important results relating to the multiplicative axiom or axiom of selections and to the continuum problem. Interesting, however, as his work is, it does not offer any satisfactory account of the foundations of mathematics as a science, but only deals with it as a game, and contributes no more to the solution of the main problem than does the annihilating scepticism of the intuitionists.

Mathematical Induction.—So that, in view of the bankruptcy of all other proposals, it would seem that the true account of the matter must be on the lines of that of Whitehead and Russell, although this cannot be correct in detail owing to the unsatisfactory nature of the axiom of reducibility. Of great interest from this point of view is the new work in the second edition of *Principia Mathematica* (vol. 1, 1925) and in particular the new theory of mathematical induction, which by most ingenious arguments is established without using the axiom of reducibility. Unfortunately the authors do not see their way to constructing a similar account of Dedekindian Series, for which and for all that part of analysis which depends upon it we are left without any justification.

In this new edition of *Principia Mathematica* some use is made of the theories of *Tractatus Logico-Philosophicus* by Ludwig Wittgenstein, which, although mainly concerned with more purely philosophical problems, also contains contributions of fundamental importance to our subject. Of one of the principal problems in particular he has given an original and possibly final solution; but in order to understand this it is necessary to go back a little.

Mathematics and Logic.—One of the chief objects of the work of Frege and Russell was to reduce mathematics to logic, to show that all mathematical concepts could be defined in terms of " logical constants," and that all mathematical propositions could be deduced from those of formal logic; so that mathematics and logic became one and the same subject. Granting the validity of this reduction, doubt still remains as to what is the peculiar characteristic of logical or mathematical propositions, and how they differ from all others. This question Russell answered in 1903 by saying that logic or mathematics consisted of all true propositions, which were hypothetical in form and contained no constants except logical constants; this amounts practically to saying that any completely general true proposition is a proposition of logic. It subsequently became clear that this definition was much too wide, and that it was necessary to distinguish the propositions which could be stated in purely logical terms and were in fact true, from those which logic alone could assert to be true, which form the science of logic and mathematics. And the distinguishing characteristic of this smaller group of propositions which logic can assert to be true had yet to be found.

Wittgenstein's Work.—This problem Wittgenstein has probably solved; his answer is complicated by the fact that he does not accept the reduction of mathematics to logic, and gives different accounts of the propositions of logic and those of mathematics. Of these his theory of logical propositions is the more important; and if, as is quite possible, his criticisms of the reduction of mathematics to logic are unsound, it would entirely supersede his theory of mathematics, which is given only in barest outline.

Wittgenstein's account of the propositions of logic is that they are tautologies, in a sense of which a precise definition is given in terms of his theory of propositions in general. Any proposition, he maintains, is the expression of agreement and disagreement with certain ultimate possibilities, the possibilities of existence and non-existence of atomic facts. A proposition which agrees with every possibility is a tautology; one which disagrees with every possibility is a contradiction. An ordinary proposition asserts something to be the case and is true if it is the case; a tautology on the other hand asserts nothing but agrees with every possibility and is therefore true unconditionally. This account can be made to cover not only what are called in *Principia Mathematica* " elementary propositions," but also general propositions which involve apparent variables.

Symbolism.—But the importance of Wittgenstein's work does not only consist in his having defined the propositions of logic, and hence possibly those of mathematics, but also in his theory of symbolism, which seems capable of far-reaching applications to the theory of types. The theory of symbolism may indeed be expected to be relevant for the following reason. There is an obvious division of the paradoxes into two groups, which is entirely overlooked in *Principia Mathematica*. The first group of contradictions, such as those about the class of classes not containing themselves and the greatest ordinal, can be stated in purely logical or mathematical terms. They would actually occur in a mathematical treatise if it investigated the problems in question. The remaining contradictions, such as Richard's paradox, involve, besides mathematical terms, terms drawn from psychology or epistemology, such as knowing, asserting, naming or meaning. These contradictions are not therefore purely mechanical, and the responsibility for them need not, as must that

for the first group, lie with faulty mathematics or logic, but may lie in faulty ideas of knowledge and symbolism. This was the view taken of them by Peano; but it cannot be regarded as satisfactory until an adequate explanation is given of where exactly the fault lies. The probability that it lies in the epistemology and not in the mathematics, is strengthened by the fact that this grouping of the contradictions into purely mathematical and mixed coincides with their grouping according to whether their solution in *Principia* requires the first or second part of the theory of types. So that the first part of the theory, which is undoubtedly sound, will suffice for the purely mathematical contradictions, and if the mixed contradictions can be shown to be due to the epistemological element, there may no longer be any need for the second part of the theory of types, which requires the axiom of reducibility and is so responsible for the whole trouble.

By using the work of Wittgenstein a solution has been constructed along these lines, on which the theory of types is so modified that all need for an axiom of reducibility disappears, and mathematics consists entirely of tautologies in Wittgenstein's sense.

BIBLIOGRAPHY.—*Mathematische Zeitschrift* (1921); *Mathematische Annalen* (1922); L. Wittgenstein, *Tractatus Logico-Philosophicus*, Ger. and Eng. (1922); *Principia Mathematica* (1925). (F. P. R.)

II. THEORY OF NUMBERS

In the article NUMBER (19.847) an excellent summary is given of the classical theory. Modern mathematics has seen the rise of a new theory, the "analytic" theory, which has developed with great rapidity, and has almost monopolised the attention of arithmeticians.

(*a*) *Theory of Primes.*—The modern developments of the theory of numbers depend in the main on the application to the theory of the ideas of the theory of functions of a complex variable (*see* 11.301). It was in the theory of the distribution of primes that these ideas first bore fruit.

It is usual to write $\pi(x)$ for the number of primes less than x. It has been known since Euclid that the number of primes is infinite, that is to say that $\pi(x)$ tends to infinity with x. The central problem of the theory has been the determination of the order of magnitude of $\pi(x)$ when x is large, and its solution is embodied in the *Primzahlsatz*, or "prime number theorem," expressed by the formula

$$\pi(x) \backsim \frac{x}{\log x}$$

where the symbol $\backsim$ expresses the fact that the ratio of the two functions tends to unity. This theorem, conjectured by A. M. Legendre (1798) and C. F. Gauss (about 1792), was first proved by J. Hadamard and Ch. J. de la Vallée Poussin in 1896. The real founder of the modern theory, however, was B. Riemann, who, in a famous memoir published in 1859, first indicated the road along which subsequent research has progressed. Riemann did not prove the prime number theorem; strangely enough, he did not mention it, his object being to obtain, not an asymptotic formula for $\pi(x)$ but an exact expression in the form of an infinite series. Nor did Riemann attain the goal at which he aimed, his analysis, profound and beautiful as it is, being altogether incomplete and inconclusive. But it was Riemann who first recognised where the key to the solution lay, viz., in the study of the "Riemann zeta-function,"

$$\zeta(s) = \zeta(\sigma + it) = \Sigma n^{-s} = \Pi\left(\frac{1}{1-p^{-s}}\right)$$

(where $n = 1, 2, 3, \ldots$, and p runs through the series of primes), considered as a function of the complex variable s. Riemann established some, and conjectured others, of the properties of $\zeta(s)$; one famous conjecture, that all the complex zeros of $\zeta(s)$ lie on the line $\sigma = \frac{1}{2}$, remains unsettled to this day.

Riemann's memoir bore no fruit for over 30 years, when the way was cleared by the researches of Hadamard in the theory of analytic functions (*see* FUNCTION, 11.301 *seq.*). These researches led Hadamard himself, de la Vallée Poussin, and other writers, to a proof not only of the prime number theorem but of very much more. Thus de la Vallée Poussin proved that the logarithm integral $\mathrm{Li}x = \int_2^x \frac{dt}{\log t}$ represents $\pi(x)$ with an error of lower order than $x(\log x)^{-k}$, where k is any number however large. He also investigated the distribution of primes of a linear form $am+b$ or a quadratic form $am^2+bmn+cn^2$ where a, b, c are integers without common factor, showing, for example, that the primes are, on the average, equally distributed between the various arithmetical progressions $am+1$, $am+2$, ..., as had been conjectured long before by P. G. Lejeune Dirichlet. There is a corresponding theory for the "prime ideals" of the "corpus" associated with any algebraic number. The analogue of Riemann's zeta-function was discovered by R. Dedekind, but it is only recently that, in the hands of E. Hecke and E. Landau, the development of the theory has been pushed to a point corresponding with that of the ordinary theory.

The outstanding unsolved problem of the theory is that of the determination of the order of the *difference* $\pi(x) - \mathrm{Li}x$. This problem is bound up essentially with Riemann's unproved hypothesis concerning the zeros of $\zeta(s)$. If Riemann's hypothesis is true, the maximum order of the difference differs from that of $\sqrt{x}$ by logarithmic factors only. In any case the difference assumes values *of either sign* which tend to infinity with x. This theorem, proved by J. E. Littlewood in 1914, disposes of the old conjecture of Gauss and B. Goldschmidt that $\pi(x)$ is always less than $\mathrm{Li}(x)$.

Apart from applications to the theory of primes, there is a large literature connected with the pure theory of $\zeta(s)$. It has been shown by H. Bohr, E. Landau and F. Carlson that (to put it roughly) nearly all the zeros lie very near the critical line; by G. H. Hardy and J. E. Littlewood that (equally roughly) a considerable proportion lie actually on it. But the hypothesis itself remains unproved.

(*b*) *Additive Theory.*—The "additive" theory of numbers includes Combinatory Analysis (*see* 6.752), Partitions (*see* 19.865), the theory of the representation of numbers by sums of squares, cubes, or higher powers, and so forth.

The central problem is that of determining (exactly or approximately) the number of representations of an arbitrary positive integer n in the form $a_1+a_2+\ldots+a_s$, where the a's are numbers of some special type (*e.g.* squares), and s may be fixed or unrestricted, according to the particular problem envisaged. There is a fundamental difference between the "additive" theory and what may be called the "multiplicative" theory, in which the central idea is that of the resolution of a number into prime factors. Analytically, this difference expresses itself as follows: the multiplicative theory depends on the theory of "Dirichlet's series" of the type $\Sigma a_n n^{-s}$, the additive theory on that of power series $\Sigma a_n x^n$. A great deal of the additive theory is purely algebraic, and is intimately bound up with the theory of elliptic functions. This side of the theory (founded by L. Euler) has been developed to a high pitch by English mathematicians, notably A. Cayley, J. J. Sylvester, and P. A. MacMahon, while more recently the methods of complex function theory have been applied to the theory and an "analytic additive" theory has been founded. Among many curious results we may mention the theorem of S. Ramanujan, that the numbers of the unrestricted partitions of numbers of the forms $5m+4$, $7m+5$ and $11m+6$ are divisible by 5, 7 and 11 respectively.

One of the most remarkable problems of the additive theory is "Waring's Problem." It was asserted by E. Waring (1782) that any number n is the sum of at most 4 squares, 9 positive cubes, 19 fourth powers, and, generally, $g(k)$ powers, where $g(k)$ is a number depending on k alone and not on n. This problem—in so far as it simply asserts the existence of *some* such number $g(k)$—was solved by D. Hilbert in 1909. J. L. Lagrange (1774) proved that $g(2)=4$ (any number is the sum of 4 squares, and some numbers not of less), and E. Wieferich (1909) that $g(3)=9$ and $g(4)\leqq 37$. Only a finite number of numbers (probably only 23 and 239) require more cubes than 8 (E. Landau, 1908), while an infinite number require 4 at least; and only a finite number of numbers require more than 19 fourth powers (G. H. Hardy and J. E. Littlewood, 1924), while an infinite number require 16 at least; and asymptotic formulae for the number of representations have been found. But our knowledge of this field is still extremely incomplete.

The "empirical theorem" of Chr. Goldbach, that every even number is the sum of two primes, has also received a considerable amount of attention, but is still unproved. Among other unsolved problems of the same character may be mentioned that of proving the existence of an infinity of primes of the form m^2+1 or (more generally) am^2+bm+c. This problem is not to be confused with the problem of primes $am^2+bmn+cn^2$, solved by de la Vallée Poussin.

(*c*) *Miscellaneous Investigations.*—The work of Dirichlet and L. Kronecker on the approximation of irrational numbers by rationals has led to extensive investigations lying on the border line between arithmetic and analysis, developed above all by H. Minkowski under the titles of *Diophantische Approximation* and *Geometrie der Zahlen*. The central idea in this theory is that of the lattice (*Gitter*).

A lattice point (*Gitterpunkt*) in space of any number of dimensions is a point with integral co-ordinates, and most difficult and fascinating problems arise when we consider the number of lattice points which lie within a volume of specified form in n-dimensional space. Thus Minkowski proved that any convex figure in space of two dimensions with symmetry about a centre, its centre at a lattice point, and of area 4, includes other lattice points besides its centre; with a whole series of corresponding theorems concerning more general configurations. Another class of lattice-point problems is exemplified by the

" circle " problem of Gauss and W. Sierpinski, that of determining approximately the number of lattice points inside the circle $x^2+y^2=n$ when n is large. A first approximation is naturally given by πn, the area of the circle, but the estimation of the error is a problem of exceptional difficulty. This problem and the analogous problem for the hyperbola $xy=n$ (Dirichlet's divisor problem) were connected with the theory of $\zeta(s)$ [see (*a*) *supra*] by Landau. These problems also are susceptible of manifold generalisation. And in all these problems, we observe the dominating and irresistible tendency of modern higher arithmetic, the tendency to abandon its ancient tradition of isolation and assimilate itself so far as possible to the theory of functions, in order to utilise the immensely powerful weapons which the latter theory alone can provide.

There is one famous problem in which no such reduction of arithmetic to analysis has been effected. " Fermat's last theorem " asserts that there is no integral solution of $x^n+y^n=z^n$ (other than the trivial solution $x=z$, $y=0$) for any value of n greater than 2. It was the attempt to prove this theorem that led to the whole development of the theory of algebraic numbers; but, in spite of the wide-spread attention which it has excited, and the extreme importance of the general theories of which it has been the starting point, the theorem itself remains unproved, though important additions have been made recently to our knowledge by A. Wieferich, D. Mirimanov, L. E. Dickson, and H. S. Vandiver. Thus Wieferich proved that the theorem holds for odd prime values of n, and values of x, y, z, not divisible by n, unless $2^{n-1}-1$ is a multiple of n^2.

One old conjecture has been definitely disposed of. Mersenne asserted that 2^n-1, where n is a prime not exceeding 257, is prime when, and only when, $n=1, 2, 3, 5, 7, 13, 17, 19, 31, 67, 127, 257$. This statement contains at least four errors, relating to the values 61, 67, 89, 107; and it need no longer be taken seriously.

BIBLIOGRAPHY.—An indispensable work for the serious student of higher arithmetic (on any of its sides) is L. E. Dickson, *History of the Theory of Numbers*, 1920. This work is not, however, specially concerned with the analytic theory.

For general accounts of the theory of primes see the article " Die neuere Entwicklung der Analytischen Zahlentheorie " by H. Bohr and H. Cramer in the *Encyklopädie der Mathematischen Wissenschaften* (2C8); E. Landau, *Handbuch der Lehre von der Verteilung der Primzahlen* (1909), and *Einführung in die elementare und analytische Theorie der algebraischen Zahlen* (1918).

For the additive theory see P. A. MacMahon, *Combinatory Analysis* (1915–6), and *An Introduction to Combinatory Analysis* (1921); P. Bachmann, *Niedere Zahlentheorie: 2. (Additive Zahlentheorie)* (1910); G. H. Hardy, *Some Famous Problems of the Theory of Numbers* (1920). For Fermat's last problem see P. Bachmann, *Das Fermatproblem* (1917); L. J. Mordell, *Four Lectures on Fermat's Last Problem* (1921).

Comparatively little of recent work is accessible in a connected form, and the study of the original memoirs is indispensable.

III. THEORY OF SERIES

The most striking modern developments in the theory of series (*see* 24.668; 10.753; 12.956) have also been suggested by the development of the theory of functions.

The theory of functions of a real variable has been revolutionised by the ideas of E. Borel and H. Lebesgue, and this has inspired a corresponding revolution in the theory of Fourier's series and " series of orthogonal functions " generally.

A system of functions $\phi_m(x)(m=1, 2, 3, \ldots)$ is said to be *orthogonal* if

$$\int_a^b \phi_m(x)\phi_n(x)dx=0 \quad (m\neq n) \qquad (1)$$

The simplest examples are obtained by taking $\phi_m(x)$ to be $\cos mx$ or $\sin mx$ and the interval (a, b) to be $(0, 2\pi)$; or $\phi_m(x)$ to be Legendre's polynomial $P_m(x)$ and (a, b) to be $(-1, 1)$. There is then a simple procedure by which we may endeavour to expand an arbitrary function $f(x)$ in the form of a series $\Sigma a_m\phi_m(x)$, viz., by multiplying this series by $\phi_m(x)$ and integrating over the interval (a, b): the formula thus suggested is

$$f(x)=\Sigma a_m\phi_m(x),\ a_m=\left(\int_a^b f(x)\phi_m(x)\,dx\right)\Big/\left(\int_a^b \phi^2_m(x)\,dx\right) \qquad (2)$$

A more accurate analysis of this procedure raises a multitude of profoundly interesting and difficult questions. On the one hand we may start from a series with arbitrary coefficients a_m, and inquire whether there exists a function which stands to it in the relation expressed by the equation (2). In particular, given a trigonometrical series $\Sigma a_m\cos mx$ or $\Sigma b_m\sin mx$ or, more generally $\Sigma(a_m\cos mx+b_m\sin mx)$, with arbitrary coefficients, we may ask whether it is a Fourier's series, that is to say, whether there is a function $f(x)$ such that a_m and b_m are given by Fourier's integral formulae. On the other hand, we may start not from an arbitrary series but from an arbitrary function $f(x)$, form the coefficients (a_m or b_m) by Fourier's formulae or the more general formulae (2), and then inquire whether the formal development thus obtained is convergent, and whether, if convergent, it represents the function $f(x)$ and so forth.

The problems thus raised are among the most difficult of modern mathematics; and a very cursory examination of them is enough to show that the methods of the older analysis are not sufficiently powerful for their solution. It is essential that we should enlarge our conceptions, on the one hand, by taking account of the modern generalisations of the notion of an integral, and, on the other, by adopting a broader view as to what is meant by the " sum " of an infinite series.

The modern theory of functions of a complex variable (*see* 11.301) points to the same conclusion. A function $f(z)$ of the complex variable z, regular for $z=z_0$, is defined throughout a certain circle whose centre is z_0 by a power-series $\Sigma a_n(z-z_0)^n$; but the region of existence of the function is very generally more extensive than the circle of convergence of the series; and this fact has led, during the last generation, to a mass of work on the problem of " analytic continuation." This problem is that of discovering analytic representations of the function, whether by integrals, or by continued fractions, or by series of a different form, which are valid throughout a wider region than that in which it is represented by the original power series. Here also we are confronted by the need for a scientific theory of divergent series.

There are passages in the older analysts (*e.g.*, in L. Euler) which suggest a half-conscious anticipation of modern ideas. But it is roughly true to say that they did not concern themselves with the precise meaning of the infinite series of which they made such effective use. A. L. Cauchy and N. H. Abel were the first to give a precise definition of the " sum " of a series $a_0+a_1+a_2+\ldots$ or Σa_n, viz., as the limit of $s_n=a_0+a_1+\ldots+a_n$ when n tends to infinity ($n\to\infty$). Such a series as $1-1+1-\ldots$ has then *no* sum, for s_n is alternately 1 and 0; and it was the tendency, for many years after Cauchy and Abel, to banish such series from analysis entirely. A school of mathematicians survived, among whom one may cite A. de Morgan, who viewed this tendency with obvious discontent, but there was no escape from the conclusion that the followers of Cauchy and Abel were right. It is impossible to say " the sum of Σa_n is so-and-so " except after framing an accurate definition of " sum "; the definition of Cauchy and Abel was the only definition; and, until some new and wider definition was offered, that was the end of the matter.

We may define the meaning of a mathematical word or symbol as we please, provided only that the definition is free from contradiction. Given a sequence of numbers $a_1, a_2, \ldots$ we may associate with the sequence a number s in any manner that we please, and we may say, if we like, that s is the " sum " of the series. We might say, for instance, that the " sum " of every infinite series is, by definition, zero. This definition would be perfectly legitimate but futile, because it would reduce all equations involving infinite series to the trivial form $0=0$; and confusing, because it would conflict with Cauchy's definition. Cauchy's definition is only one among many, but it is admittedly the most important, and a new definition is only likely to be of value if it is consistent with the standard definition. It must satisfy what is called the *condition of consistency*; it must apply to all convergent series, and give a " sum " equal to their sum in the ordinary sense. Its value for analysis will then be measured by the extent and importance of the class of non-convergent series to which it attributes a " sum."

The simplest and most important of the definitions which have been given is that of the " first arithmetic mean." Suppose that $s_n=a_0+a_1+\ldots+a_n$ and $\sigma_n=(s_0+s_1+\ldots+s_n)/(n+1)$, the arithmetic mean of the first $n+1$ values of s_n. If s_n tends to a limit, σ_n tends to a limit also, and the two limits are the same; but σ_n may tend to a limit when s_n does not. For example, if $a_n=(-1)^n$, $s_{2n}=1$ and $s_{2n+1}=0$, and s_n does not tend to a limit; but σ_n tends to the limit $\frac{1}{2}$. If now we agree to call the limit of σ_n, whenever it exists, the " sum " of the series Σa_n, our new definition is in perfect accord with Cauchy's definition, but is applicable to an extensive class of series for which Cauchy's definition fails. It therefore fulfils the conditions required for a theory of divergent series.

The most striking illustration of the importance of these ideas is to be found in the theory of Fourier's series (*see* 10.753). The Fourier's series of a *continuous* function $f(x)$ is not necessarily convergent; further conditions on $f(x)$, of a much more artificial character, are required to ensure convergence. It was, however, shown by L. Fejér that the Fourier series of any continuous function is " summable " by the procedure indicated above; that is to say, that the arithmetic mean σ_n tends to a limit equal to the value of the function; and this fundamental result has been the starting point of a mass of modern research.

Another important definition attributes to the series as " sum " the value of the limit of the power series $\Sigma a_n x^n$ when x tends to 1 through positive values less than 1. A third (of particular importance in complex function theory) was advanced by Borel; and all of these definitions have entailed a host of still more general definitions.

BIBLIOGRAPHY.—For the general theory of divergent series see E. Borel, *Leçons sur les séries divergentes* (1901); T. J. I'A. Bromwich, *Introduction to the Theory of Infinite Series*, ch. x. (1908); G. H. Hardy and M. Riesz, *The General Theory of Dirichlet's Series* (1915). For the theory of Fourier's series, H. Lebesgue, *Leçons sur les séries trigonométrigues* (1912); Ch. J. de la Vallée Poussin, *Cours d'analyse infinitésimale*, 2nd ed., vol. 2 (1916); E. W. Hobson, *The Theory of Functions of a Real Variable* (1907, 2nd ed., 1925). The general theory of series of orthogonal functions is, for the most part, still only to be read in the original memoirs, or in works on the theory

of integral equations. A very important generalisation of the concept of a Fourier's series has been developed recently by H. Bohr in a series of memoirs in the *Acta Mathematica*.

IV. THEORY OF FUNCTIONS

The theory of functions (*see* 11.301, 14.53) has two great branches, the real and the complex theories. Recent advances in the complex theory, important as they are, have been of too technical a character for rapid summary. The real theory, on the other hand, has been remodelled from its foundations. The older form of the theory was cumbrous and unattractive. The modern theory has the aesthetic character required of a first-rate mathematical science, and its development has been perhaps the most striking achievement of modern analysis.

1. *Sets of Points.*—The theory of functions of a real variable is based upon the theory of aggregates (*see* 19.847–850) and in particular the theory of "sets of points." A set of points S is an aggregate of real numbers x, such as the aggregate of rational numbers, or of irrational numbers, in the interval (0, 1). A number ξ is said to be a "limit point" (*Häufungstelle*) of S if every "neighbourhood" of ξ, that is to say every interval $(\xi-\epsilon, \xi+\epsilon)$ including ξ, contains points of S other than ξ itself. A limit point of S may or may not belong itself to S. Thus every number of (0, 1), rational or irrational, is a limit point of the set S of rationals of (0, 1). If every limit point of S belongs to S, S is *closed*. If every point of S is a limit point, S is *compact* or *dense*. A set which is both closed and compact is *perfect*. The continuum, the aggregate of all real numbers, is perfect.

An idea of dominating importance in the theory of functions is that of the *content* or *measure* of a set of points. Suppose, for simplicity, that the set S in question is contained in (0, 1). Then Cantor defined the content of S as follows:—Divide (0, 1) in any manner into a *finite* number of intervals δ, and these intervals δ into two classes δ_1 and δ_2, according as they do or do not include points of S; and let $c(\delta)$ be the sum of the lengths of the intervals δ_1. Then the *content* of S is the limit of $c(\delta)$ when the intervals δ tend to zero, if this limit should exist.

There is a striking defect in this definition, the full implications of which were first perceived by E. Borel. *The content of the sum of two sets is not generally the sum of their contents.* Thus the rationals of (0, 1) have content 1 (since every δ is obviously a δ_1), and likewise the irrationals. The sum of the contents is 2, whereas the content of the sum is 1. The rationals of (0, 1) cannot be included in a finite set of intervals whose aggregate length is less than 1. If we abandon the restriction that the set of intervals must be *finite*, the situation is completely changed. Thus Borel observed that we may include the rational p/q in the interval $\left(\frac{p}{q}-\frac{\epsilon}{q^3}, \frac{p}{q}+\frac{\epsilon}{q^3}\right)$, and that the sum of all these intervals may be made as small as we please by choice of ϵ; and this simple remark has revolutionised the theory of functions. The first step was to frame a satisfactory definition of *measure*, and this concept, which has entirely superseded Cantor's "content," is now defined as follows. We consider sets S included in (0, 1). Let S be enclosed, *in any manner whatsoever*, in a system σ of intervals δ; let $m(\sigma)$ be the sum of the intervals of σ; and let m_e be the lower bound (or "inferior limit") of the aggregate of values of $m(\sigma)$. Then m_e is the *exterior measure* of S. The *interior measure* m_i is $1-m'_e$, where m'_e is the exterior measure of S_1, the set complementary to S, *i.e.*, the set of points of (0,1) which do not belong to S. If $m_e=m_i$, the set S is *measurable*, and its measure is m, the common value of m_e and m_i. This definition (due to H. Lebesgue) is of extreme generality, and no example of a non-measurable set is known.

Measure, thus defined, has the properties which measure ought to have, but which Cantor's content lacked. In particular the sum of two mutually exclusive and measurable sets is measurable, and its measure is the sum of the measures of the component sets. The measure of any enumerable set, and in particular of the rationals, is zero. The definition may be extended to sets in space of any number of dimensions.

2. *Integration.*—The new theory of measure has led to new theories of integration, in the light of which the older theories are of historical or didactic interest only. The most important of these theories are due to H. Lebesgue and W. H. Young.

(*a*) Lebesgue's definition of an integral is as follows. A function $f(x)$, defined in an interval (a,b), is *measurable* if the set of points $S(A)$ for which $f>A$ is measurable for every A. All known functions are measurable. We now suppose that f is bounded, so that (say) $h<f<H$, and we divide up the interval (h, H) into a finite number of intervals (l_i, l_{i+1}) or δ_i. It is this subdivision of the range of variation of $f(x)$, instead of (as in the older theory) that of x, that is characteristic of Lebesgue's procedure. The set of points for which $(l_i \leqq f<l_{i+1})$ is measurable. If we denote its measure by m_i, write $J=\Sigma l_i m_i$ and suppose that the intervals δ_i tend to zero. Then J tends to a limit I, and we write

$$I=\int_a^b f(x)dx$$

The integral so defined is a *bona-fide* generalisation of the integral of Riemann, for it exists whenever Riemann's integral exists and agrees with it in value. But it is far more general: thus the function $f(x)$ which is unity when x is a rational of (0,1), and zero otherwise, has no Riemann integral, but has a Lebesgue integral equal to zero. The definition is capable of many-sided generalisation, to unbounded functions, and functions of many variables; it throws entirely new light on the relations between integration and differentiation; and it has proved itself adapted for a mass of analytical applications of the most far-reaching importance, in particular in the theory of Fourier's series and the theory of integral equations.

(*b*) A different definition was proposed by W. H. Young. He adheres to a subdivision of the range of variation (a,b) of the independent variable; but, instead of dividing it into a finite number of intervals, divides it into a finite or infinite number of measurable sets. This procedure leads to results roughly equivalent to those of Lebesgue's theory; but it is somewhat more general and is certainly a more natural development of the older theory of measure.

3. *Geometrical Applications.*—Those new theories have led inevitably to a searching re-examination of the concepts of "curve," "surface," "length," "area," and so forth, which were generally accepted without question by the older analysts on the supposed evidence of geometrical intuition. This unreflective attitude has now been abandoned, and it is recognised that analysis is in no sense dependent upon geometry. The notion of a *curve* was first made precise by C. Jordan. A curve is a set of points (x,y), that is an aggregate of pairs of real numbers x, y, where x and y are functions of a single variable t, subject to appropriate restrictions. A simple closed continuous curve is a curve for which (1) $x=x(t)$ and $y=y(t)$ are continuous for $t_1 \leqq t \leqq t_2$; (2) $x(t_2)=x(t_1)$ and $y(t_2)=y(t_1)$, and (3) it is false that $x(t')=x(t'')$ and $y(t')=y(t'')$ for any pair of values t', t'' other than t_1, t_2. A fundamental theorem, due in substance to Jordan, asserts that such a curve C divides the plane into two "regions" D and D′ separated by the curve. Two points which lie in the same region can be connected by a continuous curve which has no point in common with C; but points which lie in different regions cannot be thus connected. We thus define the *inside* and *outside* of a closed curve in strictly analytical terms. A similar account has been given of the concepts of *area* and *length*. In particular the simple closed continuous curve C has both an area and a length if $x(t)$ and $y(t)$ are functions of "bounded variation."

4. *Integral Equations.*—Among the remaining developments of modern analysis, perhaps the most remarkable are in the theory of integral equations. The typical integral equation is

$$f(x)=\int_a^b K(x,t)\phi(t)dt \qquad (1)$$

where $f(x)$ and $K(x,t)$ are given and the unknown function $\phi(t)$ is to be determined. This equation is called an integral equation of the first kind; but it has been found that equations of the form

$$\phi(x)=f(x)+\lambda\int_a^b K(x,t)\phi(t)dt \qquad (2)$$

known as equations of the second kind, are better adapted for the foundation of a general theory. It was shown by I. Fredholm that, if f and K satisfy certain conditions, there is in general one and only one continuous solution $\phi(t)$; the exceptions arise when λ is a zero of a certain transcendental function $D(\lambda)$. When λ has one of these exceptional values, the equation

$$\phi(x)=\lambda\int_a^b K(x,t)\phi(t)dt$$

has a continuous solution other than the obvious solution $\phi(t)=0$, otherwise this is the only solution. The theory has been widely developed by Fredholm, D. Hilbert, V. Volterra and other writers.

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MATHEWS, SHAILER (1863–), American educationist and theologian, was born at Portland, Me., May 26 1863. He graduated from Colby College (A.B., 1884; A.M., 1887) and continued his studies at Newton Theological Institution and the University of Berlin. He was associate professor of rhetoric (1887–9) and

professor of history and political economy (1889–94) at Colby College. In 1894 he went to the University of Chicago as associate professor, and in 1897 became professor of New Testament history and interpretation. In 1908 he was made dean of the divinity school. In 1912 he was president of the Federal Council of the Churches of Christ in America, and he visited Japan in 1915 as representative of that body. From 1903 to 1911 he was editor of *The World Today;* from 1913 to 1920, of *The Biblical World.*

He has written a number of books including *The French Revolution* (1901); *History of New Testament Times in Palestine* (1908); *Social Teachings of Jesus* (1910); *Spiritual Interpretation of History* (1916); and *Faith of Modernism* (1924). (*See* BAPTISTS.)

MATISSE, HENRI (1869–), French painter, was born at Cateau (Nord) Dec. 31 1869. He studied at the École des Beaux-Arts, and under Gustave Moreau. He soon showed revolutionary tendencies, and was recognised as the boldest member of the group known as " les fauves." Though a painter of light, he did not treat it as the impressionists had done, by means of the juxtaposition of minute touches of colour, but by employing pure tones on a large scale. In this way he produced the effect of modelling, and, by the contrast of values, was able to give the illusion of space. He was particularly successful in his use of expressive distortion. Matisse spent two years in Morocco, but most of his work was carried on in southern France, at Collioure and Nice. Later, he reduced the size of his canvases, painting still life and landscapes, as well as small feminine figures and brilliantly illuminated interiors. He is entitled to be considered as the most eminent master of the contemporary French School. In his drawing he exhibits sometimes a nervous restrained manner, and by his use of shadow succeeds in reproducing the actual bulk of bodies without having to insist on their contour. Matisse's lithographic work is also of considerable importance.

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MATSUDAIRA, TSUNEO (1877–), Japanese diplomat, was born in Tōkyō. He joined the Imperial University of Tōkyō as a student of economics, and in 1902 he entered the Foreign Office. His first experience abroad was gained in Peking where he was a secretary of legation. His determination, however, coupled with his wide theoretical knowledge, pushed him forward until he became first secretary in London and later in Paris; but his criticism of the extreme nationalism of many of his countrymen stood in the way of his receiving imperial honours. From 1918–9 he was Japanese high commissioner in Siberia and in 1920 was appointed director of the bureau for European and American affairs at the Foreign Office in Tōkyō. In 1921–2 Matsudaira was chief secretary of the Japanese delegation to the Washington Conference. In 1924, after the diplomatic blunder committed by the Japanese Ambassador to the United States, Mr. Hanihara, it was considered that some means must be found to improve the situation. As a result, in 1925 Matsudaira was appointed ambassador and he undertook his duties with the avowed intention of bettering American-Japanese relations.

MATSUKATA, MASAYOSHI (1835–1924), Japanese statesman (*see* 17.890), was from 1917–22 keeper of the privy seal, and on resigning from this post was created a prince. He died in Tōkyō July 2 1924.

MATTEI, TITO (1841–1914), Italian musician and composer, was born at Campobasso, near Naples, May 24 1841. He became at an early age a professor at the Santa Cecilia academy of music at Rome, and subsequently had several successful European tours as a pianist. In 1863 he finally settled in London, where he remained for the rest of his life. He composed several hundred songs and pianoforte pieces, many of which became very popular. He died in London March 30 1914.

MATTER (*see* 17.891).—Since 1910 advances have been made which give much more precision to our knowledge of the constitution of matter. The atomic theory of matter, which for long appeared to be of necessity unverifiable by direct experiment on account of the minuteness of the atom (*q.v.*), received almost direct proof in a number of ways. Methods have been developed, for example, to detect the electrical effect of a single α particle from radium, and a single swift electron (*see* GASES, ELECTRICAL PROPERTIES OF).

The α particle has been shown to be a charged atom of helium projected with high velocity; the number of α particles from a given quantity of radium have been counted, and the volume of helium which they produce has been measured. In this direct way it has been shown that about $2{\cdot}7\times10^{19}$ particles or atoms of helium are required to form one cu. cm. of helium gas at normal pressure and temperature. Not only is it feasible to detect the effect of a single atom of matter in special circumstances but also to show the path of a swift α particle or electron through a gas. This has been made possible by the discovery of C. T. R. Wilson that under suitable conditions the charged ions produced in gases by α or β rays become centres for the condensation of water vapours, and are thus rendered visible as the nuclei of visible drops of water. The photographs of these droplets show in a most striking way the track of the particle through the gas, and illustrate with extraordinary detail the main effects produced by the passage of ionising radiations through gases.

The essential correctness of the kinetic theory of matter, which assumes that the molecules of matter are in vigorous but irregular motion, has been clearly demonstrated by the experiments of Perrin and others on the motion and equilibrium of small spheres of matter in suspension in fluids which show the Brownian movement. At the same time the atomic or discrete nature of electricity, which had been implicitly assumed in many theories, has received complete experimental verification, and the magnitude of this fundamental unit of charge has been measured with precision. The most accurate experiments on this subject have been made by Millikan by measuring the electric field required to support a small, charged droplet of oil or mercury. The charge on the drop was varied by ionizing the gas in its neighbourhood. In this way he has been able to show that the charge always varies by integral multiples of a fundamental unit. The charge given to a drop by friction or any other method is always an integral multiple of this unit charge. This fundamental unit is the same both for positive and negative electricity, and is numerically equal to the charge carried by the negative electron, the positive and negative ions produced in a gas by X-rays, and also to the positive charge carried by the hydrogen atom in the electrolysis of water. The magnitude of this unit charge, combined with electrochemical data, gives a most reliable method of measuring a number of important and molecular magnitudes. The value of the fundamental unit of charge and thus the mass of the individual atoms of matter are now known with an accuracy of certainly within one per cent and possibly within one-tenth of one per cent. The data found by Millikan are given in the following table:—

Fundamental unit of charge .	$e=4{\cdot}774\times10^{-10}$ electrostatic units
The Avogadro Constant, *i.e.*, the number of molecules in one gramme molecule . . .	$N=6{\cdot}062\times10^{23}$
The number of molecules per c.c. of any gas at 0°C. and 760 mms.	$n=2{\cdot}705\times10^{19}$
Mass of hydrogen atom in grammes	$m=1{\cdot}662\times10^{-24}$

From these data the number of atoms in one gramme of any element can be determined. While the average distance apart of the atoms or molecules can at once be deduced, the actual dimensions of the molecules or sphere of action of the molecules can only be approximately estimated with the aid of other and much less precise data.

Structure of the Atom.—Since the proof that the negative electron of small mass is a constituent of all atoms of matter, there has been a vigorous attack on the fundamental problem of the structure of the atom. After passing through a number of phases the general ideas on this subject have crystallized into a fairly definite form, and it is now generally believed that the atom is composed of a massive positively charged nucleus of minute dimensions surrounded at a distance by a compensating distribution of negative electricity in the form of negative electrons. Since electricity is atomic the resultant positive charge on the

nucleus must be an integral multiple N of the fundamental unit of charge e and is given by Ne. In order for the atom to be electrically neutral it must be surrounded by a distribution of N negative electrons. The value of N for each of the atoms is a fundamental constant, for on it depends the magnitude of the electric field surrounding the nucleus and the arrangement of the external electrons which in turn determine the main physical and chemical properties of the atom. The idea of the nuclear structure of atoms arose initially from a study of the scattering of α particles in their passage through matter. On account of its great energy of motion the charged α particle penetrates the structure of some of the atoms and comes under the influence of the intense repulsive field of the nucleus. Assuming that the law of force is that of the inverse square the α particle describes a hyperbolic path, and the angle of deflexion depends on the nearness of approach to the nucleus. From a close study of the scattering of α rays by Geiger and Marsden it was concluded that the number of α particles scattered through different angles was in close accord with the idea of the nucleus atom, while the actual number scattered through a given angle gave information on the magnitude of the charge carried by the nucleus. The preliminary experiments indicated that for the heavier atoms the value of N was about half the atomic weight in terms of hydrogen.

A notable advance was made by the fundamental experiments of Moseley on the X-ray spectra of the elements. He found that the X-ray spectrum was similar for all elements, and that the frequency of vibration of corresponding lines in the spectrum was proportional to the square of a number which varied by unity in passing from one element to the next. He concluded that the nuclear charge in fundamental units was equal to the atomic or ordinal number of the elements when arranged in increasing order of their atomic weights. On this view the lightest element, hydrogen, has a nuclear charge 1, helium 2, lithium 3, and so on up to the heaviest element, uranium, of ordinal number 92. This is a generalisation of great importance and simplicity which has guided all subsequent work on the structure of atoms. The essential correctness of Moseley's conclusion has been directly verified in the case of a few representative elements, by Chadwick by accurate measurement of the nuclear charge based on the scattering of α rays. Moseley showed that with few exceptions all values of the nuclear charge between 1 and 92 were represented by known elements. Moreover, when the atomic weight of the element in Mendeleeff's classification was replaced by its ordinal number certain irregularities were removed. For example, the positions of argon and potassium cobalt and nickel, iodine and tellurium were interchanged—a result in complete accord with their chemical properties (*see* CHEMISTRY).

The elements missing in the Moseley classification were of atomic numbers 43, 61, 72, 75, 85, 87. Since the X-ray spectra of these elements could be calculated with accuracy, it seemed likely that these missing elements, if present in appreciable quantity in the earth's crust, should soon be detected. The first element discovered by its X-ray spectrum was number 72 which was called hafnium by Hevesy and Coster. In a similar way, elements of number 43, 75, have been recently found in certain platinum minerals by Nonnack and Tacke, but have not yet been isolated. Thus the number of missing elements from hydrogen to uranium is reduced to three, viz., numbers 61, 85, 87.

It thus follows that the main physical and chemical properties of an element are defined by a whole number which represents both its nuclear charge in fundamental units and the number of external electrons. The atomic weight of an element is in a sense a secondary property, for, as we shall see, elements can exist of the same nuclear charge but of different atomic weights. The number and position of the external electrons, on which the ordinary chemical and physical properties of an atom depend, are defined by the nuclear charge. The mass of the atom which resides mainly in the nucleus exercises a subordinate effect on the external arrangement of the electrons.

Isotopes (*q.v.*).—On Moseley's classification only 92 elements of ordinal numbers 1 to 92 are possible, assuming that uranium (92) is the last of the elements. We shall now briefly discuss some recent advances which clearly show that in some cases several elements can exist with the same nuclear charge but of different atomic masses. Information on this point was first obtained from a study of the radioactive bodies. It was early observed that a number of products which showed different radioactive properties were inseparable from one another by ordinary physical and chemical methods. For example, ionium and thorium, radium and mesothorium, radium D and lead cannot be separated from each other, and appear to be identical in chemical properties. Elements so closely alike in chemical properties were called "isotopes" by Soddy, since they appeared to occupy the same position in the periodic arrangement of the elements. Viewed from the standpoint of the nuclear theory isotopes are elements of the same nuclear charge but of different atomic masses. As we have seen, the nuclear charge controls the ordinary physical and chemical properties of the atom, and the mass which resides almost entirely in the nucleus has only a second-order effect. On the other hand, the property of radioactivity depends on the structure and stability of the nucleus, which may be very different for atoms of the same resultant nuclear charge.

In the article on RADIOACTIVITY attention is drawn to the remarkably simple relation which exists between the chemical properties and radiations of the series of radioactive elements. With the aid of this relation we can at once write down the ordinal numbers and masses of the long series of elements which arise from the transformation of uranium, thorium and actinium, and can follow the origin of the numerous isotopes which arise. One of the most striking results of this generalisation was the prediction that the end product of the uranium and thorium series should be an element of the same ordinal number as lead but of atomic masses 206 and 208 respectively, instead of the mass 207 found for ordinary lead. This result has been directly confirmed by atomic weight determinations of uranium-lead and thorium-lead, and was the first definite proof of the existence of isotopes of a non-radioactive element.

It seemed probable that in a similar way many of the ordinary elements might consist of a mixture of isotopes, *i.e.*, elements with the same nuclear charge but different atomic masses. This has been confirmed in a number of cases chiefly by the work of Aston. The masses of the positively charged atoms present in the electric discharge in a vacuum tube are examined by bending the rays in a combined magnetic and electric field. In this way it was found that neon consisted of two isotopes of masses 20 and 22 and chlorine of isotopes of masses 35 and 37. The relative proportions of the two isotopes in chlorine was in good accord with that to be expected from the ordinary atomic weight of the mixture of isotopes, viz., 35·45.

This new method of analysis had, up to 1925, been employed for more than half of the elements and had yielded results of great interest. Some of the elements, like carbon, nitrogen and oxygen, give no isotopes, and are thus to be regarded as "pure" elements where the atoms have all the same mass and nuclear charge. Others, like chlorine, argon, krypton and mercury, are composed of a mixture of two or more isotopes. In cases like krypton and mercury as many as six well-defined isotopes have been detected. With few exceptions the masses of all the isotopes are expressed by a whole number in terms of O = 16 with an accuracy of about 1 in 1,000. For example, the isotopes of neon are 20·00 and 22·00. This important conclusion, which has been verified in a number of cases, affords a strong indication that the masses of the parts composing the nucleus have a mass either of one or a multiple of one, and are not direct multiples of the mass of the hydrogen atom which is 1·008 where O = 16. The reason of this will be discussed later. In a few cases, however, for example tin and xenon where the isotopes can be obtained together on the same record, Aston has pointed out that the whole-number rule obviously breaks down. It will be of great importance to determine the mass of all the isotopes with the greatest exactitude as the departure of the masses from whole numbers may provide valuable information on the structure of atomic nuclei.

While the ordinary physical and chemical properties of isotopes are closely similar, it is to be expected that they should differ in all qualities which involve directly the mass of the atom, *e.g.*, the coefficients of diffusion and specific gravity. In a similar way second-order effect is to be expected in the rate of vibration of the external electrons, *i.e.*, in the light spectrum of the element, and a small effect has been observed in several cases. The most obvious method of partial separation of isotopes is by the process of diffusion or evaporation. In this way a partial separation into light and heavy fractions has been shown in the case of neon, mercury and chlorine. No evidence of the separation of isotopes in nature has been so far observed except in the case of uranium-lead and thorium-lead already referred to. For example, chlorine obtained from widely different sources shows no difference in the relative proportions of its component isotopes.

Distribution of Electrons.—We have seen that the atom is to be regarded as an electrical structure in which a positively charged nucleus is surrounded by a number of electrons. The magnitude of the nuclear charge and the number of the external electrons are known for each of the elements. In considering the distribution of the external electrons round the nucleus, we are at the outset faced by the great difficulty that no possible arrangement can be permanently stable on the basis of the classical dynamics. For example, an electron in motion round the nucleus must on the classical theory radiate energy and fall into the nucleus. To overcome this fundamental difficulty Bohr has introduced a conception, based on the quantum theory (*q.v.*), in which radiation only occurs in definite quanta. This conception further developed by Sommerfeld and others has been almost completely successful in describing the properties of the simplest atom (hydrogen) with only one electron. It yields not only its natural frequencies but also the detailed changes which they undergo under the influence of electric and magnetic fields.

In atoms with more than one electron, success has so far been less complete. This is probably not entirely due to the mathematical difficulties of the classical problem of three or more attracting bodies (almost insuperable as these are) but even more to deep seated inadequacies in the modifications of classical theory required by atomic theory. The simple modifications introduced by Bohr with success for hydrogen await further development. In spite of this, however, the theory in its present form has already won marked successes. It has accounted successfully for the general structure of the spectra of all atoms and their resemblances to the spectrum of hydrogen, for the general arrangement and actual magnitudes of their X-ray spectra, and for the close analogies which these exhibit to optical spectra. It has enabled the grouping of the electrons in all atoms to be determined, with rough estimates of the size of the orbits to which they are confined. The later developments of the theory (Main-Smith, Stoner) seem to present the details and subgroups of electrons in the atom with some approach to finality, in harmony with all the physical and chemical evidence.

The theory has succeeded in accounting naturally for the form of the periodic table of the elements, especially the occurrence of the transition groups of elements ending at copper, silver and gold, and for the occurrence of the chemically similar rare-earths. It has therefore already played a great part in the simplification and co-ordination of facts of value. Its developments seem likely to supersede suggestions as to the grouping of the electrons in the atom which have been advanced previously from time to time—notably by Kossel, Lewis, Langmuir, J. J. Thomson, with certain measures of success in explaining the periodic table of the elements and the methods of chemical combination. These earlier theories were, however, for the most part descriptive rather than qualitative in character—to a far greater extent than the theory initiated by Bohr. The whole problem of the distribution and motion of the electrons in a complex atom is a very difficult one. While definite progress had been made by 1921, and great advances between 1921 and 1925, much still remains to be done before we can hope to specify with any degree of quantitative completeness the motion, position and mode of vibration of the electrons in any atom of two or more electrons.

Structure of the Nucleus.—While it is difficult to estimate the dimensions of atomic nuclei, the general evidence indicates that the nucleus of a heavy atom like uranium, if assumed spherical, has a radius of less than 10^{-11} cm. or less than 1/1000 of the radius of the external atom. No doubt the dimensions of a nucleus depend on its complexity and are much smaller for the lighter atoms. From experiments on the passage of α particles through hydrogen, it has been calculated that the dimensions of the helium nucleus of mass 4 is of the order 10^{-12} centimetres.

The most direct evidence on the constitution of the nucleus is derived from the study of the radioactive transformations. The disintegration of an atom is accompanied either by the expulsion of an α particle, *i.e.*, in helium nucleus, or the release of a swift electron from the nucleus. This shows that the nucleus of the radioactive atoms contains both positively charged masses and negative electrons, and that the nuclear charge represents the resultant charge. It is natural to conclude that the helium nucleus of mass 4 is one of the secondary units which make up the structure of a complex nucleus. This is supported by the observation that the atomic mass of many atoms is expressed by 4^n where n is a whole number. It is clear, however, from the work of Aston on isotopes that, in addition to the helium nucleus, an element of mass 1 or integral multiple of 1 enters into the structure of all nuclei. This fundamental unit of structure has been named "proton," and its atomic mass is 1 or very nearly 1 in terms of O = 16. On this view the nuclei of all elements are made up of positively charged protons and electrons. The mass of the atom measures the number of protons in the nucleus. This is in a sense a return to the famous hypothesis of Prout according to which all the atoms are supposed to be built up of hydrogen as the fundamental unit.

It seems clear that if a proton could be removed from an atomic nucleus it would prove to be the hydrogen nucleus carrying a unit positive charge. In fact, Rutherford and Chadwick have shown that the hydrogen nucleus can be liberated from certain light atoms by bombardment with swift α particles. It remains, however, to explain why the proton in a nucleus has a different mass from the free hydrogen nucleus. The latter has a mass 1·008 in terms of O = 16 while the proton in the nucleus has a mass unity, or nearly unity.

While the negative unit of electricity exists in the form of the electron of very small mass, no evidence has been obtained that its counterpart, the positive electron of very small mass, exists. The unit of positive electricity has never been found to be associated with a mass less than that of the hydrogen atom. This has led to the view that the hydrogen nucleus is the *positive* electron, and that its mass is about 1,845 times that of the negative electron. This difference in mass between the units of positive and negative electricity appears to be fundamental, and offers an explanation of the asymmetrical distribution of positive and negative electricity in the structure of atoms.

Since the helium nucleus has a mass 4 and charge 2, it should be composed of four hydrogen nuclei and two electrons. Its mass, however, is less than that of four free hydrogen nuclei. Such a change of mass in the very close combinations of positive and negative nuclei is to be expected. According to the theory of relativity energy has mass, and the loss of mass m of a system is numerically given by $E = mc^2$ where E is the energy liberated and c the velocity of light. On this view the combination of the positive and negative electrons to form the helium nucleus is accompanied by a large release of energy. From the difference between the mass of the helium nucleus and that of four hydrogen nuclei, it can readily be calculated that the helium nucleus is such a stable combination that an amount of energy corresponding to four or five α particles from radium would be required to dissociate it. The difference between the masses of the protons in the nucleus and free hydrogen nuclei is thus to be ascribed in general to the close packing of the positive and negative units composing the nucleus.

On the views outlined above the number of electrons in any nucleus can at once be calculated. For example, oxygen of nuclear charge 8 should be made up of 16 positive units and 8

electrons. For such a nucleus to hold together it seems clear that the forces between the charged units at such small distances must be different from that of the inverse square. While it has been experimentally shown that the law of the inverse square holds at any rate approximately close to the nucleus of a heavy atom like gold, this law breaks down in very close collisions of light atoms where the nuclei approach very close to each other. For example, it has been found that the number of hydrogen atoms which are set in swift motion when α particles pass through hydrogen is very different from that to be expected if the nuclei behave as point charges repelling each other according to the law of the inverse square.

By studying the scattering of α particles by the light elements, aluminium and magnesium, it has been found that the law of the simple inverse square no longer holds close to the nucleus. The experimental information at present available is too indefinite to hazard more than a guess as to the nature and magnitude of the forces that come into play when nuclei approach very close to one another, as they must do in the structure of the nucleus of a heavy atom.

Stability of Atoms.—Apart from the heavy radioactive elements which belong to a class by themselves, and two other elements—potassium and rubidium—which spontaneously emit swift electrons, the atoms of the ordinary elements appear to be very stable structures which cannot be broken up by ordinary chemical and physical agencies. In considering the possibility of the disintegration of elements it should be borne in mind that the loss of one or more electrons from the outer electronic system has no permanent effect on the atom, for other electrons ultimately fall into the atom to fill their place. In order to produce a permanent transformation of the atom it appears necessary to remove a positively charged particle or an electron from the nucleus of the atom. This can only be effected by agencies which are able to penetrate the nucleus or to pass very close to its structure.

A number of experiments have suggested that possibly helium and hydrogen may be liberated by the passage of an electric discharge through gases, but on account of the presence of these elements in many materials it is difficult to prove definitely that they arise from artificial transformation. During the last few years there has been a vigorous attack on the question whether transformation of nuclei can be effected by the action of intense electric discharges through gases or vapours. By passing a heavy current through mercury vapour, it is claimed that gold is produced in appreciable quantity. By a similar mode of procedure it is stated that lead can be converted into mercury. For obvious reasons, it is very difficult to be certain that the elements observed were not originally present in some form in the material subjected to the electrical discharge. In the cases mentioned above, we should have expected that the gold or mercury would have a different atomic weight from ordinary gold but definite evidence on this point is not yet available. The whole question whether transformation of atomic nuclei can be produced in such a comparatively simple way and on such a large scale is still *sub judice*. The energy of the electrons in the discharges used is in general small compared with that of the α particle, with the aid of which transformations on a minute scale were first shown.

The α particle expelled from radium is one of the most concentrated sources of energy known to us, and on account of its speed should be able to penetrate the structure of the nuclei of many of the lighter atoms, and still retain sufficient energy to disrupt the bonds that hold the parts of the nucleus together. In the case of an atom of high nuclear charge the α particle may lose so much of its energy in approaching the nucleus that it may be unable to effect its disintegration. It has been found that when α particles pass through hydrogen or any material containing combined hydrogen, some of the particles pass so close to the hydrogen nucleus that they set it in swift motion. These swift hydrogen atoms can be detected by the scintillations they produce on a zinc sulphide screen. This is purely a case of collisions of atomic nuclei, and the speed of the H atom set in motion can be calculated by the ordinary laws of mechanics. The maximum range or distance of penetration of such a particle is about four times that of the incident α particle.

In a similar way other nuclei must be set in swift motion by their collision with α particles, but it can be calculated that in most cases such nuclei are unable to travel as far as the α particle, and thus remain undetected amid the great number of incident α particles.

Rutherford showed that when a strong beam of α particles passes through oxygen or carbon dioxide, only a few H atoms of a penetrating type are present and these appear to have their origin in the radioactive source. When, however, the rays pass through dry nitrogen, a much larger number of penetrating particles is observed. By bending these particles in a magnetic field, it is clear that these swift particles are not charged atoms of nitrogen but projected hydrogen nuclei. These H particles are detected by the scintillations they produce in falling on a screen of zinc sulphide, and progress in this line of work has been much facilitated by the designing of special counting microscopes of wide aperture which have a large field of view. Rutherford and Chadwick found that in addition to nitrogen, swift H particles are liberated from boron, flourine, sodium, aluminium and phosphorus. By a variation in the method, similar H particles, but of lower speed, were observed from neon, magnesium, silicon, sulphur, chlorine, argon and potassium. Kirsch and Petterson claim that H particles are also liberated from carbon and oxygen, but this question is still *sub judice*.

It seems clear that these H particles are liberated from the nuclei of these elements by the bombardment of α particles and in a sense we may say that these nuclei have undergone a nuclear transformation with the ejection of a proton at high speed. For elements like B, N, Na, Al, P, the velocity of expulsion of the H particles is in all cases greater than that for a free H atom in a close collision with an α particle. For example, using α particles of range 7·0 cm. in air, ordinary H atoms can not travel further than 30 cm. of air. On the other hand, the H particles liberated from nitrogen travel 40 cm. and from aluminium 90 cm. It is thus certain that H particles observed from the elements given above cannot be due to the presence of ordinary hydrogen as an impurity. In the case of aluminium, a few of the H particles are released with more energy than that of the α particle which effects their release. No certain evidence has yet been observed that other types of particles are set free in these disintegrating collisions. It might have been expected that nuclei of mass 2 or 3 or 4 should also appear in some cases, as there is some evidence that secondary units of this kind go to build up atomic nuclei.

It is of interest to note that the protons set free by the α particles appear to be ejected equally in all directions, although their speed is somewhat greater in the forward direction of the α particle. This difference is no doubt due to the fact that the bombarded nucleus is set in motion by the collision.

It is difficult to be certain of the mechanism of these collisions and in particular whether the bombarding α particle is captured by the nucleus when the proton is liberated. By photographing several hundred thousand tracks of α particles in nitrogen by the Wilson method, Blackett has observed a number of collisions, involving the escape of a high speed proton. There is, however, no trace of the α particle after the collision, indicating that it is captured by the nucleus. If this be the case, the nucleus gains an α particle of mass 4 and loses a proton of mass 1. No definite evidence of the mechanism of the collision is as yet available for the other " active " elements.

It should be borne in mind that the disintegration observed in this way is on an exceedingly small scale. Not more than 10 particles in a million get sufficiently close to a nucleus to release an H atom. It seems clear, however, that while the ordinary atom is undoubtedly very stable, its disintegration can be brought about by the aid of sufficiently powerful agencies which are able to penetrate its structure. As already pointed out, there are strong reasons for believing that the helium nucleus is a very stable structure which cannot be broken up even by the swiftest α particle at our disposal.

While it is reasonable to suppose that all the elements have been built up by combinations of protons and electrons, there was in 1925 little evidence to throw light on the conditions necessary to lead to the formation of complex nuclei. No doubt, however, this process of aggregation has gone on in the past, and may still be in progress under favourable conditions, if not on this earth, at any rate in some of the stars. (E. Ru.)

MAUDE, SIR FREDERICK STANLEY (1864–1917), British soldier, son of Gen. Sir Frederick Maude, V.C., was born at Gibraltar June 24 1864. He entered the Coldstream Guards in 1884, took part in the Suakin operations, 1885, and joined the Staff College in 1895. In the South-African War, as brigade-major of the Guards Brigade, he took part in the advance to Pretoria. After a spell in Canada as military secretary to the governor-general, he took an active part in the development of the organisation and training of the new Territorial Force. On mobilisation in Aug. 1914 he was posted to the staff of the III. Army Corps and served in France until June 1915. In Aug. he was hurried out to the Dardanelles to take up command of the 13th Division. There he played a conspicuous part in the evacuations of Suvla and of Helles, and in 1916 his division was dispatched from Egypt to Mesopotamia to aid in the relief of Kut-al-Imara. They arrived in time to bear a share in the final desperate endeavours to save the doomed stronghold, but the effort came to naught and after the surrender of Kut-al-Imara, Maude and his division remained facing the Turks on the Tigris. He was advanced in Sept. to the position of army commander in Mesopotamia.

Realising that victory in this theatre of war must hinge on effective organisation and adequate preparation, Maude spent three months at Basra, ensuring that when the time came his field army should be capable of acting with vigour and decision. Then, when all was ready early in Dec., he suddenly pushed forward and within a few weeks had driven the Turks in confusion out of their entrenched camp around Kut. Moving relentlessly on, and making great captures, he occupied Baghdad March 11. He spent the next few months consolidating his position and preparing plans for a fresh offensive. He was, however, struck down by cholera, and died at Baghdad Nov. 18 1917. His conquest of Mesopotamia and his transformation of a depressing situation into one of signal triumph ranks as one of the finest feats in modern military history. (*See* Mesopotamia, Operations in.) See Maj.-Gen. Sir C. E. Callwell, *Life of Sir Stanley Maude* (1920).

MAUNOURY, MICHEL JOSEPH (1847–1923), French soldier, was born at Maintenon (Eure-et-Loir) Dec. 11 1847. Commissioned to the artillery from the École Polytechnique in 1869, he saw service in the Franco-German War, and in 1883 was placed on the staff at the military school of St. Cyr. He retired in 1912, having been military governor of Paris and a member of the Conseil Supérieur de la Guerre. On Aug. 19 1914 he was given charge of the army improvised in Lorraine from the reserve divisions, and was entrusted with the investment of Metz. On Aug. 24 he made a brilliant attack on the left flank of the V. German Army; and when, on Aug. 26, a new VI. Army was assembled on the Somme, the command was given to Gen. Maunoury. It was this army, which, on Sept. 4, was launched against the flank of Von Kluck's I. Army—an action which opened and exercised a decisive influence on the battle of the Marne. Maunoury continued to command the VI. Army throughout the development of the Aisne line of battle and in the early phases of trench warfare. On March 15 1915 he was severely wounded, and thereafter held no active command. From Nov. 1915 till March 1916 he was Governor of Paris. He died on March 28 1923 and was created marshal of France posthumously.

MAURA, ANTONIO MONTANER (1853–1925), Spanish statesman, was born in Palma de Mallorca May 2 1853. He was educated at Valencia and Madrid where he studied law. Though his pronunciation of Spanish was first defective, by perseverance and force of personality he became in later years a great forensic and parliamentary orator. Elected deputy for his native city in 1881, he joined the Liberal party; but his instincts were conservative and in 1901 he went over to the Conservative party of which he eventually became leader. He was a constructive statesman, and though the chaotic state of the Spanish political fabric inspired in him a desire for reform, he always regarded the constitution as sacred. In 1903 he became Prime Minister, and his zeal for reform made him many enemies among the corrupt political factions of Spain. He negotiated with France on the subject of Spanish rights in Tangier and Morocco and with Great Britain concerning the *status quo* of the seas. In 1913 he resigned the leadership of the Conservative party, but, in response to appeals from the king, he formed governments in 1918, 1919 and 1921. True to his constitutional ideals, he refused to make common cause with the Directorate of 1923 which superseded parliamentary government in Spain. He died Dec. 13 1925.

MAUREL, VICTOR (1848–1923), French singer (*see* 17.907), died in New York Oct. 23 1923.

MAURICE, SIR FREDERICK BARTON (1871–), British soldier, was born Feb. 1 1871, and was commissioned in the Sherwood Foresters (Notts. and Derby Regiment) in 1892. He saw service in the Tirah campaign 1897–8 and the South African War 1899–1900 and from 1904 until 1914 held a series of general staff appointments, the last year as instructor at the Staff College. On the outbreak of the World War he was appointed General Staff Officer (1st grade) to the 3rd Div., British Expeditionary Force. He became brigadier-general, general staff, in 1915 and the same year he was advanced to the post of Director of Military Operations at the War Office. Here he was, during the middle period of the War, the intimate and valued assistant of Sir William Robertson, until the latter's resignation early in 1918. After the spring disasters Maurice wrote a letter to the Press challenging the accuracy of ministerial statements, considering them an attempt to shift the responsibility on to the army when several hundred thousand troops were retained in England to guard against a hypothetical invasion. By this act of moral courage he fulfilled his sense of honesty at the sacrifice of his career. Retired for the breach of discipline he became a military correspondent, and after the War, as Principal of the Working Men's College, St. Pancras, London, and Vice-President of the British Legion, was prominent in social work. His publications include *Forty Days in 1914* (1920); *Lord Wolseley* (with Sir George Arthur, 1924); *Robert E. Lee, the Soldier* (1925). (*See* Western Front.)

MAURITANIA (*see* Senegal, 24.643).—This region of French West Africa, between the Senegal river and Rio de Oro, was constituted a colony in 1921. The area, including Saharan regions, is 154,000 sq. miles. The population, mostly Moors, *i.e.*, tribes of mixed Berber and Arab descent, is 280,000. Port Etienne, on Lévrier Bay, Cap Blanc, created since the occupation of the country by the French, is the seat of a growing fishing industry.

MAURITIUS (*see* 17.912).—A British crown colony in the Indian Ocean, 500 m. east of Madagascar. Its area is 720 square miles. The estimated population at the end of 1923 was 381,678. An influenza epidemic swept the island during the months of May, June, July 1918 when 11,000 persons died, the death-rate in that year reaching the high figure of 64·9 per thousand. Primary education is free but not compulsory. The total number of primary schools in 1919 was 148, of which 57 were Government schools and 91 schools receiving state aid. The number of pupils on the registers was 22,120. Of the state-aided schools 67 were Roman Catholic, 10 Church of England, two Mahommedan and one Hindu. In all schools under government inspection the teaching of elementary hygiene and sanitation is compulsory.

Finance and Trade.—The highest figures for the revenue of the colony were reached during the financial year 1920–1 when the total revenue was rupees 40,168,210; expenditure in the same year was Rs. 24,729,510. Figures for subsequent financial years were:—

	1921–2 Rs.	1922–3 Rs.
Revenue	25,599,994	23,547,734
Expenditure	26,307,658	22,031,176

At the close of the financial year 1923 the public debt of the colony was £1,265,724.

Sugar production remains the principal industry of the colony, the total average under sugar cultivation being in excess of 175,923 acres. A record sugar crop was produced during the crop year 1918–9 when the output of the sugar factories was 252,772 metric tons; the output for 1923–4 was 195,356 metric tons. The production of aloe fibre ranks next to sugar in order of importance; rum, copra, coconut oil are other products that have shown an increase. Increased attention has been given to tobacco growing and the cultivation of tea has progressed. Lectures and demonstrations in modern agricultural methods are given by the Government agricultural instructor. The total trade of the colony reached record figures during 1919 when the combined values for the year were Rs. 174,843,348—imports Rs. 47,037,024, exports Rs. 127,806,321. Imports for 1923 were valued at Rs. 76,835,565 and exports Rs. 69,841,935.

The total mileage of the railways on the island in 1923 was 144 miles. The Mauritius Govt. railway main line gauge is 4 ft. 8½ inches. The short Bois Chéri light railway has a 2 ft. 6 in. gauge. The mileage of telegraph lines in 1923 was 415½ m., and of telephone lines 169¼ miles. Cable communication is maintained with Zanzibar, Australia, Réunion, Madagascar, Durban and other places.

See A. Macmillan, *Mauritius Illustrated* (1914); also *Colonial Office List* (Annual Series, London); *Mauritius Blue Book* (Annual, Mauritius). (H. C. Wa.)

MAURRAS, CHARLES (1868–), French writer and politician, was born at Martigues, Provence, of a royalist family. He first became prominent through his literary criticisms in the *Revue Encyclopédique* and the *Gazette de France*. He was at first the only Royalist on the staff of the *Action Française*, but soon converted almost all his colleagues. After visiting Greece and Italy he published *Trois idées politiques* (1898); *Les amants de Venise* (1902); and *L'avenir de l'intelligence* (1905). This was his most productive period, during which his royalist propaganda exerted a powerful influence; he assisted Léon Daudet in transforming the *Action Française* into a daily paper, which took place in 1908, and soon became engrossed in journalistic work. In his *Kiel et Tanger* (1910) he criticised French foreign policy, while *Le dilemme de Marc Sangnier* (1906) dealt with religious problems. Though an avowed atheist, Maurras somewhat paradoxically favoured an alliance with the Catholic Church which he regarded as closely connected with the monarchy. And indeed the *Action Française* lost considerable influence when the French clergy withdrew their support and defeated Daudet during his candidature for Parliament in 1923 and 1925.

During the War Maurras worked for the disintegration of Germany and for an overwhelming victory for France. His war articles appeared in eight volumes entitled *Les conditions de la victoire* (1915–20). Though his polemical writing injured his literary fame, Maurras nevertheless gained the reputation of being one of the most accomplished of modern French authors; and his critical works, such as *L'étang de Berre* (1915); *Le conseil de Dante* (1920) and *L'allée des philosophes* (1924) are written in restrained but powerful prose. His poems, often of great beauty, were collected in *La musique intérieure* (1925). Though the writings of Maurras produced a profound effect on French thought, his influence on practical politics has been but slight; for his political theories suffer from extremism and exaggeration, both characteristics of his race. His nationalist ideas failed to take deep root in his own country, but they triumphed in Italy; and *L'Idea Nazionale* with its fascist doctrines owed much to the *Action Française*. The French movement with which the name of Maurras is associated may be regarded as an inchoate Fascism; a minor intellectual revolution, which has not developed into any great political upheaval. Among Maurras' many works may be mentioned the following: *Jean Morêas* (1891); *Le chemin de paradis* (1894); *Anthinéa* (1901); *L'enquête sur la monarchie* (1900–9); *La politique religieuse* (1912); *Quand les Français ne s'aimaient pas* (1916).

MAX, ADOLPHE (1869–), Belgian politician, was born in Brussels Dec. 31 1869. From 1894 to 1903 he was successively provincial councillor of Brabant, councillor of the Commune and alderman of Brussels, and finally burgomaster (1909). In 1914 when the German troops entered Brussels he refused to perform his duties under the authority of the German governor, and demanded complete freedom of action. He protested vigorously against the abuses of the army of occupation, and fought with indomitable energy for the rights of his fellow subjects, and for the reduction of the heavy taxes and requisitions which were imposed on the town. He further founded a central committee to deal with supplies which, under the name of *Le Comité National*, rendered invaluable services to his countrymen. But the German authorities soon took exception to his spirited resistance, and on Sept. 26 1914 he was arrested and imprisoned in the fortress of Namur, and from there was sent into Germany, where he was closely confined. On Nov. 13 1918 he succeeded in escaping and returned to Belgium, where he was welcomed with delirious enthusiasm. M. Max was elected to the Chamber of Representatives in 1919; he was made minister of state on Nov. 21 1918, and was also elected member of the Belgian Academy.

MAXIM, SIR HIRAM STEVENS (1841–1916), Anglo-American engineer and inventor (*see* 17.918), died in London Nov. 24 1916.

MAXIMILIAN (1867–), Prince of Baden, born June 10 1867 at Baden-Baden, was a son of Prince William of Baden. As the nearest agnate to the reigning grand duke, of whom he was a cousin twice removed, he was heir presumptive to the grand ducal throne. From 1907 to 1918 he was president of the First Chamber of the Baden Diet. During the War Prince Max did much to improve conditions for British prisoners in Germany, as also for German prisoners, especially in Russia. On Oct. 3 1918, when the old military and political system in Germany was on the verge of collapse, he was appointed Imperial Chancellor. It fell to his lot to initiate the negotiations for the Armistice, and also to carry through in hot haste those alterations in the old constitution which had long been demanded by the Liberals and the Socialists, but which now came too late to avert the fate of the Empire and the Prussian Monarchy. It also became his duty to put pressure upon the Emperor in order to induce him to abdicate. As the Imperial decision was delayed from day to day and the revolution became imminent, he declared on Nov. 9 1918 the abdication of William II. as German Emperor and as King of Prussia. It was clear that the Hohenzollern dynasty was doomed; and Prince Max handed over the Government to the majority Socialist leader Ebert, who became the president of the German Reich. He continued, after the abdication of the grand duke, to reside at Karlsruhe. (*See* Germany.)

MAXSE, SIR IVOR (1862–), British soldier, was born Dec. 22 1862 and was commissioned in the Royal Fusiliers in 1882, transferring to the Coldstream Guards in 1891. He served in the Sudan campaigns 1897–9, during which he gained the D.S.O., and in the Boer War 1899, as staff officer to Mounted Infantry and as commander of the Transvaal Constabulary after the capture of Pretoria. From 1902–10 he was regimental commander of the Coldstream Guards, and on the outbreak of the World War he went to France in command of the 1st Guards Brigade, which he led during the retreat from Mons and in the battles of the Marne and the Aisne. In Oct. 1914 he was promoted to the command of the 18th Division. He brought this division to France in 1915, and his unique training methods bore fruit in the battle of the Somme, where the 18th Div. obtained an opening success in brilliant contrast to the fate of other divisions on the tragic July 1 1916. As a consequence his promotion to command of the 18th Army Corps followed in Jan. 1917, and this he led with distinction down to, and including, the St. Quentin battle in March 1918. In 1917 he was created K.C.B.

The British Army was so sorely shattered in resisting the German offensive of 1918 that its reconstruction and transformation into the irresistible striking force of the autumn appears almost a miracle. In the glory of this achievement Sir Ivor Maxse has a notable share. The need for a unified direction of training was realised and he was chosen to be inspector-general

of training to the British Armies in France. By the development of the new tactics of infiltration and manoeuvre, by the improved co-operation between the different armies, and by the new elasticity of tactical handling, his work is engraved in the astounding success and low casualty list of the army during the advance to victory. After the War, at the hand of the Northern Command 1919–23, Maxse's influence in recasting the training of infantry and in making tactics intelligible to the novice was as marked as his practical achievement in the reorganisation of the depôt system. Dynamic in thought and energy, receptive to ideas, and generous in his support of youthful ability, he had a genius for training which was reminiscent of the influence of Sir John Moore, a century before. Sir Ivor contributed to this Encyclopædia the article INFANTRY.

MAYO, CHARLES HORACE (1865–), American surgeon, was born at Rochester, Minn., July 19 1865. After studying at the Rochester High School, Northwestern University and the Chicago Medical College (M.D. 1888), he began the practice of surgery at Rochester, Minn., and with his brother became surgeon at the Mayo Clinic. He made a special study of goitre, and as a result succeeded in reducing the death-rate in this class of cases by half. He has published a number of papers on surgical topics in medical journals. He was elected president of the Minnesota State Medical Society in 1905, president of the surgical section of the International Tuberculosis Congress in 1908, and president of the American Medical Assn. in 1916. He was appointed Mayo Foundation professor of surgery in 1915. During 1917–8 he was president of the examining board of applicants for commissions in the Medical Corps, having supervision over several states, including Minnesota. In 1918 he was appointed colonel in the Medical Reserve Corps, U.S.A., and for a year was associate chief consultant for surgical service. Beginning with 1912, graduate courses in medicine were offered at the Mayo Clinic in Rochester. Early in 1915 he and his brother incorporated the Mayo Foundation for medical education and research at Rochester, and to it the brothers gave $1,500,000. In June of the same year, by mutual agreement, the funds and resources of the foundation were placed under the direction of the regent of the University of Minnesota for promoting "graduate work in medicine and research in this field." On Sept. 13 1917 the Foundation, with its fully-equipped staff, laboratories and clinics in Rochester, became a department of that university. (*See* SURGERY.)

MAYO, WILLIAM JAMES (1861–), American surgeon, was born at Le Sueur, Minn., June 29 1861. He was graduated in medicine from the University of Michigan in 1883 and began the practice of surgery in Rochester, Minnesota. A small hospital was organised under the local branch of the Sisters of St. Francis, which developed into St. Mary's Hospital. Here he, with his younger brother, Charles Horace, developed the Mayo Clinic (organised 1889), which became famous throughout the world for the number and success of operations performed. The records of operations have been so carefully and accurately made and preserved that they form a valuable asset to medical science. Though the clinic has contributed no discovery of new methods or new cures for diseases, all modern methods have been covered and reduced to their ultimate accuracy. Accuracy has been the keynote to the Mayos' success. Goitre, gall bladder, appendix and gastro-intestinal operations constituted the great majority of the cases, and the proportion of deaths to the total number of patients operated upon was remarkably low. Dr. W. J. Mayo specialised in the surgery of the stomach, and published a large number of papers on gastric surgery and kindred topics. He was elected president of the Minnesota State Medical Society in 1895, and in 1907 was appointed a regent of the University of Minnesota. He was elected president of the Society for Clinical Surgery in 1911, and the following year president of the American Surgical Association. On America's entrance into the World War he was appointed a colonel in the Medical Corps, U.S. Army, and chief consultant for surgical service, alternating with his brother, C. H. Mayo, in this capacity. In 1919 he was awarded the medal for distinguished service. (*See* SURGERY.)

MAYOR, JOHN EYTON BICKERSTETH (1825–1910), British classical scholar (*see* 17.937), died at Cambridge Dec. 31 1910.

MEAD, LARKIN GOLDSMITH (1835–1910), American sculptor (*see* 17.945), died at Florence, Italy, Oct. 15 1910.

MEASLES: *see* INFECTIOUS FEVERS.

MEASUREMENTS (*see* 18.134).—The science of measurement is in practice restricted to mean measurement of the three fundamental quantities, mass, length and time, from which all other quantities, such for example as volume, density, velocity, acceleration, force and power, are derived. The problem of measurement of these three fundamental quantities presents itself primarily as a question of providing suitable units of reference against which other quantities whose values it is desired to measure may be compared.

Importance of Metrology.—On the purely scientific side all other scientific quantities are ultimately definable in terms of the three fundamental quantities with which metrology deals, and every quantitative determination resolves itself in the last resort into a measurement of one or other of these quantities. If "science is measurement" then without metrology there is no science. Even in its most direct application it covers a very wide field (*see* MENSURATION [15.134]; SURVEYING; GEODESY; EARTH, FIGURE OF THE [8.801]; MICROMETER [15.38]; TOOL, PART 13 [27.43]; MEASURING INSTRUMENTS; TIME [26.983]; CLOCKS [6.536]; WEIGHTS AND MEASURES [25.477]; WEIGHING MACHINES [25.468]; METRIC SYSTEM [15.299]). The question of the time standard, moreover, is particularly an astronomical one.

The specification of any quantity involves two factors. If we speak of three pounds, two metres, or 24 hours, in each case the complete statement consists of firstly a pure numeric, and secondly of a unit of measurement which is either the fundamental unit of reference, or a definite multiple or submultiple of it. The reference units in themselves are entirely arbitrary. There is no "absolute" standard; all measurement is relative.

Problems Involved.—The problem of metrology is twofold. First to provide and maintain unaltered the standards of reference by which other quantities are compared and measured; and Secondly to provide means by which the comparisons may be made with accuracy sufficient for the particular purpose in view. The demands of science and industry at the present day require, for certain purposes, an extremely high degree of accuracy in these fundamental comparisons, so that what, at first sight, would appear to be a fairly simple problem becomes in fact one of great difficulty, involving the most expensive and elaborate apparatus. No measurement is ever absolutely correct. Some degree of experimental error is always necessarily present, and the approximate degrees of accuracy at present attainable in certain of the more fundamental operations in metrology, are as follows:—

Comparison of two platinum-iridium copies of the International Prototype Kilogramme: 1 part in 100,000,000.
Comparison of ordinary chemical weights: 1 part in 1,000,000.
Comparison of smaller masses by micro-balance: 1 part in 100,000,000.
Comparison of two yard or metre (line or end) standards: 1 part in 10,000,000.
Comparison of end standard with line standard: 1 part in 1,000,000.
Determination of volume and density for very special work: 1 part in 1,000,000.
Determination of volume and density, ordinary: 1 part in 10,000.
Calibration of set of end standards (not less than 1 in. in length): 1 part in 1,000,000.
Calibration of subdivisions of graduated yard or metal scale in terms of whole length: 0·000005 in. or 0·0001 millimetre.

STANDARDS OF LENGTH

The history of standards of length is one of varying ascendency of three principal competing types. A length may be defined by the distance, under certain specified conditions, either between the two end surfaces of a material standard bar, or between two suitable marks engraved upon it. Alternatively reference may be made to some "natural" standard. The standard yards of Henry VII. and Elizabeth preserved in the Standards Department of the Board of Trade, are end standards, incisions marking subdivisions of the yard being secondary only. The

Elizabethan yard was superseded by one defined by the distance between two small dots on gold plugs inserted in it. When this bar was legalised in 1824, it was provided that in the event of loss it should be replaced by reference to a "natural" standard, the length of the pendulum beating seconds in the latitude of London. It so happened that within a very short period this standard was in fact destroyed by the fire in the Houses of Parliament in 1834.

The commission charged with its replacement found, however, that it was impossible to reproduce the seconds pendulum with so high an accuracy as the length of the bar itself could be reproduced by means of direct comparison with other bars which had previously been compared with the lost standard. The legal prescription was therefore abandoned, and the new standard yard, which is that legal at the present day, is a line standard constructed by comparison with other bars, without reference to any control provided by a natural standard. The metre was originally intended to be the 10,000,000th part of the earth's meridional quadrant. But it was soon found that not only was the determination of this natural standard an extremely laborious undertaking, but the accuracy attainable was less than that possible in the comparison of material standards, and the material Mètre des Archives, a platinum end standard, became the accepted standard of reference for the metric system until superseded in 1889 by the present International Prototype Metre, a platinum iridium line standard (*see* WEIGHTS AND MEASURES).

Wave Lengths as Natural Standard.—At the date of construction of the present Imperial Standard Yard, and the International Prototype Metre, sound judgment was exercised in the choice of material line standards as affording the greatest prospect of accurate comparison and reproduction and in the legal provision made for their replacement, if necessary, by reference to other similar standards periodically compared with them. Recent developments, however, have appreciably changed the situation. In the first place the experiments of Michelson, followed by those of Fabry and Perot (*see* INTERFERENCE OF LIGHT, 14.685) have finally established a natural standard (the wave length of the red line in the spectrum of cadmium) which is reproducible with accuracy at least as great as that attainable in the comparisons of material standards, which is definitely free from the suspicion of possible secular variation inevitably attaching to all material standards, and by means of which the material standards necessarily employed in everyday practice can be verified in any part of the world without the risk of accident or damage involved in the periodical transport of material national reference standards to and from the international century laboratory for purposes of comparison with the prototype. Secondly, such improvement has been effected during the last few years in the production of flat-ended standards that bars with accurately parallel ends of the quality of optical mirrors are now available, whose lengths can be more directly determined by the method of optical interference than is the case with line standards, and which are also more accurately comparable with each other than the latter.

The International Committee on Weights and Measures, at its meeting in 1923, decided in principle on the eventual adoption of a wave-length standard of length subject to the determination by experiment in the various national laboratories, of the best method of realising such a standard and the conditions necessary to ensure the greatest degree of constancy in its reproduction. Such experiments are proceeding and it is to be anticipated that within the period beginning in 1925 or 1926 a very important change may be made in the ultimate basis of reference for all measures of length.

Use of Material Standards.—Whatever ultimate basis of control may be selected, for practical purposes, in everyday measurement, material standards will always be needed. Both line standards and end standards will always be required for different purposes. So long as material standards are used for the ultimate reference the primary importance attaches to secular stability of the material. There is evidence to suggest that the present imperial standard yard has probably shortened by about 0·0002 inch since it was originally constructed in 1844, but has remained unchanged for the last 40 years. So far as is known, the international prototype metre has remained unchanged since its verification (1875–9). The evidence for this rests partly on subsequent recomparison with various national copies constructed in the same manner at the same time, and partly on two determinations, by different methods, at an interval of about 15 years, the first by Michelson and Benoit, and the second by Fabry and Perot, against the wave length of the red line of cadmium. These metre standards are all made of an alloy of 90% platinum and 10% iridium, which is now regarded as the most satisfactory alloy for the construction of a material standard for purposes of ultimate reference. Its cost, however, would be prohibitive for any other purpose.

Temperature Conditions.—All materials change in size to a greater or less degree with variation of temperature. It is therefore essential to specify exactly the temperature at which the material standard defines the unit of length, and further either to control the standard exactly to this temperature when making comparisons with it, or at least to ascertain its temperature exactly, and make allowance for its known expansion between that temperature and the standard temperature. The Imperial Standard Yard is correct at 62° F., the International Prototype Metre at 0° Centigrade. Some confusion of thought frequently arises on this point. Each of these bars serves, at its own standard temperature, to define a simple unit of pure length, that is, of absolute extension in space. These units themselves, once determined, are entirely independent of temperature. It is not correct to say that either of the fundamental reference standards is a yard, or a metre, except at its appropriate temperature of definition, 62° F. or 0° C., respectively, nor that a length of any other material is a yard or a metre solely because at 62° F. or at 0° C. it agrees with the fundamental standard. A length of any material is a yard or a metre, at whatever temperature it may be, if at that particular temperature the length is equal to the unit defined by the standard bar when the latter is at its own temperature of reference. There is a definite numerical relationship between the two principal units which has been twice accurately determined: in 1895 by Chaney and Benoit, with the result 1 metre = 39.370113 in.; and more recently (1922–5) at the National Physical Laboratory, with the result 1 metre = 39·370137 inches. The two results may be said to be in agreement within the experimental error of the various observations involved, and for all practical purposes the simple ratio 1 in. = 25·4 mm. (equivalent to 1 metre = 39·370079 in.) may be taken as sufficiently exact.

The use of this ratio implies that the two objects, being compared, are both simultaneously at their common temperature of employment. For all everyday purposes of measurement, as for example in measuring a piece of work in an engineering workshop, it is unnecessary to bring the object to be measured to the standard temperature. If the work and the gauge with which it is being measured are made of materials having the same coefficient of expansion, and the former has been compared with the reference standard at the standard temperature, it is only necessary, when comparing the work with the gauge, to ensure that both are at the same temperature (not necessarily the standard temperature) to ensure that the work will be correctly measured.

Use of Invar.—For many purposes where very precise measurement is involved, it is of great advantage to have a material with a very small thermal expansion. Two such materials have been discovered. The first, known as "Invar," is a nickel-steel alloy, containing 36% of nickel, invented by Dr. Ch. Ed. Guillaume of the Bureau International (Sèvres). Different samples have coefficients ranging from about 1.5×10^{-6} per 1° C., for large bars, down to zero, or even slightly negative values, for smaller bars, pendulum rods, drawn wire or rolled tape. These figures are to be compared with 11×10^{-6} per 1° C. for steel, and 18×10^{-6} per 1° C. for brass. Invar, unfortunately, has one very serious defect as a standard of length. It grows longer, rapidly at first and subsequently more slowly but continuously, so that after

20 years the length of a bar of invar will still be increasing at a rate of about 1 part in 2,000,000 per annum. More recently Dr. Guillaume has introduced a slightly different alloy, containing a percentage of chromium in addition to the nickel, which is described as "stable" invar. This alloy grows at an appreciably slower rate than ordinary invar, but still cannot be regarded as constant. Invar therefore is principally useful in a laboratory, in work where temporary constancy of length is the primary consideration, or in circumstances, as for example in the case of tapes and wires used for geodetic surveying, where the accurate ascertainment of temperature presents considerable difficulty. In these cases it is necessary to return the tapes or wires to the laboratory periodically for reverification. For the reasons indicated above, in everyday workshop measurements, gauges or scales should be made of material having a similar coefficient of expansion to the work to be measured, and invar therefore should not ordinarily be used for the construction of workshop standards.

Fused Silica.—The other material which has a very low coefficient of expansion is fused silica, which expands only $0{\cdot}4\times10^{-6}$ per 1° Centigrade. A metre standard constructed of fused silica, in the form of a tube, with parallel plates fused in at the ends on the platinised surfaces of which the defining lines are ruled, has been made and kept under observation at the National Physical Laboratory since 1913. So far as can be detected, no change has occurred in its length. Such a standard is extremely fragile, and for this reason would hardly be adopted either as a fundamental reference standard or for everyday use, except in a metrological laboratory.

Natural Crystal Quartz.—Reference should be made to the recent work of Perard, at the Bureau International, on end standards of natural crystal quartz. Such standards cannot, of course, be of the full length of the yard or metre. But they present several great advantages. Firstly, since the material is of great age and the molecules of which it is composed are arranged structurally in definite crystallised array, there seems little possibility of any secular change. Secondly, it lends itself to perfect optical finish of the defining end planes, which enables direct determination of length to be made in terms of light waves, with extremely high precision resulting in a proportional accuracy no less than is at present obtained in the comparison of yard or metre line standards, although the largest available specimens of crystal quartz, as well as the method of use, only enable such standards to be made and verified up to a length of about 4 inches.

Line Standards; Mode of Comparison.—The comparison of two line standards is effected as follows: The bars are placed side by side, each on one of two parallel girders contained in a water bath, which is mounted on a carriage capable of being moved in a direction perpendicular to the length of the bars. The bars are constructed with their graduations on polished surfaces in the neutral plane of their cross section, and each is supported on two rollers spaced at such a distance apart that the distance between its graduation marks has a maximum value. Under these conditions any changes in the flexure of the bars due to slight errors in the positions of the supports can have no effect on the measured distances between the graduations. Two micrometer microscopes (*see* MICROMETER, 18.381) are rigidly held in brackets supported in such a manner as to be unaffected by the motion of the carriage. Each girder has independent adjustments by means of which the lines on the bars can be brought into focus in the field of the microscopes. The water in the bath is stirred and the temperature read by means of accurately calibrated thermometers. Readings are taken by means of the microscopes alternately on the defining lines of each bar, and the mean of several independent readings is taken. The comparison is repeated with each of the bars turned end for end in turn in order to overcome any effect of asymmetry in the illumination of the graduation marks, and the bars are then interchanged on the two girders and the whole repeated once more, making eight complete sets of readings in all, from which the difference in length between the two bars is finally computed. In an important determination several bars (say six or eight) may be included, and each will be completely compared in the manner described above, against all the others, the best values for the differences between all the various bars being then computed from the individual observed differences by the method of least squares (*see* PROBABILITY, 22.376), the residual errors serving to indicate the degree of accuracy which has been attained in the work.

Calibration.—The calibration of the subdivisions of a divided scale is done in a similar way, except that in this case the carriage of the comparator moves in the direction of the length of the bar. The microscopes are fixed successively at a series of suitable intervals apart, for example, 1 dm., 2 dm., 3 dm., etc., and each principal interval of 1 dm., 2 dm., etc., is compared with every other interval of the same magnitude throughout the metre. By computation from the results so obtained the value of each decimetre is determined in relation to the whole length of the scale. In a similar manner each centimetre of one decimetre is compared with every centimetre of another decimetre, and as a result the value of each centimetre is found in relation to the whole of the other decimetre, and so in turn, in relation to the whole length of the metre. Millimetres are derived from centimetres in the same way, and so on. The complete calibration of a divided scale will be seen to be a very laborious process involving an enormous number of observations. The process is, however, simplified by the fact that the whole of the measurements are made on the one bar, so that, provided reasonable precautions are taken to ensure constancy of temperature, exact temperature measurements are not important.

The apparatus used to determine coefficients of expansion is similar to the transverse comparator, but has two independent water baths mounted on the carriage. One of these, containing a bar preferably of invar, is kept at a constant temperature, while the other, containing the bar under examination, is brought successively to a series of suitable temperatures. The two bars are compared under the microscopes at each temperature of the second, and so the variations of its length with temperature are determined.

A number of machines of different types, and varying sensitivity, are available for comparing end standards by contact measurement, or, if the end faces are of sufficiently perfect finish, they may be directly compared by the method of optical interference. In the latter case the two bars are brought in turn between two semi-silvered optically flat glass surfaces, and the number of wave lengths in the small spaces at either end between the measuring surface of the bar, and the semi-silvered surfaces of the optical flats are determined by direct measurement of the angular diameters of the interference rings formed by monochromatic light. This enables the fraction of a wave length to be determined with exactness, and if several different wave lengths are used in turn, whose mutual ratios are known, the whole number of waves is easily determined by deduction, as only a particular set of corresponding whole numbers will give fractions agreeing in every case with the series actually observed.

In the mechanical contact type of measuring machine the bar is measured between two opposed anvils, one of which may either be fixed, or may be movable by means of a micrometer screw, while the other is capable of a small movement operating some form of sensitive indicator. The two bars to be compared are inserted in turn between the anvils, and if the whole difference between them is sufficiently small the movement of the indicator over a calibrated scale may suffice to determine it. If the difference is greater, the indicator must be brought to a fixed mark by an adjustment of the moving anvil, the difference in length being then ascertained by the difference in reading of the micrometer wheel.

Mode of Calibration of End Standards.—The calibration of a set of subdivisional end standards is effected by taking them together in pairs of nominally equal added lengths, and comparing their sums, in the manner just described. In the last 20 years there have been developed, first by the firm of C. E. Johansson, Sweden, and later at the National Physical Laboratory, England, and by Hoke in America, methods of producing short flat ended gauges of such perfection that any two of them if put together will adhere firmly to each other by "wringing." The process of wringing is not yet fully understood, but appears to depend essentially on the presence of a very minute trace of liquid (grease or moisture) between the surfaces of the gauges. These gauges are usually made in series, *e.g.*, 1 in., 0·9 in., 0·8 in. . . . 0·1 inch. Suppose we wish to calibrate such a series, of which the 1 in. is supposed to be already known as the result of some previous calibration. For convenience we will assume that we have available a duplicate set of pieces, which we denote by 0·1′, 0·2′, 0·9 foot. To determine, for example, the value of the 0·7-in. gauge, we wring up in turn all the various nominally equal combinations indicated below, and compare them in a suitable measuring machine, the small observed differences being indicated by

0·7		=		0·7	0	0·7	0·5	=	1·0	0·2	5
0·7	0·1	=		0·8	1	0·7	0·6	=	1·0	0·3	6
0·7	0·2	=		0·9	2	0·7	0·7	=	1·0	0·4	7
0·7	0·3	=	1·0		3	0·7	0·8	=	1·0	0·5	8
0·7	0·4	=	1·0	0·1	4	0·7	0·9	=	1·0	0·6	9

Adding up all these equations we see that the sums of the second columns on either side cancel out, and we get

$$10\times0{\cdot}7 = 7\times1{\cdot}0 \qquad \begin{matrix}9\\0\end{matrix}$$

or

$$0{\cdot}7 = \frac{7}{10}\times1{\cdot}0 \qquad \begin{matrix}\frac{1}{10}\\0\end{matrix} \quad \begin{matrix}9\\0\end{matrix}$$

The sizes of each of the other pieces may be determined in a precisely similar manner.

It may be noted that in the determination of sizes in this manner, the length of each gauge is automatically associated with the thickness of one wringing film, which, for clearness in conception, may be regarded as representing half a film thickness on either end surface, so that when two gauges are wrung together a whole film is established between them. As the gauges are normally used in this manner, this result is logically what is required. The wringing films, moreover, are in any case exceedingly thin. When initially formed, their thickness depends to some extent on the viscosity of the liquid of which they are composed, but if a sufficient length of time is allowed to elapse they tend to thin down to a limiting thickness which is less than 0·000001 in. for all liquids.

There is one more fundamental operation which, whatever may be the nature of the ultimate standard adopted, will always be required in its practical application to everyday requirements, and that is the determination of the length of an end standard in terms of the corresponding line standard, or vice versa. This is a matter of considerable difficulty, and several methods have been employed for the purpose. Probably the best method is that introduced by Mr. H. L. P. Jolly, formerly of the National Physical Laboratory, and now of the Ordnance Survey Department, Southampton. It involves the use of an intermediate end standard, and of two special parallel faced end blocks, which can be wrung on to the ends of this standard.

Each of the end blocks carries graduation marks as shown on its polished upper surface. The composite bar is compared in the ordinary way in a comparator, with the standard line bar. Each of the end blocks is turned round in turn, and re-wrung on the end of the bar, and the comparison repeated. We thus obtain the four results:—

$$\begin{aligned} L\ a_2\ b_1 &= S_L\ 1 \\ L\ a_1\ b_1 &= S_L\ 2 \\ L\ a_1\ b_2 &= S_L\ 3 \\ L\ a_2\ b_2 &= S_L\ 4 \end{aligned}$$

or, adding and dividing by 2

$$2L\ a_1\ a_2\ b_1\ b_2 = 2S_L\ \tfrac{1}{2}\ 1\ 2\ 3\ 4$$

Each of the end blocks is then removed in turn and the other wrung centrally on the end of the bar, the new combinations being compared in a measuring machine with the end standard end bar, with the results

$$\begin{aligned} L\ a_1\ a_2 &= S_E\ 1 \\ L\ b_1\ b_2 &= S_E\ 2 \end{aligned}$$

or adding

$$2\,L\ a_1\ a_2\ b_1\ b_2 = 2\,S_E\ 1\ 2$$

From this equation, and the one previously found, we obtain the result

$$2\,S_L\ \tfrac{1}{2}\ (1\ 2\ 3\ 4) = 2\,S_E\ 1\ 2$$

which gives us the desired value of the line standard S_L in terms of the end standard S_E or vice versa.

To complete our survey of the fundamental operations involved in length measurement, reference must be made finally and very briefly to the process of verifying longer measures, such as are used in surveying. In the first place a long bar, graduated in multiples of the standard length unit, is required. This is compared, yard by yard, or metre by metre, with the standard line bar, in a large comparator. This bar in turn is compared either with suitable reference marks engraved on metal studs let into a mural base at intervals corresponding to the length of the bar, or else directly with the divisions of a graduated tape. The tapes or wires after verification, either directly, or by comparison with the mural base, are used to determine base lines in the field, by comparison with temporary bench marks set up at intervals apart roughly equal to the length of the tape.

Standards of Mass.—No attempt has so far been made to define a unit of mass by means of any natural standard, though a standard of this kind, *e.g.*, a definite multiple, say, of the atomic mass of helium, would not be inconceivable. Prior to the discovery of the radioactive elements mass was regarded as the essentially constant attribute of matter, and there was no reason to anticipate any change in a material standard of mass except by actual damage due to abrasion, oxidation, hygroscopic absorption or other similar causes. And there still remains a reasonable choice of materials, which, given due care in preservation and handling, may be expected with considerable confidence to exhibit constancy of mass.

Platinum and Platinum-Iridium.—Our predecessors, ignorant of radioactive processes, were fortunate in the choice of platinum and platinum-iridium (10% iridium) as the materials of construction for the ultimate reference standards of mass, the Imperial Standard Pound, and the International Prototype Kilogramme, respectively. The degree of consistency (within 1 part in 10^8) with which recomparisons of various national copies of the kilogramme, made after the lapse of many years, have in general repeated the original determinations, speaks convincingly, not only as to the suitability of the standards themselves, but as to the perfection of the balances used in the comparisons. The relation between the two units, according to the best ascertained determination, is 1 kg. = 2·2046223 pounds. This value received legal sanction.

Crystal Quartz.—Another material presenting a high degree of constancy of mass is crystal quartz. This, however, has the disadvantage of having a comparatively low density. In comparing two standard weights, masses in air, allowance must be made for the upward buoyant effect due to the volumes of air which they respectively displace. The less the density of the mass, the greater will be the buoyancy correction. The accuracy attained in the intercomparison of a series of platinum-iridium standards is no doubt attributable to a considerable degree to the fact that they all have comparatively high, and very closely equal, densities, so that the net buoyancy corrections are very small, and a comparatively rough determination of the air density consequently suffices to give the correction with negligible error. In comparing a number of masses differing appreciably in density, *e.g.*, platinum, quartz and brass, the accurate determination of the buoyancy correction presents much greater difficulty, and several attempts have been made to overcome it by actually conducting the weighings *in vacuo*. This involves enclosing the whole balance in an air-tight case, and manipulating the weights entirely by mechanical means from outside, without opening the case. Leakage at the glands where the operating spindles enter the case has, however, so far proved an almost insuperable obstacle to successful weighing *in vacuo*. Everyday weighings for commercial purposes are of course necessarily conducted in air, but the differences in buoyancy between the weights used, and the goods weighed, are negligible for this purpose. It is necessary, however, to provide a basis for the periodical reverification by inspectors of weights and measures of traders' weights, which may be of iron, brass or other materials. For this purpose a "commercial" standard is employed. This standard is of brass (of density 8·143) adjusted to agree *in vacuo* with the Imperial Standard Pound of platinum. Inspectors' standards are also of brass, and all verifications of these standards, and thus indirectly of traders' weights, are made by comparison, *in air*, with the commercial brass pound.

Use of the Balance.—Even when weighings are not conducted *in vacuo* the construction and manipulation of a balance for the accurate comparison of primary standards of mass are distinctly elaborate. It is necessary for the greatest care to be taken to preserve constancy of temperature, in order to maintain a steady zero reading of the balance. For this reason the room containing the balance must be thermostatically controlled, and the observer either works entirely from outside the room, or, if he enters it, must remain at a distance from the balance, all the manipulation of the weights being effected from outside the balance case by mechanical control operated by means of long rods, and the movement of the balance beam being observed either through a telescope, or by the movement across a scale of a spot of light reflected by a small mirror attached to the beam.

Consecutive Weighings.—To eliminate any effect due to slight inequality in the lengths of the two arms of the balance, at the same time to minimise the effect of any small residual drift of zero due to a gradual change in temperature conditions and to obtain a determination of the sensitivity of the balance at the time of weighing, consecutive weighings should be made to the following order:—

Left-hand pan		Right-hand pan		Mean Reading
A	x	B		p_1
A		B	x	p_2
B		A	x	p_3
B	x	A		p_4
B	x	A		p_5
B		A	x	p_6
A		B	x	p_7
A	x	B		p_8

Here A and B are the two masses being compared, and x a small known weight which serves to determine the sensitivity. Each mass is weighed an equal number of times on each pan of the balance, and the mean time of all the weighings of each mass on each pan is the same, so that the effect of any steady temperature drift is eliminated. In weighing, the balance is not brought to rest, but the pointer, or spot of light, is observed while swinging, and the extreme positions of several successive swings to right and left are noted. From these the mean readings or rest points corresponding to each arrangement of weights on the scale pans are calculated. If, for example, four successive readings are 1 2 3 4, then, allowing for the effect of the gradual reduction in the amplitude of the swing, due to damping, the corresponding rest point, p, is $\frac{1}{8}$ (1 3 2 3 3 4).

If p be the rest point when two *equal* masses of values nominally equal to A and B are on the pans, then we have

$$\begin{array}{ll} A-B \quad x=k(p_1-p) & B-A \quad x=k(p_5-p) \\ A-B-x=k(p_2-p) & B-A-x=k(p_6-p) \\ B-A-x=k(p_3-p) & A-B-x=k(p_7-p) \\ B-A \quad x=k(p_4-p) & A-B \quad x=k(p_8-p) \end{array}$$

whence

$$\begin{aligned} 8\,(A-B) &= k(p_1 \quad p_2-p_3-p_4-p_5-p_6 \quad p_7 \quad p_8) \\ 8\ x \quad &= k(p_1-p_2-p_3 \quad p_4 \quad p_5-p_6-p_7 \quad p_8) \end{aligned}$$

$$\text{or } A-B \quad = x\,\frac{p_1 \quad p_2-p_3-p_4-p_5-p_6-p_7 \quad p_8}{p_1-p_2-p_3 \quad p_4 \quad p_5-p_6-p_7 \quad p_8}$$

Usually of course several masses will be compared each with each in turn, and the best values for the differences between them finally computed by the method of least squares from all the observed differences obtained in the above manner.

The construction of the balance must be such as to ensure that after each successive arrestment of the beam and pans, the knife edges are brought into exactly the same relationship with the planes, and to secure this it is necessary to support the pans by means of a series of crossed knife edges below each terminal knife edge on the beam. If the weighings are not conducted *in vacuo*, the air density must be calculated for each weighing from observations of temperature, pressure and hygroscopic state of the air, and each observed reading corrected for air buoyancy, allowing for the effect of temperature on the volumes of the weights.

The volumes, and hence the densities, of the weights are determined by weighing them, first in air, and then immersed in distilled water, against other weights always in air. The density of the air must be calculated as usual from its temperature, barometric pressure and humidity, and that of the distilled water is known from its temperature. The difference between the two weighings, due allowance being made for the air buoyancy corrections on all the weights involved, is equal to the difference in weight between the quantities of water and air at the observed densities of each, which would fill a volume equal to that of the weight being examined. If for any reason it is considered objectionable to immerse a standard weight in water, it is possible to determine its volume, though somewhat less accurately, by means of a volumenometer, which is an apparatus for observing the change of pressure of the air enclosed within a given space, when a definite change is made in its volume, firstly when it is filled with air alone, and secondly when the weight is enclosed within it.

The calibration of a set of fractional or multiple weights in terms of the original unit can be effected by weighing together in groups of nominally equal sum by a process precisely analogous to that described above for a set of fractional end standards.

Ordinary brass weights usually exhibit a certain variability of mass, which is probably attributable to variations of surface condition depending on the degree of humidity of the surrounding atmosphere. Care should, of course, be taken to see that the metal of which weights are made is free from porosity, and weights intended for precision work should be made solid, without screwed-in tops covering holes containing adjusting material. The surfaces of high class weights are frequently electro plated with gold or platinum, with the object of minimising the effects of oxidation and hygroscopic action on the surface. Of the two, platinising is the preferable process, but weights coated with either gold or platinum have been found to exhibit instability to a certain degree, though usually less than in the case of unplated weights. The success of gilding or platinising depends upon the care exercised to obtain a firm and hard deposit.

To minimise the effects of temperature upon the action of a balance, a beam of invar may be used. But it must be remembered that invar is to a certain extent magnetic, and if results of high precision are required, care must be taken with such a beam as to ensure that it is completely screened from any possible magnetic influence. The balance should preferably be entirely enclosed within a sheet iron case.

For weighing very small quantities, and in particular for comparing the densities of small quantities of gases, micro-balances constructed entirely of fused quartz have been used. Such balances have been made both with knife edges, and preferably, with the beam torsionally supported on a thin horizontal quartz fibre at right angles to its length, and the pans supported from its ends by means of other fibres fused directly to it. The weighings are usually made by arranging a small bulb or similar contrivance at one end of the beam, counter-balanced by solid quartz at the other end. The two ends of the beam are therefore differently affected by the buoyancy of the air, and weighings are made by adjusting the pressure of the air in the balance case until the buoyancy just restores the beam to balance. The air pressure is read by means of a suitable manometer, and serves to measure the weight of the object under examination. With such balances loads as small as $\frac{1}{10}$th gramme have been weighed to an accuracy of 1 part in 10^8).

Standards of Capacity

Theoretically, the unit of capacity should be the same as the unit of volume—that is, the volume of a cube each of whose sides is equal to the unit of length. In practice, however, it is extremely difficult to construct such a cube with accuracy, and still more difficult to measure the internal volumes of vessels of different shapes in terms of the unit of length. Practical necessity has therefore ordained the use of a unit of capacity based on the unit of mass, rather than on the unit of length. In the metric system the kilogramme was originally intended to be the mass of one cubic decimetre of pure distilled water when at its temperature of maximum density (4° Centigrade).

Although great care was taken in the construction of the original kilogramme from this definition, and the result attained was closer than might have been anticipated in view of the difficulty of the problem, it has been found by very careful experiment that the litre, which is now defined as the volume occupied by 1 kilogramme of water at 4° C., actually equals 1·000027 cubic decimetres. The gallon is somewhat similarly defined as the volume occupied by 10 lb. of pure distilled water at 62° F. when weighed in air at a barometric pressure of 30 in. of mercury, against brass weights. As the weighing has to be made in air, and the density of the brass weights is not prescribed by the Act (Weights and Measures Act 1878) there is a certain ambiguity about this definition. On reasonable assumptions it has been calculated that 1 gallon = 4·545631 litres.

It will be noted that in the case of the litre the definition refers to the kilogramme *mass*—that is to say, the weighings are to be reduced to vacuum, by applying a suitable correction for the difference of the air buoyancy on the distilled water and on the weights used for weighing it. This entirely eliminates the difficulty mentioned as regards the exact definition of the gallon. Much confusion of thought has, however, arisen from the preference of some chemists for the use of the so-called "Mohr's litre," which is defined, on the same lines as the gallon, as the volume occupied by 1 kg. of distilled water, when weighed in air, against brass weights, at a temperature which has never been explicitly laid down. Roughly, a Mohr's litre equals 1·002 true litres. It is very unfortunate that the term litre should have been appropriated to a unit so vaguely defined and which differs from the true litre by an amount that, although small, is too great to be negligible. For most purposes the difference between the millilitre and the cubic centimetre can safely be neglected.

Commercial Purposes.—For commercial purposes the gallon and the litre are both represented by material standards of capacity, constructed as nearly as possible in accordance with their respective definitions. These standards are in the form of cylindrical metal vessels with flat brims, and are filled exactly to their brims by the aid of flat glass "strikes." Comparisons with other vessels are made by transfer, the vessel under comparison being first filled and emptied to compensate for the amount of water left behind in the standard when the latter is emptied into the vessel being tested.

Scientific Purposes.—For scientific apparatus, such as flasks, burettes, pipettes, etc., where higher accuracy is needed, it is found necessary as a rule to base the verification directly on the original definition by actually weighing the quantity of pure distilled water contained in, or delivered from, the vessel, making due allowance for the temperature of the water at the time of weighing and for the buoyancy of the surrounding air. In the case of vessels, such as burettes and pipettes, which are intended to deliver, and not to contain, definite quantities of liquid, it must be remembered that after delivery the walls are left wet to an extent which depends not only on the rate at which delivery is

effected and the time allowed for subsequent drainage but also on the viscosity and surface tension of the liquid being measured. The rate of delivery is of more importance than the drainage time, and provided it is sufficiently slow the quantity of liquid delivered will be reasonably constant. Suitable delivery times and error allowances are scheduled in a pamphlet on testing volumetric glassware issued by the National Physical Laboratory.

Bibliography.—The literature of metrology is somewhat scattered. The best collected account will be found in a series of articles contained in the *Dictionary of Applied Physics* (1922–3) (and in particular vol. 3 thereof), edited by Sir R. T. Glazebrook, K.C.B., F.R.S., and published by Macmillan, London. Many detailed references are given in these articles. For full descriptions of the more fundamental operations the various volumes of the *Travaux et Mémoires du Bureau International des Poids et Mesures* (Paris, Gautier-Villars) should be consulted. In addition, consult the annual reports of the Standards Department, Board of Trade (H.M. Stationery Office, London); Miller, *Phil. Trans.*, 146 (1856), on the construction of the new standard pound; Airy, *Phil. Trans.*, pt. 3, p. 17 (1857), on the construction of the new standard yard; Kaye, "A Silica Standard of Length," *Proc. Roy. Soc.*, A85 (1911); Michelson, *Light Waves and Their Uses* (Chicago University Press); C. E. Guillaume et Benoit, *La Mesure rapide des Bases géodésiques* (1908); and Guillaume, *Les Applications des Aciers au Nickel* (Paris, 1904); and *Proc. Phys. Soc.*, 32, 374; Sears, *Precise Length Measurements*, Cantor Lectures, Royal Society of Arts (1923).

(J. E. Se.)

MEASURING INSTRUMENTS.—The World War was responsible for a considerable development and improvement of apparatus intended for the measurement of engineers' gauges and products. (*See* Measurements.)

Whitworth Gauges.—Improvement in accuracy of measurement necessarily goes hand in hand with improvement in accuracy and perfection of manufacture of the articles to be measured. The original measuring machine of Sir Joseph Whitworth would have been of little value apart from the system of accurate standards (both end gauges and cylindrical gauges) which he produced for use with it. If an object is not regularly formed to a certain degree of accuracy, it cannot be said to possess a definite measurement to that degree of accuracy, and it is useless to employ measuring apparatus capable of yielding results of still higher accuracy. On the other hand, while there is no great difficulty in designing highly sensitive indicating devices, it is practically impossible to calibrate them in the absence of standards measurable to the degree of accuracy aimed at.

Johansson's Gauges.—The first substantial advance in accuracy subsequent to Whitworth's work was the introduction by the Swedish firm of Johansson, in 1908, of flat parallel faced slip and block gauges, of such perfection of workmanship that any two of them, when cleaned, would "wring" together. The gauges were made in series differing by definite small amounts, so chosen that by wringing together a suitable combination of pieces, any desired size, to the nearest 0·0001 in., could be produced. To ensure this accuracy, it is necessary that the individual pieces should each have a guaranteed accuracy of (say) 0·00001 in., in order that the cumulated error of a group of four or five should not exceed 0·00005 inch. And in order to assert with confidence that this degree of accuracy is, or is not, in fact attained in an individual piece it is necessary to be able to measure with an accuracy of the order of 0·000001 inch. When the Johansson gauges were first introduced no appliances were available which could be relied on to give measurements of this accuracy. Three entirely different methods have since been developed, however, which enable it to be done, and which, with due precautions, give mutually consistent results. These are:—

Tilting Level Comparator.—(*a*) the "tilting level" comparator, due to A. J. C. Brookes, in which the two gauges, or groups of gauges, to be compared are stood side by side on a level surface plate, and the difference in their heights is determined by the reading of a highly sensitive level, which rests by point contact upon their upper surfaces, through two ball feet.

Millionth Comparator.—(*b*) the "millionth" comparator, due to J. E. Sears, jun., wherein measurements are made between two flat parallel anvils, giving a local surface contact, the one anvil being fixed, and the other connected, through a series of spring suspensions designed to eliminate all frictional effects, with a sensitive tilting mirror which causes a spot of light to move across a scale, giving a magnified image of the displacement of the anvil on a scale of about 30,000 to 1.

Optical Interference.—(*c*) the method of optical interference developed at the Bureau of Standards, Washington, wherein the whole surfaces of the gauges under comparison may be inspected, being marked out into contours of approximately 0·00001 in. difference in height by the alternate light and dark bands forming the interference pattern.

Measurement of Internal Dimensions

Another matter of fundamental importance which has but lately found a satisfactory solution is the measurement of internal dimensions. The transference from external to internal measurement constituted a considerable difficulty, and the sizes of such objects as ring gauges, either plain or screwed, were usually estimated by the nature of their fit upon corresponding plug gauges. As the fit depends to a very marked extent upon the amount and nature of the lubricant used, considerable uncertainty existed as to the correct interpretation of the observed results. If well finished and liberally lubricated with thick grease, a cylindrical plug gauge will enter and pass through a ring gauge definitely smaller than itself without damage to either. Two instruments have now been produced for the measurement of internal diameters of either plain or screwed rings, which give results mutually consistent, if due care is taken, and the work being measured is sufficiently uniform in its dimensions, to the order of 0·00001 inch.

Chord Contact Type.—In the "chord contact" machine, due to G. A. Tomlinson, the diameter of the ring is deduced by calculation from the measured displacement, in a direction perpendicular to its length, of a double ball-ended distance piece of known length, which is allowed to make contact inside the ring, first on one side, and then on the other side, of the diameter.

Displacement Machine.—In the "displacement" type of internal measuring machine, due to J. E. Sears, the position of the ring is so adjusted that measurements are made exactly across the diameter. The ring is mounted on a carriage, which can be moved bodily in the direction of the diameter being measured by means of suitable micrometers. Contact is made first on one side of the ring, and then on the other, with a double-ended stylus attached to a sensitive indicating mechanism, and the micrometer readings are taken when the indicator reads zero. The same is done in turn with a standard plug substituted for the ring, provision being made for withdrawing the stylus temporarily as the plug passes across. If $x_1\ y_1\ x_2\ y_2$ are the four micrometer readings, the displacements d_1 and d_2 are equal to x_2-x_1 and y_1-y_2 respectively, and it is to be noticed that the pressure on the stylus is in the same direction when both x readings are taken, and also when both y readings are taken, so that any possible errors due to backlash or flexure in the indicating mechanism are eliminated. The transition from external to internal measurement is thus directly accomplished, and the final result is given by the equation

$$\mathrm{R}-d_1+d_2-\mathrm{P}=(x_2-x_1)+(y_1-y_2)-\mathrm{P}$$

Scientific Principles

The question of the general geometrical principles underlying the correct design of instruments intended to give the highest accuracy of measurement has received greater attention in recent years. Questions of the proper application of the theory of kinematic constraint to ensure definite and repeatable register of parts, of eliminating backlash and friction effects, of preventing components of errors due to inevitable imperfections of workmanship (*e.g.*, in sliding ways) from becoming effective in the actual direction of measurement, of the design and relationing of parts so that elastic deformations due to changing distributions of load do not affect the results, and so on, are all involved here.

Travelling Microscope Comparator.—These various points have been fully considered in the "travelling microscope comparator" designed by J. E. Sears, jun., for the Metrology Department of the National Physical Laboratory. The long leg of an L-shaped carriage, which bears two microscopes, is sup-

ported on two wheels running in a V-guide along the upper side of the machine bed, so that whatever position is taken up by the carriage its form is undisturbed. The focal points of the two microscopes are arranged to lie in the extension of the axis of the micrometer screw, and the object to be measured is supported on an independent carriage which, by means of a small weight attached to a cord passing over a pulley, is held permanently in contact with a stud at the end of the screw abutment. Thus errors of straightness in the V-groove are non-effective, and so is any distortion of the base of the machine proper, due to the movement of the microscope carriage. Advantage is taken of the simple ratio 1 in.=25·4 mm. (which is correct to within $1\frac{1}{2}$ parts in 1,000,000) to obtain simultaneous readings of equal accuracy in either British or the metric system, by means of suitable gearing in the compound micrometer head. The verniers read to 0·00001 in. and 0·0001 mm. respectively. The instrument can be used either with one microscope for making direct measurements against its own calibrated micrometer screw, or, using the two microscopes as a comparator, for determining the values of the sub-divisions of short scales. It has been found of considerable value in measuring the spacing intervals of diffraction gratings.

Screw Gauges.—In the course of the War the necessity for rapid measurement of large numbers of screw gauges led to the development of special machines for the measurement of both pitch and effective diameter of screw threads. E. M. Eden, then of the National Physical Laboratory, was largely instrumental in this work and in the development of the optical projection method of examining profiles of gauges, both screws and flat templets. For the latter, he found lens combinations capable of giving an undistorted magnification of 50 times over a field of initial diameter approaching two inches. These combinations were incorporated in the now well-known " horizontal projector." For screw gauges the " vertical projector " was designed, in which the path of the light is vertical, and the image-forming rays are reflected back from an optically flat mirror overhead on to a specially prepared thread-form diagram placed on the table of the machine. The screw in this case is mounted in a carriage provided with two horizontal micrometer traverses in directions parallel and perpendicular to its axis, respectively, so that measurements of pitch and diameter can be made at the same time as the accuracy of the thread form is examined.

Wilson Projection Gauge.—Mention should also be made of the Wilson projection gauge, in which the optical system is duplicated, so that the two opposite sides of a screw can be projected simultaneously on to the screen, in such a manner that the two images of the thread intermesh, and if the screw is of direct form and size, and the apparatus correctly adjusted, exactly meet. If the screw is small a space is left between the images of its two sides; if large they overlap.

The projection method has naturally proved of great value in a number of other ways. In particular, it has been used in connection with the measurement of gear wheels and gear cutting hobs. Machines for this purpose have been designed by G. A. Tomlinson, and depend for their use on the accurate reproduction of the profiles of the teeth of the gear or hob, in the form of traces made on smoked glass, by a needle point attached to a specially designed pantograph. One of the machines is also fitted with a device for recording, in a similar manner, the relative velocities of rotation of two gear wheels when in mesh. In both cases the smoked glass, bearing the record, is put into the projection apparatus and magnified 50 times at the screen. It is found that the traces are quite sharp in the magnified image, and measurements can be made corresponding to an accuracy of about 0·0001 or 0·0002 inch on the original.

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(J. E. Se.)

MEAT: *see* FOOD SUPPLY.

MECCA (*see* 17.950), capital of the Hejaz, had a resident population of about 70,000 in 1916, including some 12,000 Indians. The annual pilgrimage brings normally at least 200,000 visitors to the city, of whom pilgrims from British India and the Malay States may number 25,000. Pilgrims have been fewer during and since the World War, owing to disturbed conditions in the Hejaz. Mecca was taken by the Arabs in 1916, and bombarded by the Turks, who damaged the Great Mosque. The Grand Sherif of Mecca, Hussein ibn Ali, of the Hushimite dynasty, proclaimed the independence of the Hejaz in 1916, and assumed the kingly title. In May 1924 he proclaimed himself Caliph, but shortly afterwards was driven from Mecca and forced to abdicate in Nov. of the same year by Ibn Saud, Sultan of Nejd, who invaded the Hejaz and entered Mecca without opposition. The holy places were not damaged by Ibn Saud and his Wahabis, who performed the customary rites in the Great Mosque.

The general aspect of Mecca, as observed during the War, had changed but little, though some modern buildings had sprung up; there were a number of stately residences, including the new royal palace of six storeys, and a considerable display of wealth. The sanitation and water supply, previously very bad, had been improved. There was telegraphic communication between Mecca and Jidda, and between Mecca and Taif, the summer residence of the king, 75 m. to the southeast. Representatives of foreign powers live at Jidda, since non-Moslems are not allowed to enter Mecca.

MECHNIKOV, ILYA (1845–1916), Russian biologist, was born at Ivanovka, in the province of Kharkov, May 15 1845. At the age of 17 he entered the Kharkov University and two years later went to Germany. In 1867 he returned to Russia and was a *dozent* in zoology both at Odessa and St. Petersburg, becoming in 1870 professor ordinarius of zoology and comparative anatomy at Odessa. In 1882 he went to Messina and there began his studies into the nature and habits of microbes. Henceforth he devoted himself to pathological study and in 1888 went to Pasteur in Paris, who gave him a laboratory in the École Normale. By 1892 his views on the essential importance of phagocytosis were firmly established. In that year he published *The Comparative Pathology of Inflammation*, followed in 1901 by his chief work, *Immunity in Infectious Diseases*, and a more popular treatise, *The Nature of Man* (1903). In later years he made a special study of the bacteria infesting the alimentary canal of man. In 1908 he was awarded the Nobel Prize for medicine. He died in Paris July 16 1916. See *Life* by his wife, Olga Mechnikov (1920), trans. by Mrs. R. L. Devonshire (1921).

MEDALS AND DECORATIONS (*see* 18.2; 15.860).—These may be divided into two classes, personal and service. Personal decorations are awarded to the individual (Victoria Cross, etc.); service decorations are awarded to all persons who participate in a common service (war medals, etc.). As a result of the World War the issue of medals and decorations was the widest ever recorded, and, of these, the best known is the Victory medal.

FIG. 1.—Allied Victory Medal.

In 1918 the Allies agreed to issue a collective and distinctive medal to commemorate the War. The advantages of this were that it was symbolical of the one purpose which animated the Allied troops, and that it obviated the separate issue by each nation of its own war medal to allied forces which had served with them in their own territories. Each country designed its own medal, the stereotyped features being that each medal is bronze and has on the obverse the figure of Victory, and on the reverse the inscription " The Great

War for Civilisation." The ribbon is coloured in the form of two rainbows joined together, symbolising the calm after the storm.

The following are some of the chief decorations and medals issued since 1910:—

BELGIUM.—Service. War medal, bronze, shaped like a bell or a label. Ribbon, yellow, red edges with inner separation line of black. Victory medal. Obverse, figure of Victory; reverse, Arms of the Allies.

FRANCE.—Personal. Croix de Guerre. Established 1915. Bronze cross with crossed swords in angles. Ribbon, green, seven narrow red stripes. *Service.* War medal. Bronze. Ribbon, red and white stripes. Clasp, " Engagé volontaire " to non-conscripts. Victory medal. Obverse, figure of Victory; reverse, inscription (see above).

GREAT BRITAIN.—Since 1910 the following have been issued: *Personal.* Distinguished Service Medal (Navy), 1914. Ribbon, blue, two white bars in centre. Military Cross (Army), 1914. Ribbon, white, central purple stripe. Military Medal (Army), 1916. Ribbon, dark blue, in centre two crimson and three white alternate stripes. Distinguished Flying Cross, 1918. (Royal Air Force). Ribbon, violet and white broad diagonal stripes. Distinguished Flying Medal, 1918. (R.A.F.). Ribbon, violet and white narrow diagonal stripes. (The above two decorations are for active flying against the enemy.) Air Force Cross, 1918. (R.A.F. and civilians.) Ribbon, red and white broad diagonal stripes. Air Force Medal, 1918. (R.A.F. and civilians.) Ribbon, red and white narrow diagonal stripes. (The above two decorations are for distinguished service to aviation in actual flying.) Recognition Medal. Silver and bronze medals were issued to allies who had rendered service to British Prisoners of War and others behind the enemy lines. Ribbon, yellow; red, white and black edges, blue central stripe. *Service.* Naval General Service Medal, 1915. Ribbon, white, crimson borders and two crimson stripes in centre. African General Service Medal. New issue 1916. Ribbon, black, green and yellow (never seen without a clasp). 1914 Star. Bright bronze. Ribbon, red, white and blue, shaded and watered. Clasp, " 5th Aug.—22nd Nov. 1914." 1914–5 Star. Similar to above, same ribbon, no clasp. War Medal, 1919. Ribbon, orange, narrow stripes of white, black and blue at each edge. Clasps sanctioned for navy, but not for army. Victory Medal. Obverse, figure of Victory; reverse, inscription (see above). Oak leaf on ribbon for one or more mentions in despatches. Mercantile Marine War Medal. Bronze. Ribbon, green and red, separated by narrow white central stripe. Territorial War Medal. Bright bronze. Ribbon, yellow, two green stripes. Special Constabulary Long Service Medal. Bright bronze. Ribbon, red, white and black. Clasp, " The Great War, 1914–1918." General Service Medal (Post War). Ribbon, purple, with green central stripe; clasps for service in Persia, 'Iraq and Kurdistan.

ITALY.—Service. War Medal. Bronze. Eighteen stripes of red, white and green. Clasps bearing date of each year. Victory. Conforms to standard specification.

JAPAN.—Service. Victory Medal. Obverse, a Japanese figure of Victory.

RUMANIA.—Service. War Medal. Cross in black bronze, relieved in bright bronze. Ribbon, green with three blue stripes. Victory Medal. Conforms to specification.

UNITED STATES.—Personal. Distinguished Service Cross, Army, 1918. Ribbon, blue; red and white edges. Distinguished Service Medal, Army, 1918. Ribbon, white; red edges, narrow blue separation line. Distinguished Service Medal, Navy. Ribbon, blue, narrow yellow central stripe. Navy Cross. Ribbon, blue, narrow white central stripe. *Service.* Victory Medal. Bright bronze. Obverse, figure of Victory; reverse, design with shield and fasces and names of Allies. Battle Clasps are awarded. The only Service Medal issued by the United States to commemorate service in the World War. (A. V. W.-H.)

MEDICAL EDUCATION (*see* 18.23a).—A sound general education is necessary for the medical as for all other professions.

I. IN GREAT BRITAIN

In Great Britain before admission to a course of training a boy or girl is required to show in an examination of matriculation, character and standard that he or she has acquired a respectable knowledge of English, a language other than English, mathematics and some other school subjects of the candidate's own selection. Latin is no longer exacted by the General Medical Council (G.M.C.) although in certain universities it is compulsory for students who desire to obtain a medical degree. But the ordinary school subjects are not the only instruments available for the development of intelligence. Physics, chemistry, biology, when well taught also strengthen the mind and develop the faculty of observation which for a doctor is of paramount importance.

The General Council of Medical Education and Registration does not determine directly the requirements of the various licensing bodies, but exercises a measure of control over the doctor's training by deciding the conditions precedent to registration, first as a medical student and finally as a qualified practitioner. Since 1922 the G.M.C. has required an examination in physics and chemistry be passed by him before registration. The gain is two-fold. His school work more efficiently prepares the boy for his profession, and more time is made available in the brief five years, which is the most that can be exacted as a minimum between registration as a student and registration as a qualified practitioner. The council also allows the student to pass the examination in biology immediately after registration. The curriculum recognised as medical carries the student through a succession of stages which merge insensibly one into the other, until his accumulated knowledge and steadily increasing skill justify the conferring upon him of a degree or diploma which admits him to all the responsibilities of medical practice. It is impossible to over-emphasize the statement that the several steps " merge." They are not stepping stones. No subject is left behind when the passing of an examination qualifies a student to approach the next. The examination tests his fitness to approach subject B whilst still carrying forward subject A.

Stages of the Education.— These stages may be defined as (1) The study of the structure of the body and of its behaviour in health, anatomy (*q.v.*) and physiology (*q.v.*), to which two years are assigned. (2) The study of the behaviour of the body when perturbed by abnormal conditions, by malformations, by injury (*see* PATHOLOGY), by the invasion of parasites (*see* PARASITOLOGY) ranging from ultra-miscroscopic " germs " (*see* FILTER-PASSING MICROBES) to intestinal worms, an extension of physiology into the domain of disease. (3) The study of physiological changes which result from the administration of various chemical substances, " drugs," already anticipated by the study of the " drugs " which, in health, various organs pour into the circulation, internal secretions (*see* ENDOCRINOLOGY). (4) The study of the possibilities of modifying the behaviour of the body, when diseased, in a beneficial way by administration of drugs. (5) The proper management of the body in health, preventive medicine. (6) The care of the sick and of women in childbirth.

At all periods medical education has been adapted to the knowledge and practice of the age. Since Pasteur revealed the true cause of the large majority of diseases—the invasion of the body by micro-organisms—the science of medicine may almost be said to have come into existence. Corresponding modifications of the medical curriculum have consequently been called for, and many have been adopted—always with a certain lag. Since 1910 much has been done in adapting training to the new knowledge and new needs. An important change is the disappearance from the curriculum of the subject known as *materia medica*, a subject which used to make a painful demand upon the student's memory. Long after the date at which doctors ceased to make up their own medicines, compounded of a variety of ingredients, with all the mystery of a professional secret, or wrote equally complicated prescriptions in Latin, incomprehensible to anyone but a druggist, the student was required to know the methods of preparation and the composition of the drugs of the pharmacopoeia. He was also required to produce a certificate of having attended a course of instruction in dispensing at a hospital or with a qualified medical man or pharmacist. Modern pharmacology (*see* PHARMACOLOGY) recognises that the body's perturbations may be restrained by certain definite chemical substances, many of them produced synthetically. Of these the practitioner's armamentarium contains relatively few. For flavouring and colouring matters he no longer has much use.

The Object of Medical Training.—With the exception of the changes already referred to, developments in medical education are rather in the manner of presenting knowledge than in the selection of subjects to be studied. When so much of value must be omitted, every subject included in the curriculum should be taught in the most practical way. It must be made a part of the practitioner's outfit, which he can never afford to lose. His

knowledge of the anatomy of the living body must enable him to see its organs in their relation to one another as clearly as if it were transparent. In some degree dissecting room work has given way to surface anatomy and the study of models and frozen sections; although training in the use of scalpel and forceps is still the only means of acquiring dexterity in the surgeon's craft. In physiology, during the first year, the student is in most schools given more practical work than formerly. Beginning with the frog and passing on through isolated mammalian organs to the decerebrate mammal, he is brought in his second year more closely into contact with the human body. He learns to use methods and apparatus with which, later, he will investigate the physiological condition of the organs in disease.

The greatest changes have been introduced in the third and fourth years of the curriculum. Physiology has been extended into pharmacology, an ever-growing body of exact knowledge derived from the study, with instruments of precision, of the effects produced upon guinea-pigs and rabbits by chemical compounds of which some, like caffeine and morphine, are vegetable products, whilst others, such as phenacetin, have been prepared synthetically in the laboratory for the express purpose of modifying the behaviour of the body. When used to correct undesirable habits, these various chemical substances, with the apparatus which has been designed for the purpose of studying their effects, belong to the sphere of therapeutics (*q.v.*).

At about this stage in the student's training, bacteriology (*q.v.*), a science which is growing so rapidly as to be for the most part relatively new, claims his attention. The micro-organisms which cause disease present biological problems of the highest interest. Every medical man needs to be expert in the methods of making preparations for identification with the microscope (*see* MICROSCOPY), of preparing media and of cultivating the various organisms *in vitro*. And since the effects upon the fluids of the body which they induce can be recognised chemically, a new name, " bio-chemistry " (*q.v.*), is usually applied to the department of science in which ascertained facts are grouped together. To the physiologist and physician have been opened up the two provinces of serum and vaccine therapy and immunology (*see* IMMUNITY). Provision is made for teaching the principles of various kinds of drugless therapeutics, such as treatment with ultra-violet light (*see* HELIOTHERAPY) and with radium massage, and the demonstration of the results obtained in special clinics. Pathology (*q.v.*), formerly the post-mortem examination of patients the course of whose illness had been watched in the wards, has become more of a science. As experimental pathology, it is the study of the physiology of disease. Disturbances of function, their causes and progress, are followed by the same methods as if they were variations in the performance of the several organs during health. Autopsies confirm or modify views expressed during life regarding tissue changes which were taking place.

Clinical Units.—The most notable improvement in medical education made during recent years is the organisation of clinical units. Physicians and surgeons still go round their wards at stated hours—usually in the early afternoon—followed by troops of students to whom they point out the features of each case, expound the nature of the malady and explain the reasons for the treatment adopted. But no longer, as formerly, is the student dependent upon " walking the wards," attending lectures and reading about the illnesses of which the cases he has seen are illustrations. The clinical unit is a far more efficient training centre. Its staff consists of a director and three or four assistants. Either the director himself or one of his assistants is a whole-time officer of the university. To the unit are assigned a number of beds—usually 60 or 70—in suitable wards with adequate laboratory accommodation in their near vicinity and an ample supply of apparatus for the examination of the patients and for testing their reactions. An out-patient department is included in the unit. In short, it is a school in the sense in which a physiological institute is a school.

Students examine chemically and microscopically the blood and excreta. They make every kind of measurement, and as the wards are open throughout the day they have the opportunity of seeing how patients should be treated, nursed and cared for in every respect. As the teachers of physiology, bacteriology, pharmacology and other subjects visit the clinic from time to time, the student learns under ideal conditions how all that he has been taught combines to fit him for his life-work, the care of the sick and their restoration as speedily as possible to health. When cared for by a clinical unit patients recover more rapidly than they used to do, and in consequence the efficiency of the hospital is increased.

The Former System Contrasted.—Until comparatively recent times students were required to attend a certain amount of hospital practice during their first two years, usually six months. This was a relic of the apprenticeship through which aspirants for admission to medical, as to legal and other professional guilds, were required to pass. In Britain, this tradition is obsolete at last. No longer is a student required, or even allowed, to listen to bedside disquisitions on maladies of which even the names may be unfamiliar, in terms which carry little meaning to his mind, or to watch the physical examination of organs of which he knows but vaguely the form and situation, and to hear of their perturbations before he knows how they function normally. Not until he knows how the body works in health is he shown how disease may disturb its harmony, or taught the remedial measures which should be adopted with a view to aiding nature to set it right. Too early contact with patients inevitably led to confused thinking and false inferences which had to be corrected by subsequent reading and observation and, it may be added, developed in the tyro a conviction that medical practice consists in " spotting " the disease and administering the drug which will " cure " it. The progressive opening-out of knowledge with the synchronous revelation of ignorance, which is the aim of the modern curriculum, avoids loss of time and secures the highest degree of qualification for the exercise of the medical profession which the limited period of training allows.

Post-graduate and Specialist Work.—As a result of the careful allocation of his time the modern student finds that he has less opportunity than his forerunners of paying special attention to any branch which may attract him. Diseases of the eye, of the throat, of the ear, of the nervous and other organs, are treated with sufficient fullness for the equipment of general practitioners, but not with the thoroughness necessary to make specialists. The student who proposes to specialise must continue his studies after graduation. An increasing number of graduates who do not propose to devote themselves to a single speciality, but wish to make themselves proficient in particular branches of their work, such as gynaecology for example, defer going into practice, or return from time to time to a medical school in order to keep abreast with advances in knowledge and technique. Post-graduation courses are more numerous and better organised than they were before the War, but they are not yet, in Britain, as complete or as intensive as they might be.

Other Countries.—In the universities of Canada and Australia and of most foreign countries, progress has followed the same lines as in Britain. A logical sequence of studies and their integration in the curriculum has been the reformer's aim. In Japan the sequence of studies is much the same as in Britain; but the minimal length of the purely medical curriculum is four years, following on a course in the preliminary sciences. French medical schools still adhere to the system which they regard as " natural." Their students are encouraged to attend clinics from the date of their inscription in the faculty, and the relegation of all lectures and laboratory work to the afternoons almost compels them to devote the mornings to attendance in the wards and out-patient departments.

BIBLIOGRAPHY.—For detailed information consult *Recent Advances in Medical Education in England*, a memorandum addressed to the Minister of Health by Sir George Newman, Chief Medical Officer; and *Medical Education, a Comparative Study*, by Abraham Flexner.

(A. HI.)

United States.—In 1900 there were in existence in America 160 medical schools, mostly in fact, if not in form, private ventures; even the few schools of high grade possessed meagre

endowment and inadequate facilities. By a process of natural selection, the number of schools was rapidly reduced, having fallen in 1925 to 80, and there were grounds for the belief that this number would in the near future be still further reduced. The organisation, endowment and facilities for instruction showed a notable advance. In 1910 few medical schools actually controlled the hospitals in which their teaching was done. Subsequently there was a distinct tendency to give the university medical schools exclusive and adequate control of hospital facilities for clinical teaching and research. Harvard, Yale, Washington and other universities thus came into much more intimate relations with the hospitals in which the clinical staffs teach. The city of Cincinnati built one of the finest public hospitals in the United States and amended the city charter so as to give the University of Cincinnati (a municipal institution) complete control of the hospital for its medical school.

On the financial side, public opinion was brought to realise that the university school of medicine is an expensive enterprise, for which large investments must be made by the public in both facilities and endowment. Mr. John D. Rockefeller gave the General Education Board approximately $35,000,000 to be used primarily for the purpose of co-operating with institutions in raising large sums for the development of their medical schools, and the late Mr. Joseph R. DeLamar gave $5,000,000 each to the medical departments of Harvard, Columbia and Johns Hopkins. Upwards of $12,000,000 was raised for the establishment of a new medical department at the University of Rochester, Rochester, N. Y., and $8,000,000 was raised for the reorganisation of the medical department of Vanderbilt University, Nashville, Tennessee. Columbia University is building a new medical school, and the Presbyterian Hospital, the Sloane Hospital and the Vanderbilt Clinic are providing new clinical facilities for the use of the school, the whole involving a prospective investment of $13,000,000; so at Cleveland an admirable school and laboratory building has been constructed on a new site on which university hospitals are already being located. In this movement the state universities have participated—notably the University of Iowa, which is completing a new plant—laboratories and clinics—at a cost of $5,000,000. Many other endowed institutions also procured considerable sums for improved laboratory and teaching facilities.

In respect to organisation the main change in the period was the introduction of the full-time plan corresponding to the English unit system in the teaching of the clinical subjects. The aim and purpose of this movement are the same in both countries, but in neither had sufficient time elapsed to allow a final verdict to be passed on the merits of the system. The complete satisfaction of the Johns Hopkins Medical School in the working of this plan is shown by the fact that the system, which originally included medicine, surgery and pediatrics, has been extended so as to include gynaecology, obstetrics and ophthalmology. The system has also been adopted in the main clinical branches by the medical departments of Washington University (St. Louis), Yale University, Vanderbilt University, University of Chicago, University of Rochester, the medical clinic of Columbia University, the psychiatric, pediatric and obstetrical clinics of the University of Iowa and the neurological clinic at Harvard.

China.—Through a subsidiary board (the China Medical Board) the Rockefeller Foundation of New York has established in China a modern medical school. The Rockefeller Foundation has furnished funds amounting to $8,000,000 to build and equip the Peking Union Medical College, and in addition it was in 1921 supporting the institution on the basis of a budget for the year amounting to $500,000. The institution furnishes two years of pre-medical work, and intended to develop a four-year medical course. The China Medical Board also aids four other medical schools in China carried on by other organisations.

Belgium.—The University of Brussels had in 1921 planned a complete reorganisation of its medical department. The city, the state and the university co-operated in maturing plans for a modern teaching hospital, and new, well-equipped laboratories on a single site. (A. F*.)

MEDICAL LEGISLATION.—Since 1911 statutes have been passed in many countries creating or reorganising the central public health authority. The Ministry of Health for England and Wales created by the Act of 1919, took the place of the Local Government Board with all its powers and duties and, as regards public health, also those previously exercised by the Board of Education and other departments. Power was further created to transfer from the Ministry duties which were not incidental to health.

Ministries of Health have also been established in Canada (1919), the Union of South Africa (1919), Poland (1919), New Zealand (1920), France (1920) and Rumania (1923). A Dept. of Public Health for the Commonwealth of Australia was created in 1921, and a General Directorate of Public Health in Spain, by a Royal Decree of 1922.

Zymotic Diseases.—In Australia, New Zealand and the Union of South Africa comprehensive regulations regarding the notification and control of infectious diseases were included; similar regulations were issued in Austria (1913), the Straits Settlements (1915), Peru (1916), Chile (1918), Sweden (1919), Brazil (1921) and Venezuela (1921). A Polish law of 1920 created the office of Special Commissioner for dealing with epidemics, and a French decree of 1920 instituted a mobile unit equipped with laboratories, etc., for instant dispatch to parts of the country suffering from or threatened with a disease epidemic.

Vaccination.—By a law of 1914, vaccination against smallpox (*q.v.*) becomes compulsory in Siam whenever the health administrator deems it necessary; in the Straits Settlements (1915) it is compulsory, and re-vaccination also can be made compulsory in the face of danger; in France (1915) vaccination and re-vaccination can be made compulsory by decree, but (1918) vaccination is compulsory for state officials. Chile (1918) has compulsory vaccination in the first, 10th and 20th years of age; in Venezuela (1921) there is infant vaccination and re-vaccination every seven years, failure to comply barring from a large number of employments. In Poland (1919) there is compulsory vaccination for infants, and again at seven years. In Tunis (1922) vaccination against smallpox is compulsory, and also against typhoid, cholera and plague, if there is danger of an epidemic. Uruguay (1923) has compulsory vaccination in the first six months, and again in the 10th and 20th years. A Polish law of 1920 makes vaccination against typhoid fever and cholera compulsory for doctors, nurses, employees at waterworks and for those engaged in other specified callings.

Tuberculosis.—Anti-tuberculosis legislation has been put into force in various directions. Tuberculosis schemes and the legislation involved are discussed in the article TUBERCULOSIS. The Milk and Dairies (Consolidation) Act, 1915, provided, *inter alia*, for the registration of dairies and the inspection of dairies and herds; and prohibits the sale for human consumption of milk from a cow with tuberculosis or other specified diseases of the udder. The Milk (Special Designation) Order, 1922, of the Ministry of Health instituted the licensing of classes of milk, namely, certified, Grade A (tuberculin tested), Grade A (non-tuberculin tested) and pasteurised; and prohibited the sale of milk under a designation to which it is not entitled.

The Public Health Act, 1925, section 62, authorises a court of summary jurisdiction to order the removal to a suitable hospital or institution, of any person suffering from pulmonary tuberculosis in an infectious stage, when a source of danger to others, either from lack of proper accommodation or from failure to observe sanitary precautions. In Denmark, laws of 1912, 1918 and 1919 made compulsory the notification of pulmonary and laryngeal tuberculosis by the doctor in attendance, who is also required to instruct those in charge of the patient as to sanitary precautions.

A Japanese law of 1919 gives power to examine any person whose calling might make him a source of transmission, to forbid the exercise of a particular calling by such, and to forbid or restrict trading in old clothes, old books and other articles which might carry infection. In Denmark, compulsory isolation of infectious cases is also empowered with certain limitations; and laws of 1918 and 1919 provided for the use of public funds to

support hospitals for tuberculosis, sanatoria and convalescent establishments. A French law of 1916 instituted public dispensaries for treatment and for giving instruction in anti-tuberculosis measures. A decree of 1920 laid down regulations for the establishment, working and supervision of sanatoria. An Italian royal decree, 1919, instituted a central anti-tuberculosis committee, and a Swedish royal decree, 1912, regulated subventions to hospitals for treating tuberculosis.

Venereal Diseases.—The English Venereal Diseases Act (1917) prohibits treatment by unqualified persons in areas to which it is applied, when gratuitous treatment has been provided and approved, and prohibits all kinds of advertisements of quack remedies for such diseases. In Sweden (1912) an affected person is obliged to obtain and complete medical treatment; the same applies to the Union of South Africa (1919), where it is also an offence for an infected person to follow certain employments, or to engage such a person in the employment; and to Czechoslovakia, where an infectious person may also be removed compulsorily to hospital if necessary, and an examination by a doctor can be enforced where there is reason to suppose that a person is infected with such a disease. In the state of Rio Grande do Norte, Brazil, by a decree of 1921, a special service for the prevention of venereal diseases was created, and provision was made for action against charlatans and for diffusing information regarding modern methods of avoiding the contagion. In Italy, a royal decree, 1923, approved of regulations for the prevention of venereal diseases, including the examination and treatment of prostitutes. A Danish law of 1922 obliges a person suffering from venereal disease, in a stage when it may be communicated or transmitted, to inform the other party to a proposed contract of marriage, and this party must be instructed by a doctor before contracting. The parties must make a declaration of freedom from such disease. The same procedure must be adopted if one of the parties suffers from epilepsy. When there is reason to believe that one of the parties may have disease or weakness of the mind such party must present a medical certificate of mental health and make a declaration as above mentioned.

Housing.—The British Housing Act, 1925, *inter alia*, makes it a duty of the local authority and the medical officer of health to inspect houses, prohibits the erection of back-to-back houses, and gives power to close and demolish houses deemed unfit for human habitation. The Public Health Act, 1925, gives a local authority power to cleanse, disinfect or destroy articles infested with vermin in dwellings, and to oblige a landlord or tenant to cleanse the dwelling; powers are granted for cleansing of the person also. A Belgian law of 1919 instituted the National Society for Housing, amongst its powers being that of destroying unhealthy dwellings; a revising law of 1921 gave power to expropriate such houses and sites as are required. Similar powers were granted to authorities in France by a law of 1915. A law of 1922 codifies the laws relating to working-class dwellings. A Peruvian law of 1916 obliges landowners to remove and prevent conditions on their land which are deemed to favour the existence of malaria.

Infant Welfare.—The British Notification of Births (Extension) Act, 1915, extended the Act to areas in which it had not been adopted. A Belgian law of 1919 instituted the national work for infant welfare. In France a law of 1917 provided financial help for necessitous women in connection with child-birth, and when the mother nurses the child assistance continues for a period of 12 months. In Germany (1922) help is given to women in the same circumstances, insured and uninsured. An English Act of 1920 regulates the employment of children, young persons and women in industrial occupations; and a Peruvian law of the same year is a similar measure.

Food.—The English Public Health (Milk and Cream) Regulations, 1912, prohibited the addition of any preservatives to milk intended for sale for human consumption, any thickening to cream or preserved cream or any preservatives to cream with less than 35% of milk fat; the only permissible preservatives in cream intended for human consumption are boric acid, borax, a mixture of these, or hydrogen peroxide. By an order, 1917, no more than 0·4% of boric acid may be added and the cream must be sold as preserved cream and labelled as unsuitable for infants and invalids. Public Health regulations, 1923, fixed the minimum percentage of milk fat in dried milk of various descriptions, and that of milk fat and total solids in condensed milks. Containers must declare the contents, and skimmed milk be labelled as unfit for babies.

Drugs.—Most countries have legislated to restrict the use of opium, cocaine and related substances. The English Therapeutic Substances Act, 1925, regulates the manufacture, sale and importation of serums, vaccines, salvarsan, insulin, etc. Other countries have legislated similarly. (R. Sc.)

MEDICAL RESEARCH.—Progress in medical research since 1911 can be subdivided according to the branch of medical science into which it falls most naturally. An arbitrary classification, however, has the drawback that many subjects might be discussed equally well under other headings than those in which they are presented.

Anatomy

First place in this section must be given to the collections of specimens illustrating war injuries and diseases that have been formed by certain museums, notably that of the Royal College of Surgeons of England. Extending to many thousand specimens these collections present a picture of the medical and surgical effects of war in the widest sense, that has never been equalled. Other anatomical researches of note were upon the distribution of the absorbents from the lower intestine and upon the caeco-colic sphincter tract. The former offers explanation of many peculiarities of disease in this region and is of value surgically; the latter is a new conception, likens the tract in question to the stomach and supports this contention by numerous references to several species of lower animals.

Physiology

Hormones.—Bier found reason to believe that a chemical stimulus (hormone) secreted by the retina initiates the formation of the lens in the larva of Triton, and that a hormone formed from bone-marrow underlies repair of bone. From this he argued that repair in general is dependent upon special hormones formed at the seat of the injury according to the type of tissue needing repair. The part played by the nervous system in repair still remains obscure.

Shock and Blood Transfusion.—A large amount of work was done upon shock and allied conditions. Shock is of great complexity but sudden removal of large quantities of fluid (blood) with the resulting disturbance of the circulation is a fertile cause. In correspondence with this, treatment by transfusion (*see* Blood Transfusion) is of the greatest value and the methods of transfusion as well as the substances to be used were made the subject of numerous inquiries. Broadly speaking, for surgical shock and loss of blood by haemorrhage, injection of solutions of gum arabic are of great value, particularly if a small amount of glucose be added. Volume of injected fluid and rapidity of action are fundamental considerations, composition of the injected fluid is a matter upon which some latitude can be allowed, and use of blood is by no means obligatory. On the other hand where transfusion is performed for anaemia (*see* Anaemia) due to disease the character of the injected fluid is of first importance. Here, use of human blood is indicated and it is necessary, by careful examination of patient's blood and donor's blood to ensure that they belong to blood groups that are not mutually antagonistic.

Muscle Tone.—Physiological research of unusual importance was carried out (Sherrington, Magnus and others) upon muscle tone in the decerebrated animal by means of which tendon and other reflexes received a clearer explanation and afforded information upon many reflex postural responses to stimuli that appear to be voluntary. This line of research supplements experimental psychology, a branch of investigation that has made strides during the past two decades (*see* Psychology).

Respiration.—In the province of respiration, the relation of lactic acid and muscular exercise to the respiratory quotient

has been investigated. Under exercise a lactic acid maximum of 0·3% in the muscles can be reached in about 30 sec., and this, or rather less, is the longest time that maximal exertions can be kept up. For these short maximal efforts there is reason to believe that carbohydrate alone is used by the muscles. Regulation of rhythmic respiration, from experiments carried out on cats, appears to depend upon the action of an inspiratory mechanism, the apneustic centre, at the level of the striae acusticae, an expiratory mechanism just below it, both of these centres being controlled by the pneumotaxic centre which is situated in the upper half of the pons. The actual stimulating agent is carbon dioxide.

Other Discoveries.—Very many subjects of inquiry must be passed over here, *e.g.*, discovery of rhythmic contractions of capillaries discovered by means of a special modification of the microscope; the behaviour of the spleen in poisoning by carbon monoxide; the action of lead upon red blood corpuscles; researches on bilirubin and urobilin and other pigments in relation to jaundice; on "buffering" of blood whereby the addition of a given amount of acid to blood is represented by a smaller change in reaction than would occur in simple watery solutions because of the existence of weak basic salts of carbonic and phosphoric acid, especially in the red corpuscles; and numerous investigations upon the action of insulin upon blood sugar and other constituents of the body as well as upon the interaction of insulin and other endocrine secretions.

Energy Expenditure.—Of more general interest is a research carried out upon the energy expenditure in sewing with a machine and hemming by hand. Careful measurements were made by means of the respiration calorimeter, but one most instructive result is that influenza exerts a depressant influence on energy output during rest when the patient has apparently recovered completely. In the case of the woman made the subject of measurement for five weeks after her apparent complete recovery, with the body weight returned to normal, energy expenditure was 4% lower than before the illness.

Tissue Culture.—Minute portions of chick and duck embryo heart have been cultivated in special glass cells. Under suitable conditions these portions of tissue live, grow and beat rhythmically in the culture medium for prolonged periods. If two portions of heart from the same species are placed in the same culture cell, each beats rhythmically at an independent rate until the masses fuse by growth when the beats become synchronous. If in the experiment the two portions are chick and duck, fusion by growth may occur but independence of rhythmic contraction persists (*see* also article Tissue Culture).

As an example of information obtainable only by use of apparatus of extreme accuracy, Katz showed from a study of the curves of right and left intraventricular pressure and of aortic and pulmonary artery pressure that during normal experimental conditions right and left ventricular systoles and also their ejection phases neither begin nor end simultaneously and are, as a rule, of unequal duration.

Bio-chemistry

Insulin.—Much of the research falling into this category is concerned with the minute physical chemistry of the cell and therefore is of a fundamental character though hardly suitable for analysis in this place. An important practical result of laboratory work consisted in a simplification of the method of preparing insulin (*q.v.*) whereby a larger amount of the material of a higher potency was prepared from a given amount of raw material in less time and at smaller cost. Insulin forms a picrate when freshly ground pancreas is mixed with solid picric acid. The insulin picrate is extracted by means of acetone. By this discovery the cost of insulin treatment of diabetics has been reduced to one-third or less.

Vitamins.—Perhaps the most striking subject upon which biochemical investigations have been conducted during recent years has been that associated with accessory food factors (vitamins) and food deficiency diseases. Investigation of *beriberi*, a nutritional disease associated with various nervous and paralytic symptoms, which occurs in man and can be induced in pigeons by feeding exclusively on polished rice, showed that addition of a minute quantity of the milling was sufficient to prevent onset of the disease or cure it if in existence. Then followed investigations into the causation, prevention and cure of scurvy and inquiries into the factors underlying growth of the body generally or of special systems (*e.g.*, bone in rickets). It cannot be said with certainty that rickets depends exclusively upon absence of a special vitamin, for other factors, such as a sufficiency of calcium and phosphorus, are necessary. Moreover, sunlight, particularly the ultra-violet portion of the spectrum, is no less essential than due provision of the requisite vitamins for production of that normal growth of the body of which normal growth of bones is but a part. As a result of the entire series of investigations upon accessory food factors, it may be said that at the present time fat-soluble vitamin A and water-soluble vitamin B are regarded as being bound up with processes of growth and in addition there are anti-scorbutic and anti-beri-beri vitamins. These vitamins have been found in a great variety of animal and vegetable substances and the amounts present vary within very wide limits. Their nature is unknown, and the most certain points in connection with them are the minuteness of quantity in which they are present and the potency of their activity. As to their origin the suggestion has been put forward on experimental grounds that they are compounds of high energy content produced by the influence of ultra-violet light, but this hypothesis cannot be regarded as proved, indeed, some experimental observations are against it.

Diagnostics

Radiology (*see* Radiotherapy and Röntgenology).—On its diagnostic side, quite apart from the use of contrast meals and injections opaque to the rays, it is now possible to produce far better radiographs with exposures measured in fractions of a second than were possible at the beginning of the century with exposures lasting minutes. This is largely due to the employment of X-ray tubes in which the anticathode is a mass of tungsten, heated by an independent current. For treatment, in order to approximate the wave-length of rays emitted by the X-ray tube to the wave-length of the gamma rays of radium, apparatus has been produced with a voltage in the region of 200 kilovolts. So far this type of apparatus is employed chiefly in the treatment of cancer. During the routine examination of large numbers of cases various anatomical peculiarities have been observed and some hitherto unknown morbid processes in bone have been described. Radiology has also proved useful in study of the physiology and pathology of the heart and great blood vessels, in pulmonary conditions, notably tuberculosis and bronchiectasis, in diagnosis of renal and biliary calculi, and it has been suggested as a means of diagnosis when perforation of a gastric or intestinal ulcer is suspected. The intentional injection of oxygen or air into the peritoneal cavity as an aid to radio-diagnosis has been employed somewhat extensively; it is stated to be devoid of risk and renders diagnosis of fluid or solid masses relatively easy. The use of radium (*see* Cancer; Radium) is confined chiefly to the treatment of cancer, but in some conditions of skin, *e.g.*, naevi, and in certain uterine conditions it has a well recognised applicability.

Therapeutic Use.—Other forms of radiant energy, sunlight (Heliotherapy), mercury-vapour quartz lamp, carbon arc, radiant heat, all of which depend upon the presence of ultra-violet light in the first instance and warmth in the second, are employed therapeutically to an increasing extent. A disadvantage under which X-ray and ultra-violet forms of treatment labour is the absence of a satisfactory standard of dose. Sabouraud's pastille is only reliable for "soft" radiation. The "skin erythema dose" is unsatisfactory because as used in France it is two and a half times as great as the "Hauterythemdosis" of the Germans. Even in German institutions the erythema dose varies between 285 R units and 1,120 R units (Martius).

Effects of Radiation.—Numerous researches have been made on the effects of radiation, particularly the gamma rays of

radium, upon cells and tissues of the animal body, plants, seeds, bacteria, protozoa. It has been shown that the cell in division is more vulnerable than the cell at rest and that there exists a wide range of radiosensibility amongst animal cells and tissues. Amongst the most radiosensitive are the lymphocytes. So far as composite tissues are concerned the intestinal mucosa is highly radiosensitive, exposure of the abdomen to unduly heavy dosage leading to excessive formation of mucus, mucoid degeneration, intestinal haemorrhage, paralysis of intestinal muscle, desquamation of large tracts of mucosa and death from toxic absorption. While there is universal agreement that, directly or indirectly, rays produce injurious effects upon cells there is doubt whether smaller doses do not stimulate the activity of cells. Opinions are divided upon the point, but the failure to observe any but injurious effects may depend upon the fact that the experimenters have not reduced the amount of radiation they employed to sufficiently low limits. In the case of Ascaris ova increase in rate of division was not observed until the amount of radiation received by the eggs was reduced to that derived from about one ten-millionth of a milligram of radium bromide for a period of about 30 hours.

Pathology

Histology.—Morbid histology has been in some measure at a standstill, although during the War it was employed extensively in striving to unravel the pathology of war nephritis, gas gangrene, gas poisoning and, indeed, of any novel pathological condition. Its most striking success was in reference to the mode of extension of gas gangrene from the seat of infection. The action of the toxin secreted by the infecting bacilli extends along the muscle bundles far in advance of the bacilli themselves, produces glassy changes of the muscle fibres correlated with a loss of contractility that can be demonstrated on the operation table and is a necessary precursor to advance of the bacilli themselves by multiplication. These observations were the prelude to a radical modification of the surgery of the condition and a definite improvement in results.

Bacteriology.—In bacteriology (*q.v.*) a useful step was taken by the Medical Research Council in forming the national collection of type cultures at the Lister Institute. Begun in 1920 it now contains more than 2,000 living strains of bacteria, protozoa and fungi, available for workers in widely different lines of research.

Experiments upon the conditions under which bacilli, particularly the sporing anaerobes of tetanus and gas gangrene, exert pathogenic activity showed that if washed clear of toxin and inoculated without contaminating substances they remained inert. Multiplication, followed by manifestation of the ordinary disease phenomena, occurred only if they were injected along with toxin (not necessarily their specific toxin) or with some solid particles such as lime or silica. In other experiments the presence of silica exerted an important influence on the multiplication of tubercle bacilli in the tissues.

Diphtheria.—Important observations were conducted in many countries upon the so-called Schick test as a means of diagnosing susceptibility to diphtheria (*see* Infectious Fevers). If a minute quantity of diphtheria toxin, highly diluted, were injected intradermally in man there occurred a patch of redness locally about 2 cm. in diameter in certain persons, whereas in others the injection was without effect. Heating of the toxin destroys its power of producing this effect. Further search indicated that in those persons who are negative, diphtheria antitoxin is present in the blood serum, whether naturally, or as the result of having passed through an attack of diphtheria, or of gradual immunisation owing to the fact that the person is a diphtheria carrier. In Schick-positive persons there is absence of antitoxin and therefore the injected toxin is not neutralised and produces its pathological effect. Subsequent examination on a large scale showed that the reliability of the test was of a high order. The natural corollary is that during an epidemic all Schick-positive persons should receive a prophylactic treatment with diphtheria antitoxin. Later work showed that diphtheria "anatoxin," *i.e.*, toxin detoxicated by addition of formaldehyde and exposure to a temperature of 37° C. for a few weeks, was equally efficacious in producing immunity.

Scarlatina.—By a similar process of reasoning the two Dicks in America introduced an intradermal diagnostic test for scarlatina, the toxin being derived from broth cultures of a variety of haemolytic streptococcus found in the throats of scarlatina patients and believed by some to be the cause of the disease. So far the Dick test is not on such firm ground as the Schick test. Nevertheless some authors have expressed their view that the test is of much value in determining susceptibility or insusceptibility to scarlatina and that an anti-scarlatinal serum prepared by means of the haemolytic streptococci is in many instances efficacious in immunising the Dick-positive individual and rendering him negative on subsequent intradermal tests.

Tuberculosis.—A further extension of the principle has been applied in the case of tuberculosis (*q.v.*), but the work is still in its earlier stages and the time is not ripe for dogmatic statement. From time to time papers are published indicating that antibody formation is not a universal function of the tissues but that there are special sites for its formation. So far there is no consensus of opinion on the subject nor are the instances adduced sufficiently marked to be convincing but it is certain that variations occur in local resistance of the tissues to infection. The most recent suggestion is that antibody formation is a function of the reticular endothelial system.

Tularaemia.—A hitherto unrecognised disease was described by McCoy in 1912 when investigating ground squirrels in Tulare county, California, that had been attacked by a plague-like disease not caused by *B. pestis*. Since that time it has been found widely in the United States and was definitely recognised as affecting man in 1914. Since 1914 tularaemia has occurred in at least nine laboratory workers engaged on investigations with *B. tularense*. The micro-organism is an exceedingly minute cocco-bacillus and it is considered that infection in man was by inhalation or by a blood-sucking fly. Transmission from rabbit to rabbit occurs by the rabbit louse and the rabbit tick, neither of which bites man.

Dental Caries.—A bacillus (*B. odontolyticus acidophilus*) has been isolated from carious teeth and in pure culture forms sufficient acid to dissolve the enamel. Undecayed teeth placed in such pure cultures for a period of weeks show loss of enamel at spots and local growth of the bacilli along the dental tubules. Microscopically the appearance of this artificial caries is identical with that of natural caries.

Botulism.—Numerous papers have been published upon botulism, a form of severe food poisoning (*q.v.*) dependent upon an anaerobic bacillus (*B. botulinus*). The nervous system is profoundly attacked by the toxin, difficulty of vision, dilated pupils, ptosis and paralyses being among the earliest symptoms. The toxin differs from other toxins in being pathogenic when administered orally; it is absorbed in the stomach and upper duodenum. An antitoxic serum has been prepared and is useful in treatment. This form of food poisoning was originally associated with sausages but occurs in connection with a great variety of foods. Most of the recorded cases have occurred in America.

Spirochaetes.—During the War there occurred in Flanders amongst the men in the trenches a severe form of disease associated with jaundice and haemorrhage which was traced to a spirochaete similar to or identical with *Sp. icterohaemorrhagica*, which in Japan infects rats and is transmitted by them to man. The same organism was found in the rats infesting the trenches.

Syphilis.—In the case of another spirochaetal disease, syphilis (*see* Venereal Diseases), Brown and Pearce succeeded in transmitting the disease to rabbits by intratesticular inoculation and showed the close resemblance of the pathological and clinical manifestations to those met with in man. By a prolonged series of experiments on rabbits Pearce answered in the negative the long debated question whether yaws and syphilis are manifestations of a single disease. Much work has been done on the Wassermann reaction. All doubts are not set at rest nor is the behaviour of the reaction completely understood, but it has stood the test of time and is considered of some diagnostic value.

In the investigation of spirochaetal diseases caution in deduction from experiment is shown by the fact that spirochaete-like bodies are to be found in the lateral ventricles of normal monkeys, rabbits and guinea-pigs. Only after animals that had been injected long previously with material from disseminated sclerosis (which is regarded by most authorities as of syphilitic origin) had been found to present these bodies in their lateral ventricles, was their existence in normal animals also discovered.

Typhus.—In typhus and trench fevers minute parasites were discovered belonging to the group now named Rickettsia. For a short time the relation of the Rickettsia to the disease was in doubt, but largely owing to the work of Bacot, an eminent entomologist who contracted typhus during his investigations and died therefrom, it is now recognised that both diseases depend upon the presence of varieties of Rickettsia, and that these parasites are conveyed from patient to patient by body lice. One of the most delicate manipulative operations ever attempted, and actually carried out with brilliant success by Bacot, was the filling of the rectum and intestine of lice with Rickettsia-infected blood by means of a fine capillary glass tube.

Bacteriophage.—An interesting phenomenon called after d'Herelle, its discoverer, has attracted much attention. When working with certain cultures of intestinal bacteria d'Herelle observed that on occasions culture apparently failed, the broth remaining quite clear. Subsequently he found that addition of a minute quantity of one of these clear fluids to a culture tube, cloudy with growth, was followed by clarification of the latter; as little as one part in a million was sufficient. He considered that he had obtained evidence of a filter-passing " microbe bactériophage " and obtained the phenomenon by successive culture from intestinal contents, sewage, soil extracts. This clarifying power is a property of leucocytes, tears, nasal mucus, eggwhite and other substances.

From the first the filter-passing microbial explanation met with opposition, many authorities regarding the phenomenon as being due to the action of an autolytic enzyme, or a catalyst causing the micro-organisms to produce autolytic ferments. Later, Fleming described a somewhat similar phenomenon by means of a special micro-organism that he isolated (*M. lysodeikticus*). This organism in thick suspension is in a few minutes completely dissolved by tears in a 1–9,000 dilution and using it as an indicator he found evidence of the lytic principle in nearly all tissues of the body, but not in urine, cerebrospinal fluid or sweat. In the vegetable kingdom he found it in the turnip alone. It is doubtful whether there is a single lytic substance or more than one. The essential difference between this and d'Herelle's phenomenon is that the former cannot be transmitted in series. Fleming therefore speaks of it as a " lysozyme," and points out that some bacteria are sensitive to lysozyme action and others not, thus raising the speculation whether the pathogenicity of bacteria may be determined by the absence of lysozyme.

Filter-Passing Microbes.—Since 1905 papers have appeared from time to time in medical literature on the " filter passer " or " filterable virus " (*see* FILTER-PASSING MICROBES). A series of morbid conditions is now recognised with more or less certainty as being due to a virus so minute that it passes through the pores of a porcelain filter, or in some cases is beyond the lowest limits of microscopic vision. Of these diseases rabies, vaccinia and perhaps, variola are the best known. In lethargic encephalitis and herpes evidence is tending in that direction but is not conclusive owing to the discovery that laboratory animals mainly used for this type of work (monkeys, rabbits) may under normal conditions present appearances in their brains that have been regarded as evidence of experimental transmission from man.

Dengue has been added to the list, while the so-called mosaic disease of the tobacco and tomato plants (*see* PLANT PATHOLOGY) is stated to be due to a filterable virus, and distemper in dogs may show a like origin. In addition a transmissible filter-passing virus has been recognised in the rabbit; at first this virus was thought to be the cause of varicella but it is now recognised to be the cause of a naturally occurring infection of the rabbit.

Gye and Barnard have described and photographed by means of ultra-violet light, respectively, a filterable virus derived from certain malignant tumours, following in this direction the pioneer work of Rous on chicken sarcoma. Finally, in the opinion of some authorities the cause of influenza (*see* INFLUENZA) is not Pfeiffer's *B. influenza*, this being merely a usual concomitant, but is in reality a filter-passing virus that has not yet been determined with certainty.

OBSTETRICS AND GYNAECOLOGY

Eclampsia.—The exact pathology of eclampsia has not yet been solved. Obata, as the result of injecting mice with extracts of human eclamptic placenta, considers that it is an intoxication by placental poisons made possible by a weakening in its normal capacity of neutralisation on the part of the maternal blood. Treatment of the condition on conservative lines has recently gained ground against more radical measures, and control of convulsions by hypnotics with venesection and administration of oxygen have replaced operative procedures. Under these conditions the previous mortality has been reduced by more than 50 per cent.

Fibroids.—The chief direction in which change of view is taking place among gynaecologists is that of the treatment of uterine fibroids. The old method of curetting has given place in large measure to hysterectomy, which in turn may be destined to give place to radiological treatment in a large proportion of cases. In several important gynaecological clinics on the Continent surgical treatment of uterine fibroids is the exception in an uncomplicated case.

MEDICINE

Anaemia.—In pernicious anaemia (*q.v.*) it has been shown that one of the cardinal features is an increase in the mean diameter of the red cells which is independent of the degree of the anaemia, and persists through the course of the disease. On the other hand anisocytosis increases with the anaemia. In the remissions which occur naturally or after splenectomy, though the haemoglobin may rise there is little change in the diameter of the red cells. In treatment transfusion has been found of little value, but benefit has resulted in some cases from removal of a portion of the bone marrow from the tibia. Apparently removal of some of the bone marrow acts as a stimulus to regeneration of marrow and therewith of the blood cells that are needed by the body. Purpura is described as being of two varieties (1) that which is dependent upon destruction of blood platelets; (2) that which occurs in anaphylactic conditions and is due to direct injury of blood vessels. In the platelet variety a blood platelet antiserum has been prepared and is of therapeutic value.

Heart Diseases.—Diseases of the heart and great blood vessels have been studied by means of the electrocardiograph and numerous conditions, particularly heart block and those in which the nervous mechanism of the heart beat is concerned, have been investigated. Systematic examination of recruits in whom cardiac symptoms developed during early training resulted in a clearer perception of those abnormalities of heart action which were transient and of little importance as distinguished from those which were significant of disease.

Cerebrospinal Meningitis.—Cerebrospinal meningitis (*q.v.*) and lethargic encephalitis (*q.v.*) have received much attention. In cerebrospinal meningitis it has been shown that three, possibly four, different types of meningococcus occur and that antiserum treatment to be successful must be homologous. Epidemics could usually be traced to a carrier and the chance of their occurrence was greater where men were confined in a relatively narrow space, *e.g.*, barracks. A special method of treating carriers by means of inhaling chloramine-T was instituted with some success. In the case of lethargic encephalitis, it appears probable that the cause will be found to be a filter-passing virus.

Herpes.—In the case of herpes in rabbits and herpes in man, including herpes zoster, it has been found possible to transmit keratitis and some other special conditions from animal to animal and man to animal by means of a filter-passing virus.

When this has occurred microscopical appearances are found in the nervous system apparently identical with those met with in lethargic encephalitis. The whole question, therefore, is in an unsettled condition.

Liver Cirrhosis.—An interesting observation is that a form of progressive degeneration of the lenticular nucleus occurs which is associated with hepatic cirrhosis. Since its first description by Wilson in 1912 over 70 cases have been described but the pathological agent remains completely unknown, though there are indications that the liver is the seat of the primary pathological process. Clinically the symptoms are chiefly cerebral and the hepatic cirrhosis which is so constantly found at autopsy is usually latent.

General Paralysis of the Insane.—In the case of general paralysis of the insane, a form of treatment that has been advocated is inoculation with benign tertian malaria which is then treated with quinine. Maniacal and early cases have been found to respond to this treatment best. Intelligence, articulation, writing and equilibrium improve markedly, but defects of character and manners remain. Some cases may even be able to return to responsible duties. Advanced cases merely remain stationary. The idea underlying this treatment is that the malarial parasites stimulate the body to the formation of spirochaetal anti-substances.

Respiratory Diseases.—In the province of respiratory diseases, gas poisoning necessitated urgent investigation from the commencement of 1915. An intense oedema was produced which blocked the finer air passages and in its minor degrees led to a widespread bronchopneumonia. Variations were met with as the nature of the gas used was changed, but from the respiratory point of view at least the phenomena were fairly constant. In pneumonia, experimental work on monkeys showed that four types of pneumococcus occur and do not protect against one another.

Asthma.—Work on asthma has shown that in a large proportion of cases, if not in all, the disease is of an anaphylactic nature, an intense reaction being produced in the bronchial mucous membrane of a person sensitised to some particular substance of protein origin. Determination of the particular substance in any individual case may be lengthy, but if it be determined there is a possibility of successful treatment by gradual immunisation.

Tuberculosis.—In tuberculosis (*q.v.*) two important methods of treatment have been suggested. In one, an endeavour has been made to increase the antagonising cells in the body by repeated irradiation of the spleen. This organ is a storehouse for lymphocytes and it is known that the lymphocytic content of the blood can be raised by repeated small doses of X-rays. The method has not as yet a great following. The other method is by administration of a gold salt $[Au(S_2O_3)_2Na_3]$ named "sanocrysin" by Möllgard, originator of the method. The underlying idea is not purely chemotherapeutical for it is held that the poisonous action of the organisms killed *in vivo* by chemical means is neutralised by an antiserum. The experimental work was carried out in Denmark and has been confirmed and extended in this country. Careful selection of cases must be made when applying sanocrysin to man as the reaction in pulmonary tuberculosis may be very severe, but with due precautions great benefit may accrue.

Diabetes.—In the case of diseases of endocrine origin the outstanding example of advance is afforded by the insulin (*q.v.*) treatment of diabetes (*q.v.*). The pathology of the condition was fairly well known but the great achievement of Banting and his collaborators was that they succeeded in isolating the material in sufficient quantity for therapeutic purposes. Numerous researches have been undertaken in the endeavour to simplify the treatment but it still remains necessary for insulin to be injected intravenously and repeatedly in severe diabetes.

Goitre.—The relation of iodine to endemic and to exophthalmic goitre (*q.v.*) has been investigated. A close relation between the cellular condition of the thyroid and the amount of iodine has been demonstrated and it is held that relative or absolute deficiency of iodine is the immediate cause of simple goitre however this deficiency may be occasioned. Treatment by internal administration of iodine has met with much success. Success has also been claimed for radiological treatment and for surgery in cases in which iodine and other medical treatment has failed.

Paratyphoid—Description has been given of a paratyphoid epizootic in a flock of sheep with a consequent human epidemic of paratyphoid (40–50 severe cases with four deaths) that occurred in the Essen district. *B. paratyphosus B.* was isolated from the sheep's flesh and from the patients' stools. It was not here a case of contamination but the sheep suffered from the same disease as the human beings.

A peculiar disease has been occurring since July 1924 among the fisher folk of the Frisches Haff, the great freshwater lagoon of East Prussia. Many suggestions were put forward as to its aetiology but finally it was traced to arsenic freely contained in the waste water of two cellulose factories which was pouring into the Haff in large quantities.

Racial Blood Indices.—On the basis of observed peculiarities of group II. and group III. red blood cells, another research would group mankind according to their racial blood index (*see* RACES OF MANKIND). Analysis of the large amount of material accumulated since 1919 suggests that so far as blood groups are concerned races fall into six divisions strikingly different in type. These six divisions are European, Intermediate, Human, Indo-Manchurian, Afro-South-Asiatic and Pacific-American. No better indication could be given, than this last example, of the wide range covered by medical research. (W. S. L.-B.)

MEDICAL SERVICE, ARMY (*see* 20.19).—An Army Medical Service (*service de santé*, Fr.; *Sanitätsdienst*, Gm.; *servizio sanitario*, It.; *eisei kimmu*, Jap.) is an indispensable technical branch of the military organisation. On its efficiency the man-power of an army to a great extent depends. Its duties include the care of sick and wounded, the prevention of disease and the preservation of health, the medical examination of recruits, the invaliding of men unfit for further service, the supply of medical and surgical material, the administration of military hospitals and the command, education and training of a personnel for all these purposes. In time of war the collection, evacuation and distribution of battle casualties and the strategical and tactical employment of a variety of medical units for these duties are additional functions of an army medical service.

Administration.—The army medical service of the British forces is administered by a director-general in the adjutant-general's branch of the War Office, with a staff for personnel and mobilisation services, for preparation of statistical reports and consideration of professional questions, and for the supply of medical and surgical material, together with two new directorates of hygiene and pathology which were instituted after the World War in consequence of the lessons of the War and of the scientific advances in the domain of medical research. The director-general also administers the nursing services and the Army Dental Corps, the former through a matron-in-chief and the latter through an inspector of dental services at the War Office. He is represented in commands at home and overseas by deputy directors and assistant directors with deputy assistant directors for hygiene and pathology. A similar form of administration exists in other armies. In the United States the surgeon-general controls not only the medical, dental, nursing and a new corps, the sanitary corps, but also the veterinary corps.

Advisory Boards.—These are composed of military and civil members and are associated with the British Army medical administration. They meet from time to time at the War Office for consideration of general professional policy, questions of hygiene and of pathological research, nursing services and the co-operation of voluntary aid in war.

Personnel.—The estimated peace establishment of the Royal Army Medical Corps in 1926 was 584 officers and 3,579 other ranks. They serve in all stations at home and overseas where there are British troops, including India. Their work there is supplemented by assistant-surgeons of the Indian Medical Dept., formerly the Indian subordinate medical department, and by natives of an Indian Hospital Corps, formerly the army

hospital corps and army bearer corps, who with soldiers trained for hospital duties from combatant regiments formed the subordinate staff of British military hospitals in India before the War. A separate body of officers, the Indian medical service and sub-assistant-surgeons of the Indian Medical Dept. served until the World War with Indian regiments and in regimental hospitals under much the same conditions as the British regimental medical services of earlier days. Since the World War, station hospitals for Indian troops have been instituted.

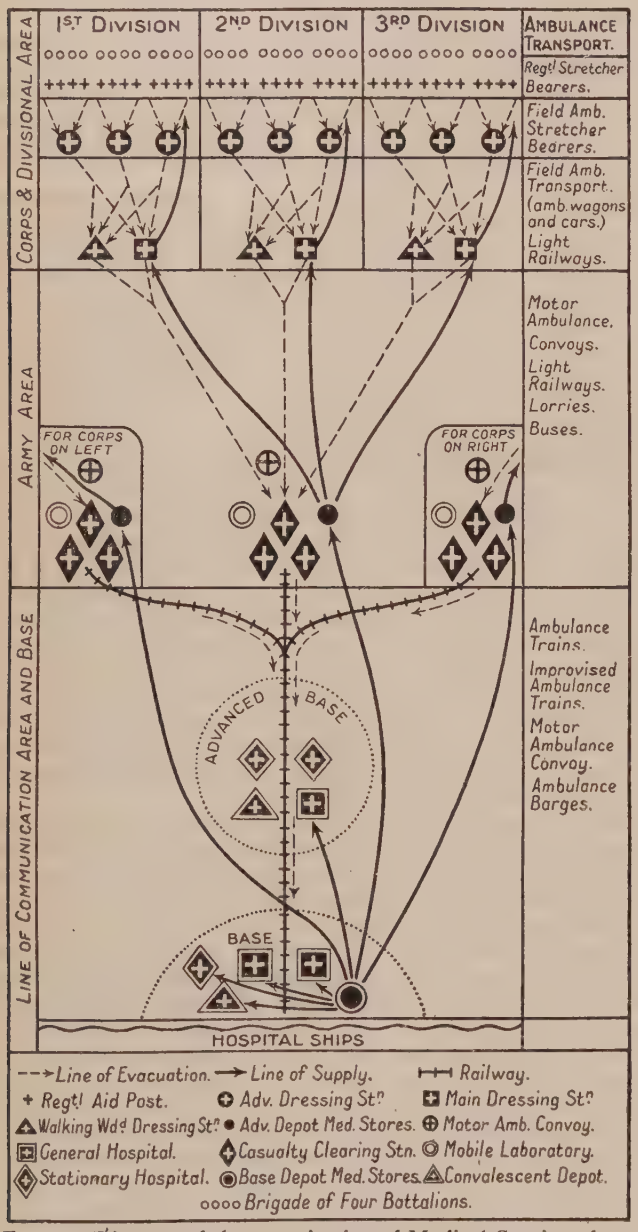

FIG. 1.—Diagram of the organisation of Medical Services, from a corps front of three divisions in an army to a sea base.
(From "History of the Great War" [Medical Services], Vol. II. By permission of the Controller, H.M. Stationery Office, London.)

The army dental corps, with an establishment of 71 dentists, is estimated to provide one dentist for every 600 recruits or for every 1,500 troops in a command. (*See* DENTISTRY.)

Queen Alexandra's Imperial Military Nursing Service (Q.A.I.M.N.S.) has an establishment of 270 nurses and the Queen Alexandra's Military Families Nursing Service (Q.A.M.F.N.S.) an establishment of 91 nurses. They serve in the larger military and families hospitals at home and overseas, except India.

Territorial Army Royal Army Medical Corps.—The personnel is organised in peace to provide a regimental service, one field ambulance for each division of the Territorial Army, eight casualty clearing stations, three general hospitals and eight sanitary sections. These are field service units and form a cadre for the training of the R.A.M.C. (T.A.). Previous to the World War the Territorial Force had three field ambulances, one casualty clearing station and one sanitary section for each division, together with 23 general hospitals. The reduction therefore in Territorial Army R.A.M.C. units since the War has been considerable.

Military Hospitals Reserve.—An establishment of 2,000 other ranks is organised to provide trained personnel to staff military hospitals in England on the outbreak of war when the regular Royal Army Medical Corps personnel is withdrawn, and to furnish reinforcements for an expeditionary force.

Service.—The number of medical officers (1924) was 939, of dentists 155, of nurses 675 and of veterinary officers 124. In continental armies with conscript service the fixed establishments for medical services cannot be computed for purpose of comparison on the same basis as those of the British and American voluntary armies.

Training.—Officers of the R.A.M.C. attend preliminary and post-graduate courses at the Royal Army medical college, and military training with the men at the R.A.M.C. depôt at Aldershot, where there is also an army school of hygiene. In America, an army medical centre was opened in 1923, at Takoma Park, near Washington, District of Columbia. It consists of schools for the training of the medical, dental, nursing and veterinary corps. There is also a medical field service school at Carlisle, Pennsylvania, and a school of aviation medicine at New York. In Italy, there is an army medical school at Florence, and in France, at Lyons, in addition to the post-graduate school at the Val-de-Grâce, for student candidates.

Military Hospitals.—In the British Army, military hospitals and small depôt hospitals are established in all commands. In America, there are garrison hospitals and eight large general hospitals, similar to some of the larger military hospitals in England. In continental armies there are also garrison hospitals, but in France, military sections of the civil hospitals take their place to a great extent.

Army Medical Stores.—In some continental armies most of the medical and surgical material is or was prepared in army medical laboratories and factories. In Great Britain and America it is distributed from army medical stores, that for the British Army being at Woolwich.

War Organisation.—A regimental medical service, field ambulances, casualty clearing stations, general hospitals, convalescent depôts, advanced and base depôts of medical stores, motor ambulance convoys, ambulance trains, hospital ships, sanitary sections and squads, and mobile hygiene, bacteriological, X-ray and dental laboratories come into being for service with a British Expeditionary Force on the outbreak of war; there are equivalent units in other armies under different names and organisation. To complete their personnel on mobilisation the medical and nursing reserves are called up. For this purpose there is a regular reserve of R.A.M.C. retired officers and men liable to be recalled to service, a supplementary reserve of officers, a home hospital reserve of the St. John Ambulance Brigade, the Territorial Army R.A.M.C. and the Voluntary Aid Detachments (under T. A. County Assn.) of the British Red Cross Society, the St. John and the St. Andrew Ambulance Associations. There are also important reserves of the Q.A.I.M.N.S. and the Territorial Army Nursing Service. But in a great war, practically the whole of the country's medical resources may be enrolled within the limits of age. In the World War, the peace establishment of the R.A.M.C. thus expanded to 15,000 officers and 120,000 ranks; while in the U.S.A. the medical service expanded to 30,591 officers and 264,181 other ranks. A similar vast expansion occurred in nursing personnel and in the number of medical units. Military hospital beds, for example, reached a total of 637,746 for the British forces and 353,887 for those of the United States.

The various units are distributed in the war zone, from front to base, in divisional, corps, army and lines of communication, areas of command, according to the nature of the functions

for which they are organised. The regimental medical service consists of an officer and four men of the R.A.M.C. with 16 men of the regiment as stretcher bearers and nine as sanitary detachment. In battle, a regimental aid post (*poste de secours*, Fr.; *Truppenverbandplatz*, Gm.; *posto di medicazione*, It.), to which they collect the wounded, is established. Each division has three field ambulances (the equivalent of the medical regiment of a U.S.A. division, the *groupe sanitaire divisionnaire* of the French, and the *Sanitätsbattalion* of the German organisations). A field ambulance is composed of a headquarters and two companies, each company consisting of a bearer and a tent division, representing the bearer company and the field hospital respectively of the time of the South African War and previous equivalent units of the continental army divisions. With a cavalry division there is an organised field ambulance for each cavalry brigade.

Working of the Systems.—In battle, the tent division opens an advanced dressing station at a point to which its wheeled ambulance transport can be brought, and a main dressing station further back. The bearer company removes the wounded from the regimental aid posts to the advanced dressing station, and the transport brings them from there to the main dressing station. The motor ambulance convoys (*section sanitaire auto*, Fr.), composed of 50 motor ambulance cars each and with one convoy to each corps, bring the wounded from the main dressing stations to the casualty clearing stations (evacuation hospital, U.S.A.; *hôpital d'évacuation*, Fr.; *Kriegslazarett*, Gm.) which are established in the proportion of one to each division, at or near railways and at the head of the lines of communication. From there, when fit to travel, the sick and wounded are taken in ambulance trains to the general hospitals, which are units of 1,000 or less beds placed at sea bases or other convenient centres. Hospital ships transfer the patients to home ports, whence they are distributed to hospitals throughout the country.

Such is the normal system of collection, evacuation and distribution of sick and wounded in a war zone. It is liable to modification according to circumstances and the nature of the terrain, especially as regards methods of transport by road, rail, river, canal or air. It worked well in the World War, where the test was severe. During the battles of the Somme, for example, the British field ambulances collected 316,073 wounded between July 1 and Nov. 30 1916, including 26,675 in the first 24 hours; 304,285 were transferred to the base hospitals, and on one day, July 6, 10,112 arrived in hospital ships at Southampton and Dover.

The mobile laboratories and advanced depôts of medical stores are usually placed with or near the casualty clearing stations. For sanitary duties a sanitary section, of 25 men, is allotted to each division and base, and sanitary squads of five men each to small posts, such as railheads. Their influence and that of medical research had remarkable results during the World War in preventing disease. Enteric and typhus fever, the scourge of armies in past wars, became negligible quantities in the British and American forces, and fatal gangrene of wounds and trench fever, for long a cause of much inefficiency, were brought under control. Indeed, the two outstanding features of the army medical service of the present day are its power of controlling disease and its power of systematically, rapidly and effectually bringing battle casualties under life-saving surgical and hospital treatment.

In this beneficent work it is assisted by voluntary aid organisations. Amongst all civilised nations there are national Red Cross societies (*see* RED CROSS) organised as auxiliaries of their army medical services in time of war. They are of special value in distributing voluntary gifts and comforts, such as are not supplied through official sources, to the various hospitals in the home territory and in the war zone, in organising auxiliary hospitals and in various other activities. Those recognised by their governments, together with the whole of the personnel and units of the medical services of armies, are protected and become the recipients of special privileges under the Geneva Convention of 1906, should they fall into the power of the enemy during war.

(W. G. MA.)

MEDICAL SERVICE, NAVAL.—In Great Britain the Royal Naval Medical Service is administered by the medical director-general, an officer selected from the list of surgeon rear-admirals. He is responsible to the Board of Admiralty for the efficiency of his department. The work of the medical department includes questions regarding the personnel of the Naval Medical Service, the supply of surgical instruments, drugs, medical material, etc., assessments arising from invalidings and claims for compensation, the hygiene and sanitation of ships, hospitals and establishments, preparation of estimates for the medical vote, nursing and sick-berth reserve forces and publication of the medical statistics of the navy.

Conditions of Service.—The medical director-general superintends all professional and administrative details of naval medical establishments and the practice of medical officers. Candidates for cadetships and for commissions in the navy are physically examined at his department. He also nominates the appointments of all naval medical officers which are submitted to the board for confirmation. The existing ranks date from 1919, and are: On entry, surgeon lieutenant; after six years' satisfactory service, surgeon lieutenant-commander; after six years' service in the latter rank, surgeon-commander, providing the necessary promotion examination has been passed; the senior ranks of surgeon captain and surgeon rear-admiral are reached by selection.

Until the outbreak of the War candidates were entered by competitive examination, but, owing to the lack of applicants since the War, these examinations have not yet been resumed, and for the time being officers are entered for temporary service, engaging for three years with the option of turning over to the permanent service if considered suitable. Officers senior to the rank of surgeon-commander do not normally serve afloat, but are employed in hospitals and depôts. Conditions of service, etc., are published in the official monthly *Navy List*.

All ships, except the smallest, carry medical officers, larger ones carrying two. In view of the fact that ships are frequently on isolated service, the medical officer, in addition to his ordinary medical and surgical duties, has to fulfil the function of medical officer of health, and consequently has to advise his commanding officer on all questions relating to the protection of the health of the crew, and suggest any measures considered necessary for this purpose. He must acquaint himself with the conditions of health prevailing at the ports the ship is likely to visit, and veto the introduction into the ship of any water or food likely to carry disease. It is his duty to instruct the ship's company in "first aid" and personal hygiene, with special reference to venereal diseases and the evils resulting from the abuse of alcohol. In fleets and squadrons the hygienic responsibilities are, as far as is compatible with efficiency, relegated to the senior medical officer of the flagship, who is designated the fleet or squadron medical officer as the case may be. This arrangement does not, of course, absolve individual medical officers from responsibilities concerning their own ships. The Royal Naval Dental Service was inaugurated in 1920, and is supervised by a dental officer of commander's rank attached to the staff of the medical director-general. The sick-berth nursing staff, instituted in 1884, has a complement of 1,100 highly trained men who carry out their duties both ashore and afloat.

Equipment and Hospitals.—The special accommodation which is allocated for the sick in all ships is termed the "sick bay." These places, in spite of the fact that all serious cases are, for their own comfort, transferred to hospital on the earliest convenient occasion, are specially equipped for the comfort of patients and for all medical and surgical contingencies. The larger ships have special operating rooms. Also, for the greater safety of the wounded in action, spaces are reserved in the most protected part of the ship. These are known as "medical distributing stations." The nursing on board is carried out by the sick bay staff. The naval hospitals are: Haslar, Chatham, Plymouth, Portland, South Queensferry, at home; and Malta, Hong-Kong, the Cape, Bermuda, Wei-Hai-Wei, abroad. In addition, there is a naval mental hospital at Great Yarmouth.

All these hospitals conform in every way to the most modern requirements of medicine, surgery and hygiene.

Auxiliary Services.—These include the medical officers of the Royal Naval Volunteer Reserve, Queen Alexandra's Royal Naval Nursing Service Reserve and the Royal Auxiliary Sick-Berth Reserve. The personnel of these services is called up for periodical training and would be mobilised on the outbreak of war.

Foreign Navies.—The organisation in the principal foreign navies is similar to the British. Medical officers of the French navy—instead of being selected from candidates qualified in the ordinary way, as is the practice in the British, Italian and Japanese navies—are professionally educated at special naval medical colleges, and subsequently hold purely professional titles of rank. Italian naval medical officers, in common with other non-executive officers of that navy, hold military in contradistinction to naval rank. The medical organisation in the Japanese navy is almost identical with the British.

The World War.—At the outbreak of the War the naval medical service was expanded by mobilisation of its retired, emergency and Royal Naval volunteer reserve officers. Later, a large number of temporary surgeons were entered for general service, and also medical students were taken in for service in destroyers under the title of surgeon probationers. Queen Alexandra's naval nursing service was more than trebled by the mobilisation of the reserve sisters and the sick-berth staff, supplemented by the naval auxiliary sick-berth reserve.

Except under abnormal climatic conditions, and during epidemics of influenza, the health of the navy during the War was remarkably good. This satisfactory state of affairs can be attributed to:—

(*a*) The careful supervision of the personnel by the medical officers and the strict quarantine precautions enforced.
(*b*) The care exercised concerning food, water and victualling arrangements, both in ships and establishments.
(*c*) Preventive inoculation against enteric fever.
(*d*) The comparative isolation of the fleets lessening the chance of venereal infection and abuse of alcohol.
(*e*) Lectures given to the men on personal hygiene.
(*f*) Measures taken to lessen the monotony of ship life in war time.

Casualties.—As compared with land warfare, the number of men killed outright in action was striking, and this, combined with the numbers of deaths from immersion, made the ratio of killed to wounded far higher in the navy than in the army. For instance, at Jutland, out of 6,688 casualties there were 6,014 either killed or drowned. The higher proportion of fatal wounds was due to the conditions of modern warfare—explosion of large shells in closed compartments. In comparison with the wounds in the trenches, where the clothing and skin were ingrained with filth, wounds in the navy were less disposed to become septic. Burns formed a high proportion of the casualties, and were chiefly caused by the ignition of our own cordite or from the momentary flash of a high explosive shell in a confined space. A considerable number of casualties arose from gas poisoning, caused by the explosion of shells, the most lethal factor in these cases being nitric oxide gas. (G. L. B.)

United States.—In 1926 the Medical Corps of the U.S. Navy consisted of 38 medical directors, 4 of which had the rank of rear-admiral and 34 of captain; 66 medical inspectors with the rank of commander; 320 surgeons, with the rank of lieutenant-commander; 217 past assistant surgeons, with the rank of lieutenant; and 147 assistant surgeons, with the rank of lieutenant (j.g.). The Dental Corps consisted of 66 dentists, with the rank of commander; 71 past assistant dental surgeons, with the rank of lieutenant; and 22 assistant dental surgeons, with the rank of lieutenant (j.g.).

The medical and dental officers are admitted to the corps after passing satisfactory examinations and as vacancies occur. Above the rank of lieutenant-commander promotion to each grade is by selection and examination. All medical officers receiving their appointment to assistant surgeon are given a course at the Naval Medical School in Washington, after graduation from which they receive their assignments to different posts of duty, either on board ships, at naval hospitals as internists or at other naval bases. The health and hygiene of the navy personnel are entrusted to the medical and dental officers of this branch of the service. Fully equipped hospital ships with an efficient personnel and skilled medical officers, including specialists, accompany all large fleets.

The Hospital Corps consists of pharmacists, pharmacist mates, first, second and third class, and hospital apprentices, as well as a corps of trained female nurses who serve on special hospital ships and in hospitals ashore. The enlisted men in the Hospital Corps are given special training and instruction at the various pharmacist and pharmacist mate schools throughout the country. During the World War those members of the Hospital Corps who had enlisted or had been drafted into it were put through a special course of training in civilian hospitals. The Naval Medical Reserve is composed of officers taken from civilian life and from among ex-naval medical officers. They receive a certain amount of training each year, are examined annually, and are promoted according to precedence, as in the regular service. They are ready to be called upon in any emergency.

The surgical instruments, medicines and dressings are all supplied, in great part, from the Navy Medical Supply Depot in Brooklyn, New York, and from the Medical Supply Depots in Mare Island, California, and Canacao, Philippine Islands. The entire Naval Medical Corps is under the direct supervision of the surgeon-general of the U.S. Navy, who is appointed by the President for this duty, for a term of four years, after which he may be reappointed. This duty carries with it the rank of rear-admiral.

3,093 commissioned officers of the Medical Corps of the U.S. Navy served in the World War, together with 24,587 enlisted men in the Hospital Corps. (C. C. B.)

MEDICINE, GENERAL.—Since 1910 the progress of medicine has been much influenced by the four years of the War, which, while interfering with steady research, brought with it urgent problems, caused diseases previously rare or unrecognised to become matters of common knowledge, and produced epidemics on an enormous scale, thereby calling forth much investigation and new knowledge.

Influence of the World War.—Trench fever and a special form of kidney affection, called trench nephritis, were practically new diseases; and the serious condition of epidemic (lethargic) encephalitis (*q.v.*), though it may have existed previously, for the first time became common and was recognised during the War. Certain industrial forms of poisoning, namely of trinitrotoluene among munition workers, and of tetrachlorethane among aeroplane makers, were temporarily in evidence, and an impetus was given to research into the conditions modifying efficient performance of labour. Deficient diet caused scurvy, especially in 'Iraq, and other "deficiency diseases" came into evidence, especially in central Europe. Cerebrospinal ("spotted") fever became for the first time epidemic in Great Britain (*see* SPINAL MENINGITIS); as a result of the depressing conditions and the lowered bodily resistance, influenza (*q.v.*) became pandemic all over the world in 1918–9; and a fatal form of infective heart disease (*endocarditis lenta*) became much more frequent in discharged soldiers. A form of infective jaundice (*spirochaetosis icterohaemorrhagica*), formerly known as Weil's disease, became prevalent in Flanders, and its true nature, namely, an infection with an animal microbe, akin to that of yellow fever (*q.v.*) (*Leptospira icteroides*), was found in Europe to be identical with that described in Japan in 1914. Paratyphoid fevers (*see* INFECTIOUS FEVERS) A and B, though of course known before, became much more familiar during and after the War, and it may be noted that the distinction between the forms of enteric fever known as typhoid and paratyphoid was not recognised in the Boer War (1899–1902), when the disease exacted a relatively heavier toll than in the World War, when the troops were eventually extensively protected by T.A.B. vaccination. Dysentery (*q.v.*), as in past wars, became prominent, as did malaria (*q.v.*) in the eastern areas of the campaign. The influence of a Sanitary Corps in the prevention of disease among the Allied Armies was a noticeable feature (*see* MEDICAL SERVICE, ARMY). Much progress has also been made in the prevention of tropical diseases (*see* THERAPEUTICS and TROPICAL MEDICINE).

Mental Diseases.—The War provided a tremendous field for the observation of the mental perturbations commonly designated as "shell shock," due to the psychical effects of long-continued bombardment, mental strain and anxiety, repression or the active forgetting of terrifying experiences, and of fear. Incidentally it gave an opportunity for testing the opinion of the more advanced followers of Sigmund Freud of Vienna, who, on the assumption that the sexual instinct is stronger than those of self-preservation and of the herd, have increasingly tended to refer mental symptons akin to those of shell shock to the conflict resulting when some sexual experience had, in obedience to the conventional influences, been repressed and thus removed out of the zone of consciousness. The value of Freud's contribution to morbid psychology (*see* PSYCHO-ANALYSIS) in the conception of mental conflict resulting from the active forgetting or repression of unpleasant experiences is undoubted, but to refer them mainly to sexual causes was shown by war experience to be too narrow a view, and the treatment by psycho-analysis and interpretation of dreams, and the patient's "associations" aroused much opposition. On the other hand curative measures on psycho-therapeutic lines, such as sympathetic analysis, re-education and occupational therapy, met with success and approval (*see* PSYCHIATRY, PSYCHOSES, PSYCHOTHERAPY).

Orthopaedic Surgery (*q.v.*).—Orthopaedic surgery also made great advances as the result of the numerous cases of injury during the War, and remedial gymnastics and exercises have thus been of great use in furthering recovery in such cases.

Preventive Medicine (*q.v.*).—The prolongation of life and diminution of infant mortality in Great Britain have both improved by about 50% in the last half century, and in the United States of America the average age at death has advanced from 40 in 1855 to 58 years at the present time. This has coincided with improved conditions of hygiene and environment, and has stimulated active measures in the prevention of disease—the ideal of medicine. The establishment in 1919 of the Ministry of Health in Great Britain was a far-seeing advance for the improvement of the national health and the prevention of disease (*see* THERAPEUTICS). In America regular periodic examination of healthy, or supposedly healthy, persons has been begun, and the statistical experience of life-assurance companies has already proved that this practice exerts a beneficial effect on the mortality of those adopting this course. The prevention of disease has been greatly assisted by the Rockefeller Foundation in New York, which has undertaken a world-wide campaign with this object on very broad lines through its International Health Board, its Division of Medical Education and its China Medical Board. In 1913 the Rockefeller Sanitary Commission, founded in 1909 for the eradication of hookworm disease (*q.v.*), was incorporated as the International Health Commission (called the International Health Board after 1916) of the then recently established Rockefeller Foundation, and since then has carried out campaigns against yellow fever (*q.v.*) in South America, which have practically exterminated it and incidentally led to Noguchi's discovery of the cause (*Leptospira icteroides*) of the disease, against malaria (*q.v.*) and tuberculosis (*q.v.*) (*see* also THERAPEUTICS). In connection with the National Insurance Act (1911) the Medical Research Committee (now Council) was created, and research workers have been financed and an enormous impetus given to the advancement of medicine and so to the diminution of disease.

Industrial Health.—The special conditions bearing on health in factories and industries, particularly the dangerous trades, have attracted specialised attention, particularly in America, where a School of Industrial Medicine has been instituted in connection with Harvard University.

Insanity.—The prevention of insanity by early treatment in psychiatric clinics, usually attached to general hospitals and often part of the neurological department, has been an important step in the prevention of mental disorder (*see* PSYCHIATRY). It is connected with the social service and after-care movements. In 1908 the American Council of Mental Hygiene was founded, in 1918 a similar council was started in Canada, in 1920 the French League of Mental Hygiene was inaugurated and in 1922 the British National Council for Mental Hygiene was established. This is evidence of the awakening interest in health of the public at large since the War, as is also shown by the Society for the Prevention of Venereal Disease, the League of Health and the British Empire Cancer Campaign.

Comparative Medicine.—The increase of experimental research has been followed by the study of comparative medicine and pathology, whereby human and veterinary medicine may mutually help and benefit each other; an Institute for research in the pathology of animal diseases and a professorship were established at Cambridge in 1923, and the study of experimental epidemics has been undertaken in laboratories at the Rockefeller Institute, New York, and at Manchester.

Statistical Methods.—Biological, anthropological and statistical methods are now being more formally utilised in medicine than in the past, and exact measurements and skilled calculations are being employed. An individual's constitution, or "the aggregate of hereditary characters, influenced more or less by environment, which determines his reaction to the stress of environment" (G. Draper), was present to the mind of Hippocrates and others, but the rise of bacteriology diverted attention from the internal to the external factors of disease. Anthropological measurements, formerly used for the recognition of the racial characters of mankind, have now been applied by Draper of New York to patients suffering from certain diseases, and the data thus obtained analysed by biometrical experts.

Applied Physiology.—Applied physiology was extensively developed and utilised during the War, for example in aviation, the transfusion treatment of surgical shock and haemorrhage, and the relief of gassing, and has advantageously been continued since on other lines, such as ventilation, the effects of sunlight and ultra-violet rays on bacteria, infections, general health and rickets (*see* PUBLIC HEALTH). Following on the established value of open-air treatment of tuberculosis and other infections, the beneficial influence on bodily resistance induced by sunlight (heliotherapy) and ultra-violet rays has been utilised. Heliotherapy (*q.v.*), practised for 20 years at Leysin by Rollier in surgical tuberculosis, has been adopted in Great Britain. Sunlight prevents and cures rickets, and its relation to the anti-rachitic vitamin D is an addition to knowledge, possibly of potential importance in connection with other "deficiency diseases." Ultra-violet rays act on a complex alcohol, cholesterol, present widely in the body and also in the skin, so as to confer on it the anti-rachitic action of the vitamin; they also raise the amount of calcium, iron, iodine and phosphorus in the blood, increase its bactericidal power and accelerate the healing of wounds. The tungsten-arc and mercuric-vapour arc lamps are employed to provide artificial ultra-violet rays. Diathermy or the application of a special form of intensive heat has been employed in cancer, pneumonia and other infections (*see* ELECTROTHERAPY).

Biochemistry.—Closely associated with applied physiology, of which it is really a part, *biochemistry* (*q.v.*) has developed out of physiological chemistry and has risen rapidly to an authoritative position. At Cambridge the Sir William Dunn trustees have built and equipped a fine institute and endowed the professorship held by Sir Gowland Hopkins, who has 40 advanced students carrying out research under his direction. The Rockefeller Foundation, New York, has provided similar laboratories at Oxford and University College, London.

Metabolism.—Biochemistry is specially concerned with the changes always going on in the body and described by the name metabolism. The basal metabolism means the average minimal chemical changes compatible with life taking place in the body during complete rest and when food is not being digested and absorbed, and corresponds with the minimal heat-production 18 hours after a meal of a mixed dietary—the working expenses, so to speak, of the resting body. This is estimated directly by measuring by respiratory calorimeters the heat evolved, or indirectly, and more easily in practice, by chemical analysis of the respiratory exchange, and has been shown to be remarkably constant in normal conditions. In disease the metabolic rate

may be altered; for example, in myxoedema it is lowered and all the vital processes are on a lower plane; whereas in fever and exophthalmic goitre it is accelerated. In the last-named disease the condition of the patient can be judged by the degree of increase in the metabolic rate. Knowledge of the chemical processes underlying metabolism is rapidly growing in exactness.

Vitamins.—The recognition of the *accessory food factors* or *vitamins* (*q.v.*) has opened a new chapter in nutrition and in the causation and prevention of disease. They are present in food in minute quantities, which greatly contrast with their power, and are essential for health, growth, especially of bone and teeth, and in other ways. New knowledge of the effects of their absence and of the (deficiency) diseases thus caused has accumulated, but more may be anticipated. The vitamins each have their special actions; one prevents scurvy (anti-scorbutic), others rickets (anti-rachitic or vitamin D), beri-beri or polyneuritis (anti-neuritic), and recently, it would appear, one is essential for normal reproduction, the absence of which, at least in female rats, produces sterility. Starvation, partial or complete, and an unbalanced diet entail a corresponding degree of avitaminosis and deficiency disease; war or famine oedema, which resembles the " wet " form of beri-beri, has been ascribed to a diet largely composed of cereal and deficient in protein food.

Blood-Chemistry.—From improved technique chemical examination of the blood for non-protein nitrogen (in kidney disease), sugar and gases, cholesterol, calcium, phosphates, chlorides and bilirubin has become a method of clinical laboratory routine and essential for correct diagnosis and treatment. Much work has been done on the hydrogen ion concentration of the blood and the conditions of (1) acidosis, or diminution in the alkali reserve of the blood, which occurs in two forms, ketosis, as in diabetes mellitus, and another due to retention of phosphates, as in renal disease, and (2) of alkalosis or alkalaemia in which the alkalinity of the blood is increased, as in forced breathing when carbonic acid gas is removed in unusually large quantities from the lungs. Alkalosis has, like a fall in the calcium salts and the poisonous effect of guanidine, been thought to cause a convulsive state—tetany, which forms part of the condition called spasmophilia seen in children.

Bacteriology (*q.v.*) has revealed the organism responsible for a number of diseases and so opened the way to specific treatment and the prevention of the infection. In the case of scarlet fever (*see* INFECTIOUS FEVERS), ascribed to haemolytic streptococci, G. F. and G. H. Dick have elaborated a test (the Dick test), analogous to the Schick test in diphtheria, whereby those susceptible to the disease can be detected and so artificially protected against it by an antitoxin. The recognition of tularaemia (due to a cocco-bacillus), a disease of rodents and transmitted to man by the bite of the horse fly, and of melioidosis also a disease of rodents and due to the *Bacterium whitmori*, in which the exact method of its transmission to man is uncertain, bear on the desirability of the closer correlation of the human with veterinary medicine. Invisible viruses or ultra-microscopic organisms, also called filter-passers (*see* FILTER-PASSING MICROBES), because they are so minute that they pass through the fine pores of a Chamberland or other filter, have attracted much attention and many diseases in man and animals are with a fair degree of certainty or probability ascribed to their agency.

Cancer.—The outstanding discovery of the ultra-microscopic organism of cancer (*q.v.*), which is active only in the presence of a " specific factor," by W. E. Gye and J. E. Barnard, opens possibilities of cure and prevention, for which the medical world has been at work for many years.

Bacteriophage.—D'Hérelle described a phenomenon, previously noted by Twort in 1915, often known by D'Hérelle's name, which he interpreted as the existence of an ultra-microscopic virus which lives as a parasite upon living bacteria and leads to their destruction and solution. The general opinion about the active substance responsible for these changes in bacterial cultures, and called by D'Hérelle the *microbe bacteriophage*, is that it is not an ultra-microscopic virus, but an enzyme or ferment produced by the undoubted bacteria themselves.

Protozoan infections (*see* PROTOZOOLOGY) are the cause of a number of diseases, such as yellow fever (*Leptospira icteroides*), a form of infective jaundice (*Spirochaeta icterohaemorrhagica*), rat-bite fever (*Spirochaeta morsus-muris*), and seven-day fever in Japan (*Leptospira hebdomadis*), and probably sandfly fever (*q.v.*) (a leptospira resembling that of yellow fever). Thus their prevention and the employment of curative antitoxins has been rendered possible.

Immunity (*q.v.*).—After a fever the individual usually becomes immune and protected against another attack, this is acquired immunity; the blood of such a person contains antibodies which antagonise the cause of that disease, and advantage has been taken of this to inject the blood serum of patients convalescent from measles into persons who have not had the disease so as to render them immune.

Anaphylaxis.—The reverse of immunity is hypersensitiveness (anaphylaxis, allergy) which is shown by idiosyncrasies and forms the underlying factor in asthma and other diseases spoken of as " toxic idiopathies; " the substances responsible for the symptoms can be detected by skin tests and the appropriate treatment thus employed. Protein shock therapy is also employed for asthma and chronic arthritis. The importance of " focal infection " such as dental disease (*see* DENTISTRY), is now much more fully recognised (*see* THERAPEUTICS).

Exact studies upon the chemical activities of bacteria now in progress are beginning to throw light on the actions of toxins and the chemical factors involved in immunity reactions.

Radiology (*q.v.*).—In radiology there has been a steady advance in the methods of diagnosis and treatment; technique has been elaborated and special methods have been introduced. Dyes opaque to X-rays have been employed in various directions; thus lipiodol has been injected into the bronchial tubes to demonstrate dilatation of their lumen, into the spinal column to show the position of tumours, and even into the pregnant uterus to detect pregnancy. The condition of the gall bladder and the presence of gall stones can be made evident by organic compounds of iodine and bromine (tetra-iodo-phenol-phthalein and tetra-brom-phenol-phthalein), which after being taken by the mouth are excreted in the bile and show up under X-rays (cholecystography). Injection of air into the peritoneal cavity enables a clearer X-ray picture of the abdominal viscera to be obtained. The skiagrams of the jaws, showing the presence or absence of infection of the apices of the teeth and of the skull, showing the condition of the sella turcica, have facilitated the detection of focal sepsis and of pituitary disease respectively. The improvement of technique has made advances in treatment possible. By intensive X-ray exposures, following the Erlangen practice, the remedial therapy of deep-seated malignant growths has been pursued. The radium treatment of cancer in positions where the radium (*q.v.*) can be brought into close contact with the growth, is now carried out with increasing frequency, and team work in this treatment of cancer of the uterus has been adopted in a number of hospitals. Side by side with advances in treatment the effect of X-rays on the tissue cells has been investigated experimentally; the results have a very definite bearing on the methods and dosage employed in treatment, for the destructive changes induced in the cells may give rise to grave symptoms and even death. It appears that the action of X-rays may set up secondary ultra-violet radiations in the tissues and so cause severe changes.

Diseases of Function.—Functional disorder and the investigation of the early stages of disease, before the physical signs of gross structural changes appear, have attracted increasing attention and are intimately wrapped up with the ideal of medical science, the prevention of disease, proverbially a higher aim than its cure. The first manifestation of disease is commonly disorder of function, which shows itself by symptoms unaccompanied by any structural change. Clinical observation was specially directed to the detection of the earliest signs of disease by the late Sir James Mackenzie, who in 1919 started team work in this direction at the St. Andrews Institute for Clinical Research, where laboratory tests were fully utilised as an aid to the careful

analysis of the patient's symptoms in an intense search for a real understanding of the familiar manifestations of undue fatigue, malaise, shortness of breath on exertion and pain. Tests for disorder of function—some physical, as in disorders of the circulatory and respiratory organs, others chemical, such as examination of the blood and the ability of the organ to excrete coloured dyes, for example, phenol-sulphone-phthalein, as in disease of the kidney and the liver, others psychological, as in nervous disorder—have recently been much elaborated and multiplied, and bid fair to facilitate more accurate and early diagnosis and treatment on scientific lines.

Psychology (*q.v.*).—Experimental psychology, once regarded as an academic pursuit, has been the means of great economic saving in industry, and the results of research work and tests have led to the introduction of rest pauses and other modifications, with the result of an increased output of work on the one hand and benefit to the worker on the other. The Industrial Fatigue Research Board was set up during the War, and The National Institute of Industrial Psychology, established in Great Britain after the War, ensures continued practical guidance for employers and employed (*see* INDUSTRIAL PSYCHOLOGY).

Endocrinology (*q.v.*). *Ductless Glands.*—The part played by the ductless or endocrine glands in the production of disease has attracted increasing discussion, especially on the questions (1) of the endocrine balance, meaning thereby that when one gland is disordered the equilibrium which normally exists between them as a whole is upset, and (2) of the effects of disease of more than one of these glands—pluriglandular disorder. This last problem has on the one hand, from the difficulty of positive proof, aroused scepticism as to its existence, and on the other hand stimulated exploitation of commercial preparations of combined glandular extracts, the activity of which, as regards some of the constituents, is open to serious doubt. The outstanding advance in the medicinal use of endocrine preparations, and indeed in therapeutics generally, is the introduction of insulin (*q.v.*) for the treatment of diabetes mellitus (*q.v.*) (*see* THERAPEUTICS).

The use of the endocrine preparations proved to be active is passing out of the qualitative stage into the further one in which they are being so standardised that the proper dose can be administered; this has been done for insulin, adrenalin, thyroid and parathyroid extracts. The interstitial cells of the testis (" interstitial gland ") has attracted much research in connection with its influence on the secondary sex characters and in insanity. Experimental ligature of the duct of the testis (vasectomy) increases the prominence of the interstitial gland and is followed by rejuvenation (Steinach), and with this object the operation has been often performed on men, as has grafting of testes of men or chimpanzees (Voronoff) (*see* REJUVENATION).

Cardiology and Circulatory Organs.—The work of the late Sir James Mackenzie and Sir Thomas Lewis has so revolutionised our knowledge of the heart that there is a new cardiology (*see* HEART, DISEASES OF). By the electrocardiograph, which is specially valuable in showing the condition of the heart muscle, Lewis showed that the extreme irregularity of the heart in cardiac failure, called by Mackenzie nodal rhythm, is due to auricular fibrillation, a circus movement instead of the normal contraction; it is in this condition that digitalis is of value. By means of the graphic methods the irregularities of the heart have been classified.

Angina Pectoris.—Cardiac murmurs have been shown not necessarily to be of grave importance, and much work has been done on angina pectoris. The symptoms—status anginosa—of sudden obstruction of the coronary arteries which supply the heart have been defined, and the cause of angina pectoris has been referred to the failure of the heart muscle (Mackenzie), and to disease of the first part of the aorta (Allbutt); in accordance with the last view operative division or removal of its nerves has been practised and found to relieve the pain, but not otherwise to affect the disease. Bullets embedded in the heart-wall have been removed, and a contracted (mitral) valve has been remedied by surgical measures (*see* HEART AND LUNG SURGERY).

Blood-Pressure.—The existence of high blood-pressure without kidney disease or hyperpiesia (Allbutt) has been established, and it has been suggested that table salt and, probably with more reason, guanidine raise, and that hepatic extract lowers blood-pressure. The state of the capillaries—microscopic vessels—their power to contract, and their influence on blood-pressure have been investigated and much new knowledge has been acquired. The prevention of rheumatic heart disease and the responsibility of tonsils and other sites of focal infection have received considerable attention both in Great Britain and in America.

Bronchoscopy.—In diseases of the lungs the trial of new methods of treatment has gone on, such as specific or chemical remedies, and the production of artificial pneumothorax (*q.v.*) (*see* THERAPEUTICS). As the presence of adhesions inside the chest interferes with the production of a curative pneumothorax, they have been divided by a cautery, the process being watched through a hollow tube, illuminated by electric light, passed into the chest (Jacobaeus' thoracoscopy). Bronchoscopy for the detection and removal of foreign bodies from the air-passages has, in the hands of Chevalier Jackson, become a fine art; the importance of an early removal of these bodies before they have set up destructive changes in the lungs, which in the past have proved obscurely fatal, has now been fully recognised. In the abdomen a method, laparoscopy or coelioscopy, by which the contents can be seen by an arrangement similar to that of thoracoscopy, has been employed; but neither of these difficult methods is likely to come into general use.

Fractional Test Meals.—The adoption of fractional test meals as a more exact method of determining the constitution and variations of the constituents of the gastric contents has, thanks to Rehfuss, superseded the single examination made one hour after a test meal. Absence of hydrochloric acid, a normal constituent of the gastric juice, has been shown to favour the onset of pernicious anaemia (*see* ANAEMIA). Aspiration of the bile by a duodenal tube, after Oddi's sphincter, which closes the lower end of the common bile duct, has been relaxed by a spray of magnesium sulphate, enables a microscopical, chemical and bacteriological examination of the bile to be made, and also does good by drainage in cases of infection and inflammation of the biliary tract.

Tests for Hepatic Efficiency.—The search for tests to estimate the functional capacity, or the way the liver is doing its work, has been carried on with energy, and a number of tests for the individual functions have been introduced; but no one test for them as a whole is satisfactory, and another difficulty is that the liver, like the heart and other organs, has a great reserve, so that it can, although much damaged, discharge its functions so well that tests do not reveal any failure of the compensated condition; this is especially true in chronic disease. By means of a blood test—the Hijmans van den Bergh reaction—obstructive jaundice can be distinguished from other forms.

Neurology.—The physiology and pathology of the nervous system has steadily progressed; the researches into the factors presiding over equilibrium and posture have yielded valuable information; disease of what is called the extra-pyramidal system has attracted attention; acute infections of the nervous system, acute poliomyelitis, encephalitis epidemica (" sleeping sickness ") and cerebrospinal fever were more prominent in the conditions of war than before; much valuable scientific research into the method of actions of poisons on the nervous system has been carried out.

Panel Practice.—The conditions of medical practice in Great Britain were profoundly modified by the introduction, as the result of Mr. Lloyd George's National Insurance Act (1911), of the " Panel system," whereby 15,000,000 insured persons are now looked after by practitioners paid at a yearly rate of a sum which has averaged about ten shillings a year, paid partly by insurance contributions and partly by the state; this enormous undertaking is part of National Insurance and is under the control of the Ministry of Health. No one medical man is now allowed to have more than 3,500 persons on his panel. At the time of its initiation the panel system met with great opposition

from the medical profession, but this collapsed, and on the whole the system works well, and is certainly an improvement on the old system of clubs. (*See* HEALTH INSURANCE, MEDICAL ASPECTS.)

Diplomas in Special Subjects.—The enormous advances in medicine have made specialism necessary and inevitable, and as evidence of the general recognition of this need diplomas in these special subjects are granted by the universities and licensing bodies. The General Medical Council in 1922 revised the regulations for one of the oldest diplomas, that of Public Health (D. P.H.), and ordained that two years, instead of one year as formerly, must elapse from the date of a candidate's obtaining a registrable qualification in medicine, surgery and midwifery before his admission to Part II. of the examination for diplomas in sanitary science, public health or state medicine. There are diplomas in psychological medicine, in tropical medicine and hygiene, in ophthalmic medicine and surgery and in laryngology and otology, and since the War the universities of Cambridge and Liverpool have given diplomas in radiology. (*See* MEDICAL EDUCATION.)

Group Medicine.—The specialisation of medicine and the elaboration of technique prevent any one man from being master of the whole field of medicine, and accordingly there has been a tendency for men to combine in team work or group medicine, especially in America. A group of men expert in their own lines may work together or under a general physician or surgeon who, in consultation with them, correlates the collected evidence and comes to a final decision on the whole matter. These diagnostic clinics, which are exemplified by the Mayo Clinic, Rochester, Minn., are commoner in America than in Great Britain. They should have the advantage, from the patient's point of view, of providing for a fixed inclusive fee all the special examinations that may be necessary at a lower cost than in ordinary practice would be required for such a number of tests.

BIBLIOGRAPHY.—*See* Bibliographies to the articles referred to in the text; also Sir T. C. Allbutt and Sir H. D. Rolleston (Editors), *A System of Medicine*, 9 vol., various dates. (H. RO.)

MEDICINE, PRE-SCIENTIFIC (*see* 18.41).—The aim of primitive medicine, like that of primitive religion of which it at first formed an inseparable part, was to safeguard life, using the same means to attain their common end.

Main Causes of Disease.—Modern investigations reveal that savage races still attribute disease to three main causes:—

(*a*) The projection of some foreign substance into the body;
(*b*) The abstraction of something from the body;
(*c*) A sympathetic process operating on some part of the body or on some object that has been in contact with the victim.

As the supposed results are ascribed to the agency of men or spirits, their machinations have to be circumvented or their wrath diverted. Many practices illustrate these points. Thus suction is a common ceremony, performed upon the sick by many peoples, to extract the offending object. To discover the source of the evil, divination is employed. In many cases the native conception of the nature of the lesion associated with disease is very concrete. Thus certain Australian tribes look upon it as due to the abstraction of adrenal fat. In Melanesia it is held that removal of part of the soul, due to spirits, is the cause of many symptoms. The treatment of disease by savage folk can only be understood in reference to their pathological theory.

Trephining.—Among the most remarkable of the forms of treatment is trephining, which was performed from a very early date with stone implements before the introduction of metals. A decompressive trephining for epilepsy or other disorders of the brain, real or supposed, is still practised among the Aymaras of Bolivia and the Guichuas of Peru. The beliefs at the back of the process are still not clear.

Primitive Surgery.—The surgical measures of uncivilised man are not always as inadequate as might be supposed. Some savage folk have developed more than a rudimentary idea of bone-setting. Moss, fresh leaves, ashes or natural balsams are used to dress wounds, which, when poisoned, are treated by sucking or cauterisation. Among surgical instruments we note horns for cupping, a sharp thorn for opening an abscess, saws of stone and bone for amputations and special instruments for letting blood. The latter operation is very widely practised.

The Medicine Man.—The position of the medicine man is doubtless very similar among savages of to-day to what it was with early races. He exhibits a gradual differentiation from the priest. In Indonesia the medicine man is now quite distinct from the priest, but in Polynesia and North America the relationship is often so close that the two may be indistinguishable.

Survivals.—The remains of the savage's mode of treating disease survive with peculiar persistence even in centres of Western civilisation. Belief in magic and in the efficacy of charms still plays a considerable part in the attempted prevention and cure of many ailments in Europe and America. Thus, for instance, the mountaineers of southwestern Virginia and eastern Tennessee believe that an iron ring, worn on the third finger of the left hand, will drive away rheumatism. This practice shows a persistence of the very ancient belief in magical properties of the third finger and of iron. A modern English herb-doctor will peel the bark of an elm *downwards* if a cold has to be drawn down from the head, and peel it *upwards* if it has to be drawn up from the chest. Warts are rubbed at regular intervals with a gold ring. The persistence of colour as a significant factor in folk-medicine is shown by the use of red flannel as a bandage for sore throats and whooping cough, a case of sympathetic connection between the redness of inflammation and the redness of material. Finsen's red-light treatment to prevent pitting in smallpox has been said to trace back to the same folk-custom, employed in the case of the son of Edward II. In Ireland homeopathic doctors give for jaundice yellow medicines, such as saffron, turmeric, sulphur, even yellow soap.

Egyptian Medicine.—Of the pre-scientific systems of medicine of the ancient civilisations, the best known is that of Egypt. Ancient Egyptian medical treatment, chiefly magical, included a large number of traditional practices which had survived from very early times. For long the art of healing was in the hands of the temple priests. These men formed an organised body with a sort of physician-in-chief at its head. They concentrated on hygiene and diet, advising abstention from many vegetable foods, especially beans and onions, the latter a supposed aphrodisiac which also provokes thirst and tears, from mutton and pork, from certain milks and from salt which produces drunkenness and gluttony. On three days out of every 30, emetics or clysters were to be taken. Among hygienic measures, dwelling houses were to be kept clean and fumigated with resin and myrrh, the body was to be frequently bathed and suitably clothed and gymnastic exercises were recommended. Ointments, potions and poultices were in use. Among drugs were honey, incense, salt, cedar oil, sycamore bark, nitre, sulphate of copper, alum, the brains, liver, heart and blood of various animals, stag's horn and oil of camomile for frictions. Fever patients were wrapped in woollen stuffs to promote perspiration.

Ebers Papyrus.—The Ebers papyrus mentions a number of symptoms and diseases (some difficult to identify) such as intestinal worms, inflammation in the region of the anus, haemorrhoids, disorders at the pit of the stomach, fluttering of the heart, pains in the head, urinary affections, dyspepsia, angina and about 30 different affections of the eyes. Among the remedies are blood-letting, sudorifics, diuretics, drugs to produce sneezing, copper salts and oxymel of squills to produce vomiting, castor oil given in beer as an aperient and pomegranate seeds for the expulsion of worms.

Edwin Smith Papyrus.—The Edwin Smith papyrus, not yet fully described, seems to suggest skill in surgery in advance of that of any of the contemporaries of ancient Egypt. It suggests, too, rather more anatomical knowledge than had hitherto been considered likely among the Egyptians.

Statues of Healing.—On the purely magical level were the Statues of Healing. These were placed in rectangular basins upon which texts and images were carved. The water that flowed through the basins acquired magical properties through contact with the statues and thus became curative for all reptile bites. The water, either taken internally or used as a lotion, was all-sufficient; it was even unnecessary to repeat the magic formulae carved on the garments of the statue or on the basins.

These remedies were therefore more especially used by the illiterate. Statues of *Horus on the Crocodiles* were the most widely-spread and most efficacious instruments of protection against and cure for the bites of scorpions, serpents and crocodiles, their use probably going back beyond the XIX Dynasty.

Coptic Medicine.—During the last few years our knowledge of the medicine of the Copts has been considerably extended by the publication of a long and important text and by several minor finds. The Coptic material exhibits a rapid recession of the ancient Egyptian element. Coptic *materia medica* reveals unmistakable Greek and Arabic influences and magic is of secondary importance. The mouse, goat, wolf, hyaena, and other animals are all mentioned in prescriptions, but the greater number of medicaments are of vegetable or mineral origin and include, as in all early writings, emetics and purgatives. Eye-troubles were always rife in Egypt. It is thus not remarkable that about half of the 237 prescriptions contained in the Cairo papyrus (c. 9th century A.D.) deal with these conditions. For the majority of the ophthalmic remedies there is no indication of the condition for which they were applied. There are, however, 13 for cataract, 18 for dimness of vision, three each for abscesses and inflammation, 13 for trachoma and two for amauroses. Among the skin and scalp affections prescribed for are melanoderma, herpes, itch and lichen. We read of remedies for abscesses, boils, sores, cuts and bites, ulcers, gangrene sores and swellings. Cummin ground with moistened rue is taken for three days for fever. Opium, calf's fat and milk melted together and applied warm cures earache with such rapidity that the physician is advised to collect his fee in advance! A mixture of red and yellow vitriol and alum is recommended for toothache. Two formulae for the extraction of teeth are of interest, for though dental caries and alveolar abscesses have been found in mummies of the Pharaonic period there is no evidence of the extraction of teeth at that early time. Considerable knowledge of and skill in surgery may be gathered from a Coptic surgical instrument case in the Cairo Museum, the space allotted for knives and scalpels showing that operations were no simple affair.

Mesopotamian Medicine.—The civilisation of the valley of the Euphrates and the Tigris had reached an advanced degree of development about 4,000 B.C. Babylonian medicine was purely empirical. It occupied, however, a less important rôle in the art of healing than magic. The liver was regarded as the central organ for the blood, the true life principle, which was divided into two kinds, blood of the day and blood of the night. Disease was a demon that entered the body and must be expelled. The pharmacopoeia made use of mineral, vegetable and animal substances. Among remedial agents were honey and syrup of dates, herbs, blood-letting, use of cups for drawing blood to the surface of the body, cold shower and warm baths, clysters, various salves, friction with oil. An ointment composed of plants cooked in grease, or a decoction of copper-ore in beer, was used in cases of ophthalmia, a very common complaint in Mesopotamia also.

Assyrian Medicine.—The more northern Assyrian medicine had the same foundations and followed the same methods as the southern Babylonian. Therapy was exorcism and incantation was prophylaxis, although the accounts of surgical procedure in the Code of Hammurabi imply an elementary knowledge of anatomy. We gather hints, however, from the medical texts that the physicians of Nineveh may have been less ignorant than has been supposed. Some 250 vegetable drugs and 120 mineral drugs were known, as well as 180 derived from other unidentified sources, making a total of 550. The names of these drugs occur many thousands of times in the medical texts. To the above must be added remedies consisting of various alcohols, fats, oils, honey, wax and various kinds of milk. Among the names most frequently met with in the texts are: pine and fir turpentines, rose, cedar, darnel, marigold, heliotrope, asafoetida, tamarisk, liquidambar, storax, mustard, galbanum, henbane, lupin, myrrh, arnoglosson, castor oil plant, mint, tragacanth, fennel, cypress, nightshade, millet, poppy, fig, laurel, pomegranate, wheat flour and mandrake. The mandrake seems to have entered medical magic from Babylonian sources.

Persian Medicine.—Iranian medicine became laicised in Zoroaster's time when the "mages" were superseded by the physicians whose business was to restore health. It bears points of resemblance to ancient Hebrew medicine which may be dependent on it. Treatment of the sick consisted of incantations, vegetable drugs and the use of the knife. Hygiene was one of Zoroaster's main preoccupations: "A healthy man is a moral man."

Indian Medicine.—Hindu conceptions concerning the causes of disease were very confused. The confusion may be the result of the mixed origin of Indian pathology. The earlier Indian physicians utilised the senses of taste and smell as well as inspection, palpation and auscultation for purposes of diagnosis. Hygiene and diet played an important part in the life of the people. The pharmacopoeia of India is very rich, the great majority of drugs belonging to the vegetable kingdom. Charaka (pre-Buddhistic period) knew of 500 plants that possessed remedial virtues, Susruta mentions 760, of which cinnamon, pepper, cardamons, spices and sugar were native. He also gives lists of drugs classed according to their action into lists of cerebral sedatives, emetics, purgatives, anodynes, etc. Diabetes mellitus was first described by Indian physicians who noticed that flies and other insects were attracted to the urine of patients suffering from this malady.

In surgery the ancient Hindus were probably superior to any of their oriental neighbours. Susruta mentions eight kinds of surgical operations. Fourteen different kinds of surgical dressings were in use; cotton, woollen, linen and silk for bandages. Special splints of withes of bamboo were employed in cases of fracture and dislocation. These were later adopted in the British army as the "patent rattan cane splint." It is regrettable that it continues impossible to assign dates to ancient Indian medical documents with any degree of confidence.

Deteriorated Remains of Scientific Medicine.—It has become increasingly evident that the culture of many savage and semi-savage tribes is in fact little but decayed civilisation. This is particularly true in the department of medicine. Researches, for instance, on Anglo-Saxon medicine have shown it to be little but the system of the classical peoples corrupted, deteriorated and misunderstood. In view of this "derivative" character of much so-called "primitive" medicine, a reinvestigation of the medical customs of savage peoples is demanded.

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MEDINA (*see* 18.64).—Before the World War, Medina was less known to Europeans than Mecca, although it was described by the earlier travellers, Burckhardt and Burton, and by Wavell, who visited it in 1908. Before the World War the normal resident population was estimated at 40,000, of whom a large proportion were aliens who had settled after pilgrimage. The Turks deported about three-quarters of the inhabitants during the blockade, and, allowing for further decrease by disease, the population in 1920 was well under 10,000. Much new information regarding existing conditions in the city was obtained as a result of the War operations. The dimensions of the city were overestimated by earlier writers, the walls actually measuring not more than $1\frac{1}{2}$ m. in circumference, with the longest diameter a little over $\frac{1}{2}$ m. east and west. The Hejāz railway has its terminal station outside the city walls at the Bab el 'Ambari, the gate on the southwest through which runs the road to Yenbo'. There are normally three trains weekly from Damascus, and the journey takes $5\frac{1}{2}$ days. During the War a branch was carried from the main line, through a breach in the walls on the northwest side, to the outskirts of the *Haram* or Great Mosque, which was used as a munition store and was intended to serve as an inner citadel in case of siege.

At the outbreak of the revolt in June 1916 the Arabs, unable to take the city by assault, withdrew and began a blockade, which —as they were unwilling to bombard the city for fear of damage to the holy places and refused to cut the water supply conduit— lasted until the Turks surrendered the city in Jan. 1919. In 1917 Fakhri Pasha, commander of the garrison, devised a scheme for the rebuilding and modernisation of Medina, but all that happened was the destruction of a great number of houses for the sake of the beams and woodwork to feed the railway locomotives. Extensive palm plantations outside the walls, east and northeast, were also ravaged for the same purpose. Large palm gardens which formerly occupied much space within the walls were in great part built over, and the Barrel Manakha, or central open space, was encroached upon. Sherif Ali, son of King Husein, became emir of Medina in 1925. In the later part of that year the city was invested by Wahhabi troops.

MEDITERRANEAN SEA (*see* 18.67).—In 1910 the lands which bound the southern and eastern parts of the Eastern basin of the Mediterranean were under real or nominal Turkish control. In theory, that is to say, the Sultan of Turkey was suzerain of the area extending from the frontier of French Tunisia, that is from the Gulf of Gabes, to the Gulf of Alexandretta, and owned also the island of Cyprus. At the present time Tripoli, which abuts on Tunisia, is Italian; Egypt forms an independent kingdom; the mandated territories of Palestine and Syria are attached to Britain and France respectively, and Cyprus has been annexed to Britain. From the whole of this long stretch, therefore, the Turk is now excluded.

Political Changes.—In the northern part of the Eastern basin and in its connected subsidiary seas, conditions were more complicated. The whole of Asia Minor was and remained politically Turkish: from the ethnic and economic standpoint indeed it was more definitely Turkish in 1926 than it was in 1910. But the changes in the European littoral of the Aegean Sea were great. In 1910 Greece was but a small state, though at the same time Greeks were widely distributed around all the shores of the Aegean and within the adjacent lands and had great economic influence there. Crete was still Turkish, as was the whole of Thrace, together with the region vaguely called Macedonia: this meant that politically the Aegean was chiefly a Turkish sea. In 1926 Crete was Greek, and Turkey had also lost the whole of Macedonia and all but an eastern fragment of Thrace. In other words, Greece in 1926 included almost the whole of the European littoral of the Aegean, and to her previously existing ports had been added that of Salonika, which had acquired great significance. The interchange of populations between Greece and Turkey in 1923–4 meant further that the acquired area was in process of becoming ethnically more Greek than it had been in the past. On the other hand, Greek influence in western Asia Minor disappeared, and with it the port of Smyrna lost much of its former trade.

The changes on the Adriatic littoral and on the adjacent parts of the Ionian Sea had been great. In 1910 Turkey held in the Epirus area a frontage on the Ionian Sea and had also a wide window on the Adriatic. The extension of Greece to the north and the establishment of the independent State of Albania, were territorial changes which preceded the outbreak of the World War; but that War resulted in others of even greater importance. Prior to its outbreak, Austria-Hungary, which had annexed Bosnia-Herzegovina from Turkey in 1908, held the eastern coast of the Adriatic, from the edge of the very narrow strip which was Montenegrin to beyond the Isonzo. The Peace Treaties gave the greater part of the littoral to the Serb-Croat-Slovene State, and the smaller part to Italy, and left a cause of discord between the two in regard to the fate of the port of Fiume.

In the Western basin, save for agreements in the case of Morocco, there were no territorial changes: a certain amount of political equilibrium had been reached there long prior to the period under consideration. On the other hand, the new position within continental Europe generally brought about by the War lead to fresh developments within the Mediterranean zone. France, Italy and, to a minor extent, Spain made definite attempts to develop their trans-Mediterranean possessions, and to establish themselves more firmly on the shores of that sea.

Since Spanish action was limited to a coastal belt in Morocco, it may be briefly dismissed. In 1912, the year in which the French protectorate was accepted by the Sultan of Morocco, France and Spain reached an agreement as to the limits of their respective zones within that country. Spanish attempts to make occupation effective in their own zone were probably influenced primarily by the French advance: other influences were the loss of the remnants of the former colonial empire of Spain and the continuous emigration to Algeria, which had acquired a large

Spanish element in its population. The convention of 1923 between Great Britain, Spain and France in regard to Tangier, then placed under a régime of permanent neutrality, indicated the growing importance of France in the Western basin of the Mediterranean. The refusal of Italy to recognise the agreement, on the ground that she was not represented at the convention was similarly an indication that that State, now freed from anxiety as regards her northeastern frontier, was directing her policy more and more definitely towards Mediterranean affairs.

French Policy in the West.—If the developments in Morocco were the chief events in the West since 1910, yet other signs were not wanting of the new orientation of French policy there. As contrasted with Italy and even with Spain, there is in France no surplus population seeking new lands for settlement. Thus the fact that the North African territories, particularly Algeria, give opportunities for European colonisation is not of much direct importance to that country. On the other hand, there is great need of man-power, particularly for the army. Though the territories of the Mediterranean littoral are not densely peopled, they do form a recruiting ground, and Algeria, Tunisia and Morocco all furnish divisions to the French Army. But these lands are but the margin of a vast area which, interrupted politically only by smaller *enclaves*, and physically by the Sahara desert, now extends to the Gulf of Guinea and, further eastward, to far beyond the equator. Parts of this area contain a virile coloured population, whose members make good soldiers. In this connection it may be noted that Senegalese regiments have formed a part of the French Army since 1911, and that in 1919 the native element in the army was greatly increased.

The bearing of these facts is twofold. In the first place it is essential that facilities for transverse traffic between the French and the North African coast opposite should exist in peace, and that so far as possible the safety of the routes should be assured in time of war. Secondly, schemes are in contemplation for overcoming the obstacle presented by the Sahara, in such a way as to ensure easy land communication between the littoral possessions and those further south, in order that the two may develop in combination. A railway connecting French West Africa directly to the Mediterranean coast would have great strategic importance in time of war, while the feasibility of motor communication had already been demonstrated. These possibilities increase the significance of the Mediterranean ports. Bizerta, Algiers and Oran are already important naval stations and submarine bases, and the French are making great efforts to develop and strengthen all the ports on this littoral, as centres of trans-Mediterranean traffic. This emphasis on cross-routes is not only significant in itself, but is something entirely modern.

New Rôle of the Mediterranean.—Previously, as is well shown by the long-drawn-out row of British stations at Gibraltar, Malta and Aden, the Mediterranean was primarily of importance as a longitudinal thoroughfare. Up till the post-War period, between Malta and Aden, there was in Egypt a country under British influence. With the establishment of an independent kingdom there, and the changes just noted, it is obvious both that Great Britain's position in the Mediterranean has been weakened, and that a new set of traffic routes is being superimposed on the old. It may be added that if, as is sometimes stated, French withdrawal from Egypt in 1883 was due to the fear of renewed attack on the northeastern frontier of France, then French acceptance of the mandate in Syria is an indication that this reluctance to extend her extraterritorial commitments has ceased to exist under the new conditions.

Italian policy in the Mediterranean area since the War had been influenced by somewhat different motives. Italy has a steadily increasing population and the emigration laws in the United States tended to restrict one of the pre-War outlets for the surplus. Thus Italian policy was directed towards attempts to promote home industry and commerce in order to attract a part of the dense rural population from the land, and also to find new areas of possible settlement. The latter motive led to efforts to develop Tripoli, obtained from Turkey in 1912, while the former affected Italian policy in the eastern part of the Adriatic. By the acquisition of the peninsula of Istria, with the ports of Trieste, Pola and Fiume, and of Zara and the island of Lagosta, Italy obtained both complete protection for the eastern coast of the peninsula and opened up possibilities of notable commercial developments. The Italian advance meant that Austria and Hungary lost all outlets on the Adriatic, and thus had no direct access to the Mediterranean Sea.

The collapse of the former Ottoman empire resulted in the rise in the eastern Mediterranean of states which were either actually new, as are the Kingdom of Egypt, Yugoslavia and the much smaller State of Albania, or, as in the case of Turkey and Greece had undergone such radical modification—territorial, political and ethnical—as to be to all intents and purposes new. Such states were for the most part characterised by a strongly nationalistic spirit which retarded economic recovery from the effects of the War. The result was that the chief ports at first showed decay rather than advance. This was particularly true of Constantinople and Smyrna, and even Salonika, where the Yugoslav state had had a free zone since 1923, did not make notable progress. Despite their long Adriatic littoral also, the Yugoslavs were not able to develop an adequate outlet there. By an agreement reached with Italy in 1924 the port of Fiume became Italian and the adjacent one of Port Baross, Yugoslav. The friendly adjustment of this difficult question is probably an indication of future closer economic connection between the two Powers.

This summary account of conditions up to 1925 makes it clear that political developments, especially in the southern and eastern parts of the Mediterranean area, took place between 1910–25 with a rapidity all the more startling in view of the long antecedent period of complete or partial stagnation. But the apparent suddenness of the political and territorial changes was due to the fact that they were the consequences of cumulative economic changes which had been going on for a long period of time. In particular, the increased production of cereals for export in central and eastern Europe, and the discovery and working of oil-fields alike along the Carpathian border and in the Caspian region, gave to outlets to the eastern Mediterranean an importance which they did not possess in earlier times, and made readjustments inevitable. The Mediterranean Sea was no longer what the opening of the Suez Canal and the associated growth of European influence in the Far East had made it—primarily a thoroughfare for world commerce. It was becoming also an important outlet for the developing lands round its southern and eastern shores.

Present strategic conditions in the Mediterranean region are discussed in D. H. Cole's *Imperial Military Geography* (London, 1925). See also M. I. Newbigin, *Geographical Aspects of Balkan Problems* (London, 1915); I. Bowman, *The New World: Problems in Political Geography* (London, 1925). (M. N.)

MEHTA, SIR PHEROZESHAH MERWANJI (1845–1915), Indian municipal reformer, was the son of a Bombay merchant. Educated at the Elphinstone College, he was the first Parsee M.A. of Bombay University and coming to London to read at Lincoln's Inn was also the first Parsee to be called to the English Bar (1868). With Dadabhai Naoroji he founded the organisation which grew into the East India Association. Returning to Bombay he rapidly made a name as an advocate. Appointed in 1869 as Justice of the Peace, he served on the new Bombay Corporation from 1872 till his death. He also served for over 30 years on the Bombay legislature. For the last few months of his life he was vice-chancellor of Bombay University. Created a C.I.E. in 1894, he was advanced to the knighthood of the order 10 years later. He died in Bombay Nov. 5 1915.

See the political biography by H. P. Mody, *Sir Pherozeshah Mehta*, 2 vol. (1921). Much light is thrown on Mehta's services to his native city in *Rise and Growth of Bombay Municipal Government* (1913), by his most intimate co-worker, Sir Dinshah Edalji Wacha.

MEIEROVICS, ZIGFRIDS (1887–1925), Latvian statesman, was born Jan. 24 1887, the son of a country doctor in Courland, and was educated at the Riga Polytechnic. He first worked in an insurance company and afterwards in an agrarian bank.

This training gave him an insight into financial problems and prepared him for the prominent part he was to play in the stabilisation of Latvian currency. In Nov. 1918 he became the first foreign minister of independent Latvia and, as delegate to the Peace Conference, he secured Latvia's recognition and later succeeded in gaining her admission to the League of Nations. From 1918 until his death he held office almost continuously as foreign minister and was once prime minister. He was killed in a motor accident on Aug. 22 1925.

Shortly after this date a well-known student of the movement for independence in the Baltic States expressed the opinion that of all the leaders of that movement in the various states involved, Zigfrids Meierovics was at once the most statesmanlike and the most influential. He was a man gifted with an unusual power of looking ahead; and he was able to recognise the real problems facing the Baltic States in the years immediately following the World War with probably greater facility and clarity than any of his colleagues in leadership. One of the foundations of his foreign policy was the conviction that Estonia, Latvia and Lithuania possessed many interests in common and should therefore endeavour to co-operate for the common good of all three states. The confidence which he inspired in his own countrymen is abundantly proved by the insistence with which the latter kept him in office from 1918 onwards.

MEIGHEN, ARTHUR (1874–), Canadian statesman, was born at Anderson, in the county of Perth, Ontario, June 16 1874, the son of Joseph and Mary Meighen. He was educated at St. Mary's Collegiate Institute and at Toronto University, and became a barrister-at-law. He married in 1904 Jessie Isabel Cox, daughter of the late Charles Cox of Granby, Quebec. His political career began in 1908 when he was elected to the House of Commons as the Conservative member for Portage la Prairie in the province of Manitoba. His talent as a debater was at once recognised. In 1913 he became solicitor-general in the Government of Sir Robert Borden; and in Oct. 1917 secretary of state and minister of mines. Later he became minister of the interior. In 1918 he accompanied the Canadian Prime Minister to England to attend the Imperial Conference, and on Sir Robert Borden's retirement Mr. Meighen became Prime Minister and secretary of state for external affairs on July 10 1920. In June 1921 he attended the conference of prime ministers in London, where his representations were said to have had a notable effect upon the political groups in Canada. Mr. Meighen held the office of Prime Minister until the general elections in 1921, when the Conservative party was defeated; he then became the leader of the Opposition, and for four years was a vigourous opponent of the Liberal Government. He supported the disarmament resolution introduced by the Prime Minister, Mr. Mackenzie King.

The Military Service Act, under which conscription was enforced in 1917, was largely, in so far as its legal preparation was concerned, the work of Mr. Meighen, and the vigour with which he supported it in Parliament drew upon him the hostility of all those opposed to that measure. As the sentiment against conscription was especially strong in Quebec, the feeling against him in that province was intense, and prevented the policy of his party from receiving the due consideration of the electors. Mr. Meighen consistently repelled the personal attacks made upon him as the enemy of the French Canadians, but without much success. In the elections of 1925 the Conservatives, under the leadership of Mr. Meighen, were overwhelmingly victorious in Ontario and the maritime provinces, but with a practically solid Quebec against him it was impossible to obtain a majority, and the Government remained in the hands of the Liberals. In June 1926, on the resignation of Mr. Mackenzie King, Mr. Meighen took office as Premier, but his government was immediately defeated and a general election took place.

The adoption by the United States of protection, as well as the great industrial development of that country, placed Canada, in Mr. Meighen's view, at a disadvantage. He therefore strongly advocated protection for his own country, in order to prevent the United States from capturing the home markets. He was convinced also of the necessity for preserving the natural resources of Canada, particularly the almost unlimited water power so envied by the bordering states, as well as the products of the forests. He resisted all attempts made by the United States to secure for their territories electrical power generated from watercourses in Canada. Mr. Meighen made constant efforts to bring about a fusion of the diverse elements in the Canadian population. He was made a member of the Imperial privy council in Oct. 1920. (A. G. D.)

MELBOURNE, Victoria (*see* 18.90), the temporary seat of the Federal Govt. and the capital of Victoria, Australia, with a population of 816,800 (852,850 including suburbs), contains more than half the population of the whole State, and has grown with great rapidity. The formation of a Greater Melbourne council was decided upon in 1925. The city has been much improved in appearance by the planting of trees on the banks of the river and in the chief streets. There were 71½ m. of electric tramways in 1923, and the suburban railways have been electrified. In 1916 a mint for silver and bronze coins was established here. In 1924 it was decided to build a large temple in a commanding position in the city as an Australian War Memorial. In 1917 a Commonwealth Shipping Board, with its interstate headquarters at Melbourne, was set up to deal with all questions concerning shipping, but it was not altogether a success. Melbourne has a large trade, and 35% of the total wool export of Australia is dealt with in sales. Large sums have been spent on dredging and reclamation of land in the river and bay.

MÉLINE, FÉLIX JULES (1838–1925), French statesman (*see* 18.94), died in Paris Dec. 21 1925.

MELLON, ANDREW WILLIAM (1855–), American banker and public official, was born in Pittsburgh, Pa., March 24 1855. After graduating from the University of Pittsburgh, he entered the banking house of Thomas Mellon and Sons, and later became a partner. The business developed into three large institutions, the Mellon National Bank, the Union Trust Company and the Union Savings Bank, all of Pittsburgh. Mr. Mellon was elected president of the first mentioned in 1902, and was vice-president of the other two. He was interested in the development of the coal, coke and iron industry of Western Pennsylvania and was often associated in various enterprises with Henry C. Frick. He founded the town of Donora, Pa., and established a large steel mill there. Another of his enterprises was to promote the building of the first independent pipe-line, in competition with the Standard Oil Co., through Pennsylvania. He was a director in numerous corporations, and was a conservative Republican, opposing the League of Nations. In 1921 he was appointed Secretary of the Treasury in the Cabinet of President Harding, and continued to hold this office under President Coolidge. He was chairman of the Pennsylvania delegation to the Republican National Convention held at Cleveland, O., June 10 1924.

As chairman *ex-officio* of the World War Foreign Debt Commission Mr. Mellon had a large share in formulating the policy of the United States in regard to funding the war debts of foreign governments owed to the U.S. Government. He stressed the importance of debtor nations preserving the sanctity of their respective obligations but laid down that no nation can be asked to pay to another government sums in excess of its capacity, and further, that no settlement which is oppressive and retards the recovery and development of the foreign debtor is to the best interests of the United States or of Europe. In this spirit he conducted negotiations with the various European debtor States which resulted in funding agreements being arrived at with Belgium, Czechoslovakia, Estonia, Finland, Great Britain, Hungary, Italy, Latvia, Lithuania and Poland. The principal obligations funded under these various agreements amounted to $6,383,411,669, in addition to accrued interest, $1,006,502,331.

In the management of the large internal debt of the U.S. Govt. resulting from the World War, Mr. Mellon was equally successful. He laid down and rigidly adhered to a policy of providing for debt redemption annually out of current revenues. As the floating debts and the Liberty Loans fell due they were in

part paid off, in part refunded, at a lower rate of interest. As a result the U.S. national debt fell from $24,330,889,731 in 1920 to $20,298,358,156 in 1925. Mr. Mellon was a strong advocate also of tax reduction, especially in the case of the surtax rates on incomes, maintaining that these should not exceed a maximum of 20% and that such reduction would be a great aid to general business and promote widespread prosperity. Under Mr. Mellon's prompting, Congress gradually lowered the income tax rate until in 1926 the surtax was reduced to 20%, yet without any corresponding fall in the amount of tax receipts. Mr. Mellon, who has written for this *Encyclopdæia*, is the author of *Taxation: The People's Business* (1924).

MEMEL (*see* 18.104), a port on the Baltic coast at the mouth of the river Memel or Niemen, with an economic hinterland extending across Lithuania into Poland and Soviet Russia, the principal export being timber floated down the waterway. Politically, Memel is now an autonomous district of Lithuania. The population of the town, approximately 25,000, is almost entirely German, and has been so since the 13th century, when Memel, like Riga and Revel, was founded as a German trading station.

Before the World War the town of Memel, with a strip of territory east of the river, belonged to Germany, while the hinterland belonged to the Russian Empire. Under the Versailles Treaty (Article 99), Germany ceded all her territory east of the river to the Allied and Associated Powers and undertook to accept whatever disposal they made of it. Upon the ratification of the Treaty the Allies occupied the territory and took over the administration. This provisional régime lasted three years, owing to the dispute between the two new states of Lithuania and Poland over Vilna (Wilno) (*q.v.*), and the consequent delay in the official recognition of the Lithuanian Government. The Conference of Ambassadors did not take up the question of Memel till the autumn of 1922, and meanwhile it had been suggested that Memel might be given a status in regard to Lithuania like that which had been given to Danzig in regard to Poland. This was unacceptable to the Lithuanians, since the population of the country districts of Memel territory was Lithuanian in nationality, while the port was almost the only possible maritime outlet and inlet for Lithuania herself. Accordingly the Lithuanians, imitating the conduct of the Poles at Vilna, seized Memel by a surprise attack on Jan. 15 1923, and forced the French garrison to surrender and evacuate.

On Feb. 16 the Conference of Ambassadors proposed that the Allies should transfer the sovereignty over the territory to Lithuania, subject to local autonomy and to freedom of transit for Poland. In the working out of the details so many difficulties were raised by both Poland and Lithuania that in Sept. 1923 the case was referred to the League of Nations. The council appointed a commission of enquiry under the chairmanship of an American citizen, Mr. Norman Davis, and the proposed convention for giving Memel autonomy within Lithuania with freedom of transit for Poland, as revised by the Davis Commission, was eventually accepted by all parties, and signed in May 1924. In March 1924 the commission presented a draft Convention to the Council. This Convention constituted the Memel territory as a unit within the sovereignty of Lithuania with a clearly defined measure of administrative and financial autonomy and with a governor to be appointed by the President of the Lithuanian Republic. The port was defined as a port of international concern to which the provisions of the League's Barcelona transit conference apply, and was placed under a harbour board including a technical expert of neutral nationality appointed by the League.

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MEMORIALS: *see* ARCHITECTURE; SCULPTURE.

MEMPHIS, Tenn., U.S.A. (*see* 18.107), developed into a distributing centre covering the entire South after the reopening of the Mississippi river transport by the establishment of the Federal Barge Line in 1918. The population in 1910 was 131,105; in 1920, 162,351, of whom 61,181 were negroes and 5,844 foreign-born; and in 1925, 174,533, this being the census bureau estimate. Annexations in 1919 (4·6 sq. m.) and 1925 (1·2 sq. m.) brought the city area up to 26·5 square miles. The output of factories within the city limits was valued at $30,242,000 in 1909; $117,718,000 in 1919; $95,537,305 in 1923. By 1925 there were 900 industrial plants in or near Memphis, with an output estimated at $200,000,000. The greatest industrial development during the period from 1910 has been in hardwood products, cotton-seed products, heavy bags, steel and iron and automobiles, including an assembly plant of the Ford Motor Co., established in 1924, with a daily capacity of 350 cars.

Noteworthy improvements include the municipal rail and water terminal (1913); the Harahan bridge (1917); the Union Belt Railway; a new water pumping station (1923–5), multiplying by four the potential supply; a municipal auditorium seating 12,000 (1924); and the improvement and expansion of the electric service. Hydroelectric power will be available from the Muscle Shoals district of Alabama and the White river project in Arkansas. A city planning commission, created in 1921, secured the preparation of a comprehensive plan and the adoption of zoning ordinances. The cost of living in Memphis is high. The West Tennessee State Teachers College was established at Memphis in 1912. In Sept. 1925 Southwestern College, a Presbyterian institution, founded in 1875, moved from Clarksville to Memphis.

MENCKEN, HENRY LOUIS (1880–), American critic, was born at Baltimore, Md., Sept. 12 1880. He attended the Baltimore Polytechnic Institute, and in 1899 became a reporter on the Baltimore *Morning Herald*. He left that paper as editor in 1906, and joined the staff of the Baltimore *Sun*, to which he continued to be attached while engaged in many additional literary activities. In 1908 he became literary critic for *The Smart Set*, and was also joint editor 1908–23. In 1921 he became contributing editor of *The Nation*, and in 1924 was one of the two founders of *The American Mercury*, of which he became sole editor in 1925. He is a satirist rather than a critic, and represents the viewpoint of the extreme anti-academic element in the literary world. Among his numerous publications are *George Bernard Shaw: His Plays* (1905); *The Philosophy of Friedrich Nietzsche* (1908); *A Book of Burlesques* (1916); *Damn; a Book of Calumny* (1917); *A Book of Prefaces* (1918); *The American Language* (1918); *In Defence of Women* (1918); *Prejudices* (five series, 1919–26); and *Americana* (1925). He has also written critical prefaces to the works of Brieux, Swift, Stephen Crane, Cabell, Nietzsche, Ibsen and Wilde. (*See* AMERICAN LITERATURE.)

MENDELISM (*see* 18.115).—The progress in physiological science made possible by Mendelian methods is described in the articles GENETICS and SEX. In the present article the influence of those discoveries on the development of biological thought and their application to the practice of breeding are considered.

Analysis.—Modern genetics introduces into biology a factorial or analytical conception of organisms, which are now recognised as largely possessing attributes behaving as units, and as such capable of being detached and transferred to any other type with which cross-breeding can be effected. The limits governing this principle of segregation and recombination are still undetermined.

Phenotype and Genotype.—In former considerations of biological problems no account was taken of the consequences of the fact that each of the higher organisms is, in modern language, *diploid*, that is to say, a double structure containing factorial contributions derived respectively from the *haploid* or simple male and female cells which in fertilisation united to produce it. Since some of these factors inhibit the effect of others, and since some give no sign of their presence in the organism unless other complementary elements are also present, the appearance of an organism is an imperfect guide to its genetic potentialities. We have thus to distinguish the organism as it outwardly appears to be from that which it actually is by genetic composition, a distinction which Johannsen has conveniently expressed by the use

of the terms *phenotype* for the former and *genotype* for the latter. Systematic or classificatory works, both zoological and botanical, abound with errors arising from want of appreciation of this fundamental distinction, which must constantly be remembered, especially, for instance, whenever the significance of varietal or intermediate forms has to be estimated.

Variability.—Evidence formerly regarded as proof of abundant contemporary variability in the species of animals and plants must be submitted to searching tests before it can be so accepted. Observations of variability once deemed adequate are now seen to be capable of quite different constructions. Proof that an observed departure from type is a contemporary genetic variation can only be obtained in exceptional cases which have been critically observed under experimental conditions. Putative variation is commonly nothing but the recurrence of a recessive form, or the emergence of some other segregant, from a stock genetically impure; more often still the direct product of a cross. The existence, therefore, of a multitude of varietal forms, so far from simply providing a convenient basis upon which a theory of the evolution of species can be erected, becomes itself an antecedent problem; and instead of asking, as they used to do, how the species have been built up out of the varieties, biologists are rather concerned to discover whence and by what process these variations have come to exist. The belief that substantial genetic change commonly accrues by summation of impalpable differences has been generally abandoned as devoid of evidential foundation. Such differences are mostly fluctuational, largely dependent on circumstance rather than on genetical units and hence not transmissible. Summation, when a genuine phenomenon, is a consequence of purification or the attainment of homozygosis. The idea that a characteristic could in any other way increase as a result of selection is out of place in an exact or even a logical science.

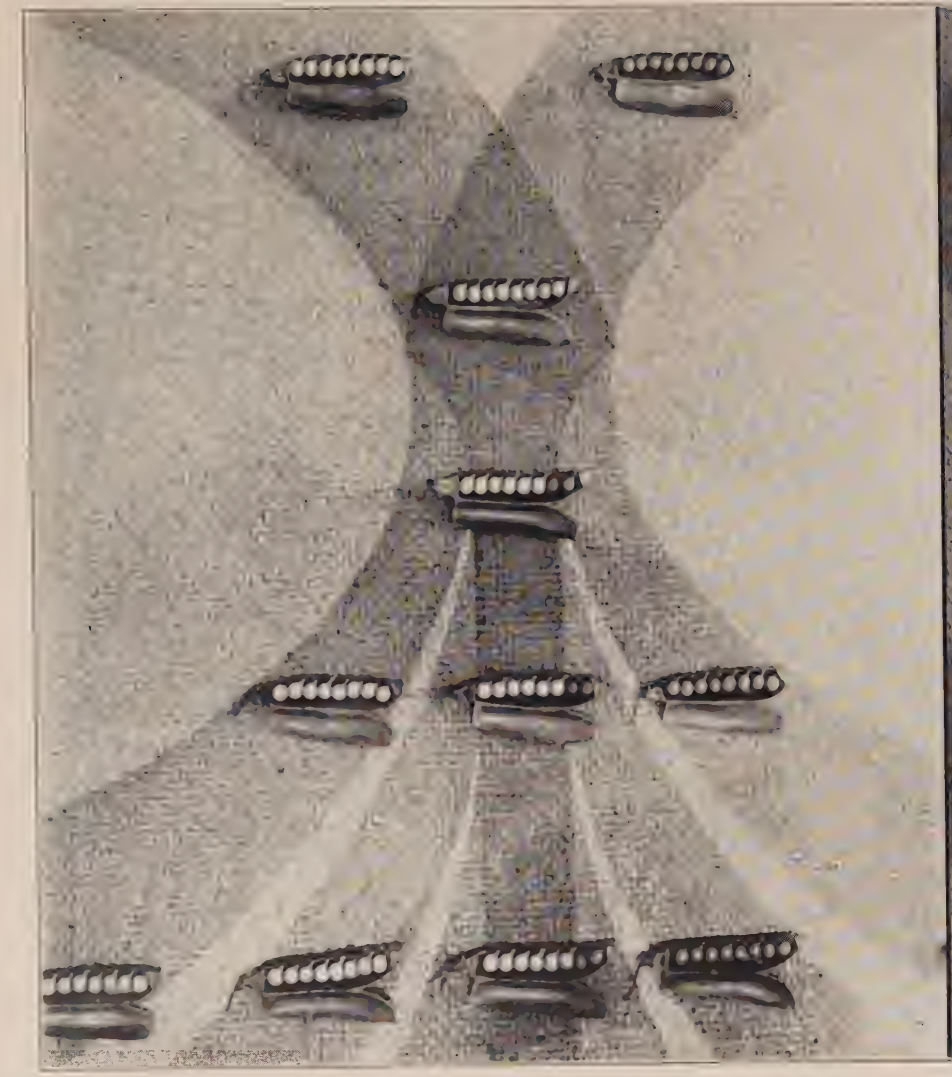
Variation by Loss and by Addition.—Whether the evidences of authentic variation remaining after the deduction of spurious testimony has been made, suffice as a basis of evolutionary theory has been questioned by competent naturalists. Lotsy, for example, maintains that we have no proof of contemporary variation arising otherwise than as a consequence of crossing; and apart from such extreme announcements it is noticeable that as regards varieties of animals and plants anciently domesticated, modern authorities usually incline to ascribe a multiple origin even for forms like wheat, the fowls, pigeons, sheep, horses, etc., which used formerly to pass for derivatives from single types, a belief now felt to be inconsistent with what is known of the limits of variability. Distinction must be made between recessive and dominant variations, arising respectively by loss and by addition. As regards recessive variations arising by loss of elements few will doubt the adequacy of the records (*e.g.*, in the sweet pea, *Primula sinensis*, etc.). As regards the *de novo* appearance of dominant characters the evidence is less abundant. Morgan and the American geneticists have made prominent several instances of this kind in Drosophila (fruit fly), of which the spontaneous origin of " eosin " (a new and peculiar pink) eyes in a white-eyed strain may be cited. Admitting provisionally these examples as free from objection they are, nevertheless, extraordinary events and not common occurrences. Were the dominant in question one already familiar we should hesitate to believe in its spontaneous origin. That a pea genetically wrinkled, having the characteristic starch of the wrinkled varieties, should without crossing produce a variety with " round " starch-grains would in modern lights appear not much less improbable than the spontaneous generation of life.

With plausibility a number of human malformations, such as praesenile cataract, claw foot-and-hand, etc., which have been regarded as descending as dominants, may be interpreted on these lines as in reality due to loss. From almost the beginning of Mendelian studies surprise has been felt that so many curious abnormalities in man, of which at least some 30 may be enumerated, should behave as dominants, seeing that novel characters most frequently are demonstrably recessive. Inasmuch as these " dominants " are so abundant in man, though otherwise rare, something no doubt remains to be explained; but we may avoid the difficulty of interpreting them all as factorial additions, for with equal probability the normal may be represented as possessing an element which, when homozygous, maintains development in its proper and normal course. Mohr and Wriedt, discussing the inheritance of a new type of shortened digits, recently made the suggestion that we have here to do with a character which, in the homozygous state, is *lethal*. In other words, if one element of " normality " only be present the individual exhibits the peculiarity, but if both elements of normality are wanting the consequent malformation is so extensive that the embryo perishes at some early stage of development. The normal element would then be recognised as the positive contribution, and in the absence of at least one such contribution the embryo is non-viable. Some slight evidence is already adduced in support of this view; and since lethal contributions certainly play a great part in genetical histories, we should be prepared for a wide application of this principle, especially to the descent of deformity.

But, as explained in the article GENETICS, nothing absolutely forbids us from inverting the representation of positive and negative factors by extension of the conception of inhibitors, of which many are familiarly known; so that we may express the apparent addition of a new element as a loss of one which when present had repressed the new attribute. This symbolism, though admittedly objectionable when dominance is complete, does without strain apply to all cases in which the heterozygote is intermediate, and a large range of alleged new dominants can be covered. In so far as this conception applies, evolution is conceived of as a process of unpacking, a progress consisting in the loss of component elements.

Mutation.—The term *mutation* introduced by de Vries, is now generally accepted to denote definite genetical variations which are sensibly discontinuous. Though contemporary examples which satisfy all tests are not abundant, there is no question that they occur and have occurred in most of the forms of life. They are indeed part of the occasional experience of most breeders of animals and plants. The special example, the Oenotheras, on which de Vries mainly founded his own theory, was singularly unfortunate and must, as explained in the article GENETICS, be now discarded as inapplicable. Mendelian analysis was only lately made known, and the group of discoveries comprised in the term genetics were in an incipient stage; nor had the criteria of genetic purity, which must be applied to a parental form before the production of new types from it can be accepted as proof of original mutation, been clearly established. The Oenotheras which produce the presumed mutations are now proved to be no pure genotypes, and the suggestion that they were in a " period of mutation " arose from a misunderstanding of the nature and consequences of heterozygosis.

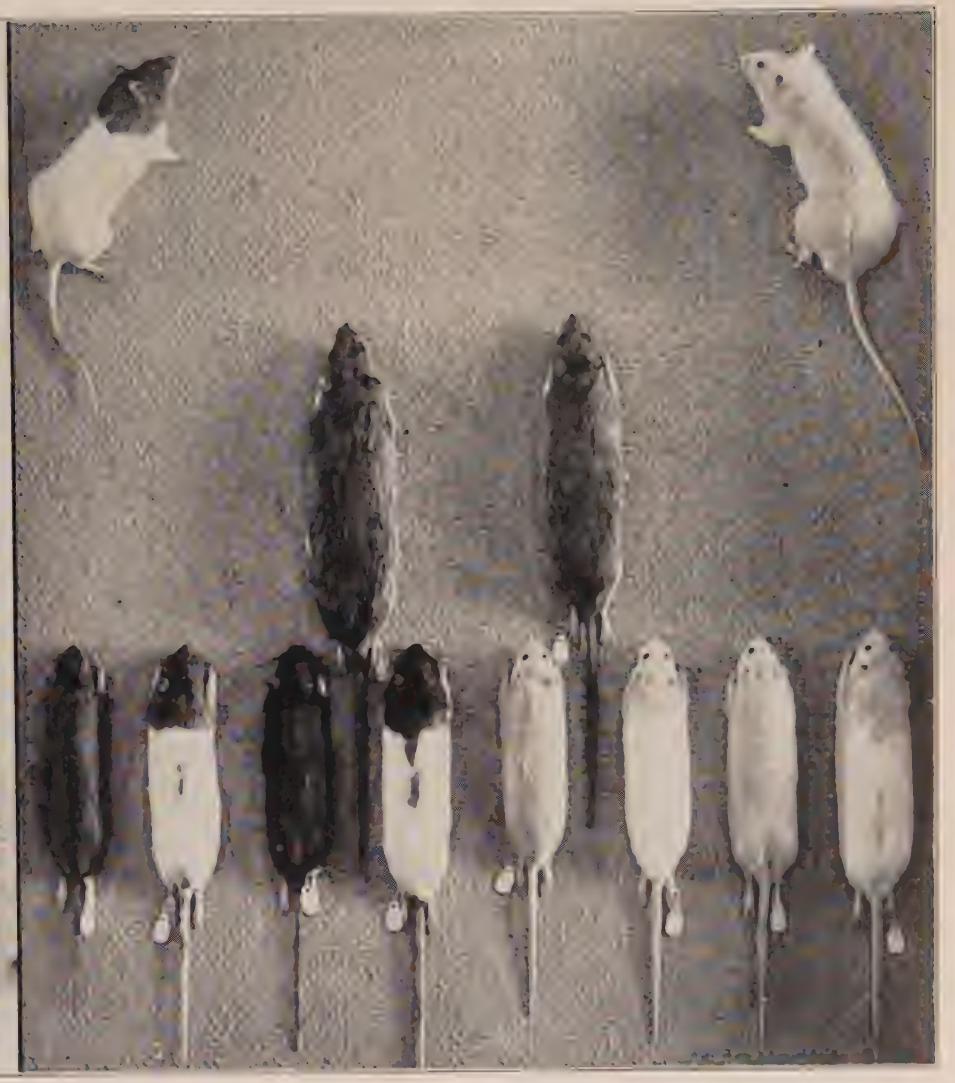
Inter-specific Sterility.—The new forms whose productions we witness are never new species. In *Primula sinensis* about 20 pairs of factorial differences have been determined, which in their several combinations present an amazing polymorphism. A systematist, if he met these forms in nature, might and probably would quite justifiably take many of them for distinct species. But interbred, they and their products are perfectly fertile. Polymorphism like this is, even in a state of nature, far more abundant and far greater than the evolutionists of the last century imagined, yet it avails us little as material out of which true specific differences can be supposed to develop. The conspicuous defect in the evidence for the origin of species by common descent remains. Though much is known as to the incidence of variation, not rarely of a magnitude which might naturally be claimed as constituting specific difference, no one has yet raised types from a common origin which when interbred produce sterility of the kind and degree forming one of the commonest attributes of crosses between natural species. By whatever concatenation of arguments theories of evolution have been constructed, the most essential link has never been supplied. The lapse of time is occasionally invoked in the hope of rectifying this and similar evidential defects, a strain which has been maintained distinct for a long period being thought more likely to show



Courtesy of the American Museum of Natural History.

SIMPLE COLOUR INHERITANCE IN THE SEEDS OF THE COMMON GARDEN PEA

When yellow-seeded and green-seeded peas are crossed, all the second generation has yellow seeds, but in the third generation three-fourths of the seeds are yellow, one-fourth green. In the second generation the green is latent, or recessive, being overshadowed by the dominant yellow. If plants from the green seeds of the third generation are crossed green seeds always result. The apparently similar yellow seeds may be pure yellow or hybrid (part yellow, part green). If yellow-seeded plants from any generation are crossed, one-third will breed pure yellow, and two-thirds will breed hybrid yellow, giving in the next generation three yellow to one green.



Courtesy of the American Museum of Natural History.

HOW THE OCCURRENCE OF A NEW SPORT VARIATION MAKES POSSIBLE THE MULTIPLICATION OF EXISTING VARIETIES

In 1911 a yellow rat (a previously unknown variety) was caught in England. It was mated with black-hooded individuals, a recognised tame race which breeds true. The offspring were all brownish-grey like wild rats, but the grandchildren exhibited eight different varieties.

As the crossing of a constant strain with a variant from another and perhaps variable strain gives so many varietes of offspring, it is readily seen that where both the strains crossed already differ in many minor characteristics, there will be (as is observed in actual life) an almost infinite number of small variations from individual to individual.

interracial sterility when crossed with its progenitor than one newly separated. Reasoning of this kind, plausible enough in scholastic days, is not acceptable in an age of chemistry, nor may we suppose that that which is never begun will be attained by mere effluxion of time. The more genetical experience extends, the more serious does this hiatus in the evidence become.

Evolution.—In allusion to this and other difficulties, which genetic research has forced into prominence, the question is sometimes asked whether the theory of evolution holds its place so firmly as it did, or, more crudely put, whether Mendelian discovery has not "upset Darwinism." It should therefore be stated explicitly that in spite of all the objections with which the doctrine of the origin of species by descent is now seen to be beset —objections of which the strength is far more clearly known than before—and though as to the manner by which new species have come into existence geneticists adopt for the most part an agnostic attitude, yet all agree that the lines of argument converging to support the theory of common origin are so forcible and so many that no alternative can be entertained.

The geological record is conclusive.

The following may be taken as a cogent instance of this: if Angiosperms had existed in the carboniferous age their remains must have been preserved; therefore Angiosperms have arisen since that time, and we cannot conceive whence they came if not by descent from the pre-existing plants. Common descent, though rarely if ever a proposition demonstrable in any detail, ranks as an axiom. For Darwin and any other evolutionist before or after him this is a concession of the main claim. Parts of the apparatus by which the validity of that claim was enhanced have fallen into desuetude. In particular the modern geneticist assigns to *natural selection* a subordinate and inconsiderable rôle. Organisms are to be considered as co-ordinated systems. That each particular structure or instinct comprised in the system, which shows permanence or definiteness makes a contribution to the success of the system equivalent to the cost of its production is recognised as a fallacy. We are also reluctant to apply to the interrelations of the collective properties of organisms arguments which would be out of place in similar considerations of the attributes of unorganised substances. We no more look for utility in the details of a peacock's feather than in the iridescence of a Roman bottle or in the regularity of basaltic prisms.

Adaptation.—It is not merely in regard to the mode by which species have arisen that agnosticism has prevailed. While unwilling to accept adaptation, with Darwin, as a summation of happy accidents, we have no alternative to offer, nor is there in the attempts of various experimenters to find that organisms transmit to their posterity structural emendations in response to parental experience anything which sensibly alleviates the difficulty. Most of these claims are obviously faulty and few require serious notice.

Each step in the progress of this branch of science has rather compelled the recognition of genetic determinism; and the hope that by change in the conditions of life or by any external influences significant alteration can be induced in succeeding generations, whether of organisms amenable to experiment or of the human population, must be abandoned.

Classification.—The full implications of factorial analysis in relation to biological classification are not yet appreciated. The fundamental idea of the systematist, that animals and plants can be grouped into species, and that the distinctions between species are of a different order from those characteristic of varieties, is now scarcely open to question. Nevertheless, the belief held very widely by systematists, that certain classes of differences are important as being more fixed, and others trivial as being more liable to variation, is scarcely consistent with genetical knowledge. The frequency and amplitude of variation and the perfection of segregation must be empirically determined for the various organisms and for the various characters. No general rules can be predicated. Anthropologists, for example, are accustomed to regard special features of anatomy as comparatively sure guides to racial origin (*see* RACES OF MANKIND). Knowing what we now do of segregation and recombination we suspect that no characteristic is incapable of segregation and so of transference to another race: given the possibility of cross-breeding, the shape of the skull or other bodily peculiarity may be transferred in its entirety to individuals descending through another parent from a different race, and hence to a resulting population, more slowly but not less completely than a language or a custom.

The classificatory dichotomies in common use in the systematic arrangement of animals and plants have no prerogative significance except for mnemonic or demonstrative purposes; the number of the dichotomies is merely an enumeration of the pairs of factorial differences; and the order in which they are taken into account, though often treated as a matter of cardinal importance, is purely arbitrary. Peas, for instance, are divided first into tall varieties and dwarf varieties, then into round and wrinkled, yellow and green, etc., but it would be logically as sound and physiologically as justifiable to divide them first into yellow and green, then into early and late and so on. If the races of men could be crossed under experimental conditions we should find the same principles governing their distinctions.

Applications.—The applicability of genetic discoveries to the betterment of the human race is discussed in the article EUGENICS, but progress in the art of breeding animals and plants is also possible by the development of Mendelism. The use and consequences of crossing in the search for new forms of economic value are now apparent. The reasons for preserving the first generation (F_1) though it may present no valuable feature and the desirability of raising from it as many individuals (F_2) as space will accommodate, are obvious. The breeder now knows what he is about and is able to interpret countless phenomena previously meaningless. Granting that the chief breeds of animals now in the keeping of civilised man are not capable of much amelioration, experience has shown that enormous improvements can be made by applying accurate knowledge to the breeding of even such old-established crops as wheat, oats, tobacco, etc. If this is true of the crops which have for ages been the object of unremitting care, it will be understood that the cultivated plants of tropical regions offer limitless possibilities.

The breeding of coconut, rubber, jute, cacao and many more has scarcely begun. These are all still raised from seed gathered almost promiscuously, the result of uncontrolled fertilisation, and the product is what we should see if our orchards were raised from seeds and those seeds gathered at random from garden varieties and from wildings in the hedgerows. At first, selection and fertilisation under control will suffice to make great progress. Even at that stage some genetic knowledge will be of value, but when the more difficult task of making genetic recombinations of desirable qualities is begun the breeder will require skill in the management and interpretation of the generations and the various terms in the series of forms which only accurate knowledge of principle can supply. Genetic science shows primarily what can be expected, provides the breeder with an aim, and also indicates how it may be attained. For example, a crop of sugar beet often contains 4% (sometimes many more) of plants which "bolt" or flower in the first year making no "bulb," and so worthless. This state of things has long been accepted as inevitable.

But when the geneticist finds that the annual habit is a recessive, he suspects that the plants which produce the bolters are heterozygous in that respect, and that if he can raise plants homozygous in the biennial habit he will have eliminated bolting. The breeder, whether scientific or practical, ignorant of genetics, would never suspect the nature of the fault, still less could he devise a cure. Common sense in the art of seed-raising is an imperfect guide. Apart from any question of making new races, the purification of existing varieties and their maintenance in a state of purity are exacting tasks. What has been done in these several phases of the industry, in ignorance of principle, is remarkable, but we may confidently foresee that the application of scientific method will, in the case of the breeder's art, effect a change in magnitude no less than that which has been witnessed in the other industries.

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MENENDEZ PIDAL, RAMÓN (1869–), Spanish philologist, was born March 13 1869 at Corunna, and studied at the universities of Madrid and Toulouse. In 1899 he was appointed to the chair of romance philology at the University of Madrid. Menendez soon acquired a great reputation as a master of his subject and lectured in South America and the United States. In 1907 he was member of a board created in that year for the development of university education in Spain and in 1913 was appointed counsellor of public instruction for the kingdom. His grammar, text and vocabulary of the *Cantar de Mio Cid* (1908) opened out new possibilities not only to Castilian philology but to historiography in general. Menendez Pidal became the leader of the *Centro de Estudios Históricos*, the main house of learning in philology and historical matters in Spain, and the editor of the *Revista de Filología Española*. His other works include *Primera crónica general* (1906); *L'épopée Castillane à travers la littérature espagnole* (1910); *Gramática Histórica Española* (1914); *Un aspecto en la elaboración del Quijote*, 2nd ed. (1924).

MENÉNDEZ Y PELAYO, MARCELINO (1856–1912), Spanish scholar and critic (*see* 18.128), was at the time of his death working at the second edition of his *Historia de los heterodoxes españoles*. He died at Santander May 19 1912.

See A. Donoso, *Menéndez y Pelayo y su Obra* (1913); Bonilla y San Martín, *Menéndez y Pelayo 1856–1912* (1914); and A. G. de Amezua y Mayo, *Nota bibliografica de Menéndez y Pelayo* (1918).

MENTAL DEFICIENCY.—Mental deficiency, or amentia (*a*, without, *mens*, mind), has been defined as that state in which the mind has failed to attain normal development, as distinguished from dementia (*de*, down from, *mens*, mind), mental defect occuring subsequently to mental development. Legislation both in England and abroad has recognised the essential difference between these two forms of mental disease, and the class of so called "mental defectives" is generally dealt with by laws differing from those affecting the insane. These laws are based mainly on a recognition of (*a*) the educational, (*b*) the social and racial problem created by the presence of large numbers of uncontrolled mentally defective persons in the community.

I. GREAT BRITAIN AND THE BRITISH EMPIRE

In England the Mental Deficiency Act of 1913 was the outcome of the Report (1912) of the Royal Commission on the Care and Control of the Feebleminded appointed in 1908, and embodied a considerable number of its recommendations.

The Elementary Education (Defective and Epileptic Children) Act, 1899, gave to local education authorities power to provide special schools (day or residential) for mentally defective children between the ages of 7 and 16 who, not being either dull or backward or idiots or imbeciles, were capable of benefiting by the education provided in such schools. Under the Elementary Education (Defective and Epileptic Children) Act of 1914 these powers were made compulsory, and both Acts were embodied in Part V., sections 51–9 of the Elementary Education Act 1921. Attendance at such schools may be enforced by a magistrate, provided it is clearly for the child's benefit that he should attend a special school. Owing to the War and to the relatively high cost of these schools many authorities have failed to provide sufficient, in some cases, any, special schools; there is practically no school provision for defective children in rural areas. The estimated number of defective children is calculated at 8 to 10 per thousand of the school population. The latter figure is probably the more accurate. This gives a total of 50,240 defective children to be provided for, but provision has only been made for 16,392 children in 174 day and 21 residential schools. In addition, the local education authorities must notify to the local control authority children who are incapable of benefiting from education in special schools or who need institutional care on leaving school. In urban areas there are 88 occupation day centres for children excluded from schools, run for the most part by local voluntary mental welfare associations; after-care committees and the above associations look after the children who have left special schools, try to find them employment, supervise them at home and establish handicraft centres for them.

The Mental Deficiency Act.—The Board of Control, a section of the Ministry of Health, administers the Lunacy and the Mental Deficiency Acts. The local control authorities are statutory mental deficiency committees of county and county borough councils, whose duty it is to provide for defectives,[1] only when they can be certified as idiots, imbeciles, feebleminded or moral imbeciles, and who in addition are either (*a*) neglected, without visible means of support, cruelly used, etc.; (*b*) found guilty of any criminal offence, and liable to be sent to or actually sent to an industrial school or prison; (*c*) notified by the local education authorities as ineducable or as needing institutional care on leaving a special school; (*d*) having given birth to or being pregnant of an illegitimate child whilst in receipt of poor relief. The duty of the authority is to (*a*) ascertain the defectives they must deal with; (*b*) provide supervision by visiting and watching over the defective at home. This supervision is in a large number of areas carred out by local mental welfare associations affiliated to the Central Association for Mental Welfare, who supply visitors for defectives living in the community. If this supervision is insufficient the authority may (*c*) send defectives to a certified institution under orders, or (*d*) place them under guardianship under orders, *i.e.*, under the charge of an individual having the powers of a parent over them. This order is made by a magistrate on a petition supported by two medical certificates. Orders are renewable by visiting justices at the end of each of the first two years, then every five years. So long as the order lasts the defective can be compulsorily detained, but defectives can be discharged by a commissioner of the Board of Control at any moment. The parents of defectives, if they oppose the making of the order, must prove that it is for the benefit of the defective that he should remain at home.

Local authorities are required to provide certified institutions for defectives; they can also send defectives to institutions provided by other committees. The War prevented the development of institutions, and a considerable number of poor law institutions have been approved for the reception of defectives under orders. The Royal Commission estimated that there were 4·6 per 1,000 defectives in the population. Some 48,778, or 1·29 per 1,000, have been ascertained, but only 19,076 defectives were in institutions under the Act in Jan. 1926, many being found in institutions and homes as rescue cases, paupers, etc.

The difficulties are: incomplete ascertainment of defective children, which handicaps preventive measures; lack of special educational facilities for training defectives; lack of institution accommodation for adult defectives; and lack of recognition of mental defect in cases coming before the courts. Greater efforts are being made to safeguard the community and the defective by segregating all with anti-social tendencies in institutions.

Scotland.—The Mental Deficiency Act for Scotland, 1913, does not differ very materially from the English Act but the local authorities are local boards of control and the parish councils. There were 2,452 certified mental defectives on Jan. 1 1925. A Scottish Association for Mental Welfare was established in 1922. There is also an active voluntary movement on foot for the establishment of a large colony for the feebleminded.

Ireland.—The Mental Deficiency Act does not apply to Northern Ireland. There was in 1926 but one institution for

[1] For definitions see the Mental Deficiency Act.

defectives in the whole of Ireland, but certain religious communities propose to open others.

British Empire.—Legislation in other parts of the British Commonwealth is generally modelled on the English Mental Deficiency Act.

In South Australia, a Mental Deficiency Act was passed in 1913; in Tasmania, in 1920. The Mental Deficiency Board then established published in 1925 a report on a mental survey of the prisoners in Hobart Gaol. In Melbourne and Sydney special schools and classes for mentally defective and backward children are being established.

The Mental Disorders Act of 1916 regulates the care of defectives in the Union of South Africa. A national council for the care of the feebleminded watches over the interests of individual defectives, and guides public opinion.

In Canada a Federal Act dealing with immigration prohibits the entry of mental defectives into the country. Each provincial government provides grants for the organisation of special classes for mental deficients in school attendance, and in Jan. 1926 there were approximately 140 such classes. Ontario, Alberta, Saskatchewan, Manitoba and Nova Scotia have made institutional provision for approximately 1,500 mental defectives, the largest at Orillia, Ontario, having accommodation for 1,200 cases. Several of the larger cities, including Toronto, Winnipeg and Vancouver, provide routine mental examinations for schoolchildren and for juvenile court cases, and since 1918 the Canadian national committee for mental hygiene has been conducting surveys throughout the Dominion to determine the prevalence and significance of the problem.

In New Zealand, the Mental Defectives Act of 1911 and the Education Act of 1914 are the Acts under which day schools, one or two residential schools and some institutions are established. A committee of enquiry (1925) under the Ministry of Health recommended the establishment of a eugenic board for the compilation of a register of mental defectives, and made recommendations for the sterilisation of certain mentally defective persons.

II. THE UNITED STATES

Americans have given a great deal of study to the proper diagnosis and training of mentally defective persons and to the eugenic aspects of the problem, and there is a very widespread and efficient organisation in many of the States. Each State has its own legislation. There are numerous special day schools, called auxiliary classes, residential schools and institutions. Many of the institutions are on a vast scale, and have thus permitted interesting experiments. One of the pioneers of the work, the late Dr. Walter Fernald, developed the Waverly Institution (Mass.) into a highly successful training colony. One of Dr. Fernald's principles was "paroling," and a very large number of patients, especially men, did remarkably well on "parole" from the institution. Institutions equally interesting are the Rome State School (New York) and Vineland (New Jersey), where Dr. H. Goddard and Dr. S. D. Porteus have carried out numerous experiments in the measurement of intelligence. Psychiatric clinics are attached to many hospitals, and afford considerable opportunities for the study of mental defect. Segregation has been tried on a wide scale in several of the States, and for some years certain States have had laws allowing the sterilisation of mental defectives. Special attention has been directed to the whole problem of defect in its relation to delinquency amongst children and adults. The national committee for mental hygiene and the joint committee on methods of preventing delinquency, the Judge Baker Foundation, Boston, Mass. (which publish numerous monographs) and other kindred associations have done pioneer work in this connection.

III. EUROPEAN COUNTRIES

The work among mentally defective persons in other countries follows much the same lines as are indicated in the description given below. The classification of defect differs somewhat in different countries, and a class of "moral imbeciles" is not universally recognised. Almost all countries have now made some provision for mentally defective persons, but the problem is still inadequately met.

France.—In France, mental defectives are dealt with under the law for "aliénés" passed as long ago as 1838, which has not been amended. Under this law persons can be placed in institutions at the request of their families, or by order of the prefect, if they are considered dangerous or in need of protection. Some difficulty is found in dealing with cases needing treatment but not institutional care, but the work of treating the feebleminded at psychiatric clinics is likely to develop since the establishment of a clinic at Paris in 1921. A law passed in 1919 recommends special classes for children, but does not make them compulsory. No statistics as to the incidence of defect are available. Some French institutions have a fine reputation, notably perhaps the Hospice de Bicêtre, near Paris, which is attached to a general hospital, and has accommodation for about 1,000 males (mostly idiots and imbeciles) and about 217 girls. Seguin, one of the pioneer teachers of defectives, worked at the Bicêtre.

Italy.—In Italy, the class "imbecili morali" is recognised. No exact figures are available as to the number of defectives. A general law on the protection of children was in preparation in 1926. There are only eight institutions set aside for the mentally defective, accommodating 761 persons. Madame Montessori's educational methods (q. v.) were based on the experience gained among defective children at Rome. She made the startling discovery that a mentally defective child taught on her methods was in some instances actually able to attain a higher standard than normal children taught on other methods. She has applied to the teaching of normal children the empirical methods so effective with defectives, and her work has reacted in favour of improved methods for both classes of children.

Belgium.—Another educational pioneer, Dr. Ovide Decroly of Brussels, similarly first interested himself in the study of defectives, and later adapted his methods in use in his special school in Brussels to the teaching of normal children. His normal school in Brussels reveals its purpose by its title, "École pour la vie par la vie," and his methods have been adopted in many of the elementary schools in Brussels. Belgium has a remarkable institution, the colony at Gheel, whose origin goes back to the 6th century, when a shrine was built to St. Dymphna, a martyred Irish saint. At least as early as the 13th century she came to be considered the special saint of "aliénés." From that time through the centuries the work has grown until today Gheel is a place of some 20,000 inhabitants caring for 2,000 "aliénés," including insane and mentally defective, with a school for 160 defective children. The principle of the colony is freedom and home-life in the families of the citizens. Other similar colonies have been founded in the country.

Holland.—The institutional care of the feebleminded is almost entirely in private hands, but special schools exist in the towns.

The Scandinavian countries have a good system of special schools and several institutions, and considerable attention has been given to the training of defectives.

Denmark.—It is estimated that there are in Denmark between 6,000 and 7,000 mentally defective persons in a population of 3,500,000, but there are no exact statistics. There are four large institutions, accommodating about 3,450 persons, and private homes taking 350 patients. Special schools are not compulsory, but they are established in most large towns such as Copenhagen, which has a school for 700. A Marriage Act is on the statute book prohibiting marriage with a mentally deficient person.

Austria.—Developments in Austria have been considerable since the War. There are special schools and classes for 2,794 children, and 20 institutions for the care and instruction of 1,498 mentally defective and epileptic children.

Germany.—Germany has a fine special school system, with schools in about 600 different places. These schools are in some instances very small, more than 200 having only one class, and 150 only two classes. There are in all about 3,500 classes in these schools, with accommodation for 67,000 children. Most of the special schoolchildren have had two years' trial in the elementary school, and those who are not able at the age of six to profit by the elementary school can attend a "Vorklasse" before being drafted into a special or normal school according to their development. In Mannheim since the beginning of the century, and later in Charlottenburg, Frankfurt-on-Main and other towns, a system of so called "Förderklassen" has been established for the backward child whose mental difficulties may be due to exterior or physical causes and not to mental defect. In other towns there are classes for those who in the later years of school life remain backward.

Switzerland.—The Institut J. J. Rousseau in Geneva has been of inestimable value in the scientific study of the child. The founder, Prof. Ed. Claparède, has proceeded on the principle that the abnormal and normal child should be studied at the same time, and the institute has now become a laboratory for the study of the child in all his manifestations. The care of the feebleminded is very well organised in Switzerland. In 1918 preparatory classes were established for the children who cannot keep up with the lowest class, and in some schools there are "crammer" classes with more handwork than in the ordinary classes, for children whose backwardness is due to "neglect," and who are probably able to return later to the ordinary classes. There are also "work-classes," which have more manual work even than the special schools. The employment schemes in institutions are admirably organised. The Basle institution, opened in 1916 for the paid employment of defectives has been most successful, and is being enlarged so as to serve the needs of defectives from any area. A work and welfare home for girls, with similar aims, was opened in 1924 at Komtz, near Berne.

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MERCIÉ, MARIUS JEAN ANTONIN (1845–1916), French sculptor and painter (*see* 18.152), died in Paris Dec. 12 1916.

MERCIER, DÉSIRÉ (1851–1926), Belgian cardinal, was born Nov. 21 1851 at Braine-l'Alleud in the Walloon part of Brabant, of a bourgeois family. He studied at the episcopal college of St. Rombaut, Malines, and at the lesser seminary of that town. On April 5 1874 he was ordained priest after following the courses of the larger seminary, where he made his first acquaintance with the philosophy of St. Thomas Aquinas. After two years at the University of Louvain, he was appointed professor of philosophy at the lesser seminary of Malines (1877). In 1880 Leo XIII., who wished to promote the study of Thomism, invited Cardinal Dechamps, Archbishop of Malines, to found a chair of Thomist philosophy at Louvain. The choice of the Cardinal fell on the young Abbé Mercier, who was appointed in 1882. Before assuming his new duties, the new professor studied in Paris under Charcot. While teaching psychology, logic, criteriology, metaphysics and ontology to his Louvain students, including a large number of laymen, he followed closely the research work of his colleagues, according to the tradition of the scholasticists, who combined theological and scientific studies.

In 1886 the Pope conferred a Roman prelateship upon him, and in 1888–9 issued two briefs urging the necessity of founding an Institut Supérieur de Philosophie at Louvain. This institute was finally opened in 1894 and included, besides the chair of philosophy held by Mgr. Mercier, chairs of cosmology, physics, sociology, etc., held first by his colleagues and later by the pupils he had formed. The institute published the *Revue Néo-scolastique* and became the centre of Neo-Thomism which exerted considerable influence on Catholic thought all over the world. In 1906 Mgr. Mercier was appointed Archbishop of Malines, and in 1907 he was created a cardinal. He used his influence with his priests and his flock to break down the barriers existing between the members of the clergy and the laymen, to eliminate all class distinctions between the Catholic bourgeoisie and the labourers, and to bring about a better understanding between Catholics and non-Catholics.

On Aug. 20 1914, while the Belgian Army was retreating upon Antwerp and the Germans were entering Brussels, the Cardinal was abruptly summoned to Rome to take part in the election of a successor to Pius X. Shortly after his return to Malines, he issued a pastoral letter, " Patriotism and Endurance," in which he protested against the burning of Louvain and the other excesses committed by the German Army, and in which he defined the position of the Belgian people towards the occupying Power. While, according to him, the Belgians owed, in soul and conscience, neither respect nor allegiance to this authority, which was not lawful, they had to accept German regulations so long as they did not violate their duty to their country, the army alone having the right to resist openly the invaders' power. In spite of the pressure exerted upon him by the German authorities, he maintained the same attitude throughout the period of occupation, protesting publicly in his sermons and pastorals against the arbitrary decrees of the governor-general, especially concerning the deportation of workmen and the administrative separation of the country, urging the people, at the same time, to remain confident in the final victory of their just cause. In Jan. 1916 the Cardinal took a second journey to Rome where he was received with enthusiasm, and brought back with him a most cordial message from the Pope. He proclaimed, in his next pastoral letter, that " The moral triumph of Belgium, in the eyes of civilisation and history, is already an accomplished fact." In Oct. 1918, on the eve of the retreat of the German troops, the Cardinal received a message from the Governor greeting him as the " revered spiritual leader of the Belgian people " and announcing to him that political prisoners and deportees would shortly recover their liberty.

After the War, the name of Cardinal Mercier was associated with informal conversations which took place at Malines following the " appeal to all Christian people " issued by the Lambeth Conference of 1920. He took a prominent part in these friendly discussions between representatives of the Roman and Anglican Churches. The first conference took place between Cardinal Mercier, Mgr. van Roey (his successor as archbishop of Malines), and Abbé Portal, on the one side, and the Dean of Wells, the Bishop of Truro (Rev. W. H. Frere) and Lord Halifax on the other. Bishop Gore, Dr. B. J. Kidd, Mgr. Batiffol and Abbé Hemmer took part in the third Conference, held in 1923. A full account of these conversations, which concentrated on doctrinal and historical rather than on administrative questions, was issued by the Archbishop of Canterbury at the end of the same year. In the spring of 1924 Cardinal Mercier celebrated the jubilee of his ordination. He died in Brussels, after an operation, on Jan. 23 1926. (E. Ca.*)

MERESJKOWSKY, DMITRI (1866–), Russian man of letters, was born in St. Petersburg (Leningrad), the son of a court official, and graduated from St. Petersburg University. He married Zinaida Hippius, the poet. His first volume of poems appeared in 1888 and was followed by more poetry, *Vera*, *Sakya*, *Muny*, *Avakum*, *Black Angel*, etc., by translations from Euripides and other Greek classics, by literary essays on Russian and foreign writers, old and new, *Eternal Companions* (1897), and a trilogy of historical novels under the general title *Christ and Antichrist* (1902–5); *Julian the Apostate* (1895), *The Renaissance of the Gods*, *Leonardo da Vinci* (1902), *Antichrist*, *Peter and Alexis* (1905). After the " trilogy " came the novels *Alexander I.* (2nd ed. 1913), *December 14*, and—in connection with the Tutankhamun excavations—*The Birth of the Gods*. About 1900–2 Meresjkowsky evolved a mystic, neo-Christian or apocalyptic teaching based on the equal sanctity of flesh and spirit as opposed to the cult of the flesh as represented by paganism, and the cult of the spirit as revealed by ecclesiastical Christianity. His other writings include works of literary criticism, *Tolstoy and Dostoievsky* (1901). He also wrote on religious, political and social questions, and published several plays. After the revolution Meresjkowsky left Russia and went to live in Paris, where he continued his literary activities.

Meresjkowsky's collected works were published in 24 vol. in 1914. The following were translated into English: *The Death of the Gods* (1901), *Peter and Alexis* (1905), *December 14* (1923), *The Forerunner* (1924), *The Birth of the Gods* (1925). See also Jean Chuzeville, *Dmitri Meresjkowsky* (1922).

MERRIMAN, JOHN XAVIER (1841–1926), South African politician, was born March 15 1841 at Street, Somerset, England. His family moved to South Africa in 1849, and John Xavier was educated at the Diocesan College, Rondebosch, and later at Radley College, England, returning to the Cape in 1861. Merriman entered politics in 1869. Three years later, despite his opposition, the Cape obtained self-government, and in 1875 he joined the Molteno Ministry as commissioner of public works. When in 1877 war with the Galeka Kaffirs broke out Merriman became virtually Secretary for War in the Cabinet.

Merriman came into office again in the Scanlen Ministry (1881–4), again as commissioner of public works. The dubious attitude of the newly-formed Afrikander Bond to the British connection alienated him from the Dutch extremists. The Bond had caused the fall of the Scanlen administration because the Ministry opposed the attempt of the Transvaal Boers to seize Bechuanaland; and when Rhodes formed a Ministry in 1890 Merriman joined it as treasurer-general. Meanwhile the Bond had adopted a constitutional programme, and 1890 saw a drawing together of the Dutch and British elements at the

Cape. But the Uitlander troubles in the Transvaal became acute, and in 1893 Merriman resigned. He was chairman of the Cape parliamentary committee which inquired into the Jameson raid of 1895, and drew up its report. The general election in Cape Colony in 1898 gave the Bond a very narrow victory, and W. P. Schreiner became Prime Minister, with Merriman treasurer-general again, though the latter was not a member of the Bond. Merriman was among the ministers who in 1906 opposed the measure to disfranchise the Cape rebels, and this led Schreiner to tender the resignation of the Cabinet. At the general election of 1904 Merriman was defeated, but was returned shortly afterwards at a by-election. In Jan. 1908 he succeeded Dr. Jameson as Prime Minister and treasurer-general (*see* 5.247). Merriman was a member of the national convention which hammered out the new constitution. On the establishment of the Union in 1910 he did not join the Union Ministry under Botha (*see* SOUTH AFRICA), remaining a somewhat detached member of the South African party. He opposed the disruptive policy of Hertzog as strongly as he had formerly supported the independence of the Boer republics. He died Aug. 2 1926.

MERRITT, WESLEY (1836–1910), American soldier (*see* 18.-173), died at Natural Bridge, Va., Dec. 3 1910.

MERRY DEL VAL, RAPHAEL (1865–), Spanish ecclesiastic and diplomat, was born Oct. 10 1865 in London, where his father was secretary to the Spanish Legation. He was educated at Baylis House, near Slough, and at Ushaw College, near Durham. Ordained priest in 1888, he began at an early date to specialise in diplomatic work for the Vatican. In 1892 he became Master of the Robes and acting private chamberlain to Pope Leo XIII., of whom he was a great favourite. In 1897 he was sent to Canada to report on the difficult Manitoba schools question, and accomplished this mission with conspicuous success. In 1900 he became Archbishop of Nicea. He was Secretary of the Sacred College of Cardinals during the election of Pius X. (July 1903) under whom he became Cardinal and Secretary of State. On Jan. 12 1913 he succeeded Cardinal Rampolla as Archpriest of the Basilica of St. Peter's, Rome, and in the following year was appointed Secretary of the Supreme Congregation of the Holy Office by Benedict XV. In Dec. 1920 Cardinal Merry del Val became Camarlingo of the Holy Roman Church.

MESOPOTAMIA: *see* 'IRAQ.

MESOPOTAMIA, OPERATIONS IN.—The Anglo-Indian operations of 1914–8 in Mesopotamia were in their initial stages conceived on comparatively speaking modest lines. The object at the outset was merely (1) to protect the Anglo-Persian oil installations, (2) to occupy the greater part of the Basra vilayet so as to secure possession of the Shatt al 'Arab and the districts immediately round the head of the Persian Gulf, and (3) to impress the Arabs and others in this region and in the territories intervening between the Ottoman Empire and India. Steps had already been taken before relations between the Entente Powers and the Porte were actually broken off, and a brigade of the 6th Indian Div. had been dispatched to an island near the head of the Persian Gulf. Then, on Nov. 7, two days after the British declaration of war on Turkey, these advanced troops appeared in their transports at the mouth of the Shatt al 'Arab.

The fort guarding the entrance was taken, and the brigade encamped some miles up the stream on the right bank. On learning this, the Turks hurried all available forces down from Basra; but, the rest of the 6th Div. having arrived under Sir A. Barrett, they were on the 17th attacked and overthrown. Basra fell on the 21st, and Barrett then promptly pushed troops up to Al Qurna, which was taken on Dec. 9. As considerable Turkish reinforcements were arriving from Baghdad, he was not altogether comfortably situated; but the Osmanlis were not in an aggressive mood, and the invaders were little interfered with during the first three months of 1915. The Indian Government in March decided to raise the expeditionary force to the strength of an army corps by adding the 12th Indian Div., and early in April Sir J. Nixon took over command from Sir A. Barrett, who had made the most of the limited means at his disposal, General Townshend at the same time taking over the 6th Division.

I. THE BRITISH ADVANCE UP THE TIGRIS

During the latter part of April the Turks showed a marked increase of activity; but all their offensive efforts were frustrated, and Nixon, encouraged by these successes, decided to occupy Imara, 60 m. north of Al Qurna on the Tigris. The task was entrusted to Townshend, who carried it out by making free use of water transport for moving his troops, and who made himself master of the place on June 3, capturing 17 guns and 1,800 prisoners. Nixon now resolved on a blow against An Nasiriya,

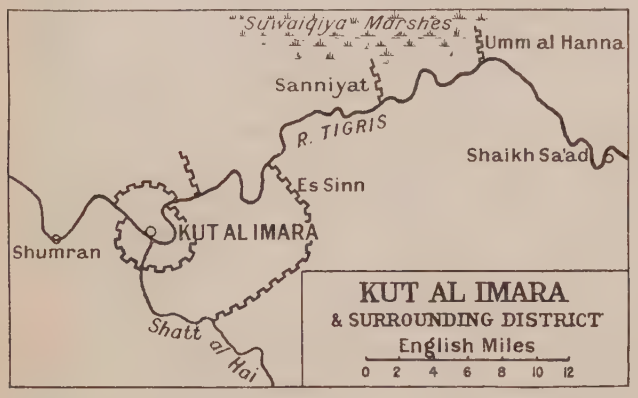
on the Euphrates, and the 12th Div. took possession of that town on July 25, capturing another 17 guns and 1,000 prisoners. The expeditionary force could then claim that it had effectually achieved the object for which the campaign had originally been undertaken, and its triumph was all the more creditable in view of the lack of transport and the inadequacy of its administrative service. The military organisation of India had not in pre-War days been framed with the idea of prosecuting martial operations overseas on an ambitious scale, and, as it was, the Government had accepted heavy commitments in Europe, in Egypt and in East Africa, in addition to the undertaking in lower Mesopotamia. There was a lack of reserve, the medical service had been starved, and the necessary military resources for an extension of the Mesopotamian operations were in reality deficient.

Occupation of Kut.—The authorities at Simla had unfortunately been inspired, by Barrett's and Nixon's successes, with the desire for adopting a more ambitious programme than that contemplated at the outset. They readily fell in with Nixon's proposal to advance up the Tigris to Kut al Imara—180 m. up-river into the heart of the enemy's country—and early in Aug. Townshend, with the 6th Div., began pushing forward from Imara. On Sept. 15 he drove an advanced Turkish force out of a position on the right bank of the Tigris about 15 m. from Kut, and on the 28th completely defeated the enemy a little farther on at Es Sinn, taking 1,650 prisoners, 13 guns and much war material. Kut was occupied, and the cavalry pursued the fleeing Osmanlis as far as Al 'Aziziya, half way to Baghdad.

Kut was a place of strategical importance, because at this point the Shatt al Hai, issuing from the Tigris, created a link with the Euphrates near An Nasiriya, and provided the line of

communications which would naturally connect Turkish forces on the lower Euphrates with Baghdad. It was furthermore the most populous spot between Imara and An Nasiriya on the one hand, and Baghdad on the other. But almost the whole of the expeditionary force, apart from detachments on garrison duty lower down, had now been projected into an isolated situation far within the enemy's territory, and it depended upon a long line of water communication—the Tigris—while it was served only by a restricted number of steamers and of smaller craft.

Still, the idea of pushing on to Baghdad had already taken shape even before the occupation of Kut. The Aug. discomfiture in the Gallipoli Peninsula (*see* DARDANELLES CAMPAIGN), coupled with a belated realisation that the Dardanelles venture



would not succeed, had rendered the British Govt. eager for some dramatic achievement in Mesopotamia. The Indian Viceroy had advocated an advance on Baghdad when the start up the Tigris from Imara was materialising, and Townshend's triumph acted as a powerful stimulus to such aspirations. Nixon intimated early in Oct. that he could open a road to Baghdad, under the circumstances then existing, but could not hold the city if it were taken. The military authorities at home, while admitting the possibility of capture, regarded permanent retention as out of the question with the limited numbers available, and they declared that if the place was to be held Nixon must be reinforced by two divisions. But, influenced by political considerations, the Government became more insistent, and in the end, although no reinforcements could be sent him immediately, and although they could not have taken part in the operations had they been sent, Nixon was told on Oct. 31 that he might advance on the city.

First Baghdad Offensive Fails.—Townshend, who had pushed a large part of his force on to Al 'Aziziya while the matter was being debated, found that the Turks were less disorganised than had been supposed, and that his own troops were tired and short of establishment; and he had serious misgivings. He, moreover, was unable to move for a fortnight, even after receiving the order to advance, owing to shortness of supplies and the need of organisation for the hazardous effort. He advanced from Al 'Aziziya on Nov. 11, and on approaching Ctesiphon some days later he found the Turks to be assembled there in strong force and expecting reinforcements. He attacked them on the 21st and was at first successful; but additional Ottoman troops arrived during the fight and recovered much of the lost ground, Townshend's losses in the action proving very heavy. During the next three days Townshend prepared to retreat, and on the night of the 25th he moved off.

No great difficulty was experienced at first; but, in consequence of the flotilla of supply transports and fighting craft being delayed by shoals, a halt had to be called on the 29th. Next day the pursuing Turks came up and delivered a resolute attack which was however beaten off, and after that the sorely tried little Anglo-Indian army was not seriously interfered with on its way to Kut, which was reached on Dec. 3. So, for the moment, ended the ill-advised Baghdad adventure. During the discussions of Oct. the Turks had been strongly reinforced from the northwest, and, by the time that Townshend had advanced from Al 'Aziziya, his adversaries had already grown so formidable that there was little prospect of his opening a road to the city. There never had been any prospect of his being able to hold the place even if he got there. Seldom has a military force been committed to an undertaking that seemed so difficult of attainment.

II. The Siege of Kut

With the approval of the Home and Indian Governments, Nixon decided that Townshend was to remain where he was, although if he did so he was bound to be invested. They assumed, altogether too readily, that he would be relieved before his supplies ran out. So his sick and wounded, his cavalry, most of the flotilla, and a portion of his animals were sent off down the Tigris (although the civilian population was unfortunately allowed to stop), preparations for standing a siege were put in hand, and on Dec. 8 Kut was hemmed in on all sides. Its situation, in a deep loop on the left bank of the Tigris, rendered the place readily defensible against assault or siege approach, and the German Field Marshal von der Goltz, who had just taken supreme command of the Ottoman forces in Mesopotamia, realised that unless it fell to an early assault the main Turkish task in this region would be to guard against a relief. Nur-ed-Din, the Turkish commander on the spot, had four divisions at his disposal, and on Dec. 10, 11 and 12 he delivered unavailing onsets upon the narrow front that was not covered by the river. After that the siege became a blockade, part of Nur-ed-Din's troops moved down the river some distance so as to confront any relieving force that might try to approach, and fortifications designed to meet such a contingency were erected.

Attempts at Relief.—Meanwhile the 7th and 3rd Indian Divisions had been detached from the Western Front in Europe, and began arriving in the middle of Dec. in the Shatt al 'Arab. General Aylmer took charge of the troops who were to undertake the relief of Kut, and units as they disembarked were pushed on to Imara with all speed and proceeded thence up the Tigris. Owing to a miscalculation as to the length of time that Kut would be able to hold out, the operations of relief were during their early days hurried more than was necessary, with the result that the force under Aylmer was during its operations in Jan. less well organised than it might have been. There was a grievous lack of heavy artillery, as well as a grave deficiency of water transport. Nevertheless the Turks were driven out of their advanced position at 'Ali Gharbi, were again defeated at Shaikh Sa'ad and, after a further defeat, fell back to the lines of Umm al Hanna, 20 m. from Kut on the left bank of the Tigris, at the entrance to a very awkward defile caused by the extensive Suwaiqiya marshes, which here approach to within a short distance of the river. The relieving force had hitherto triumphed over every obstacle; but when on Jan. 21 it essayed the storming of the Umm al Hanna position the effort failed, and so numerous were the casualties that Aylmer felt compelled to pause in his offensive and to await reinforcements. About the same date Sir P. Lake succeeded Sir J. Nixon in the chief command.

Improvement of Organisation.—Lake set himself to place Aylmer's line of communication on a better footing, to improve the medical arrangements and to develop the wharves at Al Qurna and Basra. Material of all kinds was, however, deficient, and the Turks were in the meantime developing their lines of defence on both banks of the Tigris below Kut, rendering the task of a relieving force more and more difficult. The British Government had, on receipt of the bad news about Umm al Hanna, ordered the 13th Div. to proceed from Egypt to Mesopotamia; but to move these troops from Suez to the front of the Tigris necessarily took some weeks, and it was moreover now too late to expand the water transport sufficiently to meet the needs of the growing Anglo-Indian force. Aylmer attempted no forward movement during Feb.; but on the night of March 7–8, without waiting for the 13th Div., he advanced from near Shaikh Sa'ad against the Es Sinn position, intending a surprise.

This was on the right bank of the Tigris, less than 10 m. from Kut, considerably higher up than Umm al Hanna and the defile caused by the Suwaiqiya marshes on the farther bank; but owing to the Turks holding that defile Aylmer's flotilla was prevented from advancing above Umm al Hanna. The operation involved a long march in the dark; when day broke part of the force had not arrived, and, although the enemy was surprised in the first instance, the attack was delayed. When the assailants advanced against the reinforced Turks, they were beaten back and had to retire to Shaikh Sa'ad.

Surrender of Kut.—The garrison of Kut was already on much reduced rations; but Gen. Gorringe, who had succeeded Aylmer, could make no fresh attempt for nearly a month owing to transport and supply problems. On April 5, however, the 13th Div. under Gen. Maude stormed the Hanna lines and penetrated well into the defile on the left bank of the Tigris; but, when first the 7th Div. and then the 13th Div. attacked the Sanniyat lines at its farther end, they were in each case repulsed. Kut could now only hold out a few days longer, so Gorringe tried to advance by the right bank. After its making some progress on the 17th, in spite of almost insuperable difficulties caused by floods, this movement was, however, brought to a standstill. A final effort was made by the 7th Div. on the 22nd against Sanniyat, which nearly succeeded. Finally, on the night of the 24th, a steamer loaded with provisions tried to run the blockade but failed, and on the 29th Kut, with its garrison of 9,000 British and Indian troops, surrendered. The efforts to save it had cost 24,000 casualties, but had it been known in Jan. and Feb. that the place could have held out so long, the relieving army would have enjoyed a better prospect of achieving its object.

British Opinions.—The tidings of this very grave mishap gave rise to profound dissatisfaction in Great Britain, a dissatisfaction aggravated by information gradually leaking out with regard to the sufferings of the sick and wounded after the retirement from Ctesiphon. A Royal Commission was set up a few months later to inquire into the operations that had taken place in Mesopotamia, and its conclusions were to the effect that the undertaking of a campaign on so ambitious a scale without adequate forethought and efficient preparations was worthy of blame; it also animadverted in strong terms on the very unsatisfactory character of the medical arrangements during the early stages of the venture. In the meantime it was decided that Kut must if possible be reoccupied. But the hot season was at hand. The troops had suffered exhausting trials and had met with cruel losses. Water transport, as well as artillery and other war material, remained totally inadequate. There could be no question of resuming the offensive on the hand-to-mouth lines on which the advance from Imara had been initiated in the previous year, and which General Lake had been obliged to continue when striving against time to relieve Townshend. A prolonged pause therefore became inevitable.

No reference has been made hitherto to the Russian forces in Persia. These, based on the Caspian, were actually in occupation of a considerable area of the Shah's northern territories. But they were weak in numbers, were operating in a region of wide extent, and the avenues leading towards the Mesopotamian plain traversed rugged and unproductive uplands. Military contingents so situated could afford no direct help to the Anglo-Indian army during the critical months which followed Townshend's advance to Kut, nor did their activities at any time withdraw an appreciable proportion of the forces under Von der Goltz from the theatre of war on the Tigris.

III. THE BAGHDAD OFFENSIVE

Great developments took place on the Anglo-Indian line of communications, and at the base during the summer. A reasonable amount of heavy artillery was gradually accumulated. An additional division arrived from India. Landing facilities at the ports were vastly improved. A change, moreover, took place in the chief command, for, after replacing Gorringe in charge of the forces at the front in July, Gen. Maude a few weeks later became commander-in-chief *vice* Sir P. Lake, whose health had broken down. Maude realised that there was yet much to be done before his army could hope to act with effect in this peculiarly conditioned theatre of war, and he set to work with indomitable energy to perfect his arrangements. He organised four divisions at the front up the Tigris as two army corps, and from Sept. to the end of Nov. he laboured unceasingly at the base, enjoying full support from the War Office in London, which had definitely taken over charge of the campaign from the Indian authorities. By the beginning of Dec. he had been furnished with enough river craft, his supply system was sufficiently advanced, and he had the necessary war material at his command, to justify his embarking on offensive operations of a far-reaching kind, and on Dec. 13 he struck suddenly and with signal success.

Disposition of the Forces.—Von der Goltz had left Mesopotamia, and Khalil Pasha was now in command of the Turks. They had withdrawn from Es Sinn and had established an entrenched camp nearly all around Kut, while holding on to Sanniyat, and in view of their dispositions Lake had begun a railway-line to run from Shaikh Sa'ad to a point near Es Sinn. It must be pointed out that Maude started his offensive with a force four times the strength of that which, under Townshend, had advanced to Ctesiphon a year earlier. His army astride of the Tigris was of necessity disposed in échelon, with its left (the II. Army Corps under Gen. Marshall) about Es Sinn, and its right (the I. Army Corps under Gen. Cobbe) facing Sanniyat. Maude's plan was to push his left yet farther forward, to clear the right bank of the Tigris to well above Kut, and, when these dispositions should in due course have taken effect, to force the lines of Sanniyat with his right.

Marshall opened the offensive by forcing the Shatt al Hai after a night march, and by capturing some of the Turkish defences which formed a bridge-head south of Kut. During the struggles that ensued, which lasted some weeks, Khalil's troops offered a stout resistance, so that although Maude's operations on the right bank of the Tigris were almost uniformly successful, they proceeded slowly and by successive stages. By the middle of Feb. the whole of the Turkish entrenched camp on that bank was in Anglo-Indian hands, and the Ottoman troops had all withdrawn to the farther side of the great river. No sooner had this part of the programme been accomplished than Cobbe on the 17th attacked Sanniyat. The effort failed for the moment; but when the assault was repeated five days later, it proved completely successful, and after a desperate contest in which the Turks lost very heavily, the formidable lines were at last carried. On the same day Marshall by a brilliant feat of arms forced a passage across the Tigris at Shumran, and no course was then left open to the Ottoman commander but to abandon Kut and retire in haste up the left bank of the river. Maude's flotilla, hitherto blocked by Sanniyat, pushed up at once past Kut, and the Anglo-Indian army could claim to have won a victory that went far towards wiping out the discomfitures of the previous year.

Turkish Retreat from Kut.—With his supplies guaranteed by the arrival of the water transport, Maude pressed on along the left bank of the Tigris on the heels of the fugitive Osmanlis. The river channel between Kut and Al 'Aziziya has many loops and bends, making it difficult for a naval force and a military force to act in concert; but on Feb. 26 the British gunboats after a smart action destroyed or captured practically the entire Turkish flotilla. Great prizes in war material and prisoners were at the same time being made by the advancing army, and the question of proceeding to Baghdad now arose. The army commander had from the outset contemplated the capture of that city after he should have expelled the enemy from Kut, and now received permission to carry out his plan. He found himself obliged to halt for some days at Al 'Aziziya, however, for fear of outrunning his supplies. On March 4 the Anglo-Indian army resumed its advance, and it was found that the Turks had fallen back behind the Diyala. This river presented a serious obstacle, and when an attempt was made to force the passage the effort proved in the first instance unsuccessful. But Maude promptly

threw a bridge across the Tigris, passed the cavalry and Cobbe's corps over to the right bank, and by March 11 Baghdad was in British hands.

The Turks had withdrawn northwards, but Maude allowed no pause in the offensive to take place. Cobbe pushed up the right bank of the Tigris along which a stretch of railway ran from Baghdad as far as Samarra, heavily defeated an opposing force at Mushahida, while Marshall conducted a most successful campaign on the Shatt al 'Adhaim. Cobbe, moreover, completed the operations on the right bank of the Tigris by the capture of Samarra. Then, having secured possession of a wide area of fertile territory to the north of Baghdad and driven the enemy in confusion into the deserts and uplands beyond, Maude was at last able to afford his victorious troops rest—just as the hot weather set in.

Further Progress Northwards.—The virtual conquest of Mesopotamia in a four and a half months' campaign had been brought about by the resolute execution of a plan of operations that was based on correct calculation of requirements—by a triumph of forethought on the part of a chief who always relentlessly followed up his successes in the field. Neither the stout resistance offered by the Ottoman troops, nor the formidable defence works which they had elaborated around Kut, had in reality proved the greatest stumbling block in Maude's path. The vast extent of the theatre of war, and the fact that his army must almost inevitably adhere to the line of the Tigris, which constituted one long military defile, had interposed even greater obstacles in the way. But those obstacles had been overcome by effective preparation.

A railway was constructed from Kut to Baghdad, sanitation and policing were established in the capital, comforts and recreation were provided for the troops, and effective steps were taken to tap the supply resources of the fertile tracts that were in occupation of the army. A division that had been in reserve at An Nasiriya was brought up to the front. Great efforts were also made for a time to arrange for co-operation with the Russian forces in Persia; but the untoward influence of the revolution in Petrograd of March made itself more and more felt in that quarter as the weeks passed, and before long it became manifest that little was therefore to be hoped for in that direction. The situation in Armenia was indeed becoming such as to cause Maude some anxiety, for in the late summer it appeared that the Turks under German instigation were contemplating an effort to recover Baghdad. This made Maude the keener to resume the offensive, and on Sept. 28 he struck his first blow by the capture of Ramadi on the Euphrates. This victory was followed up by successful operations in clearing the Jabal Hamrin, and by the occupation of Tikrit on the Tigris at the beginning of November. A few days later, however, the army commander was struck down by cholera, and he died on the 10th. He was succeeded by Sir W. Marshall.

IV. OPERATIONS IN 1918

The country traversed by the Tigris above Tikrit and extending north for a long distance is a sterile tract, hilly and broken at some points; the ordinary route from Baghdad to Mosul does not therefore follow the river but takes a direction to the east through Kifri and Kirkuk.

Maude's Plan.—Maude had intended to conduct his main advance by this line, but his death just at the moment when the project was to be put in execution created some delay; his successor, however, set troops in motion through the Jabal Hamrin in Dec., and by these Kifri was occupied in Jan. 1918. Having secured that point, Marshall suddenly set his extreme left wing on the Euphrates in motion in the middle of Feb., with the result that Hit was captured and the Turkish division which had retired up the river was surrounded, 5,000 prisoners and all its guns being taken. Transport difficulties were hampering the advance beyond Kifri on the other flank, but on April 29 the Ottoman forces were heavily defeated on the road to Kirkuk, losing 3,000 prisoners, and a week later Kirkuk was taken. Marshall, however, decided to withdraw his advanced troops in this quarter to Kifri, and active operations then practically ceased for five months. The collapse of Russian fighting power in Armenia had enabled the Ottoman staff to move some troops from there down to Mosul and northern Mesopotamia, and scarcely any assistance had been received from Persia; but Marshall's first campaign had nevertheless been remarkably successful and his position to the north and north-west of Baghdad had been effectually consolidated.

The British Mission to Persia.—In the meantime a special British mission, sent off in Jan. under charge of Gen. Dunsterville, and originally intended to proceed to Tiflis with the object of co-ordinating the resistance of the Armenians, Georgians and Russians to the Turks threatening Transcaucasia, had been trying to maintain satisfactory relations with the Russians in Persia. But great difficulties were placed in Dunsterville's way by the Russian officials, who were tending towards Bolshevism, while open hostility was displayed by certain of the Persian tribesmen. Some Russian troops, however, remained loyal to the Entente, and co-operating with these, small bodies of British troops were gradually pushed north so as to establish a line of communications between the Anglo-Indian army in Mesopotamia and the Caspian Sea at Enzeli. Resistance to the Turks in Transcaucasia was gradually breaking down during the early summer, and at the beginning of July the last of the Russian detachments in Persia proceeded thither by ship. The Ottoman troops appeared before Baku shortly afterwards and Dunsterville with a brigade of infantry therefore sailed for that city in August.

He found the Armenian garrison to be unreliable and the attitude of the Russian officials to be suspicious. The lines constructed for the defence of the place were of such extent as to require a large force to man them, Bolshevik armed craft afloat on the Caspian were a source of danger, and it soon became apparent that the safety of Baku depended entirely upon the meagre British force that had been thrust into it, for the Armenian soldiery displayed but little stomach for combat. Dunsterville and his men did what they could to save the place for a few weeks; but on Sept. 14 the Turks broke through the outer defences, and that night the British re-embarked and returned to Enzeli, whereupon Baku passed into the enemy's hands. A somewhat hazardous venture had failed; but it had at least prevented the dispatch of some of the Ottoman troops in Transcaucasia to confront the Anglo-Indian army in northern Mesopotamia.

Closing Stages of the Campaign.—The fall of Baku occurred just when the season had again become suitable for active operations on and about the Tigris, and Marshall was now directed to occupy Mosul, an undertaking for which he had been preparing all the summer. The best of the Turkish divisions were at this time assembled astride of the Tigris at Al Fat-ha, the point where the river breaks through the Jabal Hamrin range of hills. Here a naturally formidable position had been strongly fortified, and another position a few miles higher up the river had likewise been prepared for defence. Realising that a frontal attack would be hazardous and that a tactical turning movement was virtually out of the question, Marshall decided to throw an adequate force across the Ottoman communications between Al Fat-ha and Mosul. He entrusted the conduct of the operations as a whole to Gen. Cobbe, and arranged for a column to advance simultaneously from Kifri by Kirkuk towards Mosul.

Surrender of Ismail Hakki.—The final campaign in Mesopotamia began on Oct. 23 and it lasted only one week. Two cavalry columns, that with the shorter distance to cover being accompanied by some infantry, crossed the Jabal Hamrin many miles to the east of Al Fat-ha, passed the Little Zab a long way above its junction with the Tigris, and hit off that river several miles to the rear of the Turkish positions at and above Al Fat-ha. In the meantime the 17th Div. operating on the right bank and the 18th Div. operating on the left bank of the Tigris moved forward from above Tikrit. Finding himself threatened by the cavalry forces which were approaching the river between him and Mosul, Ismail Hakki Pasha, who commanded the Turks, now withdrew from the Al Fat-ha position to the one higher up at the con-

fluence of the Little Zab, followed up by the two Anglo-Indian divisions. But the 18th Div. advancing on the left bank of the Tigris, forced a passage across the Little Zab on the 25th, thus turning Ismail Hakki's left flank, and the Pasha thereupon transferred those of his troops that were on that side of the Tigris across the river and broke up his bridge.

On the 27th the 17th Div. was pressing the Turks, who were now all collected on the left bank of the river, and on the same day one of the cavalry columns forded the stream and began moving down that side of the channel against the enemy's rear. The 17th Div. was heavily engaged on the 28th before it finally made itself master of Ismail Hakki's position at the confluence of the Little Zab. That commander thereupon retreated to Sharqat, but on the morrow the last hope of the trapped Turkish force was destroyed, when a relieving column that was approaching from Mosul was defeated by Cobbe's cavalry. All that day Ismail Hakki resisted the advance of the Anglo-Indian forces on Sharqat. On the morning of Oct. 30, however, just as the 17th Div. was about to launch a final attack, the white flag was displayed within the Turkish lines, and the whole of one Ottoman division, together with the bulk of another one, surrendered, 11,000 prisoners, 51 guns and imposing stores of war material falling into the victor's hands.

The Kirkuk column had in the meantime been steadily working its way forward towards Mosul, almost unopposed, and Cobbe's forces were about to advance on the city from about Sharqat, when tidings came to hand of the signing of the Armistice. Mosul was occupied a week later, but the Ottoman power of resistance in this theatre of war was in any case shattered as a result of Marshall's final blow. Thus the long drawn-out struggle in Mesopotamia, which had proved so consistently favourable to the Anglo-Indian arms since Maude had launched his offensive at the close of 1916, ended in a blaze of triumph two years later, concurrently with what constituted the most sweeping tactical success that had been gained by either side during the course of the campaign.

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(C. E. C.)

MEŠTROVIĆ, IVAN (1883–), Yugoslav sculptor, was born at Vrpolje in Slavonia, the son of Croatian peasants. The rudiments of his art were taught him by his father and at the age of 13 he was apprenticed to a marble cutter at Split (Spalato), and three years later entered the Vienna Academy where he studied under Hellmer until 1904. During the succeeding years he exhibited at the Vienna Secession, at the Austrian Exhibition at Earl's Court, London (1906), at Munich, Venice and Paris—where he attracted the notice of Rodin. He was largely responsible for the formation of a nationalist artistic movement which included the sculptors Rosandić and Dujan Penić, the painter Rački and the architect Plečnik, and which culminated in the exhibition at Zagreb in 1910 and the Rome international exhibition of the following year. His work at this period centred chiefly around a projected Temple at Kosovo, for which he made a model for the building and a large number of figures of Yugoslav heroes—Marko Kraljević, Miloš Obilić, Banović Strahinja and Srdj—caryatid figures and groups and single figures of mourning widows. In 1915 an exhibition of his sculpture was held at the Victoria and Albert Museum, London.

Besides the naturalistic works designed for the Temple, Meštrović made a large number of religious reliefs and figures in walnut, of which two Pietà reliefs, one in the National Gallery of British Art and one in private possession, are typical of his bold cutting and great powers of design. His portraits include those of his mother (1908), Madame Banac (1913 and 1915), his wife (1915), Sir Thomas Beecham (1915, in the National Gallery of British Art), Lady Cunard (1915) and Miss St. George (1915). Among his later works the most important are the richly decorated Račić Memorial Chapel at Cavtat, near Dubrovnik (Ragusa), Dalmatia (1920–2), the designs for the projected mausoleum of Bishop Petar Petrović Njegoš, the Montenegrin poet, to be erected on the summit of Mount Lovćen (1924), and figures of St. Francis of Assisi and "The Artist's Mother in Prayer" (1925). In 1924 exhibitions of his work were held at the Fine Art Society in London and the Brooklyn Museum.

See M. Curčin, *Ivan Meštrović, a Monograph*, with bibliography and list of works (1919). For details of the Račić Chapel, see *Deutsche Kunst und Dekoration*, LII. (1923).

METALLOGRAPHY (*see* 18.2b).—Metallography is the study of the internal structure of metals and alloys, and of its relation to their composition and their physical and mechanical properties. Beginning with the use of the microscope for the examination of polished and etched surfaces of metals by Sorby in 1864, the scope of metallography has been widened to include other methods for the examination of the internal constitution of solids, such as the measurement of changes of volume and of heat content, and of electrical resistance, magnetic quality or behaviour towards X-rays.

The properties of metals and alloys, like those of other solids, depend partly on their chemical composition and partly on the internal arrangement of their constituents. It is possible for two specimens of metal, taken from the same homogeneous mass and identical in chemical composition, to have widely differing properties if they have been subjected to different thermal or mechanical treatments. Since this important fact has become generally recognised, other methods of examination must supplement chemical analysis in the control of materials for engineering and similar purposes, and in recent years there has been a great development of metallographic methods, together with a greatly increased application of them in industry, so that the microscope has become as indispensable as the balance in metallurgical works, whilst dilatometers, magnetic and electrical measuring instruments, and accurate pyrometers are becoming more and more frequent items of the equipment of a laboratory for the control of materials by manufacturers or users.

Preparation of Specimens.—The improved microscopical technique of the present day, and the use of high magnifications, make it necessary to prepare the surfaces of specimens with a very perfect polish. Polishing by hand on fine emery papers is preferred to the use of a machine, except in the last stage, when a rotating disc covered with cloth is used, the finest polish being given by levigated magnesia, although for low magnifications alumina is quite satisfactory. Steels are best etched by a 4% solution of picric acid in alcohol to which a small quantity of nitric acid may be added to bring out the boundaries of the crystal grains. Stainless steel and other highly alloyed steels require special reagents. Many tables are now published giving the most suitable reagents for the etching of the commonly occurring metals and alloys. Much light has been thrown on questions of metallurgical importance by the use of high magnifications, and progress is being made in this direction. It is important to observe the conditions of accurate microscopy by making a suitable choice of objective and eyepiece for the work. Mere magnification without higher resolution gives no information of value. The internal structure of martensite in hardened steel is a severe test of the resolving power of a microscope, and has been studied in detail with some success. The inverted type of microscope, in which the specimen is placed with its polished face downwards on the stage, has many advantages in convenience and rapid working, and has become popular in metallographic laboratories, in spite of certain optical disadvantages due to the larger number of reflections.

Macroscopic Etching.—In another direction, the examination of etched specimens with little or no magnification has proved of great practical value. For this macroscopic etching the surface to be examined is roughly polished and then deeply etched, acid solutions of copper salts being mostly used for steels, the copper which is deposited at first being completely removed by washing. Segregation is revealed by differences of etching, a very distinct pattern being produced, which may be recorded by

photography or by the method employed long ago by Sorby in making "nature prints," and temporarily forgotten, of using the etched surface as a printing block, rubbing printer's ink into the depressions, and transferring to paper by pressure. Macroscopic etching has proved of value in the detection of defects in ingots and castings, and also in following out the treatment of a metal during such processes as forging, the direction of the flow during working being shown by the curving of the lines representing small differences in composition in the original mass. This method is employed in some works as a regular means of control in the forge.

Strain Etching.—In 1921 a method of etching was described by A. Fry, having as its object the detection of plastic strain in mild steel. The steel to be examined is polished, care being taken to avoid any distortion, and is then annealed for a short time at about 200°C., after which it is etched in an acid solution of cupric chloride. Clearly defined dark bands make their appearance where the crystals have been deformed, and much information as to the distribution of plastic movement is obtained from a study of the figures. Rather strangely, whilst some mild steels give well defined patterns with ease, others of almost identical composition give no result, and it has not been possible to trace any connection between the composition and the degree of success of the etching. The method has therefore so far a limited value, but it is almost certainly capable of further development. On a microscopic scale, the mechanism of deformation has been studied by many investigators. Metals and alloys vary greatly in the degree of apparent confusion in the crystalline structure produced by deformation. Cupro-nickel is remarkable for its property of undergoing severe cold-working and continuing to give perfectly sharp and definite structures when etched, and this alloy, together with pure aluminium and an alloy consisting of tin to which 1·5% of antimony has been added, have been largely used in the study of the cold-working of metals and of the microscopic changes which occur on subsequent annealing.

Plastic Deformations.—The nature of plastic deformation being of such great importance to the engineer, this part of the subject has attracted much attention. A mass of metal, such as a forging, consists of an immense number of crystalline grains, the axes of which are directed at random, so that for practical purposes the metal is commonly regarded as isotropic, the individual differences being lost in the aggregate. At the bounding surfaces of the grains there is a discontinuity of properties, the origin of which is a subject of controversy. The failure of metals by fatigue (*see* FATIGUE OF METALS) under rapidly alternating stresses, cannot be explained by any assumption of isotropic character, and it becomes necessary to take into account the stresses in the individual grains. The problem is simplified by the comparatively recent discovery of methods for the preparation of single metallic crystals of such large size that they may be tested in an ordinary testing machine, the microscopic and other changes being observed. Aluminium has been studied in detail in this way by Carpenter and Elam; tungsten (in the form of wire) by Goucher and zinc, tin and bismuth by Polanyi and Weissenberg. In these instances the direction of slip and its relation to the crystalline structure have been determined.

The influence of the crystal boundary is studied by using test pieces composed of two crystal grains, a boundary crossing the specimen. Beyond the fact that the boundary offers an obstacle to slip, little has yet been established in regard to this factor, although the hypothesis of a layer of amorphous material between the grains has been applied with great ingenuity and success by Rosenhain to explain many of the facts of deformation and also of chemical attack on metals. The low tensile strength of metals, as compared with the theoretical cohesion calculated by indirect means, has led to the suggestion by A. A. Griffith that all ordinary solids contain innumerable minute flaws, and this hypothesis has attracted the attention of mathematical physicists, who have applied it with some success. By special devices, vitreous silica and glass have been prepared in an unstable condition in which the strength is of the order of the theoretical cohesion, but this has not been attained with metals.

X-ray Analysis.—Some departments of metallography have been transformed by the introduction of the methods of X-ray (*see* X-RAYS) analysis. The use of X-rays for the penetration of large masses of metal for the detection of blowholes and other defects is obvious, and whilst useful in practice has no theoretical significance; but the refined methods of crystal analysis due to Laue and to Bragg are far-reaching in their effects. The arrangements of the atoms in a space lattice (*see* CRYSTALLOGRAPHY) and the absolute dimensions of that lattice have now been determined for most of the important metals, and many interesting results have been obtained, amongst others the fact, established by Westgren, that α and β iron below 900° C. and δ iron above 1,410° C. have the same space lattice, a body-centred cube, whilst γ iron between 900° C. and 1,410° C. has a face-centred cubic lattice, and this conclusion is in harmony with the physical properties of these modifications of iron. The same method provides an accurate determination of the direction of slip in single crystals during straining, whilst the examination of drawn wires and of rolled sheets has shown that there is a tilting of the space lattices of the individual crystal grains, leading to a more or less parallel direction of one of the crystal axes throughout, this "fibre structure" being similar to that which the X-rays also show to be present in natural fibres. Studies of this kind are throwing much light on the question of the mechanical strength of materials.

Thermal Analysis.—The methods of thermal analysis have undergone comparatively little change. To ensure a uniform rate of cooling, the specimen of metal may be suspended in a furnace in which a steady temperature gradient has been established by winding a metal tube with resistance wire suitably insulated, and making the windings closer at the upper part. The specimen is then lowered through the furnace at a uniform rate by a mechanical device. It has been shown that the specimen should have a spherical or pear-shaped form in order to obtain sharply defined points on the heating and cooling curves. Thermo-couples are almost invariably used for the measurement of temperature, although the platinum resistance thermometer, used in the early and extremely accurate work of Heycock and Neville, has great advantages. Japanese workers, investigating the alloys of iron, have made much use of magnetic determinations as a means of fixing temperatures of transformation, the curves having much the same form as those derived from thermal observations; whilst other investigators have used the changes in electrical resistance with temperature for the same purpose. Several types of dilatometer have also been devised, in which the changes of length of a rod of the metal or alloy during heating and cooling are measured directly or by comparison with a standard or with a rod of vitreous silica with negligible expansion. Where the change of length is indicated by the tilting of a mirror, this method is susceptible of very great accuracy. It has proved of value in the study of hardened steels, and is now making its way from the research laboratory into technical practice.

Practical Applications.—The higher standards of strength and endurance demanded of metallurgical products by the modern motor and aeroplane industries (*see* AERO-ENGINES) and by such other branches of engineering as the manufacture of steam turbines (*q.v.*), have been responsible for the interest now being taken by engineers as well as by metallurgists in the study of metallography. Alloy steels, and many of the higher qualities of plain carbon steels and of non-ferrous alloys, have to be "heat-treated" to develop their maximum toughness or other desirable properties. To determine whether the treatment has been a correct one the methods of the metallographic laboratory must be applied. Moreover, the engineer is concerned with such problems as that of fatigue (*see* FATIGUE OF METALS), and with the general nature of mechanical deformation beyond the limits to which the theory of elasticity is applicable.

The methods devised for the study of metallic alloys have proved to be of value in the scientific examination of other solids. Whilst the original idea of the examination of metals by means of the microscope occurred to Sorby in consequence of his earlier

introduction of microscopical petrography, the technique of metallography has been applied to opaque minerals, and has made possible the detailed study of mineral veins and ore deposits. The work of the Geophysical Laboratory at Washington on the equilibrium in rock magmas (*see* PETROLOGY), with its methods of accurate measurement at high temperatures, is also based to a great extent on experience gained in the study of metallic systems.

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METALLURGY (*see* 18.203).—Progress in metallurgy after 1911 was profoundly affected by the World War. Modern warfare is so entirely dependent upon the products of metallurgy that the effort to secure military victory to some extent resolved itself into a struggle for supremacy in metallurgical output, in regard to steel products such as guns and shells, ship-plates and armour, etc., to copper and its alloys, to zinc, to lead and antimony, and, in a special degree, to aluminium.

During the war period, therefore, the progress of metallurgy became mainly a relentless struggle for output in which, in some directions, quality was sacrificed and heavy "war risks" were cheerfully taken. After the termination of the War, industrial conditions became extremely unsettled and difficult; the shortage of ships was followed by acute industrial disturbances, particularly in England. The Continental nations only slowly resumed their normal activities, and were gravely hindered on all sides by the direct and indirect economic consequences of the Treaty of Versailles. As the result of continued political and financial uncertainty, recovery in the metallurgical industries remained slow, except perhaps in Belgium, until 1925. Towards the end of that year, following the improved atmosphere resulting from the Locarno Pact, signs of improvement began to set in. Meanwhile, however, the metallurgical industries of America experienced a period of special prosperity, and the relative rate of development in metallurgical practice in the Eastern and Western hemispheres must be in part ascribed to these factors.

DIVISIONS OF THE SUBJECT

The whole period under review thus falls into three main divisions: Prior to 1914, the War period and the post-War period. The influence of the War has left important traces in certain directions but the line of development appears to be tending towards a simple continuation of pre-War lines. Thus, very great efforts in England and in certain of the British Dominions to render those countries metallurgically self-supporting were made either as the result of direct governmental encouragement and support or on account of the abnormally high prices ruling for some of the metals. This led to the development of properties and processes which were, under more normal conditions, uneconomical, and these—with governmental support unavoidably withdrawn and prices at a less abnormal level, have necessarily been abandoned. An important exception is the great development in the zinc industry in Great Britain and Australia, in which, thanks to real metallurgical advances, permanent economic success has been achieved.

In a totally different direction, however, war conditions led to a relaxation of the severity of specifications, particularly for steel products.

After the War, steel makers claimed that their difficulties were almost as great as ever. It was suggested that the relaxed specifications had led to no disastrous results and that, therefore, they might be safely continued. The British Engineering Standards Association adopted a compromise course and, while rejecting the extreme relaxations accepted under War conditions, also refrained from a return to full pre-War severity. It has resulted that "War time products" are looked upon with grave suspicion. A steady tendency towards increasing stringency in specifications, particularly in the direction of higher requirements as to the purity of metals and alloys, is now (1926) making itself felt. A similar tendency appears to exist also in America, but the methods of applying specifications and tests in that country are so widely different from those adopted in England that direct comparison is liable to be misleading.

Another effect of the War, and of the subsequent strong movement towards disarmament, has been the need for industrial rearrangements and reconstructions on a large scale. At the end of 1918, the metallurgical and allied industries were entirely devoted to armament and munitions and had then to find different outlets for their activities. The engineering reconstruction work required in the devastated regions of Europe proved no adequate outlet and in many cases, particularly in England, great works had to close down. In America, with an enormous home market the conversion of armament and munition works to peaceful output was carried through successfully on a large scale. Consequently, the industrial "slump" in that country was comparatively slight and brief.

I. IRON AND STEEL

Prior to 1914 iron and steel metallurgy showed a tendency towards the development of very large plants and larger individual units, both in regard to furnaces and rolling-mills. The tendency towards increased size made itself felt in the blast furnace, particularly in American practice; progress, however, also included development in the direction of furnaces with walls and external water-cooling, such furnaces being driven very hard.

Pre-War Progress.—In the period prior to 1914, considerable attention was given to drying the blast, and it seemed at one time that this would become universal practice. Under war conditions this development was checked, at all events in England, and has not been resumed since 1918.

Increased attention has, however, been given to the utilisation and cleaning of blast furnace gases. This became particularly important in England during the War on account of the shortage of potash, a substantial recovery of this material being obtainable from the flue-gases of furnaces in which the charge included potash-felspar. At the same time satisfactory cleaning of the gas very much increases its efficiency in stoves and under boilers, owing to the absence of fouling with dust. On the other hand, a degree of cleaning which will render the gas fit for direct use in gas-engines is a much more expensive matter, and not so obviously economical. The cleaning processes adopted are mainly of two kinds; one of these depends upon the electrostatic deposition of the dust by the method first suggested by Lodge and developed in America by Cottrell (*see* FUME PRECIPITATION). The other method depends upon filtration of the gas through fabric bags which are kept in a state of agitation, as in the Halberg-Beth system. Although, under normal conditions, potash recovered from flue-dust could not compete with the product of Continental mines, yet cleaning of blast-furnace gas will be continued. The dust itself may be utilised for the recovery of iron contained in it, by briqueting the dust by a modification of the Schumacher process, in which a weak solution of ferrous sulphate is used as binder. A further proposal is to concentrate the iron-content by some adaptation of the flotation process.

The application of flotation processes (see below) to finely divided iron-ores had not been found necessary or practicable up to 1926, but methods dealing with finely divided ores (both ferrous and non-ferrous) have been considerably developed. In addition to the Schumacher process already mentioned, reference must be made to the Dwight-Lloyd process, in which the ore is mixed with a small proportion of finely divided carbon and pressed into briquettes which are then heated to a moderate temperature. A partial reduction of the ore takes place, leading to a sintering of the briquette which thus acquires the necessary strength.

In the production of steel, the open-hearth furnace has made very great progress and appears likely to displace the Bessemer converter, although the latter seems to be holding its own to a certain extent. The steady increase in the application of basic open-hearth steel tends to give the large open-hearth furnace, particularly when working one of the continuous processes, a very great advantage.

War Period.—In the first place it became necessary, particularly in England, to make use of ores and other materials very different from those for which particular furnace plants had been designed, while the supply of operative labour became very difficult. In consequence of these and other difficulties, relaxation of quality, already mentioned above, became inevitable, particularly in regard to those grades of steel which were required in very large quantities.

Apart from the demand for enormous supplies of steels of ordinary grades, War conditions also caused great demands for

steels of the highest quality for special purposes. The production of guns was one of these, and much difficulty was encountered both in England and America with defects—known as "snow flakes" or "gun measles"—occurring particularly in nickel-chrome steels. Reversion to the use of a simple nickel-steel for such purposes followed, but this entailed a serious disadvantage, if only on account of the greater difficulty experienced in securing satisfactory heat-treatment. This difficulty was also encountered in connection with the gearing used for the propelling machinery of turbine-driven ships. High-quality steels, mainly alloy steels, were also required in relatively very large quantities for purposes of air-craft construction, principally for the working parts of aero-engines. This demand led to a great development in the production and treatment of alloy steels.

Here, and generally in the production of the better grades of steel, the electric furnace played a remarkable part. A large number of furnaces, mostly of the arc-resistance type, were installed, particularly in Sheffield. Their value lay in the super-refining of steel, sometimes produced in a basic open-hearth furnace, sometimes obtained by the direct remelting of alloy-steel scrap. Probably the power of the electric steel furnace to deal satisfactorily with such scrap, even when in the form of workshop swarf, constituted its greatest value during the War. Since the end of the War, however, the demand for such steel has almost disappeared, with the result that the greater number of the electric furnaces, both in England and America, became idle. None the less, there must be, in the future, a definite use for a certain number of electric furnaces in steel metallurgy.

Alloy Steels.—In regard to alloy steels, while nickel-chrome and nickel steels have found by far the widest application, particularly for war purposes, other alloy steels have also assumed importance.

Nickel-chrome steel in particular, in addition to the difficulties already mentioned, has been found to be subject to a defect known as "temper brittleness." Alloy steels, in order to assume their most desirable physical condition, require specific heat-treatment, which, as a rule, consists of quenching in oil, or more rarely in water, from a temperature above the critical range of the steel, followed by "tempering" or reheating to a temperature considerably below the critical range. In the majority of steels, the rate of cooling subsequent to tempering is of little importance, but in a certain number of nickel-chrome steels slow cooling after tempering leads to a form of brittleness which is entirely removed if the steel is cooled very rapidly (quenched) after tempering. The cause of temper-brittleness has received much investigation, and the results indicate that it is due to a change or "transformation" which occurs in the steel at or near 300° C.; it appears to be favoured by certain impurities, notably phosphorus.

Further, acute controversy has arisen as to the importance or otherwise of such "temper brittleness" on the ground that it can only be detected by a particular form of test—the "notched bar impact test." Hatfield has repeatedly suggested that this test measures a property of no practical importance, and that therefore temper brittleness is only "apparent" and not "real." This view, however, has not been generally accepted, since a number of investigators (Rosenhain, Greaves and others) have found a very distinct correlation between a low value under the notched bar impact test and cases of actual failure in service.

Chromium Steels.—For certain purposes, where simple nickel steels are not found adequate, a chrome-vanadium steel has been extensively used. The fact that vanadium plays a really important rôle in such steels has come to be recognised, but there are still difficulties in its metallurgical applications. For quite a different range of purposes a steel containing relatively large amounts of chromium (about 13%, Brearley) has found wide applications. Its best-known application is to the production of "stainless" cutlery, which has proved extremely successful in practice, and in spite of the relatively high cost has come into extensive use as a labour-saving device (*see* RUSTLESS STEEL). Some difficulty was at first experienced in hardening this material satisfactorily; it requires a higher quenching temperature than cutlery-hardeners have been accustomed to employ (Hatfield), and, as a consequence, the earlier products were insufficiently hardened, and gave rise to the complaint that such cutlery would not keep its edge. Later practice has overcome this defect, although the fact still remains that "stainless" knives, not being automatically sharpened by daily polishing, require careful sharpening from time to time.

New applications of this steel to other purposes where resistance to corrosion is important are being found almost daily. Incidentally, it was found that this steel is capable of resisting the severe conditions which occur in the service of an exhaust-valve in aeroplane engines, although a high-tungsten steel (18% tungsten) has been found to be slightly better. More recently, special alloy steels for use at high temperatures have been developed both in England and in Germany. These contain considerable proportions of both nickel and chromium, while in some cases tungsten is also present. Unlike the simple chromium steels, these new materials retain a considerable degree of strength at temperatures well above 700° C., particularly if tested in tension at ordinary rates of loading. Testing under prolonged loading—known as "creep stress testing"—has, however, been developed to furnish more reliable data where material is exposed to continued load at high temperatures, and it is as yet difficult to find any material which shows a higher "creep stress" than two tons per sq. in. at 800° Centigrade. This figure is attained both by some of the steels just mentioned and by a non-ferrous nickel-chromium alloy (80% nickel, 20% chromium). This whole subject is attracting much attention in view of the tendency towards the use of higher temperatures and pressures in both steam and internal combustion engines.

While the simple chromium steels of the "stainless" type still hold the field for cutlery and similar purposes where hardness is essential, their powers of resisting corrosion have been surpassed to a surprising degree by the recently developed alloy steels containing considerable proportions of both nickel and chromium, with, however, very little carbon. These are "austenitic" steels, *i.e.*, they consist mainly of what is known as "gamma" iron, are non-magnetic and very tough and ductile. They cannot, however, be hardened by quenching, although they frequently exhibit a tendency to harden very markedly under the action of cold working. The manganese steel of Sir Robert Hadfield, which proved so valuable as a material for shrapnel-proof helmets during the War, is an extreme example of this kind, as this steel becomes intensely hard when subjected to cold working, even if this only takes the form of surface abrasion. The high nickel-chromium steels do not harden to anything like the same extent, but sufficiently so to make them difficult to machine.

Like manganese steel in the quenched or "toughened" condition, they are non-magnetic, but their outstanding feature is resistance to corrosion. The best of them remain unaffected by most liquids, including sea-water, solutions of magnesium chloride and even strong nitric acid. Strong hydrochloric acid alone attacks them. These remarkable materials have only recently (1925) become commercially available, but their application is already developing rapidly. Their good physical properties, combining high strength and great ductility, make them desirable materials for many kinds of structural work, but applications on the very large scale are still hindered by their relatively high cost.

High-speed Steels.—In the metallurgical progress of the period under review, the development of high-speed cutting steels occupied an important place, their possibilities having been steadily exploited to an increasing extent, their development being naturally accompanied by an evolution of machine-tools capable of utilising the high cutting powers of the new steels. Under war conditions the great demand for tool-steels of this kind created a relatively enormous demand for tungsten, and considerable developments in the mining and production of tungsten took place. Efforts to replace tungsten by other metals were also made, and very great claims were advanced for a high-speed steel in which molybdenum in combination with vanadium was used in place of tungsten (Arnold). The action of cutting tools has received careful study by a number of investigators, largely under the auspices of the Cutting Tools Research Committee of the Institution of Mechanical Engineers.

In connection with high-speed steels, mention may here be made of a type of alloy which has been used, with considerable success, in place of such steel. This, known as "stellite," consists, according to a reliable analysis, mainly of cobalt 56%, chromium 34%, tungsten 9%, carbon 1%. Tests with this material have shown that it is capable of cutting rather faster than the best tungsten steel, provided that the cut is smooth and regular, but that for roughing cuts, where the tool is subjected to sudden shocks and jars, the alloy is unsuited, as it is too brittle and the tool frequently breaks off.

These alloys, originating in America, have received much attention and development in Germany. In England the hardness and incorrodibility of these alloys has led to their use as a substitute for platinum for such purposes as standard weights.

Cobalt Steel.—The great development of cobalt production at Sudbury in Canada has made this metal available and has attracted interest to its possible uses. A high-speed tool-steel, containing cobalt has been produced in Sheffield, which has been successful in general use and has the remarkable property that it does not undergo distortion during hardening. Great difficulty existed under war conditions in the production of accurate parts —such as those of shells and fuses—which were required to be strictly interchangeable. This difficulty extended back to the gauges and master-gauges used for the checking of such parts and ultimately in many cases to the cutting-tools used in their production. In other cases, the steel of which the gauges themselves were made gave much trouble owing to distortion during hardening, requiring considerable adjustment by " lapping " of the hardened article.

A cobalt steel has also become important for permanent magnets. Made in the first place of hardened carbon steels, the requirements particularly for the magnetos used for ignition purposes in aircraft engines led to the use of special steels containing about 6% of tungsten. A Japanese invention, based upon extensive researches carried out in that country (Hondo), has produced a cobalt magnet steel which, in its best examples, gives surprising results, combining an exceptionally high coercive force with a relatively large remanence. By the use of this steel a much smaller and lighter magnet suffices for a magneto of given power. The steel is expensive, and when supplied in quantity appears to vary in quality, while there is also some difficulty in its workshop manipulation.

Case Hardening.—Processes for the surface hardening of tough steel have come into increasing use, and methods for securing full hardness of the case, with a tough core and good gradation between the two, have been developed. More recently a method of surface hardening has been worked out in Germany (Krupp) which entirely avoids the necessity for quenching and its attendant distortion. A special steel, containing both chromium and aluminium, is employed, and the surface is hardened by the formation of a layer of intensely hard nitride, produced by prolonged heating at about 500° C. in a gas consisting mainly of ammonia.

Welding.—One of the most remarkable developments (metallurgical in the wider sense) during the period under review has been that of autogenous welding, (*q.v.*) both by the oxyacetylene flame and by the electric arc.

Both these processes afford a relatively cheap and simple means of making joints in metal, particularly in iron and steel, and as the joint consists of " the same metal " as that which is being joined there is a specious suggestion that the joint is " perfect " in the sense of being as good as the unjointed material.

Although it is quite possible to obtain welded test-pieces which break, under a tensile test, away from the actual joint, the joint itself can never be regarded as equal in strength and toughness to the unjointed steel. The reasons are that the material in the weld itself has solidified from fusion and is at best equal in properties to the same steel in the cast condition, while the rest of the plate itself has been immensely improved in quality by forging and rolling and possibly by heat-treatment. Further, adjacent to every such weld there is a region of steel which has either been severely overheated or —a little farther away—which has been heated to a temperature just below the critical range. In both these regions the steel is seriously weakened, and it is in the latter that test-pieces generally break.

The most serious difficulty, however, is that of being sure that any autogenous weld is truly sound. Examination of many welds has shown that complete soundness is difficult to secure, and that it is the exception rather than the rule, even in careful practice. Also, it is not possible to ascertain by any external examination of a weld whether it is sound or not. Examination by the aid of a powerful X-ray installation can sometimes be employed to assure the soundness of an important weld, but as a rule this is not feasible. It would seem, therefore, that there is grave doubt whether welded joints can be relied upon to carry severe working stresses or whether they should be employed in vital parts unless an exceptionally heavy factor of safety can be allowed.

Experience in aeroplane construction supports these doubts, and a construction in which steel tubes are joined together by pinned and soft-soldered joints has been found more reliable than autogenous welding, provided that the working stress on the solder is kept to a low value. On the other hand, the welding processes afford a ready means of making joints and effecting repairs where no other process could be used, and under war conditions particularly rapid repairs were frequently executed with great success. At the same time, welded joints should not be compared with the unjointed material but rather with joints made in other ways, such as riveting; and there the comparison is much more favourable except for the serious element of uncertainty. The application of welding, and particularly of electric arc welding, to such purposes as ship construction, has, however, found considerable acceptance.

Cast Iron.—This metal has received much attention, both on the practical and the research sides. In Germany this is strongly indicated by numerous patents and scientific papers and in Great Britain by the formation and growth of the Cast Iron Research Association. One of the most striking developments is that of so-called " Pearlite " iron, in which the rate of solidification is adjusted, by suitable preheating of the sand moulds, to the thickness of the casting and the silicon content in such a way as to secure desirable (pearlitic) microstructure and specially good physical properties. Special furnaces suitable for the production of cast irons low in total carbon, or specially desulphurised, have also been developed.

In America the production of malleable castings on a large scale has progressed, with the introduction of electric furnace melting for the iron and malleable-annealing in continuous furnaces of the tunnel-kiln type. The casting of grey iron castings in permanent metal moulds has also been developed, the chilling effect of the iron mould being avoided by the interposition of a hard layer of relatively non-conducting refractory material. The exposure of cast-iron to increasingly high temperatures has revived the problem of the " growth " of this metal, particularly on repeated heating and under the influence of superheated steam. The view that growth is essentially due to oxidation occurring in the graphitic pores of the iron is still held, but it is recognised that this action is not solely due to silicon and that it may be as much dependent upon the treatment of the iron and its consequent structure as upon its chemical composition.

II. NON-FERROUS METALS

Flotation Process.—The outstanding feature in the progress of non-ferrous metallurgy is summed up in the one word " flotation." Published scientific research (Langmuir, Sulman and Picard, Edser) has gone far towards the explanation of this process which has made enormous progress and has revolutionised the practice of the extraction of many non-ferrous metals, particularly those occurring in the form of sulphide minerals, such as galena, zinc-blende and the various pyritic copper ores. Its effects have been direct in superseding most gravitational methods of separation, and indirect in view of the fact that flotation deals primarily with very finely divided material, including the " slimes " which were the greatest difficulty of the pre-flotation metallurgist. Not only has this affected ore-grinding and handling practice, but it has brought about a great change in smelting practice also. Thus the treatment of copper concentrates is being carried out to a rapidly increasing extent in the reverberatory furnace to the steady exclusion of the blast furnace.

The Principles of the Process.—The principles of flotation do not appear to be entirely understood, as there is considerable divergence of opinion whether flotation phenomena are the result of purely " surface tension " forces or whether electrical forces play the most important part. The operations involved are, however, sufficiently clearly defined and consist essentially of three steps which may overlap or merge into one another. The first of these may be described as the " oiling " process, which consists in adding to the pulp or mixture of finely ground ore and water some " oiling " reagent. This may be either an essential oil or one of a great range of chemical substances, generally organic in character. Only a very small amount of such a reagent is used, since the addition of larger quantities produces entirely different effects due to the formation of oil films of appreciable thickness.

The minute amount of oil reagent, on the other hand, appears to produce some change on the surfaces of certain minerals having a metallic or semi-metallic character—zinc-blende being a typical example—which makes them less readily " wetted " by the liquor of the pulp, or, put in another way, increases the angle of contact

between these surfaces and the liquid. The gangue of the ore is less affected or not at all affected by the oiling reagent, but in many cases it is necessary artificially to increase the difference between mineral and gangue by the addition of some "gangue modifying reagent" which renders the gangue more readily wetted by the aqueous liquid of the pulp. These "gangue modifiers" are as a rule alkalis or mineral acids.

The third step in the process consists in adding to the pulp some substance which causes the ready production of a stiff and lasting froth when air is introduced, either by agitation or by blowing or drawing it through the liquid in a finely divided state. Very frequently the "oiling reagent" also serves as the froth-producer. When the pulp thus prepared is treated so as to produce a froth, the oiled mineral particles adhere to the air-bubbles very firmly, the mineral-air surfaces evidently being the seat of less potential energy than the mineral-water surfaces and consequently the buoyancy of the combined bubble with its mineral burden causes it to float to the surface, where it accumulates as a very stiff mineralised froth which can be mechanically separated in various ways. A further action appears to take place, which is related to the flocculation of the mineral particles by the oil emulsion in contact with air-bubbles. This results in the attachment to each bubble of the finest mineral particles in large and heavy agglomerations, thus greatly increasing the efficiency of the whole process.

The flotation process has found its largest application in the concentration of various types of sulphide ores, and, on this ground alone, has attained very great industrial and technical importance. Its application to other minerals has, however, been actively pursued and in a great many cases with considerable success. Minerals having a more or less metallic character are particularly suited for flotation, so that native metals constitute an obviously promising application. For the treatment of finely divided gold-bearing ores the older cyaniding processes in their modern forms continue to hold their own, but a few large mines have adopted flotation. In some cases, where graphite has interfered with cyaniding, a little agitation with oil is serviceable in rendering the graphite harmless.

Application to minerals of the oxidised type is less simple, and here it seems to be necessary, in many cases, to submit the ore to a previous "activating" treatment. Considerable success in the treatment of ores of this kind has been attained by the use of sodium xanthate as a flotation reagent. Preliminary roasting in a reducing atmosphere in the hope of producing a more or less metallic surface coating upon the ore particles has been tried, while "sulphidising" by exposing the finely ground ore to the action of hydrogen, ammonium or organic sulphide has also been used with great effect in some cases. Another problem is that of "differential flotation" for the purpose of separating different metalliferous minerals in a complex ore, such as the separation of zinc-blende or sphalerite from galena. In a certain number of cases, oiling reagents have been found which act differentially upon different flotable minerals, but every particular case still requires extensive research which does not always lead to a satisfactory industrial solution.

Smelting.—Beyond its immensely important direct effects in rendering possible the economic concentration of a number of ores and in cheapening the concentration of others, the development of flotation has also profoundly affected smelting practice, since the product of flotation, being very finely divided, differs widely from the product of gravity concentration. The concomitant progress of the reverberatory furnace has been accompanied by the development of the use of powdered coal as fuel, which has attained very wide extension.

Extremely finely divided coal is blown or otherwise forced into the combustion-space of the furnace, where it burns with a flame very similar to that of a jet of gas. The obvious advantages of such a system are that the loss of heat involved in the gasification of coal in producers is saved, together with the labour and the technical difficulties involved, while most of the advantages of gas-firing can also be secured by burning powdered coal. As against this must be set the cost of grinding the coal sufficiently fine and of injecting it into the furnace, while disadvantages also attach to the fact that the ash of the coal is introduced into the furnace and thence into flues, regenerators, etc. The question of the manner in which the coal is to be powdered and conveyed into the furnace receives rather different treatment in different forms of the process, but it is coming to be recognised that extremely fine grinding is advantageous, and in one process the coal is made into an "emulsion" of coal-dust and air which is said to flow and to be capable of being pumped like a dense liquid. The coal particles appear to become coated with a closely adherent (probably "absorbed") layer of air, and as soon as the temperature becomes high enough very rapid combustion takes place.

The use of coal-air mixtures or "emulsions," however, implies the introduction into the furnace of a relatively large amount of cold air, and this materially affects the question of regeneration or recuperation of the heat of the waste gases of the furnace. This is also affected by the presence of the fine ash-dust which tends to clog or even to flux the tubes or chequer-work. In some furnaces, where an extremely high temperature is not required, the problem can be solved by dispensing with regeneration or recuperation entirely and utilising the heat of the waste gases for raising steam, etc. Another point to be borne in mind is that a suspension of coal-dust in air may be a powerful explosive and must be treated with the care due to such substances. The use of oil fuel for firing metallurgical furnaces has also assumed large dimensions, and rivals the extension of powdered coal firing. It possesses many advantages in regard to the points just discussed, so that the relative merit of the two processes becomes mainly a question of cost.

In the methods for the extraction of non-ferrous metals, during the period under review, there has also been an important development in an entirely different direction. This is the great advance in hydrometallurgical processes, such as direct leaching and electrolytic treatment of ores. The elimination of the German zinc smelters during the War, so far as supplies of zinc ores from the British Empire and the Allied countries were concerned, undoubtedly supplied a stimulus to this development, which has been particularly marked in connection with the extraction of zinc from its ores. The treatment of many other ores has also come within reach of "wet way" methods, and these promise to play a large part in metallurgical extraction.

III. COPPER

The effect of flotation, powdered-coal firing and the advance of hydrometallurgical methods on the metallurgy of copper have already been referred to, but mention may be made of the leaching of alkaline ores with solutions of ammonia and ammonium carbonate which has been developed at the Calumet and Hecla mines. Leaching methods are employed by the largest individual producer of copper—in the Belgian Congo. In regard to the metal itself, there is an increasing tendency for the exclusive employment of electrolytic copper. In part, this arises from the increased supplies of this quality of metal, but more from the increasing demand for high purity. "Best selected" and "tough" (arsenical) copper are still in demand for some purposes, particularly for locomotive fireboxes and stays. The value of the arsenic has been found to lie in a certain neutralisation of the effects of oxygen; where more complete deoxidation is possible the value of arsenic is more doubtful.

With regard to finished copper, much attention has been paid to certain anomalies which occur during severe cold-working, such as wire-drawing, while the effect of heating the metal in a reducing atmosphere has also been further studied. A particularly interesting case of failure in copper when heated in a bath of fused sodium chloride has been studied by the Bureau of Standards at Washington. This material became brittle and broke with a typical inter-crystalline fracture. It was shown that this arose from an electrolytic effect produced by the contact of the copper with the iron containing-vessel in the presence of the fused electrolyte (Rawdon). Metallic sodium is formed in contact with the copper and appears to penetrate between the crystals of the metal. A case has also been described where molten solder (lead-tin) acted in a similar manner when in contact with a particular kind of brass, the so-called "manganese bronze" (Dickenson).

Copper Alloys.—With regard to copper alloys, some progress has been made in the difficult question of nomenclature. A committee appointed by the Institute of Metals has issued a nomenclature report which defines the old terms "brass" and "bronze." The former is defined as any alloy of copper with zinc containing more than 50% of copper; if other elements besides zinc and copper are present, they are to be named as a prefix to the term "brass." Thus an alloy containing 2% tin, 28% zinc and remainder copper would be termed a "tin brass." Bronze on the other hand is defined as implying an alloy of copper with tin, containing more than 50% of copper, with the same convention in regard to additional elements. Thus an alloy containing 10% tin, 2% zinc, and remainder copper would be called a zinc bronze. An attempt is also made to systematise nomenclature of more complex alloys. So far as brass and bronze are concerned, these two terms are now rarely used except within the definitions named.

An immense amount of experiment and research has been devoted to copper alloys. A considerable number of special alloys are now known, each possessing valuable properties. The aluminium manganese copper alloys have been very fully described in the ninth

report to the Alloys Research Committee of the Institution of Mechanical Engineers; these include alloys capable of attaining tensile strengths as high as 52 tons per square inch. Other copper aluminium alloys—known as aluminium bronzes—with or without the addition of iron, have found considerable industrial application in America, mainly as forgings, sometimes of considerable size. In Great Britain small die-castings of such alloys are used for parts of electrical switch-gear. Other alloys of special strength have been launched under various proprietary names.

For war purposes a most important part was played by the cupro-nickel alloys, containing either 15 or 20% of nickel, remainder copper. The production of this alloy on the very large scale required for the war revealed difficulties arising mainly from casting-defects in the slabs used for rolling. The remarkable power of this material to undergo severe cold-working, without becoming excessively brittle, suggests that it is likely to have other useful applications beside bullet envelopes, but for industrial purposes these alloys have not been widely exploited. On the other hand, the much more expensive Monel metal has been widely pushed and has found considerable practical application, mainly on account of its valuable combination of great strength with great resistance to corrosion. This alloy is manufactured "direct" by the reduction of ores from the Sudbury district in Canada, and special virtue is claimed on the ground that it is a "natural" alloy and has not been melted together in the foundry. It has been shown that such a claim cannot be substantiated.

Corrosion.—In connection mainly with copper alloys, a large amount of study has been devoted to corrosion, under the auspices of the Corrosion Research Committee of the Institute of Metals. The results have been embodied in a series of extensive reports, and serve to throw new light on the corrosion, particularly, of marine condenser tubes. This is ascribed, essentially, to the formation on the surfaces of the tubes of an adherent, but by no means impervious, deposit of basic salts. By restricting the circulation of water in contact with the metal under these deposits, they lead to the formation of solutions containing a fairly high concentration of cupric chloride, and such a solution rapidly attacks brass, with the resulting formation of pits and ultimately of holes. It is considered that the brass as a whole is dissolved under these deposits, but that in certain conditions the copper is redeposited as a spongy mass, thus leading to the apparent "dezincification" of the brass at such points. The problem is there to prevent such adherent deposits.

The production of protective coatings on metals as a means of preventing corrosion has received much attention, the use both of cadmium and of chromium plating for this purpose having been developed. Cadmium plating is used chiefly for the protection of aluminium, but chromium is applicable alike to steel, copper, brass and other metals. The deposition takes place from an electrolyte of chromic acid and requires a high current density. The deposit is bright, has a bluish white lustre and remains untarnished in the air and in many vapours. Owing to its great hardness as well as its chemical inertness, chromium plating is much superior to nickel or silver plating. The finish, however, is not yet quite as good.

The theoretical aspect of corrosion has also received much attention, and special research on this subject has been initiated. Already, however, a new theory of electrochemical corrosion has succeeded in uniting the views of those formerly advocating divergent views (Bengough, Evans, Bancroft). The scope of the researches undertaken by the above-mentioned committee has been extended to include fresh-water (land) condenser plant, and a special sub-committee has been formed to study the whole question of the corrosion of aluminium alloys, while a parallel investigation into atmospheric corrosion has been undertaken by the Non-ferrous Metals Research Association.

In regard to the corrosion of aluminium alloys and its prevention, important progress has been made by the development of the "anodic oxidation" process. The metal is suspended as anode in an electrolyte and rapidly becomes covered with an oxide or hydroxide coating which stops the passage of the electric current. This coating is strong and flexible and serves as an excellent protection against corrosion, the protective effect being further enhanced by allowing the surface to absorb a coating of lanoline. The treated metal and alloys resist both fresh and salt water and a salt spray. The coating can be applied to alloys of aluminium so long as they do not contain much more than 4% of copper.

IV. PLATINUM, ZINC, ALUMINIUM, ETC.

Platinum.—The metallurgy of the noble metals has not undergone any striking development during the period under review either in regard to extraction or uses.

The cyaniding process has undergone a series of more or less minor improvements, and it was at one time thought that aluminium dust would replace zinc-dust as the precipitant for pregnant solutions. Zinc-dust, however, still predominates, and the same remark applies to the proposed method of precipitating the metal electrolytically. In regard to platinum, there has been an ever-increasing scarcity, enhanced by the complete upheaval in Russia. The Russian supply, however, is potentially the largest in the world, and production has slowly increased. Some new discoveries of platinum have been made in the Waterberg and Lydenberg districts in South Africa. Here some 60% of the metal is too fine to be caught on corduroy strakes, and some other method, such as flotation or smelting with lead, will ultimately have to be used. Another source of platinum whose importance tends to increase is the refining residue of copper and nickel.

The great rise in the price of platinum has led to the study of possible substitutes, and a number of such materials have been put forward. Thus for the "breaks" used in the magnetos of internal combustion engines, tungsten sparking points have been substituted for platinum. For chemical purposes various alloys, some containing gold and palladium, have been tried, but only with partial success, since none of them really possess the combination of properties—chemical resistance and very high melting point—which renders platinum so valuable. A number of special alloys, in which tungsten and chromium generally play an important part, also exhibit great chemical resistance, but in these cases the hardness and brittleness of the material are generally a serious difficulty. For use in chemical work on a large scale, however, a considerable number of alloys have been produced which attain a fair measure of success. Silicon itself has many advantages for some of these purposes, but in the impure form, generally met with, it is relatively weak and brittle. Platinum itself has been prepared of much higher purity than was formerly attainable, owing to contamination by calcium derived from the lime crucibles in which it was melted.

Zinc.—The metallurgy of zinc received much attention during the War. Reference has been made above to the general questions relating to zinc extraction, but mention may be made here of the growth of the enormous electrolyte plant at Risdon, near Hobart, Tasmania, where 33,000 H.P. are employed in dealing with the products of the Australian smelters, producing zinc 99·95% pure, as well as over 150 tons yearly of cadmium. There has also been great development at the United States centre at Picher, Oklahoma. Efforts are being made in Norway and Germany to obtain high recoveries of zinc from lowgrade and complex ores by electro-thermic smelting with a silicide reducing agent.

On the Allied side during the War there was at one time considerable shortage of zinc, and substitute alloys were studied for all purposes which should avoid the use of zinc. The shortage then disappeared, and at a later stage alloys consisting mainly of zinc were tried as substitutes for brass and for certain aluminium alloys. Some of these zinc alloys proved to possess remarkable properties, tensile strength exceeding 20 tons per sq. in. being obtained in cast alloys containing about 3% of copper and 7% of aluminium, remainder zinc. It was further found that these alloys could be extruded and, under certain conditions, rolled. Unfortunately, alloys of this type, when they contain both aluminium and copper, are unstable and undergo serious changes of volume, accompanied by great loss of strength, even at the ordinary temperature if kept for any considerable time.

On the German side, while there was never any shortage of zinc, this metal and its alloys were extensively employed as substitutes for other metals. Pure zinc was widely used in place of copper for electrical purposes, while zinc alloys with copper and aluminium were also largely used. Apparently, cases of failure due to the instability of these materials passed unnoticed under the stress of war; at all events, German metallurgists have described these "war bronzes" without mention of such deterioration with time, except as the result of corrosion. It may be mentioned, however, that alloys rich in zinc, which contain either copper alone or aluminium alone, do appear to be free from the trouble in question.

Aluminium.—Aluminium and its alloys have played a particularly conspicuous part and have undergone remarkable developments since 1910. Prior to the outbreak of War, aluminium itself had become relatively very cheap (below £100 per ton), and this fact stimulated interest in its use. During the War, on the other hand, while the metal itself became scarce and very dear, its applications for military purposes grew very much in importance and raised its alloys for the first time to the rank of important materials of engineering construction. Its uses arose mainly in connection with aircraft, and became increasingly important in the closing years of the War.

This rapid development of aluminium alloys under war conditions was to a considerable extent the result of progress which had been

made prior to 1914. One step in this progress was marked by the section on light alloys contained in the Ninth Report to the Alloys Research Committee (Rosenhain and Lantsberry), published in 1909; but the discovery, by Wilm of Berlin, of the possibility of hardening aluminium and its alloys, when a small percentage of magnesium had been added to them, led to the next and most important forward step.

The application of this discovery to the best of the alloys, described in the above-named report, led to the production of the now widely known and used alloy "duralumin." This contains from 3 to 5% of copper, about 1% of manganese and about 0·5% of magnesium. As rolled, this material has a tensile strength of about 18 tons per sq. in., but if heated to a temperature of 480° C. to 500° C. and quenched, it gradually acquires much greater strength—rising to about 26 tons per sq. in., the ductility remaining the same at about 16 to 18% elongation on two inches.

Such a material, possessing the strength of a very mild steel combined with a density as low as 2·8, constituted a remarkable advance in wrought aluminium alloys. At quite an early stage in its history this alloy was employed for the construction of Zeppelin airships. The manufacture of the alloys was taken up in England under licence from the German patentee, and the alloy has been extensively used in the construction of British rigid airships. Its use has, however, not been free from difficulties and disadvantages, and great efforts have been made to arrive at better alloys by research in Great Britain. As a result, a series of new aluminium alloys for use in the wrought form have been developed.

The most important of these is one developed at the National Physical Laboratory and known as "Alloy Y," having the composition: copper 4%, nickel 2% and magnesium 1½%. This alloy, when quenched from a temperature of 530° C. after previous cold-rolling, can be made to attain a tensile strength of 28 tons per sq. in. combined with an elongation of 20% on two in.; its density is 2·8, and it possesses two very important further properties, viz., remarkable resistance to corrosion, and a relatively very high resistance to fatigue (repetition stresses), particularly at slightly elevated temperatures. Forgings of this alloy have been successfully used as connecting-rods in high-speed internal combustion engines, and it is finding a constantly widening range of engineering uses. More recently, a German alloy—"lautal"—in which the alloying elements are copper and silicon, has been produced industrially. It is not superior to alloy Y or duralumin.

Aluminium Alloys.—Important as are the results achieved with the wrought alloys just described, results of more immediate importance have been achieved with casting alloys of aluminium. At first these were employed mainly on more or less subsidiary castings, such as crank-cases, and for that purpose an alloy containing from 12 to 14% of zinc and about 2½% of copper (generally known by the number of the British Air Board Specification as "L 5") was very widely used. Efforts were soon made, however, to employ light-alloy castings for more important parts in aeroplane engines, viz., cylinders and pistons. Here the value of these materials lies not so much in their specific lightness as in their high thermal conductivity. In the case of the cylinder castings of air-cooled engines particularly, this is valuable in preventing distortion arising from unequal cooling of the windward and leeward sides, while in the pistons it reduces the temperature of the compression space and thus increases the density of the indrawn charge, and at the same time allows of the employment of higher compression ratios. The effect of these advantages is to increase very appreciably the power output of an engine of given size and weight, while also reducing the petrol consumption (*see* AERO ENGINES).

The alloys first and most extensively used were those of aluminium with copper, a 12% alloy being particularly popular. Another widely used alloy contains 7% of copper with 1% of zinc. These alloys, although initially not as strong as some of those containing zinc, do not lose their strength so rapidly when heated, so that at the working temperature of an aluminium-alloy piston (about 250° C.) they are stronger than such an alloy as "L5." Even these alloys, however, are relatively very weak when hot—they register a tensile strength of about six to seven tons per sq. in. at 250° Centigrade. Recently, researches at the National Physical Laboratory have shown that the alloy already referred to above as "Y"—containing copper 4%, nickel 2%, magnesium 1½%—is particularly strong at high temperatures, even in the cast state. It is, further, amenable to hardening by quenching and ageing even in the form of castings, and when thus treated attains a tensile strength as high as 26 tons per sq. in. at the ordinary temperature and 13 tons per sq. in. at 250° Centigrade. Many important applications are opened up as the result of the remarkable properties of this alloy.

An important development in aluminium alloys is the advent of the "modified" alloys of aluminium with silicon, known as "alpax," "silumin," etc. It has been found that an alloy of aluminium with from 10 to 14% of silicon solidifies with a rather coarse, nearly eutectic, structure containing some primary crystals of silicon. If, however, just prior to casting, the alloy is treated either by the addition of a small amount of metallic sodium or by reaction with a flux containing sodium compounds, such as the fluoride or the hydrate, the resulting structure is profoundly altered; the eutectic structure becomes exceedingly fine and the alloy now shows primary aluminium—*i.e.*, the eutectic concentration appears to have been altered. The "modified" alloy shows physical properties much superior to the untreated material, particularly in regard to an exceptional degree of ductility. The alloy yields castings having very good, clean, bright surfaces, although the avoidance of internal unsoundness is not always easy. For castings in which good appearance, ductility and absence of porosity is important, while strength is a lesser consideration, these aluminium silicon alloys offer great advantages.

Important progress has also been made in improving the soundness of aluminium alloy castings and ingots by the recognition of the fact that gases, and particularly hydrogen, dissolved in the molten metal give rise to pin-holing and unsoundness in castings, particularly when cooled at moderate rates. It has been shown (Archbutt) that most of the deleterious gas escapes from the metal if it is allowed to solidify very slowly, as for instance by cooling in the furnace. Subsequent rapid remelting does not allow it to reabsorb much gas, and castings can then be made from it of exceptional soundness. Similar observations in regard to copper were made simultaneously by Edwards and Prytherch. A less expensive method of removing hydrogen or other deleterious gas is that of bubbling nitrogen through the molten metal prior to casting (Rosenhain). This process has proved as successful as presolidification and is coming into use.

An important process for the electrolytic refining of aluminium was worked out in 1925 by Edwards and his collaborators in America. Molten aluminium, to which copper has been added to raise the density, lies at the bottom of the bath; upon it floats the molten cryolite electrolyte, and on this again floats the pure aluminium. The lowest layer is anode and the top layer cathode, and by electrolysis the top layer of high purity metal increases at the expense of the bottom layer. Aluminium has in this way been obtained of more than 99·95% purity, and the properties of this high purity metal are distinctly different from those of the purest commercial metal previously obtainable (99·7%).

Magnesium.—During the latter part of the period under review, this metal began to acquire technical importance. High price and great corrodibility had formerly prevented its use, but the price has been much reduced and, if the demand increases sufficiently, this may become lower than that of aluminium, as satisfactory raw materials are plentiful and the reduction process could be rendered equally economical. As regards corrosion, the production of metal of higher purity, and especially free from chlorides derived from the electrolyte, shows much better resistance to atmospheric corrosion than the older material.

The mechanical strength of magnesium and its alloys never approaches that of the better aluminium alloys, but their greater lightness offers some advantages. Magnesium and some of its alloys have been successfully used, particularly in France, for pistons of internal combustion engines and for other special purposes. The thermal conductivity of these materials, however, is decidedly inferior to that of aluminium alloys, and this is likely to lessen the advantages to be gained from extreme lightness. As further improvements are made, however, magnesium alloys are likely to prove of increasing technical importance.

Berylium or glucinum metal has been produced in reasonable quantities, although still at a very high laboratory cost. The combination of great lightness, considerable resistance to corrosion, high strength and high melting point found in this metal may render it technically interesting provided that the cost can be made reasonable and that it can be produced in a malleable form. The latter has not, so far, been done.

Nickel.—This has received a wide range of new applications, partly as the result of the need of the nickel industry to find new uses when the principal older use—for armament purposes—came practically to an end after the Washington Conference.

Among the more important developments are the alloys for use at very high temperatures. Alloys of nickel and chromium containing various amounts of iron and manganese have been known for a considerable time as " Nichrome," and proved valuable for such uses as electric resistance heaters for temperatures not much above 1,000° Centigrade. More recently these have been improved upon by a high-purity alloy consisting solely of nickel and chromium (80% Ni., 20% Cr.), and this alloy also exhibits remarkable strength at high temperatures (up to 800° Centigrade). In this respect, however, it is not appreciably superior to the best of the special " steels " which have been developed for use at very high temperatures. These usually contain large amounts of both nickel and chromium, to which tungsten is sometimes added, the proportion of iron in some cases falling as low as 54%. The increasing use of very high temperatures in engineering practice lends special importance to these materials.

Other Metals.—Developments in the remaining metals are mostly of a minor nature. Progress has been made in connection with *cobalt.* Its use in steel and in certain special alloys has already been mentioned, but it has also been shown to give a more adherent and more durable electro-plate coating than nickel, and it is important to note that its resemblance to nickel is not nearly so close as was previously supposed. In regard to *lead* and its alloys, a remarkable development has been that of alloys with the rare-earth metals, particularly calcium and barium. These confer a remarkable degree of hardness on lead, and a special alloy of this kind is finding application as a bearing metal.

V. PHYSICAL METALLURGY

Side by side with, and to a great extent furnishing the basis for, the development in the treatment and use of metals and their alloys, there has been a very great development of metallurgical science in the direction of " Physical Metallurgy."

Alloy Systems.—A very large amount of work has been devoted to the further and more detailed study of the constitution of alloy systems. A number of the somewhat rough preliminary determinations of the equilibrium diagrams of most binary alloy systems previously made, have been revised and rendered more accurate. In ferrous alloys, the iron-carbon system has received much further study, particularly in regard to the critical points of iron itself. Important work at the Bureau of Standards, U.S.A. (Burgess and Crowe), has firmly established the three well-known critical points, A_1, A_2 and A_3, and has shown that previous attempts on the one hand to discredit the very existence of A_2 (Carpenter), and on the other to show that it was a double point (Arnold) were based on experimental error. On the other hand, German investigators (Ruer, Hanemann) have established the existence of a higher critical point, which in pure iron occurs at a temperature very close to 1,400° Centigrade.

In connection with the critical points, considerable attention has been devoted to the whole question of allotropy. A Dutch school of investigators (Cohen) have sought to show the existence of numerous allotropic transformations in many metals, but their conclusions are based on extremely slight evidence derived from determinations of minute irregularities in density changes. On the other hand, the Japanese school (Hondo) seek to show that the A_2 transformation in iron is not allotropic in character, and this view is confirmed, to a certain extent, by strong evidence that the passage through this point does not involve any change of crystallisation—evidence which has recently been confirmed by X-ray methods. The matter, however, turns upon the definition of allotropy.

In addition to the iron-carbon system, the iron-nickel, iron-chromium, the manganese-carbon and nickel-carbon systems have been carefully investigated. The systematic study of the alloys of iron, in the first place free from carbon, has been begun at the National Physical Laboratory under the auspices of a special committee. The production of iron, chromium, manganese and silicon in a very high state of purity and a study of the iron-oxygen system are some of the results already obtained. In non-ferrous alloys, considerable attention has been given to the alloys of zinc, a portion of the ternary system copper-aluminium-zinc (alloys rich in zinc) having been very fully worked out (Haughton, Bingham).

The allotropy of zinc itself has also been very thoroughly studied (Benedicks, Bingham) and the reality of the transformations established. Great advances have been made in the knowledge of the equilibria of several of the important alloy systems in which aluminium is the predominant metal. The ternary systems aluminium-zinc-copper, aluminium-iron-silicon and aluminium-magnesium-silicon (Hanson, Gayler) have been fully worked out so far as the alloys rich in aluminium are concerned. For the representation of the results of such investigations a new type of model has been devised (Rosenhain) in which the various equilibrium surfaces are represented by systems of wires coloured to indicate the phases concerned in each transformation.

The Aluminium-magnesium-silicon System.—The study of the aluminium-magnesium-silicon system has proved particularly important, throwing light on the age-hardening properties which are found in many aluminium alloys containing magnesium. The magnesium in these alloys is present as a compound Mg_2Si, which is more soluble in solid aluminium at high temperatures than at the ordinary temperature. Quenching such an alloy from a temperature just below its solidus retains the compound in solid solution and in this state the alloy is soft. Gradually, however, at the ordinary temperature and more rapidly at slightly higher temperatures, this super-saturated solid solution deposits the excess of dissolved compound in an extremely finely divided condition, accompanied by a gradual hardening of the alloy.

This process is strictly analogous to that which can be brought about in certain alloy steels which can be rendered (or kept) completely " austenitic " (homogeneous solid solution) by quenching; they are then soft and ductile, and do not undergo hardening while at rest at the ordinary temperature. If the temperature is raised so as to bring about " tempering " the solid solution breaks down in precisely the same way as indicated above and the steel becomes hard (and also magnetic). It would thus seem that hardening as the result—direct or indirect—of quenching is due to the separation from solid solution, in a state of extremely fine division, of a phase the formation of which had been suppressed by quenching.

According to the theory of amorphous metal (*see* below) each of the minute crystallites of the phase thus separated will be surrounded by a zone of amorphous metal, which is itself very hard. If the minute crystals thus separated are sufficiently small and numerous, the result will be that a considerable proportion of the whole alloy will be thrown into the amorphous state, extreme hardness resulting. On this view, the martensite of hardened steel should consist mainly of minute crystallites of alpha-iron embedded in an amorphous matrix consisting of iron and carbon (or carbide) in solution in it. This suggested constitution of martensite readily accounts for its hardness and for the fact that it is magnetic, and—in view of the intimate manner in which the minute crystallites of alpha-iron are embedded in unyielding and un-magnetisable amorphous metal—accounts also for the magnetic hardness of the martensitic steel. This view is further confirmed by the observation that the chemical behaviour of quench-hardened steel is in certain respects closely similar to that of the same steel hardened by cold work and thus rendered partially amorphous (Whiteley). Finally, it has recently been shown by X-ray methods that the space lattice typical of alpha-iron is present in martensitic steel (Westgren).

Theory of Amorphous Metal.—The theory of amorphous metal just mentioned has played an important part in scientific metallurgical thought during the period under review.

The conception that metal could be rendered amorphous by mechanical disturbance of its crystalline structure was originated by Beilby, in the first instance, to account for the phenomena observed by him and others in connection with the polishing of metals and other substances. Beilby further applied the conception to explain the hardening which metals undergo as the result of plastic deformation (cold work) by suggesting that layers of amorphous metal are formed on the surfaces on which internal slip occurs during plastic straining. Both these theories are widely but not universally accepted in England and America, but find opposition on the Continent. More recently Rosenhain has brought forward a conception which has already been present in the minds of many other investigators (notably Osmond) in a less definite form, that a film or thin layer of amorphous metal exists in the inter-crystalline boundaries of all metals, quite apart from any effects of strain. This view has been vigorously contested, but experimental evidence in its confirmation has been steadily accumulated.

The most striking series of facts supporting the " amorphous cement " theory is connected with the behaviour of the inter-crystalline boundaries under stress. In normal circumstances these boundaries are stronger than the crystals themselves, so that fractures of metals generally occur by breaking through the crystals and not by pulling them apart. It has, however, been shown that at a high temperature near to, but definitely below, the melting point, pure metals can be easily caused to break with a perfectly inter-crystalline fracture (Rosenhain and Ewen). This is ascribed to the greatly decreased viscosity at such temperatures of the inter-crystalline amorphous metal, which is regarded as possessing the properties of a

viscous under-cooled liquid. The actual viscosity, however, depends very much upon the nature of the metal and upon the temperature—the farther a metal is below its normal melting-point the higher the viscosity of the amorphous phase.

Accordingly, in some of the softer metals and alloys the amorphous material is sufficiently mobile to allow of sensible movement in relatively short times. Thus, an alloy of zinc with copper and aluminium has been discovered which, in the cold-worked state when it is partially amorphous, behaves very much like pitch; it will bend to any desired extent if allowed to do so gradually, but breaks short if rapid bending is attempted. Similarly, the inter-crystalline cement in certain metals and alloys, although it proves stronger than the crystals when the metal is loaded at any normal rate, appears to be capable of giving way by some form of viscous or visco-elastic movement under very prolonged loading such as that due to internal stresses.

Season Cracking.—Much attention has been devoted to the study of fractures occurring in various metals as the result of the application of internal or other prolonged stresses. In brass these phenomena have become known by the misleading term " season cracking," but strikingly similar phenomena have been found in a number of other metals, including certain alloys of aluminium, platinum and steel (Rosenhain and Archbutt). In the case of brass, steel and aluminium alloys, certain types of chemical reagents which act preferentially upon the material in the crystal boundaries contribute to the occurrence of such fractures, which are typically inter-crystalline (Moore and Beckinsale). At the same time in the case of the aluminium alloys at all events such chemical action serves to accelerate the fractures, but is not essential to it since it occurs, although more slowly, in high vacuum or in an atmosphere of pure dry hydrogen (Rosenhain and Archbutt). In the case of brass it seems probable that " season cracking " can occur without the intervention of any chemical action.

Similar types of cracking which have been discovered in mild steel, however, appear to be very closely associated with the effects of certain chemicals, such as concentrated solutions of alkalis, fused ammonium nitrate, etc. While there are still some metallurgists who refuse to think in terms of an amorphous inter-crystalline cement (Hatfield, Tammann), the great majority of investigators are agreed that, directly or indirectly, this conception serves to explain the occurrence not only of inter-crystalline fractures under prolonged loading but also a number of other phenomena associated with the crystal boundaries.

Intimately connected, also, with the nature of inter-crystalline boundaries are the important phenomena of recrystallisation and crystal growth, which are of fundamental importance with all annealing and heat-treatment operations, and have been studied in great detail. One of the most striking features is the relatively rapid formation of large crystals in certain conditions. Thus in an oblong piece of metal which has been severely strained, and is then heated in such a way as to be well above the usual temperature of recrystallisation at one end and well below it at the other, a zone is found in which very large crystals are formed; this may occur either as the result of a temperature-gradient being applied to a uniformly strained piece of metal or of the application of a suitable uniform temperature to a piece of metal in which there is a strain-gradient.

The explanation appears to be that for a given degree of previous plastic strain there is a temperature most favourable to rapid crystal growth (Jeffries). An interesting practical application of the ideas derived from the study of these phenomena is the production of wires of certain metals, notably tungsten, which have been so treated as to consist, for considerable lengths, of single long crystals. This result is achieved by drawing the cold-worked wire into an annealing furnace at a suitable temperature, at precisely the right rate. The tungsten wire thus produced is particularly valuable for the manufacture of electric lamp filaments (*see* ELECTRIC LIGHTING), and it has also been shown to possess interesting elastic properties (Wartenberg) which are readily accounted for by the absence in such material of any amorphous inter-crystalline material the viscous or visco-elastic properties of which affect the behaviour of the wire.

Much study has also been devoted particularly to the recrystallisation of aluminium after cold-working, and as a result very large single crystals of aluminium have been produced (Carpenter and Elam). This has opened the way for the study of single crystals under strain (Taylor and Elam) and under fatigue (Gough and Hanson), (*see* FATIGUE OF METALS). It has also given the impulse for the production and study of single crystals in other metals (Davey, Bridgeman, Czochralski). The general result emerges that in most respects single crystals behave very much like aggregates, but possess greater ductility and, in the case of copper, have an appreciably higher conductivity. Their mode of deformation under strain and fatigue is found to confirm the original theory of deformation by slip on crystallographic planes (Ewing and Rosenhain), but extensive research on fatigue phenomena both in single crystals and crystal aggregates (Moore, Jasper, McAdam, Gough, Jenkin) has as yet failed to produce a satisfactory explanation of fatigue failure. The fatigue range, however, has been dissociated from the " elastic limit " and found to be related rather to the ultimate strength.

The application of X-ray methods of crystal analysis to the study of the atomic structure of metals has received much attention. The normal crystal lattices of almost all the known metals have been worked out, as well as those of a number of alloys (W. H. and W. L. Bragg, Hull, Bain, Wyckof, Westgren, Debye, Scherrer, Wever, Owen and Preston and many others). (*See* CRYSTALLOGRAPHY; X-RAY.) The majority of metals have either a face-centred or body-centred cubic lattice; a few (zinc cadmium, etc.) have a close-packed hexagonal structure, while the more brittle metals show structures of lower symmetry. The lattice structures of solid solution alloys are found to be those of the parent or solvent metals often either expanded or contracted by the addition of the dissolved metal. On the basis of this structure a general theory of the properties and behaviour of solid solutions has been worked out (Rosenhain) which affords satisfactory explanations of their behaviour on melting and freezing, their hardness and electrical conductivities and the power of different metals to form solid solutions.

X-ray methods have also been used, as already mentioned, in very important work on the behaviour of metal under strain and fatigue. The effect of cold working on the atomic structure has been particularly fully investigated, and it has been shown (Polanyi, Mark, Körber, Sachs) that cold working, such as cold rolling, not only elongates the crystals of a metal and sets up disturbances of the lattice structure, but sets the crystals in an orientation which tends to place one of their axes in the direction of rolling. Annealing, although it rapidly brings about recrystallisation into equi-axed crystals, does not necessarily abolish the oriented structure, probably because the newly formed crystals tend to assume the orientation of their predecessors. The directional structure—called by German workers the " fibre " structure of cold worked metal—is completely removed only by annealing at very high temperatures.

VI. ORGANISATION OF THE INDUSTRY

Certain institutions and organisations have attained importance as factors in metallurgical progress. The Imperial Mineral Resources Bureau, merged in the Imperial Institute, has published a large amount of information, mainly in regard to the mineral resources of the British Empire. The continued progress and growth of the Institute of Metals has been a marked feature of metallurgical activity; this body has now attained a membership of over 1,700. In America an Institute of Metals has been formed on different lines, as part of the Institute of Mining and Metallurgical Engineers.

The British Engineering Standards Association, formerly the Engineering Standards Committee, exerts a powerful influence on the metallurgy of those metals which form the materials of engineering. The issue of standard specifications for a large number of non-ferrous metals has been undertaken. In connection with the British Government Department of Scientific and Industrial Research, a Non-Ferrous Metals Research Association has been formed and has carried out important researches, particularly in connection with copper, brass, aluminium, the

jointing of metals, die-casting, etc. The British Cast Iron Research Association has been mentioned.

This brief summary of the developments of metallurgical science deals only with a few points of outstanding interest.

BIBLIOGRAPHY.—For iron and steel metallurgy, industrial as well as scientific, the *Journal of the Iron and Steel Institute*, London, should be consulted for original publications and abstracts which cover the literature of the whole world on this subject. In addition, excellent abstracts will also be found in the metallurgical section of the journal of the *Society of Chemical Industry*, and in such journals as *Stahl und Eisen*, the *Revue de Métallurgie* and *The Metallurgist* (supplement to *The Engineer*). In addition *The Iron Age*, *the Iron and Coal Trade Review* and similar journals may be mentioned. For general metallurgy, see the annual volumes of *Mineral Industry* and *The Journal of the Institution of Mining and Metallurgy*. For the non-ferrous metals, see *The Journal of the Institute of Metals* (abstracts as well as original papers), *Revue de Métallurgie* and several German journals, *Zeitschrift für Metallkunde*, *Metall und Erz*, *Zeitschrift für Anorganische Chemie*, and the appropriate section of the *American Institute of Mining and Metallurgical Engineers* (American Institute of Metals). The publications of the U.S. Bureau of Standards (Washington) and of the National Physical Laboratory (Teddington, England) are important. The Faraday Society (London) has published in its *Transactions* several "general discussions," including particularly one on *The Failure of Metals under Internal and Prolonged Stress*, another relating to metallurgical microscopy, one on the application of X-rays and one on *The Physical Chemistry of Steel Making*. (W. RN.)

METALS: *see* ALUMINIUM; ANTIMONY; COPPER; FATIGUE OF METALS; LEAD; MANGANESE; MICA; NICKEL; TIN; ZINC.

METCALF, WILLARD LEROY (1858–1925), American artist (*see* 18.257), died in New York City March 9 1925.

METEOROLOGY (*see* 18.264).—Since 1910 considerable advances in meteorological knowledge have been made both on the observational and the theoretical sides.

The Upper Atmosphere.—During the years before the War observations on the temperature and humidity of the air strata were rapidly accumulating, more particularly from a network of stations spread over Europe, and since the W. and N. of Europe is subject during the winter to the passage of many deep cyclonic depressions, the conditions of temperature in cyclones and anticyclones up to a height of some 20 km.(12½ m.) had become known. The brief tables which were all that were available to Cleveland Abbe in 1909 had been supplemented by much information, drawn up and arranged for the European results by Lt.-Col. E. Gold (M.O.No. 210e, *Geophysical Memoirs*, No. 5), by Dr. Wegener for the Continent (*Die Temperaturverhältnisse in der freien Atmosphäre*, III. Band, Heft 2/3, Leipzig, 1909) and for Russia by Dr. Rykatchew (*Meteorologische Zeitschrift*, Jan. 1911). In 1916 a summary of the information available about the upper air was drawn up for the Meteorological Office but not published. It quoted freely from Gold's paper but included the results of observations up to 1916. This summary together with certain theoretical matter was published in 1919 under the title "Characteristics of the Free Atmosphere" (M.O. 220c, *Geophysical Memoirs*, No. 13), and from it the following abstract summarising our present knowledge of the strata from 0 to 20 km. is mostly taken.

Temperature.—As the surface of the earth is left the temperature of the air decreases with increasing height, and when the great variations of climate and of the conditions prevalent in different parts of the earth are considered it is remarkable how uniform is the fall of temperature, now commonly called the lapse rate. The height to which it extends is variable, but in all places in which observations have been made, the lapse rate up to 8 km. has been found close to 6° C. per kilometre. This holds between 2 and 7 km. not indeed exactly but approximately, for summer and winter and for places as far apart as the equator and the Antarctic in lat. 78° S. Thus in Batavia the lapse rate up to 8 km. is 6·1° per km.; at Petrograd it is 5·8°. In England in the winter it is 5·8°, in the summer it is 6·0°. These are means, but the rule holds quite well even for the individual case, for if in one part of the 8 km. the lapse rate is small this is usually compensated for by its being large in the other part. The only important exception that has been found so far is in regions and at times where the temperature is extremely low, as in Siberia or Canada or the Antarctic in the winter. In such instances the bottom layer is unduly cold and the lapse rate is negative over the first 2 km., so that the rule would make the upper air temperature too low. Also it must be remembered that the daily variation of temperature does not extend upward more than one or two km., so that the mean for the day rather than the precise temperature at the moment should represent the surface temperature. This layer, in which temperature falls with increasing height, is called the *troposphere*.

At a certain height, which varies with the latitude, with the barometric conditions, and with the season, the fall of temperature ceases, and the air up to the greatest heights that have been explored remains at a nearly uniform temperature in the vertical direction. This upper part in which there is no lapse rate is called the *stratosphere*. The boundary between the two parts is found at about 16 km. near the equator and at 10 km. in northern Europe. Over England its mean height is 10·5 km., falling to rather below 10 km. in the winter, and rising to over 11 km. in the summer. In the centre of a deep cyclone the value may easily fall to 8 km.; in an anticyclone it may exceed 12 km.

The temperature of the stratosphere is below 200° A. over the equator and in tropical regions; it is above 220° A. in northern Europe. In Canada it seems to be lower in the summer than in the winter. These anomalies are roughly expressed by the rule that the mean temperature of the air column taken with regard to height from 0 up to 19 km. is approximately the same in all parts of the earth. There is probably a physical reason for this, and it explains the unexpectedly low temperature above 14 km. over the equator and the curious reversion of temperature between summer and winter over Canada (Toronto) where the seasonal range is very large.

The annual range of temperature in the troposphere does not differ very greatly from the range at the surface; in island and coastal climates like England it is rather greater in the upper parts than at the surface; in continental climates the surface has the greatest range. In the stratosphere the range is much reduced and, as already stated, appears in Canada to be reversed although enough observations are not yet available to make this absolutely certain.

Whether or not there is any regular diurnal change of temperature above 2 km. height is uncertain; all that can be said is that if there be any its amplitude is certainly less than 1° Centigrade.

The mean annual temperatures are given in the accompanying Table I. In Europe the probable error of any value is about 1° C.; for Canada and the equator owing to paucity of observations it is greater, especially above 15 km., where it may reach perhaps 3° Centigrade. Over Europe the mean temperature does not change from 14 to 20 km. and does not change much over Toronto. Over the equator the lowest temperature, which is about 193° A., is not reached under 16 or 17 kilometres.

TABLE I. *Mean Atmospheric Temperature*

The values are in the Absolute scale with the first "2" omitted. 273·0° = 0° C. = 32° F.

Height km.	Petrograd	Scotland	Manchester	Berlin	England, S.E.	Paris	Strasbourg	Vienna	Pavia	Mean for Europe	Toronto	Equator
14	23·5	22·0	20·5	18·7	18·9	19·1	17·9	19·6	17·7	19·1	12·5	3·0
13	23·4	21·8	20·6	19·3	18·7	19·3	17·6	19·6	16·4	19·2	14·0	11·0
12	20·7	21·6	20·0	18·3	18·8	19·5	16·8	18·3	16·1	18·4	16·2	19·0
11	20·0	20·5	20·9	19·2	19·6	20·2	18·1	18·4	18·5	19·1	19·3	27·0
10	21·3	21·2	23·2	21·9	22·2	24·3	22·3	21·8	22·7	22·2	23·2	35·0
9	24·4	24·8	28·2	26·8	27·5	30·0	27·8	26·9	27·3	27·2	29·3	43·0
8	29·8	30·2	33·8	33·1	33·6	36·9	34·8	33·6	33·9	33·4	35·9	51·0
7	37·1	38·0	40·2	40·8	40·7	44·3	42·1	41·2	41·2	40·7	43·5	58·0
6	43·3	45·0	47·0	47·9	47·8	51·4	49·3	48·8	49·4	47·8	50·9	65·0
5	49·8	52·0	53·8	54·8	54·8	58·1	56·1	55·6	56·2	54·6	57·7	72·0
4	55·7	58·4	60·4	61·0	61·7	64·3	62·4	61·9	62·9	61·1	64·1	79·0
3	61·3	64·0	66·6	66·9	67·7	69·8	68·4	67·6	69·2	67·0	69·6	85·0
2	66·7	70·3	71·7	71·7	73·2	74·5	73·8	73·0	75·1	72·4	74·8	90·0
1	71·0	75·3	77·0	76·8	78·0	78·5	78·2	77·6	80·7	76·8	78·3	95·0

Pressure and Density.—The temperature of the air having been found by observation, the pressure and the density are easily found up to the height to which the observations extend. In the same way the mean pressures and mean densities can be determined from the mean temperatures without appreciable error provided the mean pressure at the surface is known.

In the lower strata the pressure at any particular height is naturally most dependent upon the surface pressure, but since the air is lighter, bulk for bulk, when it is warm the pressure decreases less rapidly than usual in a warm area, and the pressure at any given height depends more and more upon the temperature of the underlying air as that height increases. Thus it comes to pass that in the hot regions of the earth, say in the belt included between the two tropics, the pressure at the height of 9 km. is very much greater than it is at the same height over temperate latitudes, and the pressure gradient which causes the prevailing westerly winds of the cirrus level is thus produced. At a height of 20 km. the surface pressure has ceased to have much effect, and it requires a rise of nearly 20 mb.[1]

[1] The average pressure of the atmosphere at sea-level being reckoned as 1 bar = 1000 millibars (mb.). 1 mb. = 0·0295306 in. mercury at 32° F. in lat. 45°.

in the surface pressure to produce a rise of 1 mb. at 20 km., whereas a change of 1·5° C. in the temperature of the air column will produce that effect. It has been stated that the mean temperature of the air column up to 19 km. is much the same in all parts of the world, and it follows that the same level is one of nearly uniform pressure.

The pressures are given in Table II. at various stations for heights up to 20 kilometres. The values for Canada and the equator at heights above 15 km. are not very reliable owing to paucity of data.

The densities are given in Table III. The variations in the density became of great consequence during the War on account of their influence on the range of projectiles; they depend on the connection which has been found to exist between temperature and pressure.

Statistical Methods.—Statistical methods have been much in vogue of late years, and it is necessary to indicate how the method of correlation has been used for forecasting and for elucidating meteorological problems. A large number of correlation coefficients have been determined between various meteorological events, and the values of many of them are given in the *Computer's Handbook*, M.O. 223, Section V.—Tables, published by the Meteorological Office.

The advantage of a correlation coefficient in estimating the connection if any between two events, is that it expresses the connection as a decimal, which must lie between 1 and −1, and thus renders the connections between different pairs of events comparable with each other. The velocity of the wind and the steepness of the barometric gradient may be taken as an example. The actual connection is obvious from the daily weather charts; on some it is well marked, on others badly, but the fact that there is a connection is quite apparent from even two or three charts. The correlation coefficient is about 0·70.

The application of the method of correlation to forecasting can hardly be looked upon as very successful. Two highly correlated events are required happening with a definite time interval between them. A correlation coefficient may be high accidentally if it be founded on too small a number of instances, but genuinely high coefficients between meteorological events occurring with more than a few days' interval between them are hard to find. The most successful instance is perhaps the forecast of the monsoon rain of India by Sir G. T. Walker from the correlation between it and sundry other events occurring in the spring of the same year or earlier. In this case the correlation coefficients on which the forecast is based have values of about ·50; if values of ·80 or ·90 could be obtained very much greater success would be secured. There are a few coefficients of from ·70 to ·80 between the rainfall at various periods and the subsequent yield of sundry crops. Thus in the eastern counties of England if April and May be wet it is a practical certainty that there will be a large hay crop, and if the autumn be dry there will almost certainly be a large crop of wheat the next year. Mr. R. H. Hooker has calculated a most interesting set of figures relating to the correlation between the weather and the crops, and the problem has been re-analysed by R. A. Fisher and W. A. Mackenzie, *Quart. Jour. R. Meteor. Soc.*, July 1922. Similar work has been done for the potato crop in America by J. Warren Smith, and many correlation coefficients relating to agricultural matters are available from Sweden and elsewhere.

The case is different where correlation is resorted to for the purpose of elucidating some physical process in the atmosphere; here a small coefficient is just as likely to give information as a large one But the interpretation of the meaning of the coefficient is often difficult, and in many cases the value obtained is quite different from that which most meteorologists would have expected.

Sir G. T. Walker in addition to his statistical work on the monsoon rain has published several sets of correlation coefficients, and amongst them a set of 100 showing the correlation between the sunspot number and the temperature at 100 stations well distributed over the earth's surface. The correlation is negative and small, but it is large enough to be significant and to prove that during the 40 or so odd years considered the temperature of the earth as a whole was lower at the time of the sunspot maxima than at the time of the minima. It is commonly supposed that the sun is giving out most energy when its surface is most disturbed, and this idea has been confirmed by direct observation of the radiant heat. A perfectly satisfactory explanation is at present wanting. Walker also correlated between sunspots and rainfall, and found the coefficient too small to be significant. However, in none of these cases has the work been wasted, since important conclusions have been established.

For high correlation coefficients one must take data relating to the upper air. The relation between pressure and temperature is so remarkable and has such a close relationship to the theory of cyclones and anticyclones that it will be treated separately. The correlation coefficients between the thickness of the troposphere, a height commonly denoted by H_c, the surface pressure, the temperature of the stratosphere and other variables often exceed 0·70, and the generally high values show quite plainly that there is an ordered sequence in the processes going on above, which is strikingly absent from the surface phenomena.

Cyclones and Anticyclones.—In a cyclone the troposphere is cold and the stratosphere warm, in an anticyclone the reverse is the case; in a cyclone the tropopause is low, in an anticyclone high. Thus as an area of low pressure passes across the map the following changes occur in the various air strata above. The deficiency of pressure is about the same from the surface up to some 10 km.,

TABLE II. *Mean Pressure of the Atmosphere*
(Millibars)

Height km.	Petrograd	Scotland	Manchester	Berlin	England, S.E.	Paris	Strasbourg	Vienna	Pavia	Mean for Europe	Toronto	Equator
20	55·0	55·0	55·2	54·8	54·9	56·0	54·7	55·0	54·8	54·9	..	53
19	64·0	64·2	64·6	64·0	64·1	65·6	64·0	64·4	64·0	64·1	..	63
18	74·5	74·8	75·4	74·8	75·0	76·6	74·8	75·2	75·0	75·0	..	75
17	87·0	87·3	88·0	87·4	87·5	89·6	87·6	88·0	87·6	87·8	..	90
16	101	102	103	103	102	105	102	103	103	102	..	107
15	118	118	120	120	120	123	120	121	121	120	120	128
14	138	138	140	140	140	143	141	142	142	140	142	152
13	161	161	164	164	164	167	165	165	165	164	167	178
12	187	187	192	192	192	195	193	193	194	192	195	209
11	218	219	224	225	224	228	226	226	227	225	228	244
10	255	256	261	262	261	266	263	263	264	262	266	283
9	297	299	302	305	303	309	307	306	307	305	309	327
8	346	348	352	354	352	357	355	354	356	353	358	376
7	400	402	407	408	407	412	410	409	412	408	413	430
6	461	464	468	470	469	473	472	471	474	470	475	491
5	529	532	537	538	538	541	540	539	542	538	543	558
4	606	608	613	614	615	617	616	615	618	614	618	632
3	692	694	698	699	699	701	700	700	703	699	703	713
2	787	787	793	795	795	796	794	795	797	794	798	803
1	896	894	898	900	900	900	900	900	901	899	903	903

TABLE III. *Density, Grammes per Cubic Metre*

Height km.	England, S.E.	Europe	Canada	Equator
20	87	87	88	96
19	102	102	102	113
18	119	119	121	135
17	139	139	144	162
16	162	162	169	191
15	191	191	198	225
14	223	223	233	261
13	261	261	268	294
12	305	307	314	331
11	355	358	365	374
10	409	411	415	419
9	463	467	470	469
8	524	528	528	522
7	589	590	592	581
6	658	661	662	645
5	735	735	733	714
4	819	819	815	789
3	909	913	905	871
2	1014	1017	1011	968
1	1128	1128	1134	1067
0	1253	1258	1258	1174

above which it falls off rapidly until the normal value for the height is reached at about 18–20 kilometres. The temperature from about 2 to 8 or 9 km. falls, and from 10 to 20 km. it rises. The height at which the lapse rate ceases, the limit of the troposphere falls. These statements are based on the very high correlation coefficients that are found to exist between pressure and temperature. It will be seen from the accompanying Table IV. (which gives the correlation coefficients) that close to the surface the correlation is low, but it is very high from 4 km. to 8 kilometres. There are probably two reasons for this. The surface temperature is governed by many considerations—the time of day, the state of the sky, the strength and direction of the wind; higher up these disturbances do not apply, for, as has been already stated, the diurnal variation is very shallow and the correlation between the components of the wind and the temperature is surprisingly small above a few km. height. Secondly, it may well be that the chief item in determining the temperature is the recent vertical motion of the air, and a systematic vertical flow of air either up or down is plainly impossible quite close to the surface. The

TABLE IV.—*Correlation Between Pressure and Temperature*

Height, km.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Jan.–March	−·02	·54	·82	·79	·86	·85	·84	·87	·91	·81	·35	−·32	−·38	−·37
April–June	·14	·28	·49	·79	·89	·89	·92	·87	·81	·45	·20	−·12	−·24	−·01
July–Sept.	−·02	·31	·56	·72	·75	·81	·83	·87	·87	·88	·43	−·08	−·41	−·19
Oct.–Dec.	·33	·56	·76	·77	·83	·87	·85	·85	·86	·78	·29	−·24	−·34	−·50
Means	·11	·42	·66	·77	·4	·85	·86	·86	·86	·72	·32	−·19	−·36	−·28

rise and fall of the tropopause (H_0) and the regularity with which it occurs is shown by the high correlation, ·84, between it and the pressure at 9 km. height. There is hardly a single instance of observations made in Europe at a time of really low barometer in which H_0 has not been found well below its average value. The dependence of the temperature of the stratosphere on the barometric conditions is not so close, the correlation being only ·50; but based on some hundreds of observations as these correlation coefficients are, ·50 is amply significant. Still the importance of a correlation in general depends upon its square rather than upon itself, and the significance of ·50 is very different from that of ·90 or ·85.

One noticeable result of this high correlation between pressure and temperature is that the density is not subject to much variation save close to the surface, for a high pressure and a high temperature act upon the density in opposite ways, and since they occur together the density remains comparatively unchanged. (*See* also below, *The Meeting of Air Masses from Different Climates.*)

Stability for Vertical Displacements; Available Energy.—The rate of decrease of temperature with height is normally less than the 10°, C. per km. by which clear ascending air is cooled by adiabatic expansion. Consequently a small portion of air, if forcibly raised or depressed, usually tends to return to its original level. The periodic time T of its vertical oscillation, if undamped, has been calculated by Väisälä (*Soc. Scient. Fennica, Comm. Phys. Math. II.*, vol. 19, p. 38) to be

$$T = 2\pi\sqrt{\frac{\theta_0}{g(\gamma_0-\gamma)}}$$

where θ_0 is the absolute temperature of the air in the equilibrium level, g is the acceleration of gravity, γ is the actual decrease of temperature per unit increase of height, γ_0 the adiabatic value of γ. Thus at a height of three km. T is normally about ten minutes, while in the stratosphere T is about five minutes.

Any energy that there may occasionally be in a vertical column available for producing thunderstorms or other local disturbances has been made conspicuous by Sir Napier Shaw, who has plotted upon a special chart observations of temperature against those of pressure at the same height, so as to produce, without calculation, the entropy-temperature-diagram familiar to engineers. Fig. 1 is a simplified sketch of it showing the observation for Benson, Oxfordshire, on July 5 1923, 7 P.M. He regards the dry air as the working substance and calls its entropy the "realised entropy," while the moisture he regards as merely a reservoir of latent energy.

Let A and B be two points where the curve representing the observations cuts the same adiabatic for cloud. If a sphere of unit mass of cloud at A is pushed up it will follow this adiabatic. If we may assume that the surrounding air, in descending to take the place of that which has risen, does so by a very small displacement spread over a large horizontal area, and in such a way that unit mass descends across each level surface, then what has occurred will apparently be indistinguishable, as far as energy changes are concerned, from the passage of a unit mass round the thermodynamic cycle from A *via* the adiabatic to B and back by the observed curve. Then, from the known properties of the entropy-temperature-diagram, the mechanical energy will be proportional to the area enclosed between the curves, and will be consumed or given out according as the observed curve lies below or above the adiabatic.

Actually two diagrams are employed, in order to represent humidity as well as temperature and pressure.[1]

Radiation in the Form of Electromagnetic Waves.—Just as a point has no parts and no magnitude, so a single direction contains no radiant energy. To mark off a definite flux of energy we must have two areas not in the same plane. For simplicity let us think of two square centimetres placed one metre apart and both normal to the line P Q joining their centres P and Q.

We are now able to define the "intensity of radiation" in the direction P to Q as being 10^4 times the amount of energy that goes through both square centimetres in the order P to Q in one second.

The intensity of radiation $K_\nu d\nu$ in the range of frequencies of vibration between ν and $\nu+d\nu$ has been shown to have the following value inside a black enclosure at a uniform temperature θ absolute centigrade,

$$K_\nu d\nu = \frac{2h\nu^3}{c^2}\left(e^{\frac{h\nu}{k\theta}}-1\right)^{-1}d\nu$$

where c is the speed of light, $h = 6{\cdot}55\times10^{-27}$ erg sec, $k = 1{\cdot}34\times10^{-16}$ erg degree^{-1}. (Planck, *Vorlesungen über die Theorie der Wärmestrahlung*, Barth, Leipzig.) This is known as the "full" radiation. Further it was proved by Kirchhoff that if a portion of air absorbs a fraction α of the energy in a ray of frequency ν then that portion emits in the direction of that ray the same fraction α of the full radiation, $K_\nu d\nu$, corresponding to its temperature θ.

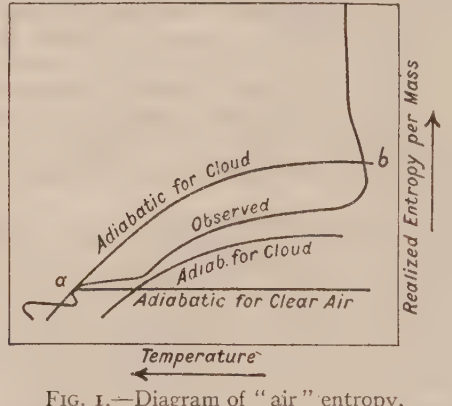

FIG. 1.—Diagram of "air" entropy.

Through any sphere of one centimeter diameter in the atmosphere radiations of various frequencies are passing simultaneously in all directions without blocking each other's paths. A division at a wave-length of three microns has nearly all the energy of solar origin on the short side of it and nearly all the energy of terrestrial origin on the long side.

When a ray passes through a centimetre length of atmosphere its energy is in general divided into three parts. One part, almost unchanged in wave-length, is turned aside and scattered in most directions. Another part is absorbed, that is to say—changed into heat-energy of the air. Whatever is left goes straight on unchanged in wave-length. The fraction that is scattered in unit length of path depends on the wave-length and the

[1] See the report of the meeting of the International Commission for the Investigation of the Upper Air, held in London 1925 (M.O. 281 published by H.M. Stationery Office, London).

presence of dust and cloud particles. Even air molecules scatter, and more so in the shorter wave-lengths. Hence we see a yellowish sun in a blue sky (Rayleigh). The fraction that is absorbed in unit length of path depends on the wave-lengths and the various gases present; N_2, O_2, O_3, CO_2, H_2O, each absorbing strongly characteristic wave-lengths. At the same time each small sphere of atmosphere is sending out, at the expense of its heat energy, long-wave radiations equally in all directions.

With such an abundance of processes going on simultaneously the difficulty of the observer has been to separate that one which he wished to observe; and the difficulty of the theorist has been to include them all without making his theory too cumbrous.

"Long Wave" Radiation.—W. H. Dines (*Geophysical Memoirs of the Meteorological Office*, No. 18) has measured the radiation which will not go through a glass plate and which reaches the earth from different zones of the sky. He finds that the intensity of radiation from a thick fog is within a few per cent. of that from a "full" radiator at the same temperature; whereas the intensity of radiation from a clear zenith sky at sunset ranges from about 0·65 of that from a grass meadow in December to 0·74 of it in September. The meadow was practically a full radiator. From the way in which the intensity increases as the zenith distance increases, W. H. Dines concludes that there must be at least two groups of radiation differently absorbed; one group comprising two-thirds of the energy is half absorbed in passing normally through a horizontal layer of clear air 100 millibars thick, the other group, comprising one-third of the energy, is only 1/20 absorbed in this way; whereas 100 millibars of thick fog absorb eight-tenths or nine-tenths of all the incident energy. The sum of the radiations received by a horizontal square centimetre from all parts of the sky amounts to 500 gr.-cal. per day on the average for clear skies, or 700 for fully clouded skies, while at 10° C. a full radiator gives out 711 of these units.

A similar but not identical account is given by A. Angström (*Quar. Jour. Roy. Meteor. Soc.*, April 1924). He divides the energy sent out by a full radiator into three groups of wave-lengths comprising one-fourth, one-half, one-fourth of the whole energy. For the first group a clear moist atmosphere is almost perfectly transparent. The second group is almost totally absorbed in the first 30 metres above ground when the vapour pressure is 10 mm. of mercury. The third group has a variable absorption chiefly dependent on the amount of water-vapour present.

"Short Wave" Radiation of Solar Origin.—A square centimetre placed outside the atmosphere normal to the sun's rays would receive, according to the extensive researches of Abbot, 1·94 gr.-cal. per minute. The question of natural fluctuations about this mean is still in debate (*vide* the *Monthly Weather Review*, July and Aug. 1925). When the sun is in the zenith of a clear sky a unit of incident energy is divided roughly as follows: 0·78 comes to earth in the direct beam, 0·06 is scattered to space, 0·06 is scattered to earth and 0·10 is absorbed, warming the air. When the sun is nearer the horizon the scattering and absorption are much greater relative to the transmission. Abbot states that clouds reflect about 0·65 of the solar radiation falling upon them. Much further information will be found in the Smithsonian publications, in L. V. King's paper in the *Phil. Trans. Roy. Soc.*, A, vol. 212 (1913), and in recent papers in the *Meteorologische Zeitschrift*. The absorption by ozone is now being studied by Dobson and Harrison (*Quar. Jour. Roy. Meteor. Soc.*, 1925).

Turbulence and Diffusion.—A statement that the wind has a velocity of so many metres per second customarily refers to some mean value taken over say 10 minutes or more. Actually portions of air are moving faster or slower than the mean, as well as up and down and horizontally to and fro across the mean track. These deviations are well shown on the records of pressure-tube anemometers. The wandering portions carry qualities with them. Thus fragments coming from a rapid, damp, hot, smoky current into an adjacent slow, dry, cool, clear layer would bring with them some of the momentum, moisture, potential temperature and dust characteristic of the layer in which they had previously journeyed. The motion of such fragments is too intricate to be analysed in detail; but its general effect can be summed up by a statistical coefficient representing the average rate of transfer of the quantities mentioned. The theory of diffusion, originally worked out by Fourier for the diffusion of heat in metals, and applied by Fick to the diffusion of salts in liquids, has been extended to eddy-diffusion in the atmosphere by Åkerblöm, G. I. Taylor (*London Roy. Soc. Phil. Trans.*, A, vol. 215, pp. 1 to 26), Hesselberg and Sverdrup, and W. Schmidt and others.

If χ be the concentration of the dust or other diffusing substance it has become customary to assume that the changes proceed in accordance with an equation of Fick's type such as

$$\frac{\partial\chi}{\partial t}+\bar{u}\frac{\partial\chi}{\partial x}+\bar{v}\frac{\partial\chi}{\partial y}+\bar{w}\frac{\partial\chi}{\partial z}=K\left(\frac{\partial^2\chi}{\partial x^2}+\frac{\partial^2\chi}{\partial y^2}+\frac{\partial^2\chi}{\partial z^2}\right)$$

where x, y, z, t are rectangular co-ordinates and time; $\bar{u}$, $\bar{v}$ and $\bar{w}$ are the components of the *mean* velocity, and K is the diffusivity. This view of the process has led to K being observed under a variety of circumstances, by the increase of wind aloft, by the rate at which water vapour finds its way upward to the clouds, by the scattering of smoke or of balloons or of volcano ash. It has thus become known that K is of the same order of magnitude whether the diffusing substance be momentum, dust, moisture or potential-heat. It has further appeared that in the first three kilometres K is roughly proportional to the speed of the mean wind, and is decreased when the static stability of the atmosphere increases. But the variation of K which overwhelms all others is that dependent on the size of the portion of atmosphere which is observed. Thus if the air is confined to a capillary tube, K is about 0·2 cm.^{2} sec.$^{-1}$, if the portion is a few metres across K is of the order of 10^3, if a few hundred metres K is about 10^5, if a thousand kilometres across K is of the order of 10^{11} in the same units (Defant). We may explain this by saying that diffusivity is a compensation for neglect of detail, and that the amount of compensation increases as the things neglected include in succession molecular motion, gusts, squalls and cyclones. In other words, the mean-velocity $\bar{u}$, $\bar{v}$ and $\bar{w}$ takes on a new sense whenever the size of the portion of the atmosphere under observation is enlarged, and this enormously affects K. See a paper by L. F. Richardson in the *Roy. Soc. Proc.*, A, 1926.

A vertical gradient of mean wind tends to produce eddies, statical stability tends to damp out eddies. The condition in which these effects just balance has been formulated by L. F. Richardson (*Phil. Mag.*, Jan. 1925). Rayleigh's theory of unstable temperature gradients has been brought into meteorology by D. Brunt (*Meteor. Magazine*, v. 60, 1925, p. 1).

The Heat Balance of the Atmosphere.—Gold (*Lond. Roy. Soc. Proc.*, A, vol. 82, 1909, and simultaneously Humphreys (*Astrophys. Journ.*, vol. 29, 1909, p. 14) showed that the existence of the stratosphere could be explained if it were in radiative equilibrium. The discussion as to the atmosphere generally has been continued by Emden (*Sitz.-ber. d. Akad. Wissensch. Wien*, 1913, p. 55), W. H. Dines (*Quar. Jour. R. Meteor. Soc.*, April 1917), W. Schmidt (*Akad. Wiss., Wien, Mat.-Nat. Kl.*, 127–75, 1918), Chapman (*Quar. Jour. R. Meteor. Soc.*, April 1925) and others, and has joined with theories of radiative equilibrium in stars. (See E. A. Milne, *Phil. Mag.*, Nov. 1922. It is, however, doubtful whether the horizontal transport of heat can be neglected in comparison with that in the vertical.

There are seemingly four methods by which an appreciable vertical flux of heat energy is produced in the atmosphere: (1) Convection, which carries heat upwards from the earth's surface; its action does not extend beyond the first few kilometres. (2) The latent heat set free by the condensation of aqueous vapour, which carries upwards to the regions where clouds are formed the solar heat which has evaporated the water from the sea or wet land surface; this acts in just the same region as convection. (3) Radiation, which mostly carries heat upwards from a lower to a higher stratum. These three methods present no difficulty, but it must be pointed out that "convection" here

means local convection, *i.e.*, heat carried by an ascending current that is produced by local warmth, not heat carried by an air current or by eddy motion due to the general circulation. This distinction, however, is difficult to maintain, because even frictional eddies behave as thermodynamic engines. (4) Stirring by eddies in the wind *i.e.*, turbulence. W. Schmidt has made an estimate which shows that the amount of heat carried downwards across the 2 km.-level in Europe by this cause to be 50 gm. calories per sq. cm. per day.

An important conclusion follows. Since above the region of the formation of heavy clouds neither convection nor the supply of latent heat by condensation is efficacious, the actual lapse-rate there must represent the balance of two opposing tendencies, one radiation, tending toward an isothermal condition, and the other mixing, tending to an adiabatic lapse rate.

Dynamics of Wind.—In the upper air it has been shown by Gold that the wind velocity approximates to the ideal "geostrophic wind" which is imagined as blowing parallel to the isobars with a speed v given by

$$v.2\omega\rho \sin \phi = \partial p/\partial x$$

where ω is the earth's angular speed, ρ is the air density, ϕ is the latitude, ρ is the pressure, and x is horizontal distance normal to the isobars. In the first kilometre this simplicity is modified by eddy-viscosity. Elaborate theories on the dynamics of wind continue to develop.[1]

The Meeting of Air-Masses from Different Climates.—Dr. J. Bjerknes writes as follows:—

Cold currents in the temperate zone can be traced back, more or less directly, to polar regions; in winter also to cold continents. On their way they are heated by contact with the ground and become unstable, provided that no adequate heating takes place in higher layers. Polar currents in temperate latitudes therefore frequently have cumulus or even cumulo nimbus with showery weather.

Warm currents in the temperate zone can be traced back to subtropical regions; in summer also to warm continents. On their way northward they are cooled in contact with the ground and become stable. If the cooling continues to the dewpoint then stratus clouds or fogs are formed.

Where cold and warm currents border each other, in typical depressions or elsewhere, precipitation is usually formed. In cases where the warm current gains terrain (warm front) it climbs upwards on a gently inclined wedge, say 1/100, formed by the underlying cold current. Impervious cloud-sheets are formed in the climbing warm current, low clouds close to the warm front and higher clouds farther forward. Precipitation is usually falling from the whole extensive cloud system, but that falling from the higher parts evaporates before reaching the ground. In cases where the cold current displaces the warm (cold front) the precipitating clouds are likewise formed in the rising warm air. The advancing cold wedges are frequently so steep that violent ascending motion and correspondingly strong precipitation results. On the other hand, such precipitation is mostly confined to a narrow belt along the cold front.

Extratropical cyclones examined individually show a great variety of types. Usually the young cyclones consist of two oppositely directed currents, one cold occupying a little more than the half of the area and one warm current covering the remaining area—the "warm sector." During the development of the cyclone, air from the warm sector ascends and is replaced at the ground by the cold air. This motion transforms potential energy into kinetic energy, which appears in the increasing winds and deepening of the depression. After a couple of days all the air from the original warm sector is lifted off the ground, but can still be found aloft (occluded cyclone). During the ascension the warm air is cooled adiabatically, and finally it reaches a level where it finds surrounding air of its own temperature, so that the buoyancy can lift it no farther. Having reached this stage the cyclone is maintained merely by the inertia of the circulating air masses. If no new energy is supplied the cyclone decays gradually.

Original papers on this subject will be found in Oslo, *Geofysiske Publikationer*, and elsewhere. For the relation between the source of air and its temperature see C. K. M. Douglas, *Quart. Jour. R. Meteor. Soc.*, July 1925.

Antarctic Meteorology.—Great additions to our knowledge of the meteorology of the Antarctic regions were made by the publication of the results of Scott's Antarctic expedition of 1910 to 1912. The observations were taken mostly by Dr. Simpson, who has worked them up and discussed various problems left in a more or less uncertain condition by previous expeditions. He has greatly extended our knowledge both from the observational and theoretical sides. Amongst other matters Dr. Simpson has established the anticyclonic character of the weather in the Ross Sea area, and has shown that the blizzards are not parts of the circulation about the centres of cyclones moving from west to east over the Antarctic Ocean.

New Methods of Observation.—Upper wind was observed during the War (1) at night by pilot balloons carrying candles, (2) by shell bursts observed by two mirrors, (3) by sound-ranging

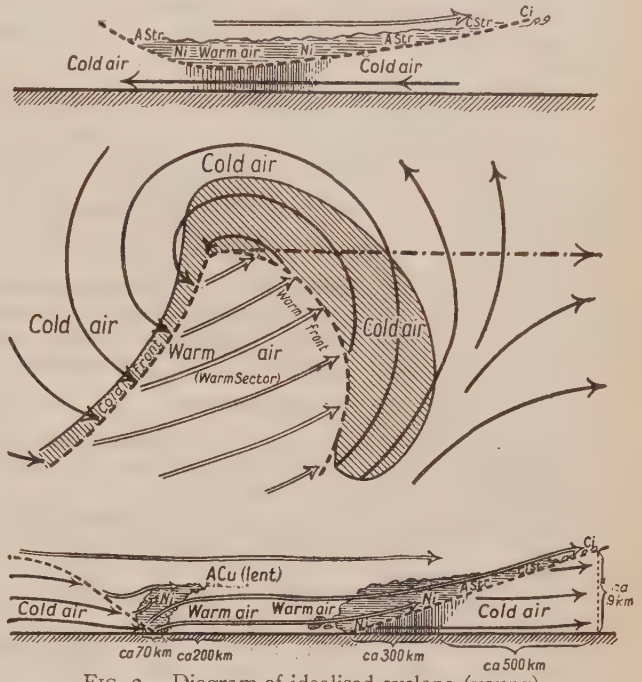

FIG. 2.—Diagram of idealised cyclone (young).

(From "Life Cycle of Cyclones, and the Polar Front Theory of Atmospheric Circulation." J. Bjerknes and H. Solberg, *Geofysiske Publikationer*, Vol. III., No. 1.)

on a balloon that exploded. Subsequently a method has been developed for observing wind above fog by shooting spheres upward. Particulars of such things will be found in the *Computers' Handbook* or the Professional Notes of the Meteorological Office. Clouds can be photographed by moonlight (Oslo, *Geofysiske Publikationer*, vol. 3, No. 12). The amount of water in thin clouds can be measured (*Quart. Jour. Roy. Meteor. Soc.*, Jan. 1925). The upgradient of temperature near the ground can be measured by thermocouples (*Phil. Mag.*, Jan. 1925) and by an optical method (*Quar. Jour. Roy. Meteor. Soc.*, April 1925). Upper air temperature is regularly measured from aeroplanes, and can also be observed by balloons that explode at a prearranged temperature (M.O. Prof. Note 19). For radiation instruments see *Dictionary of Applied Physics*, vol. 3.

Weather Forecasts.—Forecasts for one or more days ahead continue to be made by the process of drawing a map to represent weather observations received by telegraph from an area some thousands of km. in diameter. The accumulated and classified experience of what usually does follow such a distribution of pressure, temperature, cloud and wind is then employed to form the forecast. The Smithsonian Institution is progressing in its studies looking toward weather forecasts based on solar radiation observations.

Organisations.—The International Meteorological Committee and its subcommissions in 1925 reattained their fully international character, which was destroyed by the War. A post-war restricted organisation known as the International Union for Geodesy and Geophysics has a section for meteorology which is active.

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[1] See papers by J. Bjerknes, Oslo, *Geofysiske Publikationer;* Brunt, *Phil. Mag.*, Feb. 1926; Jeffreys, *Quar. Jour. R. Meteor. Soc.*, Jan. 1926; and books by Exner, Richardson and Shaw.

Weather (1912); Dr. Julius v. Hann, *Handbuch der Klimatologie* (3rd ed., 3 vol., 1911); *Lehrbuch der Meteorologie* (3rd. ed., 1915); V. Bjerknes and others, *Dynamische Meteorologie und Hydrographie* (Carnegie Institute of Washington, 1912); H. N. Dickson, *Climate and Weather* (1912); Dr. Alfred Wegener, *Thermodynamik der Atmosphäre* (1911); M. W. Campbell Hepworth, *National Antarctic Expedition 1901–1904* (London, Roy. Soc., 1913); *Ice Observation, Meteorology, and Oceanography in the North Atlantic Ocean*, Report on the work carried out by the S. S. "Scotia" (1913); C. G. Abbot, F. E. Fowle and L. B. Aldrich, "New Evidence on the Intensity of Solar Radiation outside the Atmosphere," *Smithsonian Miscellaneous Collections*, vol. 65, No. 4; Sir Gilbert J. Walker, "Correlations in Seasonal Variations of Weather," *Memoirs of the Indian Meteorological Department*, vol. 20 and 21; Anders Ångström, "A Study of the Radiation of the Atmosphere," *Smithsonian Miscellaneous Collections*, vol. 65, No. 3 (1915); G. C. Simpson, *British Antarctic Expedition 1910–1913*, *Meteorology*, 3 vol.; W. J. Humphreys, *Physics of the Air*, Franklin Inst. (1920); F. M. Exner, *Dynamische Meteorologie*, 2nd ed. (1925); R. G. K. Lempfert, *Meteorology* (1920); L. F. Richardson, *Weather Prediction by Numerical Process* (1922) (the *Geophysical Memoirs*, pub. by the Meteorological Office); the *Meteorological Glossary* (fourth issue, M.O. 225.11, the Meteorological Office); *The Dictionary of Applied Physics*, vol. 3.

For *original papers* see the Bibliography issued by the Royal Meteorological Society, the bibliography published monthly in *The Monthly Weather Review* (Washington), also references in text.

(W. H. Dı.; L. F. R.)

METER: ELECTRIC AND GAS (*see* 18.291).—Meters are used to measure the amount of electricity or gas supplied to the customers of the company concerned. In the case of electric meters these register the number of units supplied for light, heat or power.

I. ELECTRIC METERS

These meters include induction-motor, mercury-motor and commutator meters, which register the revolutions of a disk or other armature caused to revolve, by the action of the current, at a speed proportional to the amperes or watts passing through the meter, and electrolytic meters in which the current or a shunted fraction of it passes through an electrolyte and decomposes it, the rate of decomposition being proportional to the current employed.

Induction-motor Type.—In the Ferranti alternating current watt-hour meter, a series coil of a few turns of thick wire carrying the main current is arranged below, and a shunt coil of many turns of fine wire is arranged above a horizontal rotary disk of aluminium. This disk is situated in the gap between the poles of a permanent magnet and the lower bearing of its vertical spindle is a sapphire carefully selected to reduce friction to a minimum. The magnetic fields due to the shunt and series windings produce a resultant rotating or shifting field which interacts with eddy currents, induced in the disk so as to exert a driving torque proportional to the watts. A retarding torque is produced by the action of the permanent magnet also causing the speed of the disk to be proportional to the watts. A worm on the spindle drives the registering train; the registering dials are of the clock pattern, or of the cyclometer pattern.

To read the meter is a simple operation. In the clock pattern, starting from left to right, the figure last passed by the thousands pointer in its revolution is written down and the same procedure is followed for the hundreds, tens and units pointers in succession, the tenths registered on the small lower dial being read only when testing the meter. In the cyclometer pattern, the figures are written down just as they appear on the register. The cyclometer figure wheels are actuated by a falling weight; thus, the changing of the figure wheels does not throw any extra load on the meter.

Mercury-motor Meters.—In the Chamberlain and Hookham direct current ampère-hour meter, a copper disk is caused, by the action of the current, to rotate in a mercury chamber subject to the influence of a magnetic field due to a large permanent magnet. The vertical spindle of the disk, arranged to rotate with the minimum friction, is connected to the registering train with its series of clock dials. The peripheral wall of the mercury chamber is formed by a leather-lined metal band which is readily removable to permit inspection and refilling with mercury.

Commutator Meters.—Commutator meters have a wound armature connected in parallel with a shunt and arranged to rotate in the field of a permanent magnet.

Electrolytic Meters.—In the Reason syphon-tube meter, a solution of a mercury salt is hermetically sealed in a container, at the top of which are arranged a mercury anode and a cathode. During the operation of the meter, mercury is liberated at the cathode and collects in a syphon tube in the container; this tube, when full of mercury, discharges into the lower part of the container. Close to the right limb of the syphon tube is a vertical scale which registers the mercury level; in one form of the meter, this scale reads from 0 to 200 units. Below the scale is another which registers the level of the lower mercury column; this scale may read from 0 to 4,000 units. When reading the meter, both scales are read and the sum of the readings is taken. The Reason single-tube meter has one vertical mercury tube, which is read like a thermometer. In both forms, the mercury can be used repeatedly, the meters being re-set by tilting; the container is flexibly mounted to facilitate this operation.

In the Bastian electrolytic meter, acidulated water is decomposed by the action of the current, and the amount of water decomposed is read off on a vertical scale.

II. GAS METERS

There are two main types of gas meters, viz., wet meters and dry meters. A wet gas meter has a strong iron case containing water, which is normally at a definite level called the "water line." Inside the case is a rotary drum divided into compartments and mounted on a horizontal spindle geared to a vertical spindle operating the registering train. The drum is rotated by the unbalanced elastic pressure of the gas admitted to each compartment in turn on the surface of the water. After leaving the drum, the gas passes to an outlet pipe which delivers it to the burners. In order to maintain the level of the water, when loss occurs through evaporation or other causes, most wet meters are provided with means for automatically making good the loss; these are called compensating meters. In most of them, the water to make good the loss is delivered from a water reservoir within the meter case and communicating with the main body of water.

Dry Meters.—In an ordinary dry gas meter, the upper part of the meter case forms the registering chamber in which are situated the registering train and the valve box, which is shut off from the registering chamber and contains gas inlet and gas outlet valves. The registering chamber is separated by a horizontal partition from a lower and larger chamber, which is divided by a vertical partition into two equal chambers. In each of these a bellows of concertina shape, with flexible leather sides, works to and fro horizontally; the vertical partition forms the

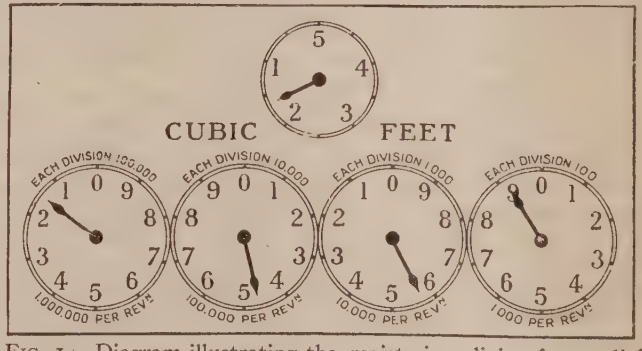

FIG. 1.—Diagram illustrating the registering dials of a 10-light dry gas meter.

fixed base of each bellows. Arrangements of levers and cranks transmit the motions of the bellows to the valves in the valve box and also to the registering train. When the meter is in operation, gas from the main supply pipe enters one of the bellows and inflates it, while the gas in the corresponding chamber is expelled through a delivery pipe to the burners; at the same time, gas is being expelled from the other bellows by the pressure of gas admitted into its bellows chamber. Working in this way, the meter supplies gas continuously to the burners, and the valves in the valve box are opened and closed at the proper times required by the flow of the gas. At the same time the registering train is operated continuously.

Automatic or Prepayment Meters.—Prepayment gas meters are fitted with a box containing mechanism which operates when a coin is passed through a slot in the box and controls the supply of gas to the meter. The value of the inserted coin or token determines the automatic cutting-off of the gas supply.

Reading a gas meter is a simple operation. Fig. 1 represents the registering dials of a 10-light dry gas meter. The registering train is geared so that the hundreds pointer revolves 10 times while the thousands pointer revolves once, the thousands pointer revolves 10 times while the tens of thousands pointer revolves once, and so on; also, adjacent pointers revolve in opposite directions. Starting from right to left, the figure last passed by the hundreds of thousands pointer in its revolution is written down and the same procedure is followed for the tens of thousands, the thousands and the hundreds pointers in succession; thus the reading in fig. 1 is 1,459 hundreds. Assuming that this was the reading at Michaelmas and that 1,356 hundreds was the reading at the preceding Midsummer, then the amount of gas consumed during the summer quarter would be 145,900 minus 135,600 or 10,300 cubic feet.

The small upper dial is not usually read. It records the flow of small quantities of gas and can therefore be used for ascertaining whether all pipes and gas fittings are gas-tight, or what amount of gas is consumed by any of the burners. (T. E. L.)

METHODISM (*see* 18.293).—The official returns of world-wide Methodism presented to the oecumenical conference at Toronto in 1911 showed that there were 55,808 ministers; 98,121 lay preachers; 8,768,616 church members; 99,497 churches, worth over 100 million sterling; 90,124 Sunday schools, with 898,722 officers and teachers and 8,273,809 scholars. The detailed table below shows the position in 1925.

The numerical strength of Methodism is not to be gauged by the number of members. To the members must be added a very large body of communicants and worshippers. About 10% of the population of Great Britain are Methodists. In Canada Methodists are 11% of the population; in Australia, 12%; in New Zealand 6%; in South Africa, including Rhodesia, 7%; and in the United States, 20%.

I. IN GREAT BRITAIN

British Methodism has faced with courage and with a large measure of success the new problems of the 20th century. It has consolidated its sections and, in addition to its ordinary routine of work, has given special attention to three great issues—the reunion of Methodism, temperance reform and foreign missionary enterprise.

At least 450,000 officers and men of the Wesleyan, the Primitive, and the United Methodists fought in the World War, of whom 40,000 fell. Methodism cared for its people and materially assisted its members by its war emergency and sustenation funds, for augmenting ministerial allowances and helping circuits suffering from the higher cost of living. In spite of the serious effect which the War has had upon the spending power of the people, the incomes of the Methodist church funds have largely increased. In all the churches the salaries of the ministers have been considerably advanced. There are no unemployed Methodist preachers, and no dearth for candidates for the ministry.

Missions.—The British Foreign Missionary Societies working under the direction of the three Methodist Conferences also have a record of expansion and success. The Wesleyan Missionary Society has erected and equipped 12 colleges with 5,031 students, and also 36 high schools with 6,068 scholars, in addition to 16 theological and normal training institutions for native preachers. Important Medical, agricultural and industrial hospitals and schools have also been established in West Africa, South India and China. These societies work in close co-operation with other branches of Christendom by adopting the apportionment of regions of missionary enterprise. They develop a missionary

Denomination	Ministers	Lay Preachers	Church Members and Probationers	Sunday Schools	Officers and Teachers	Sunday Scholars	Churches Etc.
Wesleyan Methodists:—							
Great Britain	2,537	18,651	515,139	7,318	119,596	840,205	8,580
Ireland	183	599	29,137	322	2,217	22,929	410
Foreign Missions	748	10,343	255,753	2,802	10,200	161,152	4,750
French Conference	33	69	1,607	13	106	736	116
South African Conference	277	5,198	163,541	1,107	3,253	44,982	4,673
Primitive Methodists	1,107	13,634	216,597	4,020	55,230	407,571	4,593
United Methodist Church	755	5,602	187,405	2,236	38,171	264,796	3,055
Wesleyan Reform Union	24	456	9,871	194	2,410	22,770	203
Independent Methodist Churches	391	..	10,384	166	3,183	24,758	165
Australasian Methodist Church	1,083	8,218	160,911	3,680	25,887	204,174	4,706
New Zealand Methodist Church	199	766	24,214	396	3,129	31,008	880
United States:—							
Methodist Episcopal	21,406	15,914	4,711,994	36,893	414,175	4,847,735	29,487
Methodist Episcopal, South	8,076	5,403	2,478,623	17,570	162,439	2,053,173	17,615
Methodist Protestant	1,356	..	186,275	1,965	18,970	191,270	2,379
African Methodist Episcopal (coloured)	7,000	6,330	650,000	7,200	29,996	320,000	7,500
African Methodist Episcopal Zion (coloured)	3,962	..	412,315	2,092	16,245	193,000	2,716
Coloured Methodist Episcopal	3,039	2,590	366,315	2,543	18,884	193,000	3,824
Free Methodist	1,483	1,673	34,751	1,346	9,648	103,676	1,259
Wesleyan Methodist	666	..	21,000	521	3,442	30,133	675
Primitive Methodist	85	73	9,986	87	1,524	16,807	86
Congregational Methodist	500	..	21,000	182	1,146	8,785	352
New Congregational Methodist	27	..	1,256	27	143	1,298	24
Union American Methodist Episcopal (coloured)	205	105	18,812	67	321	2,531	267
African Union Methodist Protestant (coloured)	260	..	3,750	49	441	3,088	58
Reformed Zion Union Apostolic (coloured)	79	..	10,000	36	212	1,508	58
Reformed Methodist Union Episcopal (coloured)	52	..	2,126	18	204	1,792	29
British Methodist Episcopal (coloured)	20	6	700	18	125	..	21
Coloured Methodist Protestant	33	..	1,967	24	..	1,016	26
African American Methodist Episcopal	35	..	5,811	25	..	934	27
Canadian Methodist Church	2,475	1,946	414,047	3,807	43,333	351,633	4,797
Japan Methodist Church	234	..	29,000	..	..	44,000	..
Totals	58,330	97,576	10,954,287	96,724	984,425	10,359,452	103,331

spirit among the native Christians and the creation of a native ministry. Thus, there is a large number of native preachers and generous financial support is given to their missions by the native churches. In 1913 the Wesleyan Missionary Society held its centenary and raised £280,000 as a special fund for development. The women's auxiliary of the society has largely increased, and a plan is being developed for realising closer co-operation with the parent society.

Educational and Social.—The decline in the number of Sunday school teachers and scholars has given serious concern to the conferences. Efforts have therefore been made to increase the efficiency and the attractiveness of the Sunday schools, the work of which is not limited to Sunday, nor to school methods. The boy scouts, girl guides and life brigade movements, summer schools and Bible study circles supplement the work of the Sunday schools. The Wesley Guild and Christian Endeavour societies in British Methodism, and the Epworth League in America are doing much to consolidate the work among young people.

The Wesleyan Church has largely transferred its day schools to the county education authorities under the Acts of 1870 and 1902, and has now only 392 day school departments, with 32,847 scholars. But the same Church has largely developed its higher and secondary educational work. The two Wesleyan training colleges for teachers—for men at Westminster and for women at Southlands (Battersea) have attained a very high standard of efficiency. An increasing number of the students take university degrees. The teachers thus trained hold many of the most important posts as headmasters and mistresses in the London and provincial day and secondary schools and also in the British Dominions.

In addition to a number of important educational institutions, the three British Methodist Churches have six theological colleges for training candidates for the ministry, which are being more and more brought into line with the curriculum of the various universities. In 1926 Oxford celebrated the bi-centenary of the election of John Wesley to a fellowship of Lincoln College, and, to honour the occasion, conferred the degree of Doctor of Divinity upon the Rev. John H. Ritson, the president of the mother conference, a scholar and graduate of Balliol College, and the first Oxford man elected to the chair of John Wesley.

Another department of British Methodism is its home missionary work in the villages and city centres. Wesleyan Methodism has its connectional and lay evangelists. Open air evangelistic services are regularly held, and in many places the theatres and public halls are utilised for extra services. New central halls take the place of down-town churches. The London Mission of Wesleyan Methodism is doing a great work at Westminster, Kingsway, Clerkenwell and other centres. Primitive Methodists have four halls in the poorest parts of London, the principal ones being in Whitechapel and Southwark.

The British Methodist churches have been impressed with the economic and social results which have followed prohibition (*q.v.*) in the United States. Each of the sections has an active temperance and social welfare department. In 1920 the Wesleyan Conference declared that the sale of intoxicating liquors as a beverage was "definitely opposed to the best interests of the State and to the Kingdom of God," and recommended the Methodists everywhere to work and pray for the total and permanent prohibition of the common manufacture and sale of alcoholic drinks. The three Churches have adopted a progressive temperance policy—first of local option, secondly, the complete extension of magisterial licensing authority to all political and social clubs, rich and poor alike; and, thirdly, the entire Sunday closing of all drinking bars in England and Wales.

The Methodist Brotherhood works in unison with the Dominion agents in London, who assist emigrants to the United States, Canada, Australia and South Africa, arrange their passages, and secure them employment. The Brotherhood embraces all Methodist churches, and it has met with conspicuous success in assisting the Methodist emigrant and maintaining his association with Methodism in his new country.

Methodist Union.—Methodist union transcends in importance all other movements in Methodism at the present time, and it is probably fraught with more momentous issues to the churches concerned than anything since the death of Wesley. A great impetus was given to this movement by the decennial gatherings of the Methodist Oecumenical Conference, which, instituted in 1881, meets alternately in London and America. It consists of 600 delegates from all parts of the world, half of whom are ministers and half laymen. Each assembly has been followed by some decisive step forward along the path of union, and in all cases the ministry has loyally accepted the decisions of the majority. The results of union have far exceeded the anticipations of the churches, and there has been a great increase in the membership and financial resources.

In 1913, the Wesleyan Methodist Conference appointed a committee to collect information on the subject of union and to report to the next Conference. A final scheme of union was submitted to the yearly conferences of the three Churches in 1925 and was adopted by a very large majority. The scheme, which has presented no serious difficulties, will be again presented to the three conferences of 1926 together with the drafts of the proposed Parliamentary Enabling Act of Union and of the proposed Chapel Model Deed of the new United Methodist Church of Great Britain. If these are approved an application will be made to Parliament, and there is every prospect of the union of the three Churches in one British Methodist Church being effected in 1928.

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(R. W. P.*; J. E.*)

II. IN AMERICA

The noteworthy changes in American Methodism since 1909 include (1) the steady growth of all its major branches; (2) movements toward the organic union of various units within the Methodist group and with other evangelical churches; and (3) educational advances resulting in liberalising tendencies in theology, a higher appreciation of non-Christian religious groups with a consequent new approach to the problem of world evangelisation, the further democratisation of Episcopal Methodist Churches and an increasing zeal for social justice, interracial understanding and the application of the teachings of Jesus to all human relationships and affairs, in politics and sociology as well as to purely personal conduct and belief.

Church Union.—The year 1925 saw the consummation of the Union of the Methodist, Presbyterian and Congregational Churches of Canada in the United Church of Canada. The Methodist Church, as the largest of the three denominational units, went into the United Church with 100% of its constituency, which at the time of the merger included 2,475 ministers, 1,946 lay preachers, 414,047 members, 451,636 church-school pupils, with 43,333 officers and teachers. In the United States a plan for the organic reunion of the Methodist Episcopal Church and the Methodist Episcopal Church South failed (1925) by a narrow margin of the combined votes of lay and ministerial members of the southern church. The vote in the Methodist Episcopal Church at the same time was overwhelmingly in favour of the union. The vote of the Methodist Episcopal Church South, while rejecting the specific plan submitted, did not close the issue, which was to be considered again at the next session of the respective General Conferences of the two bodies. In Great Britain the union of the Wesleyan Methodists, the Primitive Methodists and the United Methodist Church was also nearing its consummation.

Educational Advances.—The educational advances to which must be attributed certain tendencies already summarised include the following (1) an increase, commensurate with the growth in church membership of, in the number, enrolment and financial support of secondary schools and colleges; (2) a rapid rise, especially in the United States, from the previous low average educational preparation and professional training of ministers, together with a corresponding advance in the curriculum standards for collegiate and theological institutions; (3) increasing attention to religious education through the church-school with the extension of the programme of religious education to include week-day instruction; (4) the widespread distribution and use of religious-educational literature in text-book and periodical form, the total regular circulation of which exceeds the combined total membership of all Methodist Churches.

Episcopal Methodist Churches.—The coloured Methodist Episcopal Church, an offshoot from the Methodist Episcopal Church South, leads all branches of Episcopal Methodism with increases of over 60% in membership and over 100% in church-school enrolment in 15 years. The Methodist Episcopal Church in 1916 adopted the Episcopal area system with a flexible limit on the residence of a bishop in any one area. A World Service Commission since 1924 acts as an overhead co-ordinating agency for all benevolent boards. The educational activities of the Church have been consolidated in one board of education with separate departments for colleges, negro education, church-schools and the Epworth League. During 1920–5 the centenary of the organisation of the foreign missionary enterprise was celebrated by Episcopal Methodist Churches, notably the Methodist Episcopal Church and the Methodist Episcopal Church South, by a five-year financial campaign, which has quadrupled the annual missionary offerings of the participating churches.

See Methodist Year Books; Disciplines, Proceedings of Conferences, General Oecumenical Conferences; Methodist periodical literature. (H. H. M.)

METROLOGY: *see* MEASUREMENTS.

MEUSE-ARGONNE: *see* VICTORY, ADVANCE TO.

MEXICO (*see* 18.317), a federal republic of North America, has an area of 767,198 square miles. In 1912 the estimated population was 15,501,684, of which about 20% were whites. Political disturbances have resulted in a movement towards the cities for safety, and across the frontiers for employment and political asylum. This is reflected in the 1921 census, which gave a population of 14,234,852. The population of Mexico City, the federal capital, was 633,367; Guadalajara, 119,468; Puebla, 96,121; San Luis Potosí, 85,000; Monterey, 85,000; Vera Cruz, 48,633.

I. POLITICAL HISTORY

On Sept. 27 1910 Porfirio Diaz was re-elected president for a seventh term. The closing years of his rule were marked by economic depression, crop failures, excessive importation of foodstuffs and political restlessness, ill-concealed by the festivities of the Centennial of Independence. Since 1908 various political activities had indicated a demand for a change in the presidential office. Conspicuous in this demand was Francisco I. Madero, who supported a nationalistic programme. His *sucesion presidencial en 1910* attacked the administration mildly; but as his adherents increased in number, he became more outspoken. He was arrested on charges of sedition and was imprisoned at San Luis Potosí. Escaping to San Antonio, Texas, he issued the *Plano de San Luis Potosí* demanding electoral reforms, division of agrarian property and the resignation of Diaz.

Armed revolt was planned for Nov. 20 1910, but there were numerous premature outbreaks. Against these a reign of terror was initiated, but resistance spread. By Dec. there was armed revolt in a dozen states. Diaz attempted to meet disaffection by promises and belated reforms. After minor reverses the northern rebels took Ciudad Juarez May 10 1911, thereby showing the military impotence of Diaz. This success, with others at Pachuca and Cuernavaca, induced Diaz to assent to the demand for his resignation. It was agreed that Francisco de la Barra should assume a provisional presidency and call a new election. Diaz resigned May 25, and left the country next day. On June 7 Madero entered Mexico City in triumph. He really controlled the country, De la Barra having scant power. The ensuing election resulted in an overwhelming majority for Madero, who was inaugurated as president on Nov. 6 for a term to end Nov. 30 1916. He soon found himself opposed by reactionary politicians, several of whom he had appointed to his Cabinet. His government was characterised by neglect of the demands of the revolution, by financial blunders, by quarrels with State governors, and by weakness towards the opposition. Revolt by former supporters began at the time of his inauguration. Emiliano Zapatas in Morelos, Bernardo Reyes in the north, Pascual Orozco in Chihuahua, and other rebels were in the field. In the fighting, many foreigners were killed. Conditions were chaotic in 1912. On March 14 President Taft prohibited shipment of arms to Madero's opponents. Americans, advised to leave the country, departed by thousands. The north generally was in anti-Government hands.

Huerta Seizes Executive Power.—On Oct. 12 Felix Diaz revolted in Vera Cruz; he was captured and was confined in Mexico City. On Feb. 9 1913 he and Reyes (who also had been imprisoned) were set free by disaffected soldiers. Gen. Victoriano Huerta, head of the Government troops, turned traitor and imprisoned Madero and Pino Suarez, forcing them to resign. Huerta on Feb. 19 seized the executive power through constitutional forms. Three days later Madero and Pino Suarez were executed. President Wilson rebuffed Huerta's efforts to obtain recognition, believing that he did not represent the will of the people, and that he was responsible for the political executions; President Wilson demanded a general election in which Huerta should not be a candidate. The demand was rejected. On Oct. 10 Huerta seized the legislative and judicial power, arresting 110 members of Congress for inquiring into the mysterious death of Senator Belisario Domingues, who had harshly criticised him.

Meantime revolt, led by Governor Venustiano Carranza of Coahuila, appeared in both the north and the south. In the *Plano de Guadalupe* the rebels declared Huerta a usurper. They won numerous successes, among them the capture of Torreon in March 1914. Following the outbreak of revolution, American war vessels had been observing events in Mexican harbours. At Tampico a boat's crew from the "Dolphin" were arrested on a military reserve. The American commander demanded a salute to his flag for the incident and was supported by President Wilson. Huerta refused unless the Mexican flag were similarly saluted, and the Americans seized Vera Cruz on April 21. Huerta had been embarrassed by the mission of John Lind, whom Wilson sent as a personal representative to induce Huerta to assent to his own elimination. Though unable to effect foreign loans or to make peace with the Carranzistas, and in spite of advice by the foreign diplomats to yield to Wilson, Huerta ended diplomatic relations with the United States on April 22. Argentina, Brazil and Chile proffered their good offices; representatives of these nations met representatives of Huerta and the United States (Carranza holding aloof) in conferences at Niagara Falls, Canada, but the representatives failed to agree on a provisional president. Huerta was finally forced to resign July 15 1914, and was succeeded by Francisco Carbajal, who held office less than a month.

Carranza, though he did not support the Zapata programme, and quarrelled with Villa, still headed the Constitutionalists; after obtaining control of the capital, he set in motion plans for a presidential election. He was unable to control the generals summoned to a nominating convention, and they moved from Mexico City to Aguascalientes, where they nominated Gen. Gutierrez, an adherent of Villa, as provisional president. Villa drove Carranza out of the capital, the latter occupying Vera Cruz as the Americans evacuated that port Nov. 23. Villa and Zapata alternated in control of Mexico City and no fewer than four factions claimed the executive power in 1915. In that year Villa, who had shown strength in the north, was defeated by

Gen. A. Obregon. A conference of Argentina, Brazil, Chile and other American Powers, seeking to stabilise the situation on Oct. 19, recognised Carranza as *de facto* president.

Villistas Murder Americans.—Villa ignored the settlement, and on Jan. 10 1916 a band of his adherents assassinated 18 Americans taken from a train near Santa Ysabel. On March 9 he raided Columbus, N.M., killing 17 Americans. A punitive expedition of 12,000 United States troops, led by Gen. Pershing, invaded Mexico. It penetrated to the vicinity of Parral, but failed to capture Villa, who was reported dead. Carranza had grudgingly acquiesced in the invasion, but now protested, stating that the movement of American troops in any direction other than northward would provoke attack. On June 20 American negro cavalrymen moving eastward were attacked at Carrizal; several were killed and about a score were captured, but were released upon a sharp demand by the United States. The expedition was finally withdrawn Feb. 5 1917. In Sept. a commission attempted to make an agreement for policing the international line, but failed because Carranza denied the right of the United States to pursue raiders into Mexican territory.

In 1917 a new constitution was proclaimed. It incorporated in Art. 27 the principle of nationalisation of subsoil resources, chiefly as a means of controlling the petroleum industry. Decrees attempting to force the oil companies to observe the constitution were protested by foreign powers as confiscatory and subversive of rights acquired under the prior constitution of 1857. During 1919 the controversy was bitter. The companies, threatening cessation of production, forced Carranza in Jan. 1920 to concede the privilege of operating without compliance with the decrees but without prejudice to the final adjudication of the difficulty.

During 1919 rebel activities against Carranza were widespread, and many acts of violence were committed against foreigners and Mexicans by both Government and rebel partisans. A conspicuous case was the abduction for ransom of W. O. Jenkins, U.S. consular agent at Puebla, Oct. 19. He was alleged by the Mexican Govt. to have been implicated in his own abduction, but was released Dec. 5 1920. During the World War Mexico's "rigid neutrality" was highly pro-German. The famous Zimmermann note, by which Germany tried to align Japan and Mexico against the United States, was intercepted and published in March 1917.

Obregon Elected President.—The presidential campaign began in 1919, Carranza's power then reaching its zenith and afterwards rapidly declining. There was corruption in the army, banditry throughout the country and non-enforcement of the constitution Amid widespread unrest two generals, A. Obregon and P. Gonzales, conducted presidential campaigns, while Carranza supported a civilian candidate I. Bonillas, who had been Mexican minister to Washington. When Carranza's efforts to control state administration for the election of Bonillas led him to attempt a military invasion of Sonora, the home of Obregon, armed revolt broke out. On April 9 that State declared its secession until it could be assured of its sovereignty. The defection spread quickly through the north and west. By the end of the month Carranza was isolated in Mexico City. Adolfo de la Huerta was set up by the rebels as provisional president. Carranza attempted to move his Government to Vera Cruz, but his trains were broken up, and when he left them to make his way over the mountains to a Gulf port, he was murdered on May 21 at Tlaxcalantongo. Obregon entered the capital May 8. On May 25 de la Huerta was made substitute president for the unexpired term by the reassembled Congress. In Sept. Obregon was elected president with only nominal opposition. His inauguration Dec. 1 1920 was attended by large delegations from the United States, but by no one representing the Government though many Latin-American and European diplomats were present. Recognition by the United States was delayed by the non-solution of the petroleum controversy and the general spirit of labour unrest.

The distinguishing features of Obregon's presidency were his efforts to obtain recognition and to carry out the revolutionary programme. The two policies were in direct antagonism at many points. The Association for the Protection of American Rights in Mexico demanded that American vested interests, menaced by the new constitution and subsidiary legislation, be protected by a special treaty. The demand was grounded on the realisation that congressional legislation was subject to reversal and that the decisions of the Supreme Court were more in accordance with political exigency than with the principles of jurisprudence. The Obregon Govt. remained firm in its determination to do everything compatible with national integrity to restore harmonious relations, but refused to enter into the proposed treaty. In pursuance of this policy Obregon on July 13 1921 invited the European nations having claims against Mexico to send representatives to a permanent Mexican Claims Commission. This invitation was accepted in Nov. by France, Great Britain, Italy, Spain and the Netherlands. In Sept. of the same year negotiations were begun with a committee of international bankers looking toward a refunding of the national debt.

In June 1921 the U.S. Secretary of State (Hughes) described the fundamental issue as resting on a construction of the confiscatory enactments, which would declare that recognised American property titles must not be invalidated. The decision of the Mexican Supreme Court in 1922 that Art. 27 was not to be construed retroactively, paved the way for a presidential decree to the same effect. Secretary Hughes announced an informal commission composed of Charles B. Warren and John B. Payne, to confer with Ramon Ross and Fernando Gonzales Roa concerning agreements preliminary to recognition. The conferences, begun May 14 1923, were facilitated by promulgation, on April 26 preceding, of a new petroleum law recognising the validity of concessions made prior to May 1 1917, although it required concessionaires to revalidate their claims within three years. Elimination of land difficulties was attempted by legislation increasing the size of individual holdings exempt from partition, and relieving from expropriation large irrigation companies with colonisation contracts. But the provision that land expropriated should be paid for in bonds threatened a deadlock. The Mexican position was weak on this point, as the old legislation had prescribed compensation prior to expropriation.

Despite all difficulties, however, the commission reached a final agreement on Aug. 15. By its terms subsoil mineral rights acquired and developed before May 1 1917 were recognised as valid, and the provisions of Art. 27 of the Mexican Constitution, it was agreed, should apply only to later acquisitions. American properties expropriated by the Mexican Govt. in carrying out its agrarian policy were to be paid for at their equitable value. The U.S. Govt. reserved all rights to which it was entitled under international law in respect of titles acquired by its nationals before May 1917 to properties which were supposed to be petroleum yielding but which had not been developed and proved. Provision was also made for a Special Claims Commission for the settlement of American claims created since 1910, and a General Claims Commission for settlement of American and Mexican claims since 1868. The conventions calling for these commissions were ratified in Feb. 1924. The special commission was composed of Ernest B. Perry, Fernando Gonzales Roa and Dr. Rodrigo Octavio of Brazil, and the general commission of Nathan L. Miller, Aquiles Elurduy and Dr. Cornelis van Vollenhoven of Holland. The special commission held preliminary meetings in Mexico City in Jan. 1925, but postponed regular sessions until September. Claims must be presented before it within two years from the date of its first meeting, with a possible grace of six months. The general commission held preliminary meetings in Washington in 1924. Claims were admissible before it within one year, with six months' possible grace. Following the agreement upon these conventions, the United States extended formal recognition to Mexico, Aug. 31 1923. France shortly followed suit, Great Britain showing reluctance because of the indefinite status of her oil interests.

Papal Delegate Expelled.—The general plan for refunding the Mexican debt, agreed upon in Paris in April 1922, was concluded in New York in May by Secretary of the Treasury Adolfo de la Huerta and the bankers' committee. Mexican rebels, headed by Felix Diaz, made unavailing efforts to prevent consummation of the debt agreement. Mexico assumed full obliga-

tion for all the foreign debt principal, about $500,000,000, for some $200,000,000 interest, and for certain internal debts held outside Mexico. Payments were to begin Jan. 2 1923.

The bandit Villa, who had been bought off by the Provisional Govt. in 1920, was assassinated in 1923. Another outstanding incident of the year was the expulsion of the papal delegate Mgr. Filippi, who had incurred the displeasure of the Government by assisting at the open-air dedication of a shrine at Cubilete Tuanajuato. Open-air religious exercises were prohibited by a State law, though the dedication took place on private property. The episode evoked protest from the Vatican and from Catholic societies throughout Mexico and the American continent.

Preliminary manoeuvring in anticipation of the presidential election set for July 6 1924 began in 1923. The president is constitutionally barred from succeeding himself, and there had been a "gentlemen's agreement" by the Sonora triumvirate, de la Huerta, Obregon and Calles, that Calles should succeed Obregon. Nevertheless there was decided opposition to this programme in the Co-operatist party, which had been formed by the triumvirate and had a majority in the Chamber of Deputies. On Sept. 24 de la Huerta, possessing wide prestige because of the success of his financial negotiations, resigned from the Cabinet to conduct a campaign on his own behalf. Meanwhile Calles, as the friend of Obregon, was canvassing for the Co-operatist nomination. This, however, went to de la Huerta, on a programme promising the extension of Co-operatist ideas in industry, prior indemnification of landholders for expropriations, and guarantees of municipal autonomy. Calles, disappointed at not receiving the Co-operatist nomination, was put forward by the radical National Agrarians, pledged to carry out their programme and protect the rights of labour. The campaign became exciting when Obregon and the new Minister of Finance, Alberto Pani, accused de la Huerta of extravagance in office and of misrepresentation concerning arrangements whereby a bank of issue was to have been created and a loan secured. Recriminations were mutual. The de la Huerta faction alleged that Co-operatist adherents in Congress were menaced with massacre by troops under Gen. Arnulfo Gomez. Meantime the state elections, coloured by the national campaign, caused numerous frays.

On Dec. 5 the de la Huerta movement resorted to a plan of campaign called the *Plano de Vera Cruz*. The military forces of five States rebelled under the leadership of generals Estrada and Guadalupe Sanchez. At least six additional States speedily joined the movement, the conservative elements, the labourites and the agrarians generally supporting de la Huerta. Obregon took the field, conducting a campaign on three fronts. Rebel successes soon showed that the Government was in a precarious condition. Its chief weakness was lack of war materials, of which Mexico produces none. Application was made to the U.S. Govt. for the purchase of arms, munitions, airplanes and war vessels. Arms, munitions and airplanes were supplied. President Coolidge by proclamation forbade export of arms to the rebels, and their attempts at blockading and mining ports were in Jan. 1925 forbidden under threats of naval action. American assistance thus turned the tide. During the closing days of Dec. Government forces had retaken Puebla and driven back the opposition lines which had been concentrating on the capital. During Jan. honours were even, but in Feb. large hostile areas were retaken by the Government. Several rebel armies dispersed and their leaders sought refuge in exile.

The direct intervention of the United States was given in this case because of the recent recognition and a desire to protect the visible agency of the international agreements. The stand of the American Govt. was justified by Secretary Hughes on the ground that it protected constitutional procedure; he added that it must not be held to constitute a precedent, as every instance of intervention must be decided by its individual circumstances. It was in all essential aspects a continuation of the policy initiated by Woodrow Wilson in 1913. The Aguila (British) oil interests were accused by Obregon of assisting de la Huerta; on the other hand, E. L. Doheny, an American oil prospector, announced that he had advanced a loan of $5,000,000 to Obregon.

Election of Calles.—In the presidential elections Calles emerged successful. His Conservative opponent, Gen. Angel Flores, who fell ill during the campaign, received relatively few votes. Rumours of his prospective rebellion were not realised. The announced programme of Calles was to obtain for Mexico the economic and social advantages enjoyed by the American people. From the time of the inauguration of Obregon the labour situation had been steadily growing worse, but a firmer attitude toward labour was seen when Calles federalised the railway service, reducing the likelihood of strikes. Recurrent street railway strikes in Mexico City had marked the rule of Obregon; the first of them to occur under the presidency of Calles demonstrated the precarious position of capital under the existing strike legislation.

During the spring of 1925 Calles ruled illegal a strike by the Tampico Federation of Labour Unions, whose members were employed by the Huasteca Petroleum Co., because the difficulty was between unions, not between employers and labour. Firm presidential action prevented a national sympathetic strike. The Union of Bank Clerks in May 1925 made such demands on the banks that they threatened to close their doors. The Labour leader, Luis Morones, refused to support the Union. The Labour party under the leadership of Morones definitely split with the Agrarian party in May because the Labourites declared that the Agrarian programme was injuring not only agriculture but business and industry as well, and hence the labouring people.

Church and State.—The hostility to the Roman Catholic Church became evident with the promulgation of the constitution of 1917. During 1925 a separatist movement by means of an organisation known as the Mexican Apostolic Church was attempted. During March Separatists and Catholics came into conflict in Guadalajara, Aguascalientes and Queretaro. In Mexico City the Separatists seized the church of La Soledad and ejected its priest. Calles declared the act unconstitutional, but closed the church to worship and declared the Catholic parishioners rebels. Foreign priests were debarred, March 19, from preaching in Mexican churches. Numerous churches were closed because of disorders. The constitution provided that ministers practising religion must be of Mexican birth, and limited the parishioners of each to 1,000.

The troubles between church and state were accentuated by events in 1926. On May 15, George Caruana, the papal delegate, was ordered to leave the country, and on July 3, the Government issued a decree to enforce and strengthen the orders against the clericals. Heavy penalties were specified for any infringement of the regulations. Many Roman Catholics declared their intention to resist and Pope Pius XI. declared Aug. 1 1926 as a day of prayer for intervention in Mexican affairs.

Conditions on the American border, never satisfactory, grew worse after the passage of the law limiting immigration into the United States. In May 1925 a treaty was negotiated covering smuggling of drugs and aliens, migration, deportation, hunting, fishing, and health problems. The terms facilitated the disposal of American undesirables who had infested the Mexican side of the boundary. The treaty controlled also the movement of labourers into the United States. It was estimated that 500,000 Mexicans entered California in 1924.

Public interest was aroused in June by the declaration of Secretary of State Kellogg, made public through the Press, that conditions in Mexico were not entirely satisfactory, and that the United States would support the Government of Mexico only so long as it protected American lives and rights and complied with its international obligations. The statement referred to seizures of American property at the unreasonable demand of Labourites, and was felt in some quarters to have been inspired by friends of Calles himself in order to strengthen his hand against the demands of his radical supporters. The unusual character of this announcement called to public attention the existence of a new treaty between Japan and Mexico which permits settlement of Japanese from California on the west Mexican coast, and concedes special status to Japanese vessels in Mexican waters. It also accentuated the fact that American diplomatic protests concerning land seizures had met with scant attention.

On Aug. 28 1925 relations with Great Britain, severed because of difficulties culminating in the assassination near Puebla of Mrs. Rosalie Evans, were resumed and accredited representatives were exchanged.

Defence.—Military service in the active army or in the National Guard is compulsory. The normal strength of the army has been settled at 50,000. A school for the training of aviators has been established and progress has been made towards organising an air force. The five gunboats, which comprised the Mexican navy, have been reinforced by the addition of a small coastal defence boat bought in 1924.

Education.—Government education in Mexico is compulsory and secular. In 1923 there were 14,231 primary schools with 1,187,407 pupils. A number of private schools conducted by religious societies of the Roman Catholic Church were obliged to close in 1926. In 1925 the National University in Mexico City, which was refounded in 1910, had a student body of more than 6,000. The expenditure on education in 1923 was $24,500,000.

II. ECONOMIC AND FINANCIAL HISTORY

Finance.—On July 1 1922 the public debt of 1,056,973,713 pesos (1 gold peso = $0.4985) included 583,280,887 pesos of pre-revolutionary debt and 473,692,826 pesos of post-revolutionary debt. Revenues and expenditures 1921–5 were, in pesos:—

	Revenues	Expenditures
1925 . . .	145,000,000[1]	143,199,686[1]
1924 . . .	289,959,500[1]	[2]
1923 . . .	278,110,300[1]	347,006,719[1]
1922 . . .	277,567,019	267,137,468
1921 . . .	279,832,932	258,312,774

[1] Estimated.

[2] No estimates of 1924 expenditures were published. The Federal Govt. derives its largest income, outside of petroleum production and mining, from import duties: second in importance is the stamp tax: and third, taxes collected in the Federal district and territories. The income tax was introduced in 1924 in face of marked and widespread opposition.

Production and Industry.—Mexico possesses 30,027,500 ac. of cultivated lands well suited for agriculture. The agrarian reforms, begun in 1915, whereby lands of large estates have been expropriated are responsible for a noticeable decrease in agricultural production. In April 1925 President Calles reaffirmed his campaign pronouncements on the agrarian and labour problems, asserting that land distribution would be continued legally, but that it must not move in advance of means of development. In Aug. 1925 it was announced that one-third of the Government's land division programme had been fulfilled. It was estimated that since 1915, 12,000,000 ac. had been given to small farmers. The grazing lands of the republic are estimated at 120,444,200 ac.; and forest lands at 43,933,200 acres. Estimates of chief crops of 1924 were: corn (maize), 106,293,000 bu.; wheat, 13,962,000 bu.; raw cane sugar, 186,964 short tons; cotton, 138,000 bales (of 478 lb. net). Other important crops are beans, coffee, tobacco and henequen. The census of 1923 showed livestock as follows: horses, 512,336 valued at $20,455,109; mules, 300,960, valued at $18,713,476; cattle, 2,363,427, valued at $95,622,494; sheep, 1,196,098, valued at $5,777,605; goats, 2,106,044, valued at $7,714,330. The decrease in livestock since the enumeration of 1902 was 60%.

Petroleum.—A new petroleum law, published July 20 1925, was pending before Congress during September. It had received presidential sanction as adequately interpretative of Art. 27 of the constitution. It gives the chief executive sole and complete authority to concede and regulate rights to explore for and exploit oil-fields; it confirms leases and concessions as well as titles perfected, if dated prior to May 1 1917. The petroleum industry is defined as a public utility, and the principle is reasserted that the nation exercises direct and permanent ownership of the subsoil.

The total production of petroleum from 1901–23 inclusive was 1,055,257,562 barrels valued at $828,241,710. The peak of production, attained in 1921, was 193,397,587 barrels, about 28% of the world production and worth $182,936,817. In 1922 there were produced 182,278,457 barrels, about 21% of the world production, worth $167,397,872; in 1923, 149,529,088 barrels worth $142,916,885, 14·7% of the world production; in 1924, 139,587,000 barrels, 13·8% of the world total. In 1923 Mexican production was second to that of the United States. Some 15,000 ac. were under exploitation. In May 1925 it was estimated that foreign investments in petroleum concerns totalled $350,000,000. Consistent progress was made in the exploitation of the petroleum-bearing areas, which are known to be more widely distributed than the present development would indicate. During the first 10 months of 1924, 247 new producing wells were brought in with an initial daily production of over 800,000 barrels. At the end of Oct. 1924 there were 1,016 producing wells, their initial daily production running more than 3,344,000 barrels. Most of the producing wells were in the Panuco fields. From Jan. 1 to March 25 1925 new wells numbered 74; their maximum daily production was 364,367 barrels, exceeding the amount produced by new wells during the first three months of 1924, which was 218,596 barrels. In March 1925 the petroleum companies agreed to an added tax of one cent per gallon on gasolene the proceeds from which, estimated at 8,000 pesos daily, are being applied to road construction.

Production of light and heavy crude oils for the first six months of 1925, totalling 65,369,987 barrels showed a decrease of 8,911,376 barrels from the corresponding period in 1924. All the loss was in heavy crude oil, the light crude oil showing an increase of 2,145,172 barrels. Continued salt-water intrusion in the Toteco holding of the Mexican Seaboard diminished their production in 1925; salt water also reduced production in the Cacalilao fields.

Mining.—There was marked resumption of mineral production in 1918 and 1919. Practically all the established mining companies operated continuously during 1924, some of them extending mining and milling facilities so as to increase production and improve metallurgical recoveries. Prospecting and development work increased, notably in Chihuahua, Sonora and Zacatecas. The de la Huerta revolt did not seriously interfere with the operation of established mines. Taxation continued upon the 1923 basis, being so high that the average mine paid as much in taxes as it produced in net profit. Freight rates were approximately 50% higher than those of 10 years earlier. Labour conditions were chaotic because of numerous State laws, and caused much misunderstanding between companies and employees. These conditions discouraged new mining investments, but good prices for lead and silver offset them, and earnings for 1924 were good. Productions of the chief minerals for 1922–4 was (in kgm.):—

	1924	1923	1922
Gold	24,647	24,162	23,276
Silver	2,844,104	2,824,599	2,521,832
Copper	49,113,194	53,371,482	26,977,786
Lead	164,140,130	155,720,342	110,455,912
Zinc	18,936,336	18,481,271	6,141,937

Antimony, tin, tungsten and arsenic are produced in considerable quantities. For the first time in several years quicksilver was exported in June 1925; there was promise of continuous increase. The movement was of 600 kilos shipped from Tampico and produced by a cinnabar mine in Zacatecas. Numerous filings of claims in Chihuahua for gold and silver locations, reopening of old workings in the Santa Barbara district of that State, and the development of electrical power in Durango for mine operations, indicated in 1926 that mining prospects continued good, in spite of the political unrest.

Commerce and Industry.—Notwithstanding political and economic difficulties, trade showed gratifying stability. Mexico sold to the United States in the first 10 months of 1924 products to the value of $167,087,305, or 19·2% over the figures for 1923, and bought from the same source goods worth $135,076,703, an increase of the same percentage. Increased production of lead, copper and silver, with greater shipment of vegetables to Ameri-

can winter markets, permitted purchase of larger quantities of automotive vehicles, agricultural implements, mining machinery and railway equipment.

For the year ending June 30 1913 Mexican imports were $95,857,000, and exports $149,752,000. For 1921 they were respectively $178,775,221 and $203,273,450. Imports from the United States in 1921 were 74·6% of the total, and exports to the United States 88·3%. In 1923 Mexican exports of all classes were: animal products, $2,019,486; vegetable products, $32,782,-061; minerals except petroleum, $80,213,217; petroleum $237,-213,698; miscellaneous, $2,109,872. Petroleum constituted 67% of the total exports. Minerals reached 22·5%, constituting with petroleum 89·5% of the 1923 exports. Agricultural exports to the United States were 14% of the trade with that country, petroleum 38% and other mineral products 45%. Canadian exports to Mexico were in 1920, $410,825; in 1921, $1,086,197; in 1922, $1,197,597, and in 1923, $3,291,098, and in the year ending March 31 1925, $2,856,409. Imports from Great Britain, high in 1920 and 1921, dropped to pre-War level in 1922–3. The movement of trade has been steadily away from the Gulf ports towards towns on the American border, which in 1923 handled over 42% of the volume. There were 108 mills operating, employing 38,232 hands. The annual production of boots and shoes was over 700,000 pairs. In 1923, 235 sugar-mills produced 121,000 metric tons.

Labour.—Conditions in labour have been disturbed since the revolution began. Strikes and financial losses have been as follows:—

	No. of Strikes	No. of Strikers	Financial Loss	
			To Employers	To Employees
1922	197	63,000	$4,134,680	$2,983,610
1923	146	54,396	3,694,324	1,479,055
1924	138	29,244	4,627,385	1,805,191

Labour troubles at Vera Cruz caused the chambers of commerce to transfer their business to Tampico in Nov. 1924. In March 1925 a federation of land and sea workers, comprising 17 Vera Cruz unions affiliated with the Mexican Federation of Labour, gave up political activities and agreed not to strike without federation approval.

Communications.—In the de la Huerta revolt the railways in rebel hands were badly depleted in stock. In March 1924 an official report of the ownership of railways showed that the National Railways (51% of whose stock is held by the Government) had 13,205 km.; Government railways, 517 km.; private lines 7,529 kilometres. The total in operation was 21,251 km. or 13,197 miles. The Mexican Railway, a British concern, has 520 m. between Mexico City and Vera Cruz; it was in Government hands from 1916–20. The Tepic-La Quemada line of the Southern Pacific was completed April 1926. It connects Mexico City with Nogales. During 1925, 45,000 men were employed on the 100 m. of the road, 17 tunnels having been constructed before June. The new wireless station erected on the Island of Lobis, near the coast of Tampico, affords facilities to the petroleum companies to communicate with ships at sea. There are wireless stations at Mexico City, Tampico, Vera Cruz and on the Pacific Coast at Mazatlan.

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(H. I. P.)

MEXICO CITY, capital and metropolis of the Republic of Mexico (*see* 18.344), had a population of 615,367 at the census of 1920 (271,956 males and 343,411 females) of whom 23,668 were foreign-born; estimate for 1924, 880,000. Between 1910 and 1925 several new residential suburbs (*colonias*) were created, which grew rapidly by the cutting up of adjacent estates (*haciendas*) into building lots; many squat buildings of colonial days in the business districts were replaced by sky-scrapers; new streets were cut; dirty squares were transformed into neat flower-decked plazas and the magnificent National Theatre begun in 1900 was partially completed, 12,000,000 pesos having been expended on it up to 1922. The Legislative Palace, however, was still unfinished in 1925, and was about to be torn down instead of completed. In 1923 the area of the city was about 15 sq. m., divided into eight sections (*cuarteles* or *demarcaciones*), and sub-divided further into about a thousand squares (*manzanas*). There were over 200 m. of tramways, and the tram service, furnished by an English company and managed by English and Canadians, was efficient. At different times the official names of many streets were changed, either to commemorate recent events and heroes, or in the interest of convenience; *e.g.*, all the streets in one section received names of trees and flowers, in another names of foreign cities, so that the character of the name of the street would give a general idea of its location.

Industry and Commerce.—Manufacturing, still relatively unimportant, was represented in 1925 by some 215 establishments, with an annual output valued at 10,000,000 pesos, and employing about 10,000 workers, most of whom were Indians and half-breeds (*mestizos*). The leading products were tiles, cigars and cigarettes, textiles, drugs and chemicals, oils and extracts, shoes and other articles of clothing, various articles of food, beer and other beverages, furniture, iron and steel, mosaics and jewelry. Of greater importance were trade and finance. In Mexico City are the headquarters of most of the business carried on in the country, and it is the principal distributing centre of the republic. Deposits in the banks on Oct. 31 1923 (64,278,894 pesos) were 53% of the total for the country. About 30% of all the imports into the republic are received in the capital. The annual sales of the commercial establishments of all kinds were estimated in 1925 at over 250,000,000 pesos. The textile industry was largely in French hands; hardware, cutlery, chemicals and drugs, in German hands; the oil and mining interests were chiefly English and American; banking, predominantly Canadian; retail trade, predominantly Spanish; but both banking and trade were shared by French, Spanish and Americans, and by 1925 there was a successful National Bank of Mexico. The National Railways of Mexico were returned to private management on Jan. 14 1926, under the so-called Pani-Lamont agreement.

Social Conditions.—An increasing number of automobiles, higher wages, and a decreasing number of bare feet, indicated some advance in prosperity; and a brighter outlook for public health was given by President Calles's firm support of clinics, dispensaries and similar improvements. But the general standard of living of the population was still very low; beggars were exceedingly numerous and very importunate; business was "nervous"; and foreign capital was not available in the amounts needed. The organisation of labour advanced rapidly after the foundation in 1918 of the *Confederacion Regional Obrera Mexicana* (usually referred to as "CROM") by L. N. Merones, an electrician, who became Secretary of Industry and Commerce in the Calles Administration. In the demonstration of May 1 1925, in Mexico City, 93 unions, with 100,000 members, took part.

By 1925 collective bargaining was the rule, and it was claimed that " CROM " had effected an increase in the average weekly wage from 50 centavos to 3 pesos.

Education, etc.—By the constitution of 1917 elementary education was made free, compulsory to the age of 15, and secular, but pending the provision of enough secular schools many of the old schools under religious auspices continued to function. The national university, which had been suspended for half a century, from the time of Maximilian, was re-opened in 1910. A summer school was established in 1922, designed especially to attract foreign students for the study of Spanish. The World War increased the interest of Mexicans in reading, and as a result several new periodicals, of a superior quality, were established in the city, which had the first printing press in the new world and the first regularly issued newspaper. Mexico City was the scene of riots during the revolutionary disturbances of 1910 and 1911. On June 7 1911, the day on which Madero made his triumphant entry into the city, there was a severe earthquake, which cost many lives. In Sept. 1921 the centennial of Mexican independence was celebrated with great pomp.

MEYER, EDUARD (1855–), German historian, was born at Hamburg Jan. 25 1855. He was educated at Bonn and Leipzig, where in 1879 he qualified in ancient history. He afterwards became professor of ancient history at Breslau (1885), Halle (1889) and Berlin (1902). Meyer realised the great importance of folklore, historical monuments and numismatics as aids to the study of ancient history, and the value of his original methods in treating the subject was recognised by the universities of Oxford, St. Andrews and Freiburg from which he received honorary degrees.

Meyer's principal works are: *Geschichte des alten Aegypten* (1887); *Forschungen zur alten Geschichte* (1892–9); *Wirtschaftliche Entwicklung des Altertums* (1895); *Die Entstehung des Judentums* (1896); *Zur Theorie und Methodik der Geschichte* (1902); *Geschichte des Altertums* (3rd. ed. 1909); *Caesars Monarchie und das Principat des Pompeius* (2nd ed. 1919); *Preussen und Athen* (1919); *Ursprung und Anfänge des Christentums* (3 vol. 1921–3).

MEYER, MARIE PAUL HYACINTHE (1840–1917), French philologist (*see* 18.349), died at St. Mandé, near Paris, Sept. 8 1917.

MEYERHOLD, VSEVOLOD EMILIEVICH (1873–), Russian theatrical producer, was born in Moscow and from 1898–1905 was well known as one of the most distinguished actors of the Moscow Art Theatre. He then began to produce plays, adopting a new convention in opposition to the " true-to-life " ideas of Stanislavsky, in which the actor and the stage setting presented a complete harmony. After the Revolution he carried these methods to an extreme, using no curtain and a bare stage with purely formal scenery. He managed the Revolutionary Theatre, Moscow, and also acquired a theatre of his own, and in both produced political propaganda plays. His views are set forth in his book, *The Theatre* (St. Petersburg, 1913).

MEYNELL, ALICE (1849–1922), British poetess. By her marriage in 1877 Alice Thompson became Alice Meynell. She had the fortune to find herself in that mid-Victorian era which still held freshly to its heritage from Keats and Shelley, from Wordsworth and Coleridge. It felt its heart torn by the griefs of the Brontës, stirred by their glories; and almost clung to the hand of Elizabeth Browning. Eagerly awaiting every recurring sign of Tennyson's fertility, it yet respected the long pause of Patmore; and took for its own the volumes of Dante and Christina Rosetti, warm from the press. With these two women of song, Elizabeth and Christina, Alice Meynell's name is now commonly tripled. But it was not they who moulded her thought or her expression. Her aloof independence was proof against all precedents; and of her prose it may be noted that, notwithstanding her love for Lamb and Landor, only the American, James Russell Lowell, is mentioned by her as in any way her master in style. She was her very own spiritual and intellectual self as both woman and writer. That was the secret of the singleness of her personal influence while she lived, and secures an enduring freshness and originality in the work she bequeathed.

Mistress Anne Killigrew had been told by Dryden " thy father was transfused into thy blood. " That girls alike with boys, inherit from fathers as from mothers, was the theme of a verse where Alice Meynell, after the desolations of the European War, gave the comforting signal:—

> The crippled world! Come, then,
> Fathers of women with your honour in trust,
> Approve, accept, know them daughters of men,
> Now that your sons are dust.

Her own father, having left Cambridge and unsuccessfully contested two costly elections for Parliament as a free trader, became very much a citizen of the world. After his marriage with Christiana Jane Weller, a beautiful and accomplished girl to whom her adoring friend Charles Dickens fitly introduced him, he made his home much in Italy, devoting himself to the liberal learning of the two daughters: Elizabeth, the elder, afterwards Lady Butler, famous as a war painter; and Alice, who early began to put her rhymed thoughts shyly upon paper. Despite the affectionate appreciativeness that ruled her home (usually an English one) her composition remained mostly her own secret until an American friend, to whom they were confided, encouraged her to show, and then print, them.

The volume of *Preludes* was issued (for the girl what an association) by Tennyson's then publisher, Mr. Henry S. King, on the word of his " reader "—later his successor—Mr. C. Kegan Paul, who, not trusting his own judgment all the way, read some of them aloud to George Eliot, receiving her deciding approbation. The critics were mostly silent; and even those who praised hesitated. But the volume made its own quiet way, Ruskin in all ways first in his soaring praises: " The last verse of that perfectly heavenly ' Letter of a Girl to her own Old Age,' the whole of ' San Lorenzo's Mother,' and the end of the ' Sonnet to a Daisy,' are the finest things I have yet seen or felt in modern verse. " Rossetti, too, spread the news of the young poet's advent, reciting " Renouncement " by heart to his friends, and saying that it was " one of the three finest sonnets ever written by women. " Browning, having read a brief quotation buried in a halting press appreciation, " conceived the desire to read the rest for myself," and found its beauty " even beyond what the indifference of the reviewer should have prepared me for." The volume brought her many a friend—and more. For the reviewer in *The Pall Mall Gazette*—a paper to which she was later to be a conspicuous contributer—quoted the sonnet " My Heart shall be thy Garden," and found for it a reader whom it reached revealingly. A consequent introduction to the sonneteer by a common friend was followed by a marriage that fulfilled for him Crashaw's " heaven-on-earth " for 45 years.

On Mrs. Wilfred Meynell, as she then (1877) became, fell a long silence as a poet. The muse does not ordinarily leave cards on the happily and busily married; the domesticities and the " sweet sense of providing " are not the fashioners of those " sweetest songs " that breed from " saddest thoughts." Eight children were born, one of whom died in infancy: a grief that put into poetry the dread reminder that the giver of life is also the giver of death: " and she who slays is she who bears, who bears. " A like sensitiveness to life's cruelties put her, for all her reticence, on political platforms, and marched her in multitudinous processions, in favour of the granting of votes to women and the opening of long closed professional doors. Compassion was the companion of all her walks abroad, for the over-burdened man and animal; for the beggar-woman to whom she cried with her gift, in Portuguese fashion, " Have patience, little saint "; for the underfed in London slums which she at one time sedulously visited; and for the beast in the shambles, in shame for whose martyrdom she refused to eat meat until, after persuasion, she sought by more impersonal methods to further laggard reforms.

Her married life matured her vigilance as a mistress of prose. In W. E. Henley of *The Scots Observer* and *The National Observer*, she encountered an editor who heartened her by his boisterous welcomes: " That woman's taking her place at the steering wheel " was one of his recorded acclaims. Later, in *The Pall Mall Gazette* of Harry Cust's editorship, she was accorded a

weekly column which left her a large range in the choice of subjects. George Meredith, reading here her "princely journalism," sought with her an acquaintance that soon became a "dearest friendship." In a magazine—those were still the days of the magazines—he spoke of her words as having the "living tremor in them," just as he had before said that Carinthia's had the "throb beneath them." Of her essays, he wrote: "The surprise coming on us from their combined grace of manner and sanity of thought is like one's dream of what the recognition of a new truth would be. They leave a sense of stilled singing on the mind they fill. The writing is limpid in its depths."

Coventry Patmore, too, her yet warmer admirer, published, when Tennyson died, his unavailing plea for her succession to the laureateship. Her close friendship for such seniors coincided with that for her contemporaries, and for her juniors, chief among whom was Francis Thompson, who addressed to her his exquisite sequence of poems *Love in Dian's Lap*, of which, Patmore said, Beatrice or Laura might have been proud. Of the homage paid to her, another chosen friend, J. L. Garvin, has well said: "Alice Meynell was in herself a person of her age, sure, as I think, of perpetual remembrance, even if half a dozen of her shining contemporaries had not competed in vain to spoil her with praise. It was what no one could do: recognition only made her humble." And these contemporary praises notwithstanding, G. K. Chesterton predicts: "She was deservedly famous; but I will venture to prophesy that her fullest fame is yet to come. The whole modern world must immeasurably enlarge itself before it comes near the measure of her mind." She died in London on Nov. 27 1922.

Alice Meynell's *Preludes* (1875), long out of print, re-appeared in a volume of *Poems* (1893) including new ones; and these, together with yet later verses separately issued as *A Father of Women* (1917) and *Last Poems* (1923), are all assembled in the complete volume of *Poems* (1923) now in circulation. Of her prose, several small volumes of essays in the eighteen-nineties—*The Rhythm of Life* (1893), *The Colour of Life* (1896) and *The Spirit of Place* (1899)—were followed by *Ceres' Runaway* (1909), by *Hearts of Controversy* (1917), by *The Second Person Singular* (1921) and finally by the standard volume of selected *Essays* (1914)—the selection being her own. Other books were *John Ruskin* (1900), *The Children of the Old Masters* (1903), *Mary, the Mother of Jesus* (1912) and *London Impressions* (1898). Two anthologies give her choice among poems—*The Flower of the Mind* (1897) and *The School of Poetry* (1923), the first including Notes and the second Commentaries. She prefaced editions of *The Sonnets from the Portuguese* and Christina Rossetti's *Poems* (1910), as well as a decade of volumes "The Red Letter Library"; she introduced in 1903 a volume of reproductions of Sargent's Portraits; and she made for English readers a Selection from the Poems of J. B. Tabb (1906).

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(W. ME.)

MIAMI, Fla., U.S.A. (*see* 18.354), in the centre of the 200-m. strip of the "East Coast" which is dotted with winter resorts, was a focus of the rush to Florida which began about 1922. The population in 1910 was 4,571; in 1920, 29,571; in 1925, according to the state census, it was 69,754. In Sept., after annexations of territory, it was estimated at 100,000 within the corporate limits, and at 150,000 within six miles of the court-house. Between 1914 and 1924 bank deposits increased over 3,000%; post-office receipts and property valuation each over 600%; the value of buildings for which permits were issued, over 2,500%, and the total of such permits for 1924 was doubled in the first eight months of 1925.

At the opening of the winter of 1925–6 all kinds of shelter were at a premium, and tent colonies sprang up until they presented a serious sanitary problem. For the moment, speculation in land was the leading occupation (a third of the members of the Chamber of Commerce were dealers in real estate), but there were solid foundations for future prosperity. Though later in 1926, the value of land fell to some extent. The Federal Govt. had begun work on harbour improvements. Draining of the Everglades by the state was opening to agricultural settlers thousands of acres of rich swamp land, forty-five varied industrial plants were already in existence, and a sugar-mill and refinery were in operation 16 m. out on the Miami canal.

Miami Beach, across Biscayne Bay, one of the most luxurious winter playgrounds of the country, was a mangrove swamp in 1910. Coral Gables, a separately incorporated residential suburb adjoining Miami on the south, was developed in Spanish and Moorish architecture with six miles of Venetian waterways. This was created in a few years by the magic of immense investments of capital, modern engineering and far-sighted planning including a tract for the University of Miami, chartered April 5 1925 which had in view an endowment of $15,000,000.

MICA (*see* 18.355).—The three main contributors to the world's supply in order of importance are the United States, India and Canada. After the outbreak of the War the stoppage of the mica imports to Germany had a depressing effect on the mica industry; but, on the other hand, the large amount of mica required for munition purposes, gas-masks, etc., caused both the Allies and the United States to import increasing quantities of sheet mica from Argentina and Brazil. In the United States the mica mined is mainly muscovite, occurring as irregular masses, sheets and lenses in pegmatite veins traversing metamorphic rocks. The principal producing states are North Carolina and New Hampshire, but Virginia, South Dakota, Georgia, Alabama, Idaho and Colorado also produce considerable amounts.

The chief mining centres in India are the great Bihar mica belt, about 60 m. by 12 m., traversing the Menghyr, Hazaribagh and Gaya districts in the province of Bihar and Orissa; and the Nellore district in the Madras Presidency. Less important areas occur in Ajmer Merwara in Rajputana. The Canadian mica is almost entirely phlogopite. The deposits occur chiefly in Quebec to the north of Hull, and in the townships of North Burgess and Loughborough in Ontario.

The World's production figures in long tons for 1913, 1918 and 1923 were as follows:—

	1913	1918	1923
India (exports)	3,124	2,998	3,948
Canada	986	667	2,331
Other U.K. countries	118	51	127
United States (chiefly sales)	5,511	2,780	8,112
Madagascar	6	4	162
Argentina (exports)	6	169	100
Other foreign countries	10	190[1]	587[2]

[1] Including Brazil 112 tons.
[2] Including Japan 424 long tons.

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(N. M. PE.)

MICHELSEN, PETER CHRISTIAN HERSLEB KJERSCHOW (1857–1925), Norwegian statesman, was born at Bergen March 15 1857, the son of a prominent merchant and shipowner. After completing a university education in 1879, Michelsen settled in Bergen as a lawyer and at the same time entered the shipping business in which he achieved considerable success. Known as an administrator, he entered the city council of Bergen and later the Storting where he took his seat in 1891 and quickly became one of the most prominent members. In 1894 he withdrew from politics, returned to Bergen, resumed his activity as a shipowner and re-entered the city council of which he became the chairman. The general elections in 1903 by which he returned to the Storting as a member for the country district outside Bergen initiated the crowning period in Michelsen's public career. Appointed Prime Minister in the spring of 1905 Michelsen played a leading part in the events which resulted in the dissolution of the union with Sweden and the establishment of the new kingdom of Norway. In 1907 he definitely retired from politics and died near Bergen June 29 1925.

MICHELSON, ALBERT ABRAHAM (1852–), American physicist, was born in Strelno, Germany, Dec. 19 1852. His parents moved to San Francisco, Cal., where he studied in the public schools. He graduated from the U.S. Naval Academy in 1873, and was instructor in physics and chemistry there during 1875–9. He was then for a short time in the *Nautical Almanac* office. From 1880 to 1882 he studied in Berlin, Heidelberg and Paris. He resigned from the navy in 1881. In 1883 he was appointed professor of physics at the Case school of applied science, Cleveland, O., and six years later accepted a similar position at Clark University. In 1892 he was appointed professor and head of the department of physics at the University of Chicago. He early directed his researches to the velocity of light, and while in Cleveland invented his interferometer (*see* 14.693), which enabled him to measure distances by means of the length of light-waves. His researches enabled him to revise and improve upon the achievements of Fizeau in respect of the velocity of light. He perfected the methods for experimenting, and determined the rate at which light travels, with an error not exceeding $\frac{1}{40}$ of 1% of the quantity measured. Through one of his experiments it was demonstrated that the speed of light is the absolute superior limit of the rate at which matter can move, because the mass of a body depends upon its velocity —mass diminishing as velocity increases—and a body would vanish completely if it exceeded the velocity of light.

Michelson measured a metre in terms of the wave-length of cadmium light for the Paris Bureau Internationale des Poids et Mésures. The consequence is that the metre bar, hitherto carefully safeguarded in Paris, can easily be replaced, since its length is known in terms of an absolute unit. In 1892 he was a member of the Bureau Internationale des Poids et Mésures and in 1897 of the International Committee of Weights and Measures. He was made president of the American Physical Society in 1901 and of the American Society for the Advancement of Science in 1910. He received medals and prizes from many learned societies, and in 1907 was awarded the Nobel Prize for physics. During the World War he rejoined the naval service and devoted his entire time to new devices for naval use. His range-finder was adopted as part of the U.S. Navy equipment. In 1920 he was able to demonstrate by means of light-interference that the diameter of Alpha Orionis was 260,000,000 miles. This was the first computation ever made of the size of a star. He was the author of *Velocity of Light* (1902); *Light Waves and Their Uses* (1903), and numerous papers contributed to scientific journals. In 1921 he was awarded the gold medal of the Society of Arts, London. (For the " Michelson-Morley experiment " in interference of light, with its bearing on the Einstein theory, *see* RELATIVITY.)

MICHIGAN (*see* 18.371).—The population of Michigan in 1920 was 3,668,412, an increase of 30·5% over 1910. The estimated population as of July 1 1926 was 4,395,651. Of the total population in 1920, 1,670,447 were of native parentage; 1,204,545 of foreign or mixed parentage; 726,635 were foreign-born and 60,082 were negroes. The following cities in 1920 had 50,000 inhabitants or over: Detroit (993,678); Flint (91,599); Grand Rapids (137,634); Lansing (57,327); and Saginaw (61,903). A special census of Detroit on May 31 1925 gave its population as 1,242,044 on that date.

Education.—In 1920 there were in the state 1,048,390 persons of school age, of whom 710,341 (67·8%) were attending school. The illiteracy rate was 3% in 1920 as against 3·3% in 1910. In many of the public schools vocational courses were added in recent years. At the institutions of higher education, attendance greatly increased. Some of the colleges with church connections shared in this growth; but the chief enlargement was at the University of Michigan (*see* MICHIGAN, UNIVERSITY OF) and the Michigan Agricultural College. To add to the facilities for higher education, " junior colleges " with curricula covering two years of college work, were established in Detroit, Grand Rapids, Muskegon, Pontiac and Highland Park, in connection with their secondary school systems.

Agriculture.—In 1925 there were 192,334 farms in Michigan, a decrease of 14,626 as compared with 1910. During the 15 years all farm land decreased from 18,940,614 ac. to 18,036,700. During the same period the average acreage per farm increased from 91·5 to 93·8. The average value of land and buildings per ac. in 1925 was $71.41. In 1925 a total of 9,671,670 ac. was under cultivation, on which crops valued at $268,674,000 were raised. The farming area of Michigan continues to be concentrated mainly in the southern part of the lower peninsula of the state. In the upper peninsula, farms comprise less than 10% of the land area. The area nominally in woodland, including farm woodlots as well as forests and cut-over lands, comprises nearly two-thirds of the state; but of this area not more than about 5,000,000 ac., nine-tenths of which lies in the upper peninsula, now bears timber worth cutting. Most of the rest has come to be stump lands, on which the recurrence of fires prevents any spontaneous reforestation. The barrenness of the sandy soil and the shortness of the growing season have hindered the reduction of land to cultivation, and some 10,000,000 ac. (more than one-fourth of the total surface of the state) are thus a deforested desert. Several thousand acres of it revert to the state each year in default of taxes. These reverted tracts, comprising 566,850 ac. in 1918, are administered by the Public Domain Commission (created in 1915) with a view to the sale of such as can be used as agricultural homesteads and to the setting aside of the rest as forest reserves. These forest reserves (648,000 ac. in 1923) are under state forest management for the prevention of fires and for systematic reforestation.

Minerals.—In mineral production no new resources of importance were developed during the period 1910–25. The mining of iron-ore continued vigorously, that produced in 1923 amounting to 14,069,938 tons. The production of copper was pushed to the fullest capacity during the World War; but the severe decline of the market after the Armistice caused a sharp reduction of output. The amount of copper produced in 1923 was 138,304,680 pounds.

Manufactures.—The manufactured products in 1923 were valued at $3,870,434,000, as compared with $685,109,000 in 1909, an increase of nearly 465%. This advance was mainly due to the extraordinary growth of the automobile industry and its concentration in the state. The value of automobiles manufactured increased from $7,996,534 in 1904 to $96,651,451 in 1909, and to $1,551,990,000 in 1923. In more recent years this industry has continued its rapid expansion. It is estimated that more than two-thirds of the automobiles manufactured in the United States are made in Michigan. The number of wage-earners engaged in the making of automobiles and their parts in 1914 was 67,538, constituting 24·9% of the total number of wage-earners in the state; these were increased to 149,296 in 1923, their proportion to the whole being 29·6%. Foundries and machine shops with an average number of 34,080 wage-earners in 1923 produced products to the value of $165,736,521. Furniture ranked next, with 20,665 wage-earners and products valued at $93,039,416. Other industries, including logging and sawmill operations, engines and water-wheels, paper and wood pulp,

substantially increased. Michigan led all other states in output of chemicals, drugs, engines, threshing-machines, furniture and refrigerators.

Finance.—In 1923 the assessed value of property in Michigan was $5,929,615,241, on which the state levied $25,880,702 in taxes ($6.58 *per capita*). In the same year the funded and floating debt of the state amounted to $70,613,011, with a net debt of $65,655,186, or $16.69 *per capita*. Appropriations by the Legislature, $5,929,306 in 1909, advanced steadily to $9,610,553 in 1915, and then much more rapidly, standing at $28,302,639 for 1926–7. The volume of the general property tax, which comprised nearly all the state's revenue, lagged behind the appropriations at the close of the decade 1910–20, and the prospect of a treasury deficit in 1921 caused the passage of a law for a tax on corporation franchises as an emergency recourse. In 1921 accounting and purchasing were centralised under the state Administrative Board. The result of these measures was that a deficit of approximately $6,000,000 in 1921 was replaced by a surplus on July 1 1925 of $2,292,411.

Legislation and Administration.—Amendments added to the revised constitution of 1908 provided for popular initiative and referendum on constitutional amendments and in legislation (1913); for the recall of elected officials (1915); for prohibition (1916); for woman suffrage (adopted in 1917 after having been successively rejected in 1912 and 1913), and for the issue of state bonds to the amount of $50,000,000 for the improvement of highways (1917). The provisions for initiative, referendum and recall have as yet found little utilisation, but the issue of highway bonds facilitated a marked improvement in roads. An increase of the licence charges on automobiles has also increased the road funds, the application of which is largely determined by an Act of the Legislature (1915) establishing a system of state trunk roads. A further increase of road funds resulted from placing in 1924 a tax of two cents per gallon on gasolene. This yielded a substantial sum.

Among other noteworthy enactments by the Legislature are the Judicature Act of 1915, consolidating and revising the laws of civil practice and procedure; the "blue-sky" law of 1913 and the creation of the Michigan Securities Commission in 1915 to regulate the sale of securities; the provision for juvenile courts (1911); the creation of a Board of Mediation and Conciliation to deal with labour disputes (1915); a Dept. of State Police (1919); a budget commission (1919); and a state Administrative Board, consisting of all the elective state officials (1921). This board was entrusted with a general supervisory control over the functions and activities of the administrative departments, each of which, as reorganised and consolidated, continued to operate separately with an appointive official at its head. The preparation of the budget and matters of state expenditure were placed directly under the control of the board. Michigan ratified the Eighteenth (Prohibition) Federal Amendment Jan. 2 1919.

Political History.—Since 1910 there generally have been large Republican majorities in state and national elections, without appreciable representation of any other parties in the state Legislature. In the presidential election of 1912, however, Michigan gave its electoral vote to the Progressive ticket, and in 1912 and 1914 it elected a Democrat as governor and in 1923 elected the same man to the U.S. Senate. The governors of Michigan, 1911–25, were: Chase S. Osborn (Rep.), 1911–3; Woodbridge N. Ferris (Dem.) 1913–7; Albert E. Sleeper (Rep.), 1917–21; Alexander J. Groesbeck (Rep.), 1921–5 and 1925– . In a conspicuous contest in 1918 Truman H. Newberry (Rep.), was elected to the U.S. Senate by a narrow majority over Henry Ford (Dem.). Charges of excessive expenditures in this campaign were brought against Senator Newberry and numerous associates, and they were convicted in the U.S. District Court (1920) and were sentenced to two years' imprisonment. The U.S. Supreme Court set aside the conviction May 2 1921; on Jan. 12 1922 the U.S. Senate decided by a vote of 46 to 41 that Newberry was entitled to his seat. In the ensuing senatorial election, however, he was decisively defeated at the polls, whereupon he resigned the seat. (U. B. P.)

MICHIGAN, UNIVERSITY OF (*see* 18.378), has continued the promise of its earlier period as the first conspicuously successful state university. The faculty increased from 350 in 1907–8 to 797 in 1925–6, while the student enrolment grew from 5,013 to 12,312 (6,010 in the college of literature, science and the arts; 1,716 in the colleges of engineering and architecture; 536 in the medical school; 541 in the law school; 85 in the college of pharmacy; 358 in the college of dental surgery; 483 in the school of education; 23 in the school of business administration; 758 in the graduate school; 190 in the training school for nurses; and 3,147 in the summer session). On July 1 1925 there were 36,500 living graduates.

Among the buildings erected between 1910 and 1925 were Hill auditorium (1913) bequeathed to the university by Regent Arthur Hill, of Saginaw, seating 5,000 persons; the Natural Science building (1916); the university library (1919), containing approximately 400,000 vols.; the Michigan Union (1919), a student club-house, costing $1,250,000, the gift of students and alumni; the engineering laboratories (1923); the Wm. L. Clements Library of American History (1923), containing one of the three largest collections of Americana in the United States, the gift of Regent Wm. L. Clements, of Bay City; the Yost Field House (1923); James Burrill Angell Hall (1924); the Lawyers club and dormitories (1924), the gift of W. W. Cook, of New York; the physics building (1924); the university high school (1924); the medical building (1925); the university hospital (1925), accommodating 700 patients. Four dormitories for women students were also erected during this period as well as a home for nurses, the gift of Senator James Couzens, of Detroit. A new building for the College of Architecture is in course of construction and a new museum will be built in 1927. A stadium, seating 70,000, will also be completed in 1927.

The income of the university in 1925 was $12,465,160. Of this amount $3,000,000 was derived from the state from the 5/8 mill tax; $2,683,855 was appropriated by the State of Michigan for buildings, and $1,240,889 was received from student fees. Over 12,000 graduates and students of the university were enlisted in the U.S. Forces during the World War. Of these, 237 lost their lives.

Upon his resignation in 1909, President James Burrill Angell was succeeded by Harry Burns Hutchins, dean of the Law School. President Hutchins resigned in 1920 and was succeeded by Marion Leroy Burton, who had been president of Smith College (1910–7) and of the University of Minnesota (1917–20). Upon his death in 1925, Clarence Cook Little, formely president of the University of Maine (1922–5) was inaugurated sixth president of the university.

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(W. B. S.*)

MICROBE: *see* FILTER-PASSING MICROBES.

MICROPHONE.—The term microphone, originally used by Hughes to describe a loose contact device extremely sensitive to vibration, has been generalised to mean any piece of apparatus for converting rapid vibrational energy into electrical energy with similar vibrational characteristics. A number of such devices are now known; some are of scientific interest only, others are used very extensively in industry.

Microphones Proper.—A loose contact between any two conductors is microphonic—that is to say, when subjected to vibration there is no sharp definition between completely open circuit and completely closed circuit. In between these two states there is a condition where varying pressure alters the resistance, and if one or both of the substances making contact are subject to vibratory pressure, the vibration is reproduced as a varying current. The characteristic between pressure and current is only linear over small limits.

The action at the point of contact is not exactly known. When the current passing through the contact while in the microphonic

condition is examined it is found not to be absolutely constant, and this lack of constancy makes itself evident as a hiss in a telephone receiver. The discharge through a vacuum valve has a very similar sound when amplified.

The change of resistance with pressure varies greatly with materials used. Carbon in one form or another is universally rec-

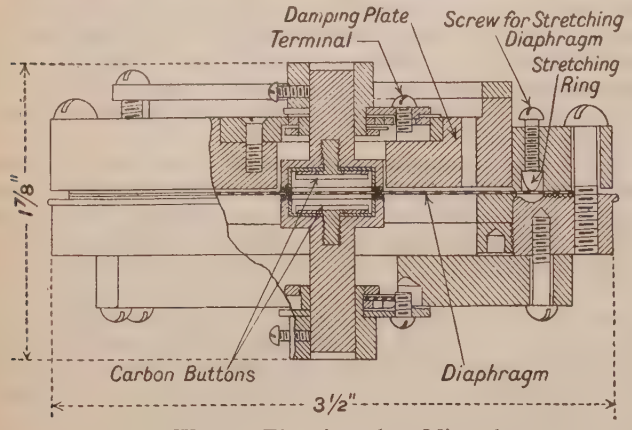

FIG. 1.—Western Electric carbon Microphone.

ognised as the best material, in that the transitory stage between open and closed circuit is more marked than with other materials. This does not mean, however, that it gives the greatest change of resistance for a given change of pressure. A contact between gold electrodes by delicate adjustment can be put in a sensitive condition, and in the adjustment gives greater changes than carbon for the same change of pressure. A considerable amplification can be obtained with microphonic contacts, the output vibratory electrical energy being many times that of the input mechanical energy.

To Edison, Berliner, Hughes and many others we owe the introduction of the contact microphone and its development as a practical device, and microphones to translate noises and music have been produced in many forms. The inventive drift has been towards multiple contacts, and practically all contact microphones are now formed of prepared anthracite granules, the sound pressure being applied in various ways, usually by means of a diaphragm. In later years a more accurate study of the response of microphones to sound pressure has been made, and two modern forms in which the response is practically independent of frequency have been made.

In the first form, the Western Electric carbon microphone (fig. 1), a diaphragm of duraluminium is stretched to a natural period well above the frequency it is required to reproduce. A

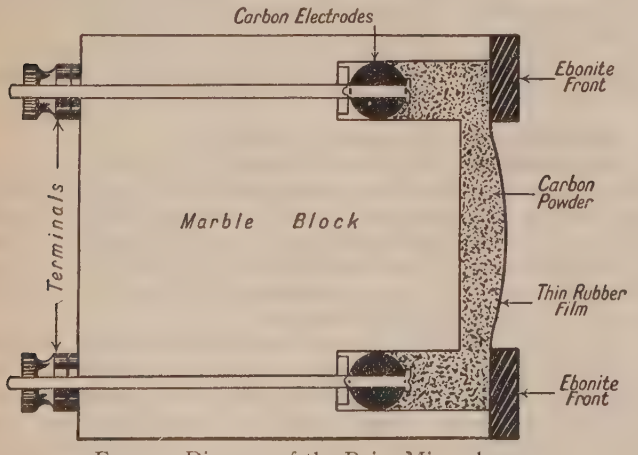

FIG. 2.—Diagram of the Reisz Microphone.

type of air damping is applied to the diaphragm, and it is allowed to rest on carbon granules. The resulting currents are practically independent of frequency. In a second form, known as the Reisz microphone (fig. 2), a diaphragm is practically dispensed with, and a layer of carbon granules is laid on a heavy non-conducting block such as marble, being held in position by some material such as silk or thin rubber. The current response is obtained at right angles to the direction of application of pressure.

The carbon granule-air system of a thickness of about 2 mm. forms a system of a very high natural period in depth, also damped by the natural friction of the carbon. The resulting

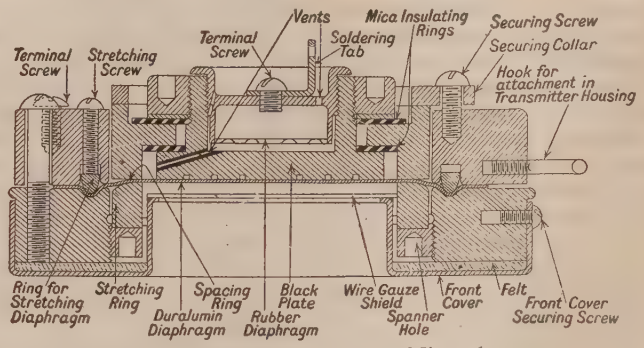

FIG. 3.—Diagram of the E.S. Microphone.

response is similar to that of the stretched diaphragm type described in the last paragraph. Lowering the period of the diaphragm or thickening up the layer of carbon granules in these two types has similar results. These high quality microphones are not sensitive and have to be used with a valve amplifier. In commercial telephony this amplification is not usually permissible, at least to such an extent, so that it is usual greatly to increase the sensitiveness by forgoing some of the accuracy of response.

Fortunately the human voice can be considerably distorted without lack of intelligibility, and by giving the diaphragm of the microphone a natural period in the middle of the important frequency ranges (about 800 cycles) amplifiers can be dispensed with owing to the increased response; music, however, cannot be reproduced with anything like fidelity. These microphones are also used well outside their range of linear response. Granule microphones all suffer to some extent from "packing"—that is, a tendency for the carbon to set itself in a hard contact condition where change of resistance with pressure is least, and much time has been spent in an attempt to overcome this difficulty. The commercial solid back microphone is one of the best forms, but occasional shaking is still necessary.

Other Response Devices.—The best known of non-contact devices is the E.S. microphone, developed into an instrument of precision by the Western Electric Co. Ltd. (fig. 3). Here the same principle is used as in the carbon microphone. A high

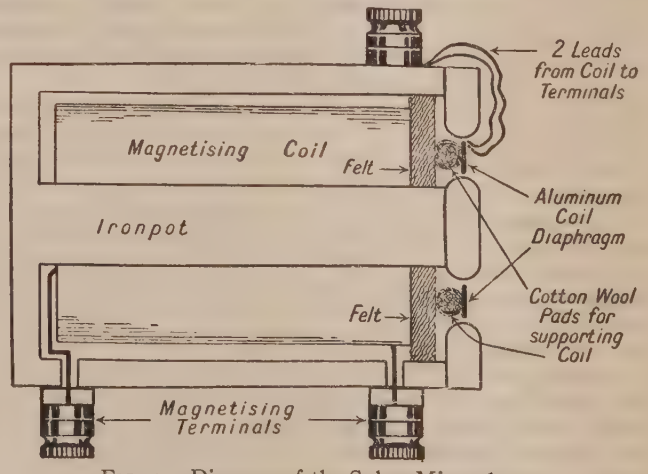

FIG. 4.—Diagram of the Sykes Microphone.

natural period diaphragm, air damped, forms one plate of a condenser, the other being a solid insulated metal piece spaced a few mils from the diaphragm. The chief use of this instrument is for measurement and for broadcasting. The amplification required is large. Various magnetic microphones have been

constructed; in fact, the first Bell microphone was practically the present receiver. The response with frequency is, however, a complex curve, although it is more linear with amplitude than a contact device. Moving coil devices have been produced by Sykes, Siemens-Halske, etc., the later forms of instrument being constructed so that the moving coil is the diaphragm.

In the Sykes microphone (fig. 4) an annular ring of aluminium foil or wire is suspended in a magnetic field, and the response is sufficiently large to enable the method to be used for broadcasting. The law of response with frequency, although not nearly so correct as the electrostatic instrument, can largely be corrected for in the amplifier.

Thermal Devices.—Hot metal wires have been used for microphone purposes. The response is, however, small except for very low frequencies, which property has been used by Tucker for gun-ranging usually in connection with a resonance chamber.

Gas Discharge Devices.—Dr. Thomas, of the Westinghouse Electric Co., and others have investigated the use of point discharges, but these devices have not come into general use. A flame carrying a current is sensitive to sound, but the effect is too small for practical purposes. The piezo electric effect has also been used, but not with much success, except for very high frequency work. See H. M. Dowsett, *Wireless Telephony and Broadcasting* (1923). (H. J. R.)

MICROSCOPY (*see* 18.392).—The modern microscope is essentially a working tool used in every form of scientific and industrial research. Specialised applications have led to the evolution of instruments designed for robust usage as factory appliances, and at the other end of the scale we have the new type of biological research microscope initiated by Mr. J. E. Barnard, F.R.S., F.R.M.S., and manufactured by Beck. In both types there is a marked tendency to forsake the older portable form of stand used in normal laboratory practice and make use of a massive optical bench or lathe bed type of stand. This gives enormously increased rigidity, and freedom from vibration, enables the accessory lighting and condenser systems to be permanently adapted to the optical axis of the instrument, and permits quick change from visual observation to photograph recording without disturbance of adjustments.

Denne Microscope.—In the microscope designed by Mr. M. T. Denne, F.R.M.S., for photomicrography, the whole system of illuminant, condenser, filter, substage condenser, stage and objective are all mounted on a triangular optical bench. This in turn is carried on a carriageway or lathe bed on which it is free to move. No conventional coarse or fine adjustment is fitted to the microscope, and the place of the body is taken by a camera. The coarse and fine focusing are operated by crank handles driving screw rods in the bed. These control handles are situated at the focusing screen end of the camera. For visual observation the whole optical system is brought up to the camera, which is telescoped, the focusing screen is swung to one side and an eyepiece is inserted in its place. The complete apparatus is mounted on a wheeled pedestal carriage, and the operator manipulates the whole from a chair at the focusing screen end of the bench.

Optical Problems.—In biology research has been directed to extending the limits of microscopic resolution by the use of monochromatic light of short wave-length. The limit of resolution—that is to say, the power to see a body composed of two dots as two separate dots in ordinary white light—is reached with standard apparatus, when the distance separating the two dots is reduced to half a wave-length of ordinary light (say 0·2 μ). Bodies far smaller than this can still be perceived as vague disks of light, but the eye cannot distinguish form or structure. There is in theory no limit to the smallness of a body which can be made visible, provided that enough light falls upon it, but the image we see of it is simply a series of diffraction disks, and can give us no further information than that something is there. A reduction in the length of the wave-length of light employed may be looked on as increasing the separation between the two points in a body. Thus an object easily visible, but just too small to be resolved, by ordinary light with a proportion of the long red rays in it, may be resolved and seen by monochromatic light from the blue end of the spectrum. As we pass toward the violet end we find that the eye is not sensitive to the violet, and that both distinct vision and accurate focusing become increasingly difficult. This band of light is, however, suitable for photography, and, although visual observation may be imperfect, photographs taken with this light reveal unseen detail and structure (*see* PHOTOGRAPHY).

In 1904 Dr. Köhler of Jena experimented with the use of ultra-violet light. This band of light is of very short wave-length—275$\mu\mu$—and possesses great resolution, but is invisible. He employed an optical system of quartz lenses, as glass stops these rays, and projected the image on a fluorescent screen where it could be examined with a glass eye lens and focused for photography.

Ultra-violet Ray Illumination.—In Great Britain the use of ultra-violet ray illumination has been applied by Mr. J. E. Barnard, F.R.S., and the technique simplified and developed. In the Barnard instrument quartz lenses, slide and coverglass are used, but in place of the older method of focusing on a fluorescent screen the object is first focused visually by means of a special form of dark ground illumination.

Dark ground illumination is entirely different from the normal illumination by transmitted light, in that the object is illuminated solely by rays of light so oblique that they cannot enter the objective of the microscope. The only light which enters is that reflected or scattered by the object itself. Objects viewed in this manner appear self-luminous against a dark background, and extremely tenuous and transparent material which would display no structure and be almost invisible when examined by transmitted light reveals material detail. Mr. Barnard's method was to focus the object first by means of visual examination against the dark ground. This focusing was necessarily crude, as the smallness of the objects only allowed them to be seen as disks of diffusion, not as distinct objects. It then becomes necessary to adjust the focus for photography with transmitted ultra-violet light. To effect this, the fine adjustment screw of the microscope is fitted with a disk head graduated in wave-lengths. Visual focus having been determined in light of known wave-length, rotation of the graduated head to the degree indicated for light of any other wave-length automatically adjusts the focus. The eyepiece is replaced by a camera body and dark slide. The dark ground illuminator is so contrived that it can be instantaneously changed over to a direct light condenser without disturbance of adjustment, and the lighting arrangement is arranged so that a beam of ultra-violet light of 275$\mu\mu$ from a cadmium arc can be directed into the optical axis. The photograph taken of the objects indistinctly discerned shows them in actual form and with considerable detail.

Special Difficulties.—Many difficulties have had to be met in this new technique. Bacteria are killed by exposure to ultra-violet rays, and search has had to be made for bands in the invisible spectrum whose effect is not immediately lethal. The most important published results to date are those connected with filter-passing organisms associated with cancer research (*q.v.*) by Dr. Gye, but the normal application of the apparatus may find fuller scope in the exploration of the structure of known bacteria of larger size. These are usually only visible under dark ground illumination when alive, and in order to render them visible for examination by transmitted light they are stained with aniline dyes. Staining kills the bacteria and alters structure. With ultra-violet light methods it becomes possible to examine the structure of living bacteria, for the different elements composing the cell present different degrees of absorption or transparency to the rays, and are as well differentiated on the negative as stained preparations (*see* BACTERIOLOGY).

The standardised model of the Barnard microscope will be approved and available as a commercial product for scientific workers. In the meantime experimental work is being done on the utilisation of even shorter wave-lengths in the Schumann region of the far ultra-violet. These rays have little penetrative capacity through air, and apparatus is being constructed to work in vacuum which may lead to a still further advance in our

means of photographically investigating minute structure beyond our present human range of vision with the best of microscopes.

Use in Applied Science.—The extension of microscopic resolution by the use of light of short wave-length and quartz optical systems has not yet found application in other than biological research. The tendency is, however, to apply high power examination to crystal structure in metallurgy, and branches of research dealing with opaque material which cannot be examined by transmitted light. Modern design has endeavoured to simplify the problems of the illumination of metallurgical and similar specimens. Devices embodying a parabolic mirror surrounding and integral with the ordinary objective have proved to be too cumbersome and heavy to be satisfactory in practice. In the same way the claims for the nominal "super microscope" devices, which consist of a primary low power microscope coupled to a second microscope of lower power whose function is to magnify the image given by the first system, have not received general endorsement. The results have been in accordance with optical theory, and have not yielded any increase of resolution. For the observation of incandescent bodies or micrometric measurements at a distance, an achromatic lens of short focus carried in a tube fitting the substage is useful. It acts as a short range telescope, producing an image in its focal plane which can be examined by a low power objective of the microscope, with satisfactory magnification, and gives a convenient depth of focus useful in the examination of large objects with uneven surfaces.

Use in Metallurgy.—For routine metallurgical work the inverted microscope with duplicate tubes for simultaneous visual and photographic work has largely superseded the older types of instrument. With the inverted microscope the specimen of metal is viewed from beneath. Light from an arc or "Pointolite" lamp is led into a vertical illuminating system beneath the objective and projected on to the specimen. The principle is the same as in simpler metallurgical microscopes, but in the newer type a very wide variation of illumination method is possible. Plain glass reflectors, silvered circles, half circles or strips or even parabolic mirrors can be used in the vertical illumination system of the inverted type of microscope. In addition to this convenient command of illumination, the focusing system has only to carry the weight of the objective and is relieved of the conventional tube. This enables a very fine and precise adjustment of focus to be simply obtained. The change from visual observation to the camera is attained by pushing an intercepting prism out of the optical axis of the apparatus.

Use in Engineering Work.—As the microscope is increasingly used as a purely workshop tool in mechanical engineering practice, there has been a demand for simple robust devices consisting of a low power objective and an eyepiece with a simple scale or graticule in its focal plane. These tools have a linear magnification of ×16 or ×20, and enable the tool maker and mechanic to achieve a very high standard of precision. In general, no focusing device is provided for the simpler types, the instrument simply being placed on the flat surface under examination. More complex devices are available for the study of fine screw threads, and the more elaborate types of workshop microscope are fitted with an electrical vertical illuminating device in permanent adjustment. In general these simplified tools may be looked on as precision measuring devices rather than instruments for microscopic investigation. The use of the high power microscope for the examination of the microstructure of metal has led to a realisation of the basic fact that the mechanical properties of metals and alloys, such factors as hardness, ductility and tenacity, are inter-related with the microstructure. The microscope alone does not afford an explanation of many of these properties, but when microscopical examination is used in conjunction with equally accurate chemical and thermal analyses, the behaviour of individual constituents can be determined and information of the greatest possible value has already been gained.

Other Industries.—In the textile industries the microscope is used from the first to the last stages. It is the weapon of the economic botanist studying the insect and fungus pests which attack the plants furnishing the raw material, and it is used by the dye chemist studying the ultimate detail of the decoration of the finished product. Each industry evolves its own particular detail of technique, but, in general, the normal research does not involve special apparatus and the conventional microscope common to all laboratories serves.

Colloid Chemistry.—The research chemist who deals with colloids, a subject of increasing importance, has to meet problems concerning suspensions of ultra-microscopic particles. For this, the apparatus known as the ultra-microscope is used. In this the power of resolution is neglected and the design is to make visible rather than to define extremely small ultra-microscopic particles. The ultra-microscope is essentially a dark-ground illuminating device, employing an intense illumination system and using magnifications up to ×1500, and the particles are seen as diffusion disks. The simplest form is the Siedentopf "Cardioid" condenser, which is a paraboloid dark ground illuminator applicable to the ordinary microscope substage.

It is, however, used with special quartz slides, as the intensity of the illumination is so high that glass fluoresces and destroys the darkness of the background. In order to estimate the quantity of particles present in a given volume, the quartz slides used with the cardioid condenser are similar to those used in the haemacytometer. A central table surrounded by a groove is ground down to a lower level than the surface of the slide, so that a known depth of liquid can be enclosed between cover and slide.

A more precise form of ultra-microscope is the Siedentopf-Zgismondy slit ultra-microscope, in which a beam of light from an arc is passed through a condenser and focused on an adjustable slit, similar to that used in a spectrometer. The image of the slit is reduced to a quarter size by a second condenser, and focused by an independent microscope objective on a small quartz windowed tank containing the liquid under examination. As the length and breadth of the slit can be adjusted and the reduction is known, the volume of the illuminated portion of the liquid under observation can be accurately estimated. The area of the illuminated zone observed is controlled by an eyepiece stop, and it is possible to count the number of particles in a known volume of solution. If a larger known volume of the solution is evaporated and the residue weighed, the total mass of particles can be calculated and the mass and, if its density is known, the volume of a single particle is estimated.

The limitations of the ultra-microscope are those of the refractive index of the objects observed. Cellulose, starch and other low refracting bodies can only be observed in relatively large particles, but metallic colloidal solutions of high refractive index have given extremely favourable results. Colloidal gold particles as small as $1{\cdot}7 \times 10^{-7}$ cm. in diameter can be observed as separate entities.

Modern Apparatus.—These more recent types of research apparatus, the ultra-violet ray microscope, the inverted metallurgical microscope, and the ultra-microscope, are specialists' instruments and will not supersede the standard instruments for ordinary work. The design of the latter may be looked on as stabilised, and no great advance has been made. The modifications introduced in practice are those of detail and convenience rather than material alteration of type. The increasing use of microphotography as a recording device has made the narrow-bodied microscope of Continental design relatively obsolete. The best modern instruments have body tubes of two inches or more in diameter.

Improvements in binocular microscopes have now reached a point where binocular eyepiecing can be used with the highest powers and oil immersion objectives. The advantages of the binocular system are a stereoscopic effect and a great relief from ocular fatigue. In the past, the old-fashioned Wenham prism type binocular was the only satisfactory system, and it was only applicable to very low powers and to the old "long tube" stand. Attempts to adapt a binocular prism system to the higher powers were not successful, and various shortcomings such as unequal light distribution in the tubes have hitherto proved insuperable. The new eyepiece systems have now been adopted by the leading

British and American makers and have proved satisfactory in practice. Monocular and binocular bodies are detachable and interchangeable on the same stands. Eyepiece focusing for disparity of vision between the eyes and interocular width adjustment are provided for.

As a result of research, and in a measure as the outcome of wartime needs, Great Britain is producing the highest grades of optical glasses according to tests carried out by the National Physical Laboratory. This mastery of material (*see* OPTICAL GLASS) has reacted on the microscope manufacturers, and British microscope objectives are being adopted for the most critical research work.

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(H. B. C. P.)

MIDDLESBROUGH, England (*see* 18.412), with an area of 4,159 acres, had a population of 131,070 in 1921. The town was given a separate court of quarter sessions in 1910. The efforts of the corporation to deal with the housing shortage have been notable: in addition to 1,283 houses contracted for, of which 877 were finished in 1925, two large buildings were converted into flats, and a number of hutments were erected at Marske-by-the-Sea for the accommodation of Middlesbrough families. The corporation purchased the omnibus and tramways undertakings in 1921. Marton, an estate of 136 acres, was presented for use as a public park in 1924. The sum of £40,000 was given by Mr. J. Constantine for a technical college in 1916, but, owing to the War and the rise in costs, the work could not be proceeded with until a further £40,000 was given by his widow and family. The Constantine Technical College was under construction in 1925. Docks for small vessels and a landing stage were being built in 1926, and an area prepared for extensions of the docks.

MIDLETON, WILLIAM ST. JOHN FREMANTLE BRODRICK, 1ST EARL OF (1856–), British politician (*see* 18.419), did not remain long out of Parliament after his defeat in the general election of 1906, as in the following year his father died, and he entered the House of Lords as 9th Viscount. He took a considerable share in the work of that House, and played an active part behind the scenes in Conservative politics, without returning to office. He had meanwhile become especially prominent as leader of the southern Unionists of Ireland, in virtue of his position as a landowner in County Cork. In the Irish Convention of 1917–8 he and a band of Southern Unionists separated themselves from the Ulster standpoint and expressed a readiness to concede a unitary Home Rule Government for Ireland, subject to provisions for safeguarding the minority of loyalists. At the beginning of 1920 he was created an earl.

MIGRATION (*see* 18.427).—The general characteristics of the movement of population between 1909 and 1924 were:—

Since the opening of the 20th century most states had begun to exert a positive control in questions of migration; its enormous increase made state regulation of overseas migration unavoidable.

With the improvement of communications, many migrants have no intention of settling permanently and becoming naturalised overseas. The annual figures of repatriation from the United States have frequently amounted to more than half of those of immigration. This is no longer due solely to the difference between conditions of living in the countries of emigration and immigration; rather, and in increasing degree, to the more or less conscious efforts of the countries of emigration to preserve their nationals' love of their homes, or those of the countries of immigration to assimilate the new elements. The countries of emigration encourage, as far as possible, temporary migration, to which, however, even before the War the countries of immigration raised economic and social objections.

During and after the War, in addition, national and political points of view began to influence migration policy decisively. In the countries of immigration, especially the United States, legislation governing selection became more stringent, and later a numerical limit was imposed on immigrants. The European states were no longer able to divert their surplus population overseas so copiously as before; even in the case of racially kindred nations, or the British self-governing Dominions. These Dominions too, under the pressure of economic depression, seek to retard immigration.

Migration has diminished, since the supply of emigrants does not tally with the demand in respect of nature and quality (race, sex and age).

The one-sided interference with immigration by the opposing groups of states results in social conflicts within those states and friction between their respective governments.

A peculiar characteristic of recent years is the increasing importance of continental migration within Europe. The social problems arising in the countries concerned are regulated in many cases by inter-state treaties (Migration Treaties, properly so-called, going beyond the International Labour Agreements) and if possible international agreement. This is the only way to avert dangers which threaten peace, and to further the social policy of the world in positive fashion.

The immediate problem is that of successfully settling Europe's surplus urban industrial population in the colonial agricultural areas of overseas countries; the lasting and general world problem is, however, how peoples of different habits and different standards of living and of radically different race (white and coloured), may be distributed evenly over the earth without endangering the peace and progress of mankind.

It is no longer enough to treat immigration purely as a demographic phenomenon occasioned by the decision of those immediately concerned. In order to understand the causes and effects of this phenomenon it is necessary to include in our survey the national and international measures which have been taken in the interests of the community.

I. PROGRESS OF STATISTICS

As early as the first International Labour Conference in Washington in 1919 the International Labour organization (I.L.O.) created under the treaty of Versailles passed various "recommendations" dealing with equal treatment of alien labourers and with collective recruitment of foreign workers, and appointed an international emigration commission, which produced a systematic programme of action at its session in Geneva in 1921. The 4th International Labour Conference of 1922 adopted a "recommendation" relating to the collection and improvement by the I.L.O. of statistical and other information on migration. In addition to current monthly publications of the most important data, the I.L.O. issued in 1925 a first annual report on the statistics of 60 countries and territories, *Migration Movements 1920–1923* (Geneva, 1925). This report embodies the results of exact and uniform statistical inquiries and provides an international co-ordination of statistics. The numbers and details of the migrants (sex, age, profession, nationality, country of last and future permanent residence) have been classified for the first time, in eight homogeneous groups: (1) oversea emigration of nationals, (2) continental emigration of nationals, (3) oversea immigration of nationals (repatriation I.), (4) continental immigration of nationals (repatriation II.), (5) oversea emigration of aliens (generally returning to their country of origin), (6) continental emigration of aliens (generally returning to their country of origin), (7) oversea immigration of aliens, and (8) continental immigration of aliens.

In giving these figures the report explains the very frequent variations in the method of compiling them, and definition of the "migrant" and also draws attention to the gaps and deficiencies of international comparisons. Migration movements during the periods 1909–1913–1914 had a transitional character, but those during the periods 1915–9 and 1920–4 can be illustrated comparatively. The tables on p. 908 show the overseas emigration and immigration (repatriation I.) of nationals in the chief European countries and the overseas immigration and emigration (repatriation II.) of aliens in certain countries of the world.

II. CHARACTER OF MIGRATION MOVEMENTS

Overseas migration has perceptibly declined since the War.

As regards the European countries of emigration the annual average (before the War 1,349,251 and 669,574 after the War), so far as proper statistics are available has decreased by 50·38%. In the countries composing the former Austro-Hungarian monarchy emigration has sunk to 70·4% of its pre-War figures: emigration from Italy 58·8%, emigration from Finland, 56·8%, and Portugal, 51·6% is less than ⅔ of what it was; the percentages for Great Britain are 43·6, for Spain 39·6, for Sweden 38·3, for Norway 34·7, for Belgium 31·6, and for Denmark 29·5%. Emigration has increased

TABLE I. *Overseas Emigration of European Nationals*

(With Repatriation Figures for Great Britain and Ireland, Italy and Spain)

Years	Austria-Hungary	Belgium	Denmark	Finland	Germany	Great Britain and Ireland		Italy		Netherlands	Norway	Portugal	Spain	Sweden		Switzerland
	Emigration	Emigration	Emigration	Emigration	Emigration	Emigration	Repatriation	Emigration	Repatriation	Emigration	Emigration	Emigration	Emigration	Emigration	Repatriation	Emigration
1909	259,145	3,650	6,782	19,144	24,921	288,761	149,068[2]	399,282	134,210	2,939	16,152	38,146	111,058	18,894	4,988	4,915
1910	258,816	5,580	8,890	19,007	25,531	397,848	164,139	402,779	161,148	3,220	18,912	39,457	160,936	24,647	4,735	5,178
1911	165,522	4,586	8,303	9,372	22,690	454,527	192,718	262,779	218,998	2,638	12,477	59,399	139,683	16,770	4,558	5,512
1912	251,743	4,402	8,636	10,724	18,545	326,959[2]	59,681[4]	403,306	182,990	2,155	9,105	88,592	194,443	14,689	5,181	5,871
1913	313,621	7,590	8,846	20,057	25,843	389,394	85,709	559,566	188,978	2,330	9,876	77,227	151,000	17,224	4,917	6,191
Average 1909–13	249,769	5,162	8,291	15,661	23,506	371,498	130,263	405,542	177,265	2,656	13,304	60,564	151,424	18,445	4,876	5,533
1914	73,067[1]	..	6,203	6,474	11,803	214,393	104,462	233,214	219,178	2,174	8,522	29,806	66,596	10,006	4,864	3,869
1915	..	..	3,302	4,041	528	76,911	92,388	66,517	167,925	1,074	4,572	22,848	50,359	4,672	3,223	1,976
1916	..	..	4,265	5,325	326	52,926	57,931	74,140	39,039	911	5,212	14,957	62,247	7,488	3,159	1,464
1917	..	..	1,614	2,773	9	10,004	12,254	13,013	16,885	867	2,518	..	43,051	2,571	2,478	656
1918	..	..	793	1,900	..	10,621	8,772	4,010	9,025	1,160	1,226	..	20,168	1,498	1,630	304
1919	..	1,967	3,341	1,085	3,223	146,935	93,023	105,833	89,833	2,439	2,432	21,614	69,472	4,008	3,573	3,063
Average 1914–9	..	328	3,253	3,600	2,635	85,381	61,471	82,788	90,314	1,437	4,080	14,871	51,982	5,040	3,154	1,889
1920	60,308	9,384	6,300	5,595	9,194	285,102	86,055	211,227	78,498	5,978	5,581	46,410	150,566	7,093	5,601	9,276
1921	76,031	2,200	5,309	3,557	24,135	199,477	71,367	194,320	92,212	3,286	4,627	17,915	62,479	5,881	4,605	7,129
1922	72,119	927	4,094	5,715	36,527	174,096	68,026	121,410	54,282	2,158	6,456	29,037	64,119	8,985	3,237	5,787
1923	75,717	2,256	7,601	13,835	115,416	269,680[3]	58,143	177,853	39,680	5,648	18,287	30,792	93,246	26,559	2,433	8,006
1924	41,131	2,922	6,319	5,429	58,637	174,451	68,614	130,779	60,676	3,366	8,492	22,279	86,920	8,401	2,539	4,140
Average 1920–4	65,061	3,538	5,925	6,826	48,498	220,561	70,041	167,118	65,070	4,087	8,689	29,287	91,466	11,384	3,683	6,868

[1] Hungary only.
[2] The figures for the years 1909–11 refer to British passages: the figures after 1912 are for true British emigrants.
[3] Including the figures for the Irish Free State (13,396 in 1923).
[4] The figures for the year 1912 refer only to the last nine months (April to December).

TABLE II. *Overseas Immigration into Certain States*

(With Figures of Repatriation of Immigrants [Emigration] in Certain Cases)

Years	United States		Canada	Brazil	Argentine		Australia		New Zealand		South Africa		Cuba	Mexico
	Immigration	Emigration	Immigration	Immigration	Immigration	Emigration	Immigration	Emigration	Immigration	Emigration	Immigration	Emigration	Immigration	Immigration
1909	683,594	195,035	93,285	84,090	231,084	94,644	83,609	54,676	38,650	33,931	..	..	31,286	..
1910	966,324	167,879	178,489	86,751	289,640	97,854	95,692	58,145	35,769	32,361	..	..	37,764	..
1911	801,868	245,830	219,260	133,575	225,772	120,709	141,909	72,609	41,389	37,189	..	..	38,053	16,939
1912	758,944	299,151	255,661	177,887	323,403	120,260	166,958	83,217	44,660	35,733	..	..	38,296	19,839
1913	1,112,164	260,218	303,087	190,333	302,047	156,829	141,906	87,131	44,588	30,369	14,251	..	43,507	17,805
Average 1909–13	864,579	233,623	209,956	134,527	274,389	118,059	126,015	71,156	41,011	33,917	2,850	..	37,781	18,194
1914	1,117,727	269,796	85,010	79,232	115,321	178,684	110,701	..	37,646	32,506	9,047	..	25,911	6,187
1915	232,145	180,198	11,600	30,333	45,290	111,459	70,436	..	25,551	22,476	5,158	..	32,795	4,297
1916	178,850	113,521	13,985	31,245	32,990	73,348	59,140	..	21,799	21,163	3,846	..	55,121	6,472
1917	172,135	46,471	7,760	30,277	18,064	50,995	53,036	..	15,649	13,869	2,079	..	57,097	9,425
1918	59,642	41,900	16,987	19,793	13,701	24,075	33,018	..	11,906	11,660	3,044	..	37,321	5,231
1919	53,532	94,796	67,680	36,027	41,299	42,279	59,980	..	20,931	19,877	9,038	..	80,488	8,437
Average 1914–9	302,338	124,447	33,837	37,818	44,444	80,140	64,385	..	66,647	20,258	5,352	..	48,122	6,675
1920	287,615	274,041	98,636	69,042	87,032	57,187	85,237	77,012	44,062	32,924	22,095	9,846	174,221	12,399
1921	702,153	236,557	67,840	58,476	98,086	44,638	80,316	63,105	41,882	28,559	20,933	13,476	58,948	19,763
1922	243,195	187,947	46,690	65,007	129,263	45,993	92,054	55,490	35,233	28,389	13,235	12,675	25,993	15,956
1923	342,140	76,015	117,013	84,549	195,063	46,810	92,859	55,319	36,488	29,668	11,641	12,666	75,461	19,827
1924	416,870	72,262	108,122	96,052	159,939	46,105	103,667	59,918	39,815	30,593	16,409	13,445	85,288	..
Average 1920–4	398,395	169,364	87,660	74,625	133,677	48,147	90,827	62,169	39,496	30,027	16,863	12,422	83,962	16,986

since the War by 107·5% in Germany, 53·9% in the Netherlands, 24·1% in Switzerland. Thus the proportion supplied by each country to the total of emigrants has altered. Before the War the proportion of the total overseas emigration from different European countries was: Italy 30·05%, the United Kingdom 28·86%, Austria-Hungary 18·51%, Spain 11·22%, Portugal 4·48%, Germany 1·74%, Sweden 1·36%, Finland 1·16%, Norway 0·98%, Denmark 0·61%, Switzerland 0·41%, Belgium 0·38%, Holland 0·19%. It now runs: United Kingdom 32·94%, Italy 24·95%, Spain 13·66%, territory of the former Austro-Hungarian Monarchy 9·71%, Germany 7·29%, Portugal 4·37%, Sweden 1·7%, Norway 1·30%, Switzerland 1·03%, Finland 1·02%, Denmark 0·88%, the Netherlands 0·60%, Belgium 0·53%.

The statistics of immigration show the annual average immigration as falling from 1,720,703 in 1909–13 to 942,711 in 1920–4, five years after it, a decrease of 45·21% falling to 46·1% of pre-War figures in the U.S.A., 41·75% in Canada, 40·76% in Argentina, 55·47% in Brazil, 87·50% in Australia, while the figures for Mexico (6·6%) and New Zealand (3·69%) remained practically unchanged, immigration into Cuba rose by 122·29% and into South Africa by 18·33%. Formerly the United States took the largest proportion of immigrants with 50·25% of the total, Argentina had 15·5%, Canada 12·20%, Brazil 7·82%, Australia 7·33%, New Zealand 2·38%, Cuba 2·20%, Mexico 1·06%, South Africa 0·83%. Now the list runs: U.S.A. 42·26%, Argentina 14·20%, Australia 9·63%, Canada 9·30%, Cuba 8·91%, Brazil 7·82%, New Zealand 4·19%, Mexico 1·80%, South Africa 1·79%.

Differences of direction (nationality of immigrants and country of last and of future residence) are even greater than those of the total volume. This is shown by the following table for the U.S.A., which is still the most important country of immigration.

Immigration of aliens into the United States by principal countries of origin, 1913–4, 1920–1 and 1922–3.

Countries of origin	Numbers of immigrants admitted			Per cent of total		
	1913–4	1920–1	1922–3	1913–4	1920–1	1922–3
Northern and western Europe	164,133	138,551	156,429	13·4	17·2	29·9
Southern and eastern Europe	915,974	525,548	153,674	75·2	65·3	29·4
British North America	86,139	72,317	117,011	7·1	9·0	22·4
Mexico	14,614	30,758	63,768	1·2	3·8	12·2
Other countries	37,620	38,054	32,037	3·1	4·7	6·1
Totals	1,218,480	805,228	522,919	100·0	100·0	100·0

The table above shows two tendencies. First, there is a reduction, already considerable before the new system came into force, of total immigration into the United States as compared with 1913–4, becoming more marked in the year 1922–3 under the influence of the new Quota law. Secondly: in 1922–3 less than one-third of the immigrants came from southern and eastern Europe, as against three-fourths in 1913–4. The number of immigrants from northern and western Europe, which was formerly about one-eighth of the total, became nearly one-third.

In the year 1923–4 the number of immigrant aliens increased to 706,896. The proportion of northern and western European "peoples" increased from 20·8% of the whole in 1913–4 to 55·7% in the year 1923–4 and the proportion of southern and eastern European "peoples" decreased from 75·6% of the whole in 1913–4 to only 27·2% in 1923–4.

Not only the volume and direction of overseas migration movements, but also the character of the migrants has changed greatly. Family migration is on the decrease, outside the British Empire. The preponderance of males is greater than before the War. According to statistics from 13 countries of emigration, males composed 55·6% of the total in 1922, 63·7% in 1923. The same increase in the preponderance of males may be seen from the statistics of the chief countries of immigration (54·2% and 62·4%). This increase is due to the fact that in 1922 the states of western and northern Europe still made little use of their quotas of immigration to the United States, while recently the southeastern states, where family emigration was most common, have not been able to send the wives and children to join the heads of their households so frequently as before. (Percentage of male immigrants to the United States was 48·4% in 1922, 58·8% in 1923.) Even emigration from the United Kingdom was affected as regards the general proportion of the two sexes (51·9% of males in 1922, 59·6% in 1923). The sexes of immigrants were most evenly distributed in South Africa and New Zealand, most unevenly in Cuba, the Argentine and the other South American states, owing to seasonal migration and the greater risk in settling. The decrease of the percentage of child migrants from 1922 to 1923 similarly points to a decrease in family migration. In the United States the percentage of immigrant children dropped from 20·6 to 14·6; in Argentina it was only 10·4%, in Cuba only 6·3%. In the British Dominions the proportion rises to 22·5% (New Zealand 23·2%). Jewish immigration into Palestine has a more family character (26·7% children in 1922, 26·9% in 1923). Of able-bodied adults, the young are more numerous than the elderly.

The countries of emigration and immigration complain even more of the alteration in distribution of occupations. Before the War up to two-thirds of the overseas emigrants from Europe were engaged in agriculture, in 1922 and 1923 only 14·6% and 14·0% respectively of the total emigrants from 14 European countries were of this class. Even if domestic servants and day labourers are counted in, this class hardly amounts to a third of the total. The statistics of countries of immigration place the percentage but little higher.

In consequence of the difficulties and restrictions on immigration and unfavourable economic conditions in Europe, repatriation home of previous overseas emigrants has decreased greatly (according to Table II. with 31·96%) and ever more rapidly. In the five years after the War repatriation to Great Britain was 18·3% less than before the War; to Sweden 24·5% less, to Italy actually 63·3% less.

The loss of population through migration per 100,000 inhabitants, arrived at by calculating the difference between figures of immigrants and emigrants, gives the following table for European countries (1920–3): Portugal −1,936, Great Britain and North Ireland −1,429, Italy −1,135, followed at a distance by Spain, Sweden, Czechoslovakia, Poland and Rumania.

The figures for the five overseas countries which have recorded both emigration and immigration show that the gain in population through migration per 100,000 inhabitants is highest in New Zealand (3,906), followed by Argentina (1,826), the United States (758), South Africa (116).

III. RESTRICTION OF IMMIGRATION

The universal depression consequent on the World War could not of itself have brought about, except in a certain degree, the decrease of emigration and its change of direction. The history of migration movements, especially in the United States, shows that for a century past periods of economic depression have coincided with the lowest figures of migration. The supply of emigrants in the European countries remained greater than the overseas labour markets, especially those of the United States, could have absorbed.

United States.—The depression which set in after a brief post-War boom, in the United States as elsewhere, in 1920–1, and the great increase in immigration in 1919–20 increased the apprehension with which organised labour, in particular, had come to regard unregulated immigration even before the War. Moreover, during the War American objections on national grounds to immigrants from south and eastern Europe, who are only assimilated with difficulty, acquired decisive importance, and public opinion was converted by motives of patriotism to a policy of restriction. The clause in the consolidated Immigration Law of Feb. 9 1917 under which persons over 16 years of age who are unable to read are not admitted, proved ineffectual in reducing the undesired element and emergency legislation for the restriction of immigration combined with national discrimination was finally approved on May 19 1921, and came into force on June 2. The number of alien immigrants, in the case of each nationality, was limited to a maximum of 3% of the number of foreign-born persons of that nationality who were resident in the United States at the time of the census of 1910. Certain categories of persons were, however, exempted from these quota.

This emergency law was to operate until June 30 1924 when the Immigration Act,[1] 1924, came into force. The earlier law had already reduced the proportion from southeastern Europe of the total immigrants by one-third. The effect of this reduction was, however, partially annulled because such persons were allowed to immigrate from the countries bordering on the United States and unaffected by this law (Mexico, Canada) even of alien origin, if they had been settled there for two years in the one case, five in the other. Thus the total immigration from Canada and Mexico rose from 66,361 for the financial year of 1922 to 290,026 for 1924. The total of immigrants had therefore not decreased. Economic depression also forced the countries of northwestern Europe to make full use of their high quotas. Clandestine immigration of southeastern Europeans by land and sea is estimated by the best authorities at 150,000

[1] See Immigration Laws and Rules of Feb. 1 1924, issued by the U.S. Bureau of Immigration (Washington, 1924).

annually. Public opinion, at one with Albert Johnson, Chairman of the Committee on Immigration of the House of Representatives, in the opinion that " the melting pot was to have a rest," welcomed the new law.

The law distinguishes three categories of persons:—

1. The old emigration is wound up under the first group; unmarried children under 16 and wives of previous emigrants, now naturalised, and certain other individual desirable types are allowed to immigrate *outside* the *quota*. Immigrants from the American continent do not come under the law at all. Persons who were not born there can no longer, under any circumstances, be accepted outside the quota of the country of origin.

2. As regards immigrants on the quota, the law adopts the following drastic principles for the first three years of its validity. The annual quota of any nationality shall be two per centum of the number of foreign-born individuals of such nationality resident in continental United States as determined by the United States census of 1890. After July 1 1927 the total number of immigrants is to be fixed at 150,000, the quota of each nationality being determined by the relationship between the number of inhabitants having that national origin to the total population of the United States in 1920.

On this basis the annual quotas from the principal countries are as follows:—

	1921–2	1924–5
North and West Europe		
Belgium	1,563	512
Denmark	5,694	2,789
France	5,729	3,954
Germany	68,059	51,227
Great Britain and North Ireland	77,342	34,007
Irish Free State	...	28,567
Netherlands	3,607	1,648
Norway	12,202	6,453
Sweden	20,042	9,561
Switzerland	3,752	2,081
South and East Europe		
Czechoslovakia	14,282	3,073
Italy	42,057	3,845
Poland	25,827	5,982
Rumania	7,419	603
Russia	34,275	2,248
Yugoslavia	6,426	671

3. Finally, persons ineligible as citizens of the United States fall into a separate group. This provision excludes the Japanese, the only Eastern Asiatics who had not already been excluded from the possibility of immigrating by the earlier special " Law of Exclusion " (China), or by the clause on the " barred zone " of Asia adopted into the law of 1917.

The most important result of the new immigration legislation, as compared with the period before the War, is that immigration from the most important European countries of emigration (Italy, the territories of the previous Austro-Hungarian Monarchy and Russian Empire) had been reduced by nine-tenths. The quotas from Sweden, Norway, Denmark and Switzerland have also been reduced by half; those for Germany and the Irish Free State remain practically unaltered. All other countries of emigration, including Great Britain, whose annual quota is now only 34,007, must now in increasing measure seek their outlet in other overseas countries.

Other Countries.—But South American and other countries have adopted similar restrictions on immigration for similar reasons. Before the War these countries—Brazil, Uruguay, Argentina—and others still encouraged white immigration, but they can no longer afford to do so. Not only have they paid more attention to selecting the right class of immigrant, but at times immigration has been suspended altogether. The bad conditions have led to some outbreaks of the proletariat in several ports, these being aggravated by the failures who drifted back from up-country. So in South America too only settlers with capital and able-bodied country labourers are welcomed. No state still grants free land. The minimum capital required, even by Brazil and Argentina, is too high for the unemployed of Europe, and they cannot make their way as unskilled labour in hot countries against the competition of the native coloured population (the North of South America, North and Central Africa, Asia Minor, etc.). Especially intellectuals who have tried their luck in these districts have very often come to grief.

IV. MOVEMENTS OF POPULATION IN THE BRITISH EMPIRE

Great Britain has long endeavoured to divert her surplus population from the United States, and has tried where possible to find it an outlet in her own Empire. The motives and results of these efforts, prosecuted with increased zeal since the War, may be regarded as typical of the migration crisis, since the Empire contains countries of emigration and immigration which are naturally complementary, and the official interpretation of the term " migration " denotes internal movements from one of these territories to another.

Empire Settlement Act.—The importance of the settlement question for the maintenance and consolidation of the British Empire was strongly emphasised by the Dominions Royal Commission, 1911–7, but although since 1890 the theory of state subvention has often been mooted, it was not until 1921 that a scheme for state-aided imperial settlement was adopted by the Imperial Conference of that year. The Empire Settlement Act, passed by the British Parliament in 1922, implemented the scheme. An Overseas Settlement Office was set up under the supervision of a Colonial Office Committee, and in 1925 a new Under-Secretaryship of Dominion Affairs was constituted, with complete charge of migration and settlement policies. Emigration departments were opened by the Dominion Governments in London. England's share of the cost of carrying through any one measure was not to exceed 50%, and the obligation to grant subsidies was not to extend beyond 15 years. The total which might be expended in one year under this was £3,000,000, exclusive of receipts from interest or repayments in later years. The scope of the law could be extended to other parts of the Empire, but in 1926 this had not yet been done. As shown by Table II., emigration to the Dominions was still less than before the War, when the broad, thinly-populated expanses of the overseas portions of the Empire had already begun increasingly to attract the stream of emigration from Great Britain in default of other labour markets. Between 1891–1900 only 28% of English emigrants went to the Colonies, the majority to the United States; between 1901–12 63% went to the Colonies, 1919–23 64%. When the American quota was reduced in 1921 84,261 out of a total of 91,262 overseas emigrants from Great Britain and Northern Ireland went to parts of the Empire.

The comparatively small financial part taken by certain Dominions in carrying through this scheme is due to economic and social difficulties. These districts need mostly agricultural settlers and labourers and female domestic servants willing to live in the country. Great Britain is, however, rather short of these classes, while the Dominions object to the immigration of the superfluous skilled industrial labourers, in view of the unemployment in their own industries and the necessity of protecting the standard of living of their own population. Objections are also raised to agricultural settlement, on the ground that this increases the agrarian losses provoked by the considerable fall of prices of agricultural produce. Then it is feared that most of the former urban elements will soon leave the land again and increase the over-preponderance of the towns which is already very great. The first step should be to settle the urban unemployed of the overseas districts on the land, since they are already used to local conditions. And so all these states, although some have had satisfactory experience with immigration, have imposed strict conditions of selection of human material from the mother-country, or insist on suitable preliminary training for settlers. Families and juvenile emigrants are much preferred. New Zealand and Canada have been comparatively accommodating. Canada, however, has not an exclusively Anglo-Saxon population to increase and makes efforts to attract agricultural labour from other European states as well. South Africa is in general opposed to all European immigration, as she is suffering particularly from unemployment and has native labour to spare.

The British Problem.—The school of Mr. J. M. Keynes holds that the present unemployment in Great Britain is intensified by the fact that 1,000,000 persons remained in Great Britain during the War who would otherwise have emigrated, and considers that the maintenance of the standard of living in the mother-country could only be ensured—imperfectly—by increasing emigration, or more safely, by reducing the birth-rate; but other experts (Sir William Beveridge and Professor A. L. Bowley) are more optimistic—they calculate that after 1931 the decline in births during the War will result in a shortage of productive labour in England, on the assumption that emigration again reaches its pre-War dimensions, the death-rate remains unaltered and the participation of women in the work of the community remains constant. The Overseas Settlement Committee think that it will be possible to secure an adequate outlet by emigration within the Empire for the surplus industrial workmen of the mother-country, although used to a high standard of living and the state unemployment allowance, as soon as world conditions have got back to normal and the agrarian crisis has been surmounted. The financial assistance of emigration by the mother-country should, in any case, further the industrial development of the Dominions and help the overseas portions of the Empire to become self-supporting.

V. LEGISLATION ABOUT EMIGRATION

Before the War freedom of emigration was almost general. Judging by the legislation of the most important countries of emigration, such as Italy, the general character of emigration policy was as follows: emigration was only restricted in the case of persons who had to be kept in the country on account of military service, criminal records or immaturity. Further, persons were prevented in their own interests from emigrating if they did not fulfil the conditions of the countries of immigration, if they possessed insufficient means or ran the risk of getting into an unfavourable position by paid passages or other concessions. In order to protect the emigrants only such shipping companies were allowed to carry them as were under supervision, so as to avoid the activities of secret agents. A special emigration fund was maintained out of various sources which created an emigration authority with local and foreign branches and established or supported special welfare institutions in the ports and elsewhere (emigrants' homes, labour registries). But according as the character and social spirit of the government was more or less democratic, so, in practice, there was more or less hostility towards emigration. These principles of emigration policy were upheld in post-War legislation, and supplemented by fiscal measures and by various restrictions in the recruiting of emigrants.

The impoverished countries of the continent of Europe encountered even greater difficulties than did the British Empire from the attitude of the countries of immigration. In spite of the great and constantly recurring unemployment, it was impossible to let millions emigrate, as had been generally expected after the War. The governments of the emigration states were themselves at first swayed by contradictory motives. Where the military motive no longer weighed in the balance, they were anxious not to increase the price of labour through emigration, so as not to hamper their export trade, or they wished to settle their surplus population at home by agrarian reform. People were mistrustful, and expected, too, a great economic wave of prosperity. Soon, however, certain countries were forced by their great surplus of population to give direct state encouragement and assistance to emigration, but everywhere they found doors shut against them. The example of conscious national emigration policy is Italy. So long as she is forced to place her labour at the service of foreign economic systems, she tries generally to get a suitable return for it (policy of valorisation), to increase the value of her labour by suitable training, in particular not to permit collective recruiting of emigrants except under conditions dictated by the state, to protect the interests of the emigrants against the transport companies and other agents during and after emigration, to preserve the sense of nationality by suitable organisations in the country of immigration (policy of schools, clubs and voting) and finally to place the whole organisation of emigration under a state general commissariat for emigration and its organs.

A whole series of countries of emigration have copied Italian legislation more or less closely since the War in their new emigration legislation. As passports and visas are still compulsory, it is possible to regulate emigration policy towards the different states. All European countries are endeavouring more or less to get their own unemployed industrial labour out of the country where possible, and to shut themselves off from foreign labour at the same time.

Statistics show that countries of emigration have been able to divert their surplus population overseas most easily where the movement is favoured by racial kinship and political interests. Most of the Germanic and Nordic states of Europe were still able to turn to the United States up to 1924 even in greater measure than before the War. The Latin and Slav countries, being almost excluded from North America, compensated themselves mostly in the South American states. So, to take 1924 as an example, 52·5% of the Italian, 44·7% of the Spanish, 37·4% of the Czech emigrants went to the Argentine. The attempts of the Italians and Greeks to get a footing in the British Dominions and South Africa had, however, very little success.

VI. MIGRATION OVER LAND FRONTIERS

Overseas emigration would never have succeeded in satisfying the urgent demand for emigration. Fortunately the European states were able to find an outlet in a few European countries, especially France, Belgium and Luxembourg.

Immigration into France.—France was impoverished in man power, and her labour market, in consequence of the work of reconstruction and the increase in her export industry resulting from the fall of the franc, was able to absorb foreign labour to an extent which varied, but on the whole increased. Statistics of continental migration are still very imperfect, but show great changes since the War. Before the War Germany received about a million continental immigrants, France comparatively very few. This immigration to Germany was almost entirely agricultural and mostly seasonal and non-permanent. In 1924, however, Germany admitted no foreign industrial labourers and only 29,196 agricultural workers, while French national statistics, taken on the frontiers and certainly some 50% too low, show the figure of continental immigrants at 262,877 in 1923 and at 223,495 in 1924. The great majority came from Italy, which now sends two-thirds of its emigrants to France; but there is hardly a country in Europe which has not sent labourers, mostly industrial, in large numbers to France in recent years. Continental migration has the advantage for the countries of emigration that it easily alters its character and often helps to increase technical knowledge.

Regulation.—But the countries of immigration are confronted not only with difficult economic and social problems, but also with problems of national health and security arising out of these mass immigrations. It has proved especially necessary to regulate the national labour market as elastically as possible, so that at any given moment only so much foreign labour as is barely necessary remains in the country. It has proved possible to adapt *collective* migration to the needs of the present labour markets by means of state treaties, and to regulate the legal and social position of those concerned in a proper way. But the good results thus attained have been largely nullified by the insufficient regulation and supervision of individual migrants. The pressure of unemployment has also caused the Central European countries to put severe limitations on the entry and settlement of foreign labour. Certain countries even expel labourers who have long been resident in the country. The resultant insecurity and the rise of prices increases the difficulties of reconstruction caused by tariff policy, etc.

Continental emigration, for example, into undeveloped Russia, is only permitted to agricultural settlers with capital ready to form model settlements in the north. On the other hand, emigration out of European Russia into Siberia has assumed extraordinary dimensions since the War. The chances of normal continental exchange of labour would have been much greater but for the emigration to Western Europe of Russian refugees. Japan and China are now themselves largely reduced to continental migration within Asia, since their only overseas outlet is now South America. Continental migration

in the interior of Africa has also assumed very great importance, and in South Africa especially, the various states have regulated it from a one-sided point of view.

There must be general state regulation for crossing of frontiers and settlement of foreigners. Great Britain, thanks to her insular position has been most successful in this since the introduction of compulsory passports. The German "Labour Centre," which works by compelling foreign hired labour to obtain permission and register, has been much less successful. France is only now beginning to attack the problem by a more exact control of identification cards, unification of the administration (Commission de la main et l'oeuvre étrangère 1924) and a long-promised legal regulation of conditions of immigration.

VII. GENERAL INTERNATIONAL REGULATIONS

The recognition of the necessity of reconciling conflicting interests in migration has led those European states which are subject to continental exchange of labour to make a beginning and conclude comprehensive migration treaties (France with Czechoslovakia, Poland and Italy). But the experience so gained is not enough to allow one simply to apply these methods of regulation internationally to world migration. The development appears here to overlook the regulation of social-political questions of detail. The International Labour Office, which has been entrusted with this task, has declared in principle for equal treatment for foreign labourers in all respects, and in detail has begun by regulating for equal treatment of foreign workers as regards workmen's compensation for accidents during work (1924). The social-political regulation touches on many other questions, notably protection of migrants (especially women and juveniles) and the regulation of the labour market. The programme worked out by the International Emigration Commission 1921 was widened and revised in many respects by the technical Interstate Conference summoned in 1924 by the Italian Govt. and attended by delegates from 57 governments. The Protocol of this conference shows the great number and variety of these problems. The agenda dealt mainly with technical matters; the transport of emigrants, hygiene and sanitary services, assistance at the ports of embarkation and disembarkation, assistance for women and children, information on employment in the countries of emigration, and the principles to which migration treaties should conform, etc.

The actual conditions of emigration and immigration in the different states touch the sovereignty of the states so nearly that most governments at present refuse to admit international regulation. This was shown very clearly by the United States House of Representatives when passing the Immigration Law of 1924. Even the different international federations of Trades Unions have not succeeded in arranging mutual co-operation. It may, however, yet prove possible to secure the collaboration of the states whose interests conflict, and thus eliminate dangers to the peace of the world. Private leagues for the protection of the emigrants are already doing good work towards bringing about a rapprochement of public opinion in different countries on questions of migration. These leagues joined in a common international conference held at Rome in May 1924.

The increase of open and secret emigration from Canada and Mexico into the United States shows that unless continental migration be regulated, the intentions of legislation regarding overseas migrants will merely be paper regulations. Either America must make up her mind to establish an effective frontier police, to register and keep continual track of foreigners, or she will not be able to stop the impulse of the peoples to immigration. In the former case her attraction for the already assimilated elements of Canada and Mexico will grow and the number of territorial disputes over this question will increase; in the latter there will be an intensification of the shortage of labour and high wages.

The Oriental Question.—The problem of Oriental immigration into the United States is of special urgency. Under the "Gentleman's Agreement" of 1907 freedom was given to the Japanese Govt. to issue passports to Japanese labourers who had been resident in the United States before the conclusion of the agreement and were seeking re-entry, and also to parents, wives and minor children of Japanese already resident in the country, but the Japanese Govt. pledged itself not to issue passports to all other Japanese nationals seeking entry into the United States as labourers. This pledge appears on the whole to have been loyally observed by the Japanese Govt., but in practice it afforded certain loopholes for evasion; the number of Japanese residents continued to rise steadily and the agitation in California against their entry increased.

The Gentleman's Agreement was superseded by the Immigration Act of 1924, which declared that no "alien ineligible to citizenship" should be admitted to permanent residence in the United States with the exception of certain specified categories, comprising approximately the classes contemplated under the Gentleman's Agreement. It was decided by the Supreme Court that all aliens who are not white and of European origin or black and of African origin—*i.e.*, essentially all Asiatics—are ineligible to citizenship, excepting those specifically exempted by the Act itself. The political effect of this measure was profound. It substituted a unilateral action based on domestic legislation for an international agreement, and Japanese national honour was wounded by an action which directly discriminated against the Oriental races. The Japanese Govt. protested strongly and proposed that Japanese immigration should be regulated like that of other foreign countries by the quota system. This proposal was rejected by the United States Senate, and the discrimination was upheld. After a brief period of acute agitation in Japan excitement subsided, but the problem remains.

In British Columbia, Japanese immigration is still regulated by a Gentleman's Agreement, but there has grown up an agitation in favour of legislation on the model of that passed in the United States. The British Empire is thus acutely concerned in this question. The British Empire had its own very delicate inter-Imperial problem arising out of the attitude of the populations of certain Dominions towards Indian immigration. Australia views any settlement of Asiatic peoples with disfavour, while in South and East Africa the discrimination in the treatment of Indian nationals under domestic legislation has seriously prejudiced political relations between these countries and India.

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MIHALACHE, ION (1882–), Rumanian politician, was born March 3 1882, of a poor peasant family. He became a village school teacher and distinguished himself as an organiser of the Village School Teachers' Federation, of which he was

eventually appointed president. In 1914 he entered politics, and after the World War founded the Peasant (Tsaranist) party first in Bessarabia, and then extended its organisation to the rest of the country. In the first elections held after the War in 1919, the Peasant party won 70 seats in the Chamber of Deputies and Mihalache was appointed Minister of Agriculture in the Vaida-Voevod Cabinet, which office he held until March 1920, when Vaida-Voevod resigned with the entire Cabinet. Mihalache distinguished himself during the World War in which he served with the rank of captain. In addition to the highest Rumanian military decoration (Michael-the-Brave) he was awarded the Legion of Honour, the Order of St. Stanislas and other foreign decorations.

MILAN (*see* 18.437), the second largest town in Italy and the most progressive commercially and industrially, had a population of 712,844 in 1921. The old quarters are giving way to blocks of new buildings, and the circumference of the city in 1926 was about eight miles. Barracks have been erected and exercise grounds made outside. The manufacture of motor-cars and artificial silk are growing industries. A free university was opened in 1924. In 1918 the royal palace to the south of the cathedral was presented to the municipality by the Crown. The Home of Rest for musicians, established by Verdi, has been transformed into a Verdi Museum, and a statue of the composer was unveiled in front of it in 1913. The Museo del Teatro, opened in the building of the famous Della Scala theatre in 1913, contains a collection relating to its history. A larger station, fronting the Piazza Doria, to replace the central railway station, was under construction in 1926.

MILES, NELSON APPLETON (1839–1925), American soldier (*see* 18.442), died at Washington, D.C., May 15 1925.

MILFORD HAVEN, LOUIS ALEXANDER, 1ST MARQUESS OF (1854–1921), British sailor, was born at Gratz May 24 1854, the eldest son of Prince Alexander of Hesse, by his morganatic marriage with the Russian Countess, Julie Thérèse von Haucke. As Prince Louis of Battenberg he was naturalised as a British subject in 1868 and entered the royal navy in the same year. In 1884 he married Princess Victoria, daughter of the Grand Duke Louis IV. of Hesse. From 1891 to 1894 he was naval adviser to the inspector-general of fortifications and in 1900 was appointed assistant director of naval intelligence at the Admiralty, being made director in 1902. In 1904 he was promoted rear-admiral and after serving as second in command in the Mediterranean was made vice-admiral in 1908. After commanding the Atlantic and Home Fleets, he was in 1912 appointed First Sea Lord of the Admiralty, but in Oct. 1914 he was compelled to resign from this position owing to public resentment at his German origin, which persisted in spite of his fine record of service. In 1917 he relinquished his German title, assumed the surname of Mountbatten and was elevated to the peerage as marquess of Milford Haven. In the following year he retired from the active list of the navy. He became an admiral of the fleet in 1921 and died on Sept. 11 of the same year.

MILITARY RAILWAYS: *see* LIGHT RAILWAYS, MILITARY.

MILK AND DAIRY PRODUCTS.—The dairy industry is in many countries the chief agricultural industry and in all countries is of the utmost importance to agriculturists. The fact that this is recognised by agriculturists themselves is evident from the rapid expansion in some countries of the dairy herds. The following statistics give some indication of such expansion and of the state of the industry in various countries:—

The Production of Milk

Great Britain.—In 1924 the total milk production was approximately 1,300 million gal. (less milk used for calf rearing). Of this, 600 million gal. were consumed as liquid milk; 500 million gal. were consumed in the manufacture of butter and cheese; 35 million as condensed milk and 61 million as cream, etc. The dairy herd numbered 3,111,000.

Australia.—In 1921, 267 million lb. of butter and 32½ million lb. of cheese were produced. The dairy herd numbered 2,343,221, with an average production per cow of 343 gallons.

Canada.—In 1921, 236½ million lb. of butter and 149¼ million lb. of cheese were produced. The dairy herd numbered 3,736,832.

New Zealand.—In 1924, 71½ million lb. of butter and 161 million lb. of cheese were exported. The dairy herd numbered 1,291,000.

United States.—In 1923 the total milk production was 109,736 million lb., of which 54,614 million lb. were consumed as liquid milk, 39,106 million lb. were consumed in the manufacture of butter, and 12,714 million lb. in the manufacture of cheese, condensed milk, ice cream, etc. The dairy herd on Jan. 1 1924 numbered 24,675,000, but this number had decreased in 1925 to 20,965,423.

Argentine.—In 1918, 41,863,000 lb. of butter and 14,177,000 lb. of cheese were exported. The dairy herd numbered 2,378,000.

Denmark.—Denmark is the main European exporting country of dairy products. In 1921, 199,500,000 lb. of butter were exported; the dairy herd numbered 1,184,268.

The Consumption of Milk

The consumption of milk and dairy products varies as much as production. In a survey of 68 American cities which have populations of over 100,000, the consumption of fluid milk was found to be ·66 pt. per head daily. In 1924, in the New York Metropolitan district, where there is a population of about 8·7 million the consumption per head was ·75 pt. daily, an increase of 85% during the preceding 30 years, due largely to improved quality. The following statistics collected by the United States Department of Agriculture give the annual average consumption per head of liquid milk, butter and cheese in various countries:—

Annual Consumption per head of liquid milk (In American Gallons).

Denmark in 1914	68·5 gal.
America in 1925	53 gal.
Canada in 1916	26 gal.
United Kingdom in 1918	22 gal.

Annual Consumption per head of butter.

Canada in 1911	27·7 lb.
Australia in 1913	25·6 lb.
New Zealand in 1914	21·7 lb.
Denmark in 1914	19 lb.
United Kingdom in 1914	17 lb.
United States in 1919	16 lb.
Argentine[1] in 1915	1·8 lb.

Annual Consumption per head of cheese.

Denmark	12·3 lb.
United Kingdom	11·2 lb.
United States	4·2 lb.
Australia	3·63 lb.
Canada	3 lb.
New Zealand	3 lb.
Argentine	2·9 lb.

[1] Factory butter only.

Production and Consumption in Great Britain.—It will be seen from the figures given above of the consumption of milk in the various countries that Great Britain's consumption is low compared with that of other nations. In 1918 the returns of the consumption of liquid milk were obtained through the local food control committees and it was found that these varied from as low as 0·10 pt. in Inverness to 0·31 pt. in London, an average for the whole area being 0·25 pint per head per day. Actual consumption would be above these figures as milk produced and consumed on farms does not appear, whereas the figures include the total population. The London figures would be approximately correct but the production of milk in Great Britain in recent years has not kept pace with the increase in the human population nor with the demand by the latter for milk products. This is shown by the following table extracted from the report of the Astor committee:—

	1871	1914	Increased Percentage
Population	26,100,000	41,700,000	60
Numbers of cows and heifers	2,091,000	2,937,000	40
Weight of cheese imported; cwt.	1,216,400	2,373,091	95
Butter imported; cwt.	1,334,783[1]	3,882,116	304
Margarine imported; cwt.	..	1,501,520	..
Condensed milk imports; cwt.	352,332[2]	771,239	128
Dried milk imports; cwt.	..	30,601	..
Total weight of Dairy produce Imported—cwt	2,903,515	8,558,567	235

[1] No separate statistics for butter and margarine before 1888.
[2] No separate statistics for condensed or dried milk before 1888.

The relative consumption of milk in Great Britain is much lower than is desirable in the national interest. This is probably due to the fact that it is known that the quality, as regards cleanliness, has been gravely defective and there is no doubt that the larger consumption in other countries is primarily due to a cleaner supply. During the past few years, however, there has been a distinct improvement in the methods both of production and distribution in Great Britain, and as a result it is safe to say that the consumption of milk is gradually increasing and there can be little doubt but that the educational work which has been carried on since 1915 is beginning to have its desired effect.

Imports of Dairy Produce Into Great Britain.—The value of dairy produce imported into the United Kingdom has also steadily risen for the last 50 years until in 1914 it reached a total of £38,000,000. Of this over £27,000,000 was paid to Denmark and Russia for butter and Holland for cream, cheese and condensed milk, whilst the balance, amounting to over £10,000,000, was paid to Australia and New Zealand for butter and to Canada and New Zealand for cheese. It will therefore be seen that Great Britain is anything but self-supporting in its dairy industry whilst many other countries have an exportable surplus. The reasons for the relative importance of dairying probably differ from country to country but in addition to any particular reasons which any country may have there has undoubtedly been a widespread recognition in most lands of the great value of the dairy cow as a producer of human food. As land, labour and feeding stuffs have increased in price, the dairy cow has more and more displaced the strictly meat-producing farm animals as an economical agent for the conversion into human food of those field crops which are not suitable for direct human consumption.

Purity of Supplies

Importance of Milk as a Food.—Most dietetic authorities are satisfied that milk is the most important individual foodstuff and that an abundant supply of milk of good quality is an important factor in the health of a nation, and especially of city dwellers. Milk contains all the nutritive constitutents required by the body—proteins, fats and carbohydrates—in a readily assimilable form, and possesses special properties which promote growth and maintain the body in a healthy condition. It is therefore a valuable food for all classes of the community and especially for children. These special qualities in milk were first made known by Prof. F. G. Hopkins of Cambridge and have since been the subject of research by numerous investigators, notably Professors T. B. Osborne and L. B. Mendell of Yale University and Prof. E. V. McCollum of Johns Hopkins University. The exact nature and composition of these growth-promoting substances or vitamins is at present unknown, but their existence is inferred from the effects produced in respect of growth and health by feeding animals on special and carefully controlled diets.

Investigations into this subject indicate the existence of at least three vitamins, all of which are present in milk. These have been termed: (1) The ricket-preventing vitamin (or fat soluble A) which is necessary to promote growth and to prevent rickets in young animals.[1] The fat of cream and butter are amongst the richest known sources of this vitamin. (2) The anti-neuritic vitamin (or water soluble B) which is also necessary to promote growth, and in addition is essential to prevent the occurrence of the disease known as beri-beri. This vitamin is found in the germ and in the bran or outer layers of certain grains and in milk. (3) The scurvy-preventing vitamin. This vitamin is found in fresh, untreated cow's milk and in fresh fruits and vegetables.

There is no evidence that heating of milk destroys the vitamins described in (1) and (2), above. The scurvy-preventing vitamin (3), above, is however sensitive to exposure to heat, and therefore dried, pasteurised, boiled or condensed milk may be regarded as inferior in varying degrees to raw milk in scurvy-preventing properties. Skimmed or separated milk is deficient in the ricket-preventing vitamin referred to in (1), above, and the development of rickets may follow from its extended use in the feeding of young children unless the deficiency be made good. Attention may here be called to the inferiority in this respect of margarine to butter as a source of fat in the diet of growing children. Margarine is, as a rule, manufactured largely from vegetable oils. These are deficient in the ricket-preventing vitamin and the nutritive value of margarine made from such oil is therefore inferior to the nutritive value of butter. Although vegetable fats and oils are deficient in this vitamin which is also essential to growth, yet the green parts of plants are the chief ultimate source of this vitamin. For this reason the diet of cows, especially of those whose milk is to be used for infant feeding, should contain an abundance of the green parts of plants and there is evidence[2] showing that the milk given by cows in the summer, when the diet consists of fresh, green pasture, is richer in vitamins than in winter when the chief foods are hay, straw, roots and concentrates.

Need for Healthy Cattle.—Healthy cattle are the first requisite for a safe milk supply. Physical inspection by a competent veterinary surgeon will go far towards the elimination of those cows suffering from obvious disease but cannot be relied upon for anything like complete protection. The tuberculin test is more searching with reference to this particular disease. There are only two practical ways in which tuberculosis may be eradicated from a herd, namely, (1) the slaughter of all reactors; (2) the isolation of reactors and the separation after birth of calves born of reacting cows. Both methods raise many practical difficulties and it is therefore worth noting that the English Ministry of Agriculture has reintroduced the tuberculosis order giving compensation for cows slaughtered when suffering from this disease. Although it is admitted that a "considerable amount of tuberculosis of childhood is to be ascribed to infection with bacilli of the bovine type transmitted to children in meals consisting largely of the milk of the cow,"[3] at the same time it is not desirable to create unnecessary alarm by exaggerating the extent of human tuberculosis due to bovine infection. There can be little doubt that much infantile debility, leading to susceptibility to many diseases, including tuberculosis, is due to inadequate milk consumption. All reacting cows do not necessarily give tuberculous milk, and risk from tuberculous milk may be negatived by efficient pasteurisation (see *Lancet*, Jan. 30 1926).

Milk Grading Rules.—There is no question that the adoption in America of the principle of grading milk has resulted in a great improvement in the general supply. As supplied under the regulations of New York City four grades of milk are permitted. Grade A Raw includes the so-called certified milk which is produced under permit and certification by the county medical association. It also includes any other milk meeting the requirements, the principal requirement being the tuberculin test. The other grades do not require tuberculin tests and have progressively less stringent requirements as to bacterial content (taken as a measure of general cleanliness), cooling and age. Grade B is not recommended for children but is considered safe for adults. Grade C is sold to bakers and others for use in cooking. The effect of the grading rules, under which the producer receives more money for the higher grades, has been to raise the general standard of the city supply without arbitrarily cutting off the lower grades from their proper market.

In England the grading of milk has also been adopted, and table on p. 915 gives the standards required under the terms of the Milk Special Designations Order, 1923, for the various designations which it is illegal to use in connection with the sale of milk except under licence granted by or under the authority of the Minister of Health.

The clean milk competitions which have taken place in Great Britain have had a very great influence in improving the production of milk and the standard of production is probably as high in Great Britain as elsewhere. The first clean milk competition was held in Essex in 1920, and in 1925 no fewer than 33 counties

[1] E. Mellanby, *Jour. Phys. Proceedings*, 52, 11 and 12, 1918; *Lancet*, March 15 1919.

[2] Barnes and Hume, and the *Lancet* of Aug. 23 1919.

[3] Report of the royal commission appointed to inquire into the relation of children to animal tuberculosis, 1911, p. 39.

British Definitions of Grades of Milk

Designation	Herds	Bacterial content		Other conditions
		Maximum number of bacilli per cubic centimeter	Coliform bacillus	
Certified	Tuberculin tested and physically examined at regular intervals	30,000	Absent in 1/10 cubic centimeter	Bottled on the farm, name of farm, day of production and word "Certified" on each bottle cap
Grade A Tuberculin Tested	Tuberculin tested and physically examined at regular intervals	200,000	Absent in 1/100 cubic centimeter	Delivered to consumers in (*a*) the bottles or the sealed containers as received from the farm; (*b*) suitable containers of not less than two gallons capacity; (*c*) bottles with the name of the dealer by whom the milk was bottled, the address of the licensed bottling establishment, the day of production and the words "Grade A Tuberculin Tested" or "Grade A" on each bottle cap
Grade A	Physically examined at regular intervals			
Pasteurised Milk				
Grade A Pasteurised	Grade A milk that after pasteurisation, as required by the Minister of Health, contains not more than 30,000 bacilli per cubic centimeter and no coliform bacillus in 1/10 cubic centimeter. All other conditions as required for Grade A milk			
Pasteurised	Any milk that after pasteurisation, as required by the Minister of Health, contains not more than 100,000 bacilli per cubic centimeter. No requirement for bottling			

undertook such competitions. More would have done so had it not been for the outbreak of foot-and-mouth disease.

The Distribution of Milk

While improvements in production have taken place during the last few years methods of distribution have also shown progression, and this has been due mainly to two factors—pasteurisation and bottling.

Pasteurisation.—No reasonable amount of inspection or laboratory control over a raw milk supply can provide a sufficient safeguard against the transmission of disease through milk. This fact is emphasised by milk-borne epidemics which have their sources in carriers or unrecognised cases of disease—hence the use of pasteurisation. Pasteurised milk has now been defined by the Ministry of Health as milk which has been heated to a temperature of not less than 145°F and held at that temperature for at least 30 min. and afterwards immediately cooled. The American cities, however, have adopted a minimum temperature of 142° F for 30 minutes. If milk be overheated the line of demarcation between the cream and the milk becomes indefinite and the milk is then less attractive to the consumer. Pasteurisation must never be regarded as a substitute for clean milk production and cleanliness in handling milk, which are the most important of all conditions affecting the milk supply, yet it does give an added safeguard to the consumer in protecting him from hose diseases which may be milk-borne from human sources.

Bottling.—The second most important advance made in distribution is the delivery of milk in sealed bottles. The improvement in delivery resulting from this method will be still more marked when the present draft order, made by the Minister of Health under the powers of the 1925 Milk and Dairies Act, forbidding the bottling of milk elsewhere than in a properly equipped dairy, becomes law. There is still room for the education of milk producers, milk distributors and consumers, and the continuance of clean milk competitions is of the greatest importance as a means of educating the farmer to the necessity of (*a*) healthy and clean cows, (*b*) healthy and clean milkers, (*c*) properly sterilised equipment and (*d*) covered milking pails. The need for the provision of free instruction to the general public of the value of milk as a food, the influence of a good or bad supply of milk on the life and health of children and the community as a whole, and the best methods of handling and storing milk in a consumer's home, is still urgent. Had the general public been educated in the past in this respect there would now probably be a greater demand for milk, produced and handled under better conditions, and, with the demand, a willingness to pay for milk of guaranteed cleanliness. Such educational work should be on the principle of enlightening, and not frightening the general public.

Condensed and Evaporated Milk.—Sweetened condensed milk, the condensed milk of commerce, is officially defined in the United States as the production resulting from the evaporation of a part of the water from whole milk. It must not contain less than 28% of milk solids, including not less than 8% of milk fat. It usually contains about 40% of added cane sugar. Evaporated milk or unsweetened condensed milk must contain not less than 25·5% of total solids including 7·8% of fat and no added sugar. In Great Britain, under statutory rules and orders made by the Minister of Health, full-cream unsweetened condensed milk must contain 31% of milk solids including not less than 9% of milk fat. Full-cream sweetened condensed milk must contain the same percentage of milk solids and of milk fat. Skimmed unsweetened must contain 20% of milk solids and skimmed sweetened 26%, while all skimmed milk must be labelled "unfit for babies." The amount of imports of condensed and evaporated milk into Great Britain has increased from 26¾ million pounds in 1888 to 251 million pounds in 1925 and, unfortunately, a very large proportion of this increase is due to the importation of condensed skimmed milk.

Dried Milk or Milk Powder.—Dried milk or milk powder is a dehydrated product of milk containing about 5% of moisture. It is used as a substitute for milk in the kitchen and extensively by bakers and confectioners. Either whole milk or skimmed may be desiccated, but the skimmed milk powder will keep almost indefinitely, whereas the whole milk powder has a tendency to become rancid. It is reported that in most processes of manufacture this difficulty has been overcome. The milk is evaporated upon revolving metal drums, internally heated, or by being sprayed into a chamber through which hot air is blown. The drum processes are carried out however at normal atmospheric pressure or in partial vacuum. In Great Britain dried milk is subject to the following requirements: milk described as dried full-cream milk must contain not less than 26% of milk fat. Milk described as dried ¾-cream milk must contain not less than 20%, milk described as dried ½-cream milk must contain not less than 14% and milk described as dried ¼-cream milk must contain not less than 8%.

Bibliography.—*International Crop Report* and *Agricultural Statistics* (Rome, monthly). See also the official statistics of Great Britain, the United States, Australia, Canada, Denmark, etc.

(E. B. Ph.; A. D. A.)

MILLAY, EDNA ST. VINCENT (1892–), American author, was born at Rockland, Me., Feb. 22 1892, and was educated at Vassar, graduating in 1917. Her work, distinguished by delicacy of sentiment, placed her in the front rank of American contemporary poets. She was awarded the Pulitzer Prize in 1923 for her poem *The Harpwearer*.

She published *Renascence and Other Poems* (1917); *Figs from Thistles* (1920); *Second April* (1921); *Aria da Capo* (1921); *Two Slatterns and a King* (1921); *The Harp-Weaver and Other Poems* (1923); *Lamp and the Bell* (1923); and *Distressing Dialogues* (1924).

MILLER, JOAQUIN (1841–1913), American poet (*see* 18.464), died at Oakland, Cal., Feb. 17 1913. In compliance with his last wishes his body was cremated and the ashes taken up into the Sierras and cast to the winds.

MILLER, OSKAR VON (1855–), German engineer, was born in Munich May 7 1855. After studying electrical technology he became director of the Deutsche Edison Gesellschaft (German Edison Company) from which developed the Allgemeine Elektrizitäts Gesellschaft (the A.E.G., or General Electric Co.). He advocated the full utilisation of electricity by means of propaganda in connection with long distance cables, and wrote articles on the supplying of towns with electricity (1896–1903). He was director of the electrical exhibition, Frankfort-on-the-Main, held in 1891 when the first high tension alternating current power-transmission apparatus was installed. The transmission was accomplished over a distance of 180 km. (from Lauffen on the Neckar to Frankfort) and with only 25% loss. These experiments were of the highest importance in the development of modern electric-technology. He promoted the development of Bavarian water power as well as a systematic electric supply for that country, and was the founder and organiser of the German museum for natural and technical science in Munich.

MILLERAND, ALEXANDRE (1859–), French politician (*see* 18.465). M. Millerand, now only a private member, threw himself into his work as a barrister, and appeared in many important civil cases. In the Chamber he was a fierce opponent of the Combes ministry, which succeeded that of Waldeck-Rousseau; for he objected to its narrow and fanatical anti-clericalism. In July 1909 he became Minister of Public Works in M. Briand's first Cabinet, his principal achievement at this time being the re-organisation of the state railways. Together with M. Briand he took strong measures to suppress the railway strike of Oct. 1910. In Jan. 1912 he was appointed Minister of War under M. Poincaré. His promotion surprised no one, for he had always taken a keen interest in questions of military organisation; and when the menace of Germany increased, he devoted himself to strengthening the national defences. He re-organised the higher command, and by the Act of May 29 1912 he gave a definite status to military aeronautics for the first time. In Jan. 1913 a personal incident brought about his retirement. On Aug. 25 1914 he was invited by M. Viviani to take the place of M. Messimy as Minister of War; and during the terrible situation which then prevailed he had constantly to take the initiative, for example, in attempting to remedy as far as possible the shortage of munitions. He was accused, however, of being too slow in providing the necessary heavy artillery, and he resigned with the other members of the Viviani cabinet at the end of Oct. 1915. In 1918 he was elected a member of the Académie des sciences, morales et politiques.

A few months after the conclusion of hostilities, on March 21 1919, M. Millerand was appointed commissioner general for Alsace-Lorraine. The problem of reuniting with the mother-country two provinces which had been torn from her in 1871 was a most serious one. For 50 years they had been under an administration widely different from that of France. A period of transition, therefore, was essential, alike from the point of view of political expediency, administration, economics and finance. The first French officials sent to Strasbourg had not been equal to their task; and for this reason it was essential to appoint a statesman of eminent authority with power to act, who would keep in constant touch with the Government. This post was filled by M. Millerand with complete success. In an important speech delivered in Paris on Nov. 15 1919, on the eve of the elections, he outlined the policy of the coalition which, under the name of the *bloc national*, was returned to power. On the resignation of M. Clemenceau, Jan. 18 1920, M. Millerand was chosen to form a Cabinet, and became both Prime Minister and Minister for Foreign Affairs. His main activities were in regard to the application of the Treaty of Versailles; and in order to force Germany to fulfil her obligations, he ordered the provisional occupation of Frankfort. He was present at the inter-allied conferences at San Remo and Spa, in April and July 1920, and in Aug. of the same year he met Mr. Lloyd George at Hythe. The situation in regard to Poland, who had been attacked by the Bolsheviks, now became grave, and M. Millerand therefore sent to Warsaw a contingent of French officers under General Weygand. With this assistance the Poles gained a complete victory over the Bolsheviks. M. Millerand about this time officially recognised the anti-Bolshevik government of Gen. Wrangel, who was soon after completely defeated. In France itself, in May 1920, he frustrated various attempts, especially by the railwaymen, to organise revolutionary strikes.

In Sept. 1920 M. Deschanel, President of the Republic, was forced by ill-health to resign. M. Millerand was elected as his successor, and out of 892 votes cast, no fewer than 695 were given in his favour. During his candidature, he made it known that if he were elected, he intended to exert a more powerful influence on the policy of the Government than his predecessors had done. He refused to admit that his office of President forced him to comply with a tradition of which he disapproved, by remaining absolutely neutral in politics. He made it clear that he intended to watch closely the foreign policy of the Government, and made no secret of his wish to strengthen the power of the President by a revision of the constitution which would modify the conditions of his election; and he put his ideas into practice, by frequently intervening in diplomatic negotiations. During the inter-allied conference at Cannes in Jan. 1922 he despatched a telegram expressing dissatisfaction at the conduct of affairs, which caused M. Briand to return to Paris, and, in fact, brought about his resignation. Working on the same lines, he summoned to the *Elysée* the prefects, or chief administrative officers of each department from all over France. In a powerful speech at Evreux in the Spring of 1923 he declared that he would not agree to the re-introduction of the *scrutin d'arrondissement*, and showed marked favour to the adherents of the *bloc national*, who had been in the majority in the Chamber since the elections of Nov. 1919, and against whom the radicals and socialists were then carrying on a campaign of public meetings.

M. Millerand's conception of the rôle of President of the Republic brought him into collision with the radical and socialist majority, which, under the name of the *cartel des gauches*, was successful in the elections of May 11 1924. He was violently attacked by the radical socialist press, which accused him of having exceeded his powers by intervening in the party struggle, and called for his resignation. M. Herriot, the leader of the *cartel des gauches*, when asked by M. Millerand to succeed M. Poincaré as Premier, announced that he would do so only on M. Millerand's resignation. The latter replied that he had been elected for seven years, and that the alteration of the party in power could in no way affect his constitutional position nor abrogate his rights. But he made it clear that he had not the slightest intention of obstructing the new Government, and that its leader could count on his impartiality. M. Herriot, however, remained immovable; and M. Millerand therefore invited the Senator M. François-Marsal, who had been his Minister of Finance in 1920, to form a Cabinet. M. François-Marsal declared in the Chamber that the attacks on M. Millerand were contrary to the constitution, and that it was in order to uphold the latter that he had agreed to take office. His Government, however, was immediately defeated; and M. Millerand tendered his resignation, protesting meanwhile against the illegality of the action taken against him. The attitude of the party in power dissatisfied the Senate, which, as a result, voted with the opposition and elected M. Doumergue as M. Millerand's successor, instead of M. Painlevé, the candidate of the *cartel des gauches*.

Some months later through a by-election, M. Millerand was elected Senator for the department of the Seine. He then became president of a group formed to denounce the policy of the *cartel des gauches* throughout the country. His success as an orator was apparent both in the courts and in Parliament. (P. B.)

MILLET, FRANCIS DAVIS (1846–1912), American painter (*see* 18.466), was drowned in the "Titanic" disaster April 15 1912.

MILLIKAN, ROBERT ANDREWS (1868–), American physicist, was born at Morrison, Ill., March 22 1868, and received his education at Oberlin College (A.B., 1891; A.M., 1893) where he was instructor in physics 1891–3. He then proceeded to Columbia University (Ph.D., 1895), and the universities of Berlin and Göttingen (1895–6). In 1896 he was appointed assistant in physics at the University of Chicago, with which institution he continued to be associated for the next 25 years in the department of physics, being professor from 1910 to 1921. In 1921 he became director of the Norman Bridge laboratory of physics and chairman of the executive council of the California Institute of Technology at Pasadena, California. He was vice-chairman of the National Research Council, Washington, D.C., in 1917, and chief of the science and research division of the Signal Corps, U.S.A., with the rank of lieutenant-colonel. In 1922 he was the first exchange lecturer to Belgium on the C.R.B. Foundation.

The best known of his researches were the "oil drop" experiments, undertaken with the view of making measurements of fundamental electrical quantity. They proved conclusively that all electrons are alike. He also undertook researches into photoelectric effect. Later research of his has tended definitely to bridge the gap between light and X-ray phenomena. He was awarded the Nobel Prize in physics in 1923 for his work in isolating and measuring the electron, and in making the first exact photoelectric determination of the light-quant. In the same year he received the Edison Medal for especially meritorious work in the field of electricity, and the Hughes Medal of the Royal Society in recognition of his determination of the electronic charge and other physical constants. (*See* PHYSICS.)

Millikan was the author of the following, among other works:—*Mechanics, Molecular Physics and Heat* (1901); *Electricity, Sound and Light* (1908); *The Electron* (1917); *Practical Physics* (1920); *Science and Life* (1923); in addition to numerous contributions to technical periodicals.

MILLS, ROGER QUARLES (1832–1911), American legislator (*see* 18.475), died at Corsicana, Tex., Sept. 2 1911.

MILNE, SIR GEORGE FREDERICK (1866–), British general, was born Nov. 5 1866 and joined the Royal Artillery in 1885. He served in the Nile Expedition of 1898, and the South African War (1899–1902). In 1913 he became commander of the artillery of the 4th Div., with which he went out to France in 1914. He was given, in July 1915, command of the 27th Div., which, three months later, he took out to the Salonika theatre. At the end of the year he was placed in charge of an army corps there. In May 1916 Milne was advanced to the command of the British forces in Macedonia, and he occupied this responsible position under the orders of three successive French commanders-in-chief until the end of the struggle. During the ensuing two years, the situation scarcely lent itself to effectual offensive operations, and the British military authorities at home were opposed to the using-up of resources in this theatre. Milne, however, filled a difficult position with unfailing tact and sound judgment, and, when a general advance at last took place in the autumn of 1918, after Bulgarian powers of resistance had waned, the forces under his personal command contributed appreciably to the bringing about of the final victory. He remained in charge of the British forces in the Near East and about the Black Sea until 1920, and on return to England was appointed to the Eastern command. In Feb. 1926 he succeeded Lord Cavan as Chief of the Imperial General Staff. Possessed of exceptional strength of character and decision, an eye so keen in its perception of weaknesses as to be proverbial in the army, these qualities were blended with a sympathetic understanding of men and a marked sense of humour. Even more significant, for an era of military transition, was his known receptiveness to new ideas.

MILNER, ALFRED MILNER, VISCOUNT (1854–1925), British statesman (*see* 18.476), occupied himself mainly, after his return from South Africa, with business interests in the City of London. But, though he took up a somewhat detached attitude with regard to ordinary domestic politics, he was active on behalf of causes which appealed to him from the imperial side; and he made several speeches in different parts of the country in the next few years on behalf of Tariff Reform and Colonial Preference. He paid a visit to Canada, where he himself and his gospel of imperialism were well received. He was roused, however, by Mr. Lloyd George's budget of 1909, and he advised the House of Lords to reject the Finance Bill, and, as he said at Glasgow, to "damn the consequences." He made several speeches in the next 12 months in defence of the Lords' position; and when the Parliament Bill came up to the House of Lords in 1911, he was a leading spirit among the "Diehards" who advised resistance to the end. He did not take a very prominent part in the opposition to the Irish Home Rule Bill; but he aptly described the state of affairs in Ireland in the early summer of 1914 as "smouldering war," and he urged the remodelling of the Amending Bill so as to reassure the Ulstermen.

The World War confirmed all his fears as to the disadvantages under which Great Britain and the Empire would labour during hostilities through the practice of unlimited Free Trade by the mother-country for over half a century. He gladly accepted in the summer of 1915 the chairmanship of a committee of technical experts and practical agriculturists, appointed by Lord Selborne as President of the Board of Agriculture, to consider the means of maintaining and increasing food production in England and Wales. The committee reported that farmers should be encouraged to grow more wheat by a guaranteed minimum of 45 s. a quarter for the four years following the harvest of 1916. Mr. Asquith's Coalition Govt. did not think the situation serious enough for this drastic remedy. Lord Milner became critical of this "wait and see" attitude; and especially reprobated on several occasions the policy of concealing disagreeable facts. "Truth all round," he said at Canterbury on Oct. 30 1915, "is the most fortifying thing in the world;" Englishmen could not brace their nerves and steel their hearts to win through by emulating the ostrich. Similarly he did his utmost, in April 1916, to induce doubting ministers to accept the policy, which the country demanded, of universal compulsory service, as absolutely necessary under the circumstances.

Mr. Lloyd George, when he formed his ministry in the following Dec., at once turned to this resolute statesman, the only British administrator who before 1914 had directed a war from the civil side, and constituted him one of his principal colleagues in his War Cabinet of four (or five including Mr. Bonar Law). Considering the attitude of the two men at the time of the South African war, the offer and acceptance argued magnanimity on both sides. From this time to the cessation of hostilities their relations were close, and, after Mr. Lloyd George, Lord Milner took the largest share in the civilian conduct of the War. In vigour, resolution and readiness to take responsibility they resembled each other; but Lord Milner's experience, scholarship, steadiness and somewhat bureaucratic habit of mind supplied an invaluable complement to his chief's daring, impatience of precedent, quickness of apprehension and intellectual agility. In Feb. 1917 he attended, on behalf of the British Govt., a conference of the Allies in St. Petersburg (Leningrad), the object of which was to improve the co-ordination in the prosecution of the War between the Government of the Tsar (then in its last weeks of existence) and the Western Powers.

He devoted himself to his duties in the War Cabinet, never making speeches in the country, and seldom in the House of Lords, where his appearances were mostly in explanation of the policy of the Government in regard to food production and control. In June 1917 he announced that ministers had added between 70,000 and 80,000 men to the people available for agricultural work. In Feb. 1918 he vigorously defended Lord Rhondda's administration at the Food Ministry against ignorant criticism, and said that in regard to food Britain was in a better position than any other country except the United States. Except for what was necessary for the conduct of the War, everything must give way to food supply. The corn production bill of 1917, and

the acceptance by the Government of the principle of Imperial Preference, and of the conservation of the raw materials of the Empire, owed much to his influence and support. He worked heartily for inter-Allied co-operation in the conduct of the War, and with Mr. Lloyd George attended meetings of the Supreme War Council at Versailles. He was in France as the representative of the British Cabinet at the time of the victorious German advance in the last 10 days of March 1918; and it was largely owing to his influence that Gen. Foch was appointed at Doullens on March 26 Generalissimo of the Allied forces in France. It being vital to have a man of unusual capacity and vigour at the War Office in this critical spring of 1918, Lord Milner was given the seals of Secretary of State for War on April 19; and it was he who presided over the Army Council during the succeeding months of the year which ended with victory.

In the reconstruction of the Ministry after the general election, Lord Milner left the War Office and became Colonial Secretary, a position for which his lifelong interest in the Empire peculiarly qualified him. In that capacity he attended the Paris Peace Conference as one of the British plenipotentiaries, and was a signatory to the Treaty of Versailles; and he subsequently helped to deal with a number of difficult questions arising under the treaty out of the disposal of the German colonies conquered in war. But his colleagues utilised his services also in other directions. His financial authority was invoked to defend ministerial finance in the House of Lords; and when a serious revolutionary outbreak took place in Egypt in 1919, he was sent there, as the author of *England in Egypt* (1892), at the head of a special mission to inquire into the causes, and to report on the form of constitution best calculated to promote Egyptian peace and prosperity. The mission arrived at Cairo in Dec. and remained till March; then in the summer of 1920 Lord Milner and his colleagues had long conferences with Zaghlul Pasha, the leader of the Nationalists, in London; and ultimately in Nov. they issued a memorandum recommending the recognition of Egyptian independence. Great Britain was to guarantee the integrity of Egypt against aggression; she would have a privileged position in Egypt and would maintain a garrison in the canal zone. The capitulations were to be abolished, and the veto on legislation affecting foreigners would be vested in the High Commissioner. The new constitution, of which these were to be the principal features, had not yet been adopted when Lord Milner, who had only accepted office because of the national need, resigned in Feb. 1921, and his great services were fittingly recognised by the Order of the Garter. Before the end of the month he married Lady Edward Cecil, the widow of Lord Edward Cecil, formerly Miss Violet Maxse.

Lord Milner returned to his business interests in the city, and during the remaining four years of his life, though he took an active part in the work of the Rhodes Trust, and also published his views (*Questions of the Hour*, 1923), he only once showed any disposition to resume public work. When Mr. Baldwin, in the autumn of 1923, boldly appealed to the country for a mandate to introduce Protection, Lord Milner accepted the chairmanship of a committee to advise the Government as to the proposed tariff. As the electorate rejected Protection, the committee proved abortive. In the winter of 1924–5 Lord and Lady Milner paid a private visit to South Africa, where he renewed old friendships and received a warm welcome from those who appreciated the great services which he had rendered to that country. Shortly after his return he was attacked by sleeping sickness and died on May 13 1925 at his residence Sturry Court, near Canterbury. His death coincided with his unopposed election to the chancellorship of his old university, Oxford; and funeral services in Canterbury Cathedral and Westminster Abbey gave expression to the public sorrow and respect. There was found among his papers, and published shortly after his death, an impressive document containing his *Credo* (1925). (G. E. B.)

MILOVANOVIĆ, MILOVAŃ (1863–1912), Serbian statesman and diplomatist, was born at Belgrade on March 2 1863, and was educated there and in Paris, where he was the first Serb to take his degree as doctor of law and was awarded a gold medal for his thesis. On returning home he was appointed professor of international law at Belgrade University and soon acquired the position of one of Serbia's leading jurists. He was mainly responsible for drafting the new Serbian constitution of 1888; and, becoming secretary of the central committee of the Radical party, he entered politics and held successively the portfolios of Justice, Commerce and Finance during the closing decade of last century. In 1901 he went to Rome as minister, and retained his post after the revolution of 1903. In 1907 he represented Serbia at the Second Hague Conference, and was appointed a member of the international court of arbitration. In July 1908 he was made Foreign Minister in the Vetimirović Cabinet, and thus had to guide Serbian policy through the difficult period of the Bosnian annexation crisis.

In 1911 he succeeded Pašić as Premier, and, being less of a party man than his old Radical colleagues, was able to bridge many gaps, and to acquire within a short space of time a unique position among the politicians of Serbia. Even in foreign politics he showed signal moderation, and though a confirmed Russophil, initiated negotiations for a commercial treaty with Austria-Hungary and actively favoured good relations with Turkey. He was one of the chief founders of the Balkan League, the decisive step towards the creation of which was taken at a meeting between Milovanović and the Bulgarian Premier, Gueschov, on Oct. 11 1911. Secret negotiations continued throughout the winter and led to the conclusion of the Serbo-Bulgarian Treaty of March 13 1912 (*see* SERBIA). Discussions were still pending between the various Balkan capitals for a more precise and comprehensive project of alliance when, on July 1 1912 at Belgrade, Dr. Milovanović died suddenly of heart failure. His removal at so critical a juncture was a grave blow to the cause of peace and moderation, and also deprived Serbia of her ablest statesman since the death of Prince Michael.

MILWAUKEE, Wis., U.S.A. (*see* 18.492), had a population in 1920 of 457,147 (100 males to 100 females); in 1925 the census bureau estimate was 509,192. If suburbs within 10 m. are included the total for the metropolitan district is over 600,000. Between 1910 and 1920 the number of negroes, though still comparatively small (2,229), increased 127%; the number of foreign-born decreased slightly, to 110,068, of whom 39,771 were born in Germany and 23,060 in Poland. Natives of Germany constituted only 8·7% of the total population in 1920, as compared with 18·9% in 1900.

The assessed valuation of all taxable property in the city had risen to $810,509,504 in 1925, more than four times the figure 20 years earlier. Adding to this the value of property exempt from taxation (about $144,000,000) and of public utilities assessed by the Wisconsin Tax Commission (about $102,000,000), a total value for all real estate and assessable personal property of over 1,000 million dollars was indicated. Ranking 13th in population among the cities of the United States in 1920, Milwaukee ranked 12th in the value of its manufactured products in 1919 and 11th in 1923 ($576,161,000 and $514,591,065 respectively, compared with $208,324,000 in 1909), leading all others in the production of cranes and hoists, large shovels, excavators and dredges, steam and water turbines, large hydraulic electric units, rock and ore crushers and many other kinds of machinery, silk stockings, wheelbarrows and work-shoes. Progress in city planning included the preparation of a comprehensive plan (1917), the enactment of zoning ordinances (1920 and 1924), and the acquisition by the city of the greater part of the lake front and of land for a civic centre.

Effect of Prohibition.—The large brewing industry was dissipated by national prohibitory legislation. Some of the companies used part of their plant for manufacturing "near beer," ginger ale and other "soft" drinks, or leased part of it for other industrial purposes, but a large part of the investment in the breweries was still lying idle in 1926.

MILYUKOV, PAUL NIKOLAYEVICH (1859–), Russian politician and historian, was born near St. Petersburg (Leningrad) Jan. 27 1859. He studied history and humanities at the University of Moscow, and received the degree of master in

history for a learned work on the *State Economics of Russia in the First Quarter of the 18th Century*. His liberal opinions brought him into conflict with the educational authorities, and he was dismissed in 1895 after one of the ever-recurrent university "riots." After the meetings of the Zemstvos in 1905 he became the political editor of an important liberal paper, the *Retch*, and took an active part in the formation of the Constitutional Democratic party (Cadets). Milyukov became the leader of that party, although he was not elected a member of the first or the second Duma. When the Tsar dissolved the first Duma he was one of the principal prompters of the "Viborg manifesto," in which the members of the assembly declared themselves ready to follow the people in resisting arbitrary rule. Milyukov did not sign, however, as he was not a member of the Duma, and escaped the persecution which accompanied the Stolypin reaction. He was elected to the third and the fourth Duma, and played the part of a leader of the opposition, systematically criticising the policy of the Government.

When the World War broke out he stood for a policy of national union and active co-operation with the Entente, but the corruption of the War Office drove him into an attitude of increasing hostility. Milyukov took office in Prince Lvov's provisional government as minister of foreign affairs. Later he strongly disapproved of Kerensky's policy, and when the Bolsheviks seized power he escaped to Kiev then occupied by the Germans and gave up the cause of the Allies as lost. After the Armistice Milyukov went to London and subsequently to Paris, where in 1921 he directed a journal (*Last News*) in which he advocated an alliance with patriotic Socialists.

MIMICRY: *see* COLOURS OF ANIMALS.

MINELAYING AND MINESWEEPING.—Explosive contrivances were moored and used against ships, as early as 1800. It was not, however, until the American Civil War that the sea mine became an accepted weapon of naval warfare; nor did it prove a potent danger to the capital ship until it played an all-important part in the siege of Port Arthur some 40 years later.

I. MINELAYING

Amongst the decisions of international conferences at The Hague it was agreed, and ratified by the Great Powers (other than Russia), that mining in war should be limited to operations within territorial waters. The unfortunate result of this was to lull the British Admiralty into a false sense of security, and the mining service thus became a side issue. The German Carbonit mine, used by the Germans throughout the World War had been originally offered to the British Admiralty. It was refused on the plea of expense; and, in its place a mine of about one-quarter the cost was manufactured and supplied to the naval service. The Hague agreement was torn to pieces within a few hours of the outbreak of the World War, and as the War progressed the necessity for constant minelaying became evident.

Elements of Mining Warfare.—Three factors are necessary for successful mining warfare—the strategic function, the operation of laying the mines and the technical efficiency of the mine itself. The first of these factors is woven into the main strategy of a naval war. The stronger fleet, in its anxiety to seek out and destroy its enemy, desires a clear sea; and, to obtain this, must insure that such a means of attrition as the mine is reduced to the utmost. On the other hand, the weaker fleet will use the mine profusely in an endeavour, by attrition, to reach an equality of force: and it will also use this weapon against merchant ships, particularly when they belong to a belligerent dependent on its carriage of foodstuff from overseas. This was the initial stage of naval strategy in the World War; and to some extent it explains the pre-War application of the Germans to mining. The second factor is the operation of laying the mines. To be successful, this must be governed by the element of surprise, and be expeditiously performed; it requires for its purpose a ship of exceptional speed, or one which, by disguise or subterfuge, can carry out the work unmolested. The value of merchant ships for minelaying was recognised, and the Germans had such ships ready at the outbreak of war and speedily augmented the number of them.

The third factor is purely one of technique. No type of mine that does not meet the following requirements is efficient. It must be safe until it is laid. When laid, it must take up and maintain its required depth, throughout all kinds of weather, for an appreciable length of time. It must be immune from mechanical failure when required to function. In the interest of all belligerents, it must automatically render itself safe should it break from its moorings. Mines that fail in any of these respects may become a greater danger to friend than to foe. The German Carbonit mine answered these tests except in the last requirement. The early British mine was unfortunately only fully efficient in the last requirement. Considerable importance attaches to the design of a minefield. A simple straight line of mines is easily and quickly laid, but presents little difficulty to the minesweepers once it is located. Lines of mines laid in zigzags, particularly when spaces of water are left clear, present the greatest difficulty to removal. On the other hand, such patterns will necessarily cover a larger sheet of water, and will require very accurate plotting, if subsequently the vicinity of the mined area is to be approached by the sea forces of the minelayer. An existing apparatus termed "taut wire gear" proved a great aid to accuracy in positioning a minefield.

German Practice.—German submarine minelayers usually confined their mines within an area of two or three sq. miles, laying them in groups of four, or even less. The position chosen was most frequently near some focal point, buoy or lightship, or at the entrance to a naval base or commercial port. For instance, during the War, over 450 mines were laid by German submarines within a mile of the Shipwash Light vessel, a position necessarily passed by all traffic up and down the east coast war channel, by the convoys to and from Holland and by Com. Tyrwhitt's destroyer flotillas whenever they left or returned to their base at Harwich. The Germans also allotted to each of these submarines a particular stretch of the British coast. The flotillas working from Flanders covered the coast from Flamborough Head south about to the Clyde, also the northern French coast; the high sea, or large boats, working from the Elbe, were responsible for the rest of the English and Scotch coasts, and the whole of Ireland. Each commander being restricted to work in his individual area, the danger of striking previously laid mines was minimised. The commanders, moreover, by this arrangement, got quickly into touch with the local movements of the traffic, the method and capacity of their opposing minesweepers and the coastal navigation within their beats. In most cases after some 10 to 14 days a commander would not hesitate to pass over a position where he had previously laid mines. He would be confident that his mines had been discovered and cleared if shipping had been seen in the area.

Moored mines could be laid in any depth up to 100 fathoms, or even more in tideless waters, and they could be regulated to lie at any depth below the surface. Deep mines were used against submerged submarines, and shallow ones against surface shipping. In a strong tide, with a long mooring-rope, the mine will bend over to the tide; so that the mines, under strong tidal conditions, always lay too deep to be harmful to surface ships. In a position such as the Pentland Firth, mines were in fact only a danger at slack water, a period of minutes only. Again, the difference in height between high and low water was an important matter. If, for instance, the tidal range was exceptionally large, as in the Bristol Channel or Bay of Fundy, all types of ships could pass over a minefield at high water in perfect safety, provided no mines had been seen at low water on the surface.

British Minelaying Resources.—At the outbreak of hostilities in 1914 the British Navy possessed seven old cruisers (Latona class) fitted as minelayers. These had a speed of only 14 knots. Shortly afterwards four merchant ships were added; and in the second part of the War a considerable number of submarine minelayers and fast destroyers were used. On Oct. 2 1914 the first line of 1,264 mines was laid by the old cruisers in an area 10 m. north of Ostend. This had the effect of forcing neutral shipping to pass through the Downs. Unfortunately, the British mines then in use proved so defective that for a time minelaying

had to cease; and although in 1915, after some technical improvement, some 15 more minefields were laid, it was not until 1916 that attention was concentrated on providing a mine of the calibre of that used by the Germans.

British Activities from 1916 Onwards.—One of the principal British minelaying operations of 1916 was a coast barrage, consisting of a double line of deep mines, running for 40 m. from the Belgian coast, at a distance of 12 m. from the shore. It was supplemented by mine nets laid by the Dover drifters. The work took five weeks to complete; but only one submarine seems to have been accounted for by it. The end of the year saw the institution of a mining school at Portsmouth for research and development.

On the assumption that the Belgian coast barrage had been effective, a similar barrage was completed in Feb. 1917 across

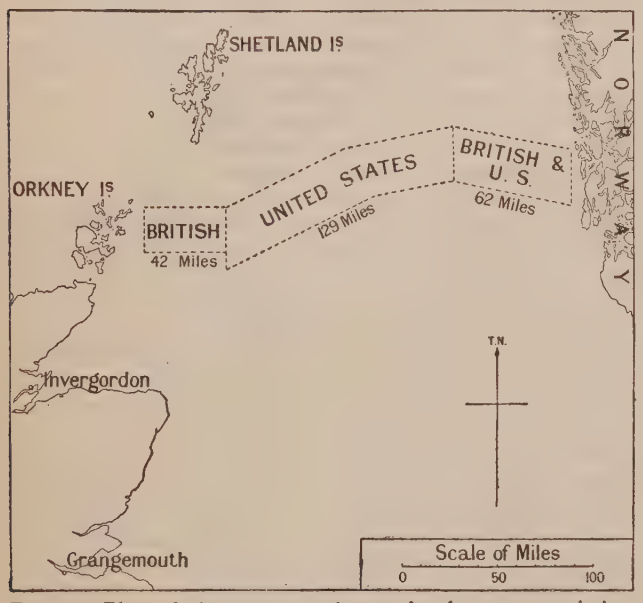

FIG. 1.—Plan of the great northern mine barrage, consisting of 63,117 mines. Laid in 1918 by British and U.S. submarines.

the Straits of Dover; but the mines dragged and had to be swept up. It was, however, relaid by the end of July 1917. In Jan. 1917 it became essential to encircle the Heligoland Bight and thus to surround all exits from German ports; but the shortage of mines at the time caused the operation to be postponed, nor was the British mine considered suitable for it. However, towards the end of 1917 the "Abdiel" and five minelaying submarines had laid nearly 16,000 mines in the German Bight; and these accounted for a certain number of German destroyers and minesweepers. The mine used in the later stages of this operation was the new British H2, which, except for its method of taking depth, was similar in principle to the German Carbonit mine.

The German method of depth-taking was for the mine, attached to the sinker, to drop to the bottom, where, after a short interval for the purpose of safety, the mine released itself from the sinker and rose to the depth for which it was set. In the British method the mine did not go to the bottom; it did not, in fact, go below the depth for which it was set. The sinker regulated the depth while the mine was still on the surface; then, in sinking, pulled the mine down to its required position. An advantage of the British system was that heavy water pressure on the mine-case was obviated; but, on the other hand, it did not obtain the exceptional accuracy in depth-taking which was noticeable in the German method. In due course the new H2 mine was delivered in sufficient quantity for the long-delayed defensive minefields to be begun by the British, and an extensive new barrage in the English Channel was then completed. Between Folkestone and Cape Gris Nez 9,500 mines were laid in 20 parallel lines, the shoals of the Varne and the Ridge dividing the area into three sections. This barrage effectively closed the Channel exit to the German submarines, nine of which were lost in attempts to pass it.

Minelaying by the United States.—The entry of the United States into the War admitted of a large augmentation in mines and in minelayers; and an attempt was made to close the northern exit from the North Sea by a mine barrage between the Orkneys and the Norwegian coast (see fig. 1). This operation was undertaken by both British and U.S. minelayers. The latter formed a base at Inverness, and supplied ten large minelayers with a total carrying capacity of over 5,500 mines. The United States used a mine of a novel type. It carried the usual charge of 300 lb. of tri-nitro-toluene, but from each mine there extended antennae for a distance of 35 ft. which, if touched by a metal ship, exploded the mine. The result was that the danger zone was largely increased.

The vast area covered by mines can best be appreciated by a reference to the plan, which gives an idea of the work carried out by the U.S. minelayers. Difficulties were encountered as the operation proceeded. A proportion of the American mines exploded prematurely; while a number of British mines took up a shallower depth than intended, and had to be swept up and relaid. The complete operation, however, was finished by June 1918. It must not be supposed that the whole water available for a submarine was effectively covered by this minefield; but the dangerous area was greatly increased and an effect on the morale of the Germans quickly produced. In July German submarines began to creep past in Norwegian waters; but the Norwegians closed this coastal lane to both belligerents by minefields of their own. Of the mines laid in the Northern Barrage 56,571 were American and 13,546 British. All this time the encircling of the Bight had been going steadily on, and some 21,000 mines were in place by the date of the Armistice. During the period of the War, approximately 160,000 mines were dropped in the North Sea and Channel by the British and American minelayers, the very great majority of which were laid during the last 18 months of the War.

II. MINESWEEPING

Before the outbreak of War in 1914 the British Navy had, to some extent, realised the possibility of a mining offensive on the part of their enemies; and, largely due to the foresight of the late Admiral Lord Charles Beresford, trawlers had been tested and had proved efficient minesweepers as early as 1907. A trawler reserve purely for minesweeping was instituted shortly afterwards. Thus, by Aug. 8 1914, 96 hired trawlers had put to sea to sweep up enemy mines, and within a fortnight another 100 trawlers had been requisitioned and were fitting out. The trawler minesweeper, however, did not entirely cover the requirements, as it was too slow to sweep the water ahead of a moving fleet; and this had been realised, and to some slight extent, catered for, by training a flotilla of eight old torpedo-gunboats. These ships were capable of towing the sweep at 12 knots, which was double the speed at which the majority of the trawlers could operate. This gunboat flotilla moved north from Dover on July 31 1914, and, with sweeps out, actually covered the track over which the Grand Fleet passed. They were necessarily much overworked in the first six months of the War, as, whenever practicable, they swept the waters through which the fleet moved, and were also constantly required to search areas where mines were expected to be laid. Fortunately no mines were laid near the bases of the fleet until much later, when this small flotilla had been considerably augmented.

Methods of Sweeping.—At the outbreak of War, the British system of minesweeping was for two vessels to tow a stout wire between them, the wire being kept at the required depth by means of water-kites. The towed wire, termed the sweep, thus came into violent contact with the mooring-rope of a mine, which it generally broke, causing the mine to come to the surface, when it could be sunk by rifle-fire. In some cases, however, the sweep would strike a horn of the mine, and explode it. This occasionally led to the parting of the sweep and consequent delay while a new wire was passed. The most serious drawback was

if the sweep failed to break the mine wire, when the mine would be towed along, more often than not unknown to the sweepers. This latter trouble caused many of the early minefields to be scattered far beyond the limits in which they were laid, and constituted a serious danger. The eventual safeguard was to heave the sweep slowly in, and to sight the whole wire and water-kites on the surface before slipping it, when a mine holding to the wire would be seen and reswept afterwards. The innovation of a serrated form of sweep wire eventually reduced the difficulty to a considerable extent. This simple method of minesweeping stood the test of the whole War, and its simplicity had the great advantage of reducing the training period which would have been necessary had a more complicated apparatus been used.

The French towed from a single vessel two sweeps, one on either side, each kept out by an otter similar to the usual otter used in trawling, but regulated for depth by attachment to a large torpedo-shaped float, the depth at the other end being regulated by a water-kite. Along each wire was distributed a series of small mechanical and explosive wire-cutters. The "shooting" of these sweeps caused trouble unless the crews were adept, and the speed at which the apparatus could be towed was limited to six to seven knots. The spread of the British system was 400 to 500 yd. per pair according to the type of minesweeper, that of the French system not more than 200 yards. In the latter part of the War the Americans adopted the French method, which had by then been somewhat simplified.

The German system was akin to the British, excepting that, in order to cover the route of their fleet more quickly, they instituted a very light form of sweep which could be towed at 20 knots. Directly this apparatus met with an obstacle it was automatically slipped, thus giving notice of the obstruction, whereupon the slower type of sweepers were hastened to the spot to clear it. In practice this system constantly led the fast sweepers to report mines when they had only encountered wrecks or some other harmless obstruction, and little confidence was therefore placed in the reports of mines by this fast flotilla.

Under ordinary cruising conditions, searches by sweepers were made whereby only a small percentage of the water was covered—sufficient, however, to allow a strong probability of the presence of mines being discovered in good time. The introduction of the "paravane," which protected the ship herself, very much reduced the mine danger; but men-of-war were not fitted with this device until 1917, nor by the end of the War was it general in merchant ships. The paravane is an apparatus which, for assured efficiency, requires skilled handling. There are situations where its use is impracticable, and it has not replaced the necessity for the minesweeper.

Early Difficulties.—The War was only a day old when the first mining operation was undertaken by the Germans. An armed merchant ship, the "Königin Louise," laid a large minefield off Southwold, at a distance well outside British territorial waters. The "Königin Louise" was sunk, but H.M.S. "Amphion" struck a mine after the action. This minefield caused considerable loss to merchant ships, many of which were neutrals. It also led to early losses of minesweeping trawlers, in which the mortality was heavy. Throughout the War, an average of half of the crew of a trawler was lost when one was mined. For the first two months of the War, for every two mines swept one trawler was lost. Improved method and greater experience later minimised the losses, until an average of one loss for every 80 mines was achieved in 1918; but the effect on shipping in the early days was such that any form of flotsam was reported as a mine.

The outcry for minesweepers became universal, and more trawlers were requisitioned. In Great Britain there was no lack of volunteers from the fishermen, nor of officers from the Naval and Naval Volunteer Reserves; but all of these were untrained in minesweeping, efficiency in which was proving so essential. By Sept. 1 1914 little had been done with the Southwold-Aldeburgh minefield, other minefields were suspected, insurance rates were rising, and the situation had become grave. A rear-admiral was appointed as Admiral of Minesweeping on the East Coast. The immediate situation was dealt with by the institution of a channel close to the coast, buoyed adequately and swept continuously. Merchant shipping was instructed to pass close to the line of buoys; but the organisation requisite to insure this information reaching all the ships, and the difficulties of enforcing obedience, were not overcome for a considerable time. The losses were reduced to a slight extent, however; and when this channel was extended from Dover to the Firth of Forth, and the organisation was perfected, losses by mine were the exception. Against the British Fleet no mines were laid during the first year of War; but the situation in mined localities had emphasised the necessity for a larger Fleet Sweeping Flotilla, and a number of special vessels, termed sloops, were laid down.

Details of Minefields.—The actual minefields laid by the Germans between Aug. 5 1914 and Aug. 5 1915 were as follows:—

1914	Aug. 5	Aldeburgh-Southwold . . .	180 mines
1914	Aug. 26	off Humber	200 mines
		Tyne	194 mines
1914	Oct. 26	Tory I. (Ireland)	200 mines
1914	Nov. 3	Smith's Knoll	130 mines
1914	Dec. 16	Scarborough	100 mines
1915	April 4	Swarte and Indefatigable Banks .	360 mines
1915	May 16	E. Dogger Banks	480 mines

These mines were all laid by surface vessels, and accounted for a heavy toll in merchant vessels and minesweepers.

At the entrance to the Dardanelles minesweeping had to be carried out under heavy shellfire. At first only slow trawlers were available, and night clearing was never a practicable operation.

Growth of the British Minesweeping Force.—In British home waters the augmentation of the minesweeping force was less difficult than abroad. Light-draft excursion (paddlers) were requisitioned in addition to the newly built craft already mentioned, and by April 1915, over 150 vessels purely for minesweeping were distributed as follows: Grand Fleet—6 gunboats, one new sloop and 10 trawlers. Scotland—47 trawlers. Humber—6 paddlers, 30 trawlers. Lowestoft—47 trawlers. Harwich—33 trawlers. Dover—12 trawlers. South Coast—24 trawlers. West Coast—4 trawlers. Clyde—6 paddlers. In the Dardanelles 8 cross-channel steamers had augmented the trawler force, and destroyers had been fitted for minesweeping.

The Submarine Minelayer.—Up to June 1915 all minefields had been laid by surface vessels; but in this month came the first effort of the submarine. A small type, termed U.C. boats, working from Zeebrugge, with Bruges as a mine-depôt, commenced laying batches of 12 mines held in vertical shoots, at first between Dover and Harwich, and later over a wider area. During 1915 54 cargoes (648 mines) were laid in this manner. The effect was a serious increase in British losses by mine, which comprised 5 supply ships, one hospital ship, 2 Trinity House vessels, 34 British steamers, 24 neutrals, 19 fishing boats, and 15 minesweepers, a total of 100 vessels. A useful form of night-sweep came into use against this menace, consisting of a light wire, a depth float kite and explosive grapnel. It was to some extent similar to the German high-speed sweep, and prone to the errors of the latter. No fully efficient minesweep for use in the dark hours was evolved in the War, although this light wire served for searching purposes on several occasions when shipping was forced to arrive at a port at daybreak. In June 1915 the Germans had also extended their minelaying to Archangel, where a unit of six British trawlers was dispatched to assist the Russians. They destroyed 150 mines in this locality under severe conditions of service.

Mining Against the Grand Fleet.—The first mining offensive against the Grand Fleet occurred in Aug. 1915, when 380 mines were laid in the entrance to the Moray Firth, distributed over lines which totalled nearly 70 miles. A large portion of the fleet was at Invergordon at the time. The results were negligible, the losses being confined to minesweepers and one destroyer. A channel was found to be clear on the northern side of the Firth, which was at once used as an exit for the fleet. On the southern side, however, a channel was cleared, but an area of mines was purposely left to form a defensive barrier and so limit the water necessary for patrol and minesweeping. On Jan. 1 1916 the

area west of Scapa Flow was mined by the " Moewe " on her passage into the Atlantic. In this field 252 mines were laid, endangering an area of 40 sq. m., which resulted in the loss of H.M.S. " King Edward VII." before the presence of mines was realised. Once located, this area was treated in the same way as the Moray Firth.

Progress in 1916.—By the beginning of 1916, 14 sloops had joined the Grand Fleet, and 35 hired paddlers were in action. The success of this latter type led to 24 being laid down by the Admiralty, and also a new type of twin-screw sweeper, known as the " Hunt " class. The value of these ships lay in their sea-keeping qualities and shallow draught. The paravane also passed its test in 1916, and by the end of the year had been supplied to 180 of H.M. ships. Shaped like a torpedo, it contained mechanism for accurate depth keeping at any appreciable speed, and was capable of carrying a heavy wire cutter on the nose, or, when used against a submarine, an explosive charge. As a mine-protection it was towed from a sliding " shoe " which worked up and down the stem of the vessel. The paravane automatically ran out from a ship under way, stretching the wire rigidly at an angle of about 50 degrees to the fore and aft line of the ship. Towed from the point of greatest draught, the wire protected the whole of the ship from a mine; for, on coming in contact with a mine mooring, this wire deflected the mooring until it entered the cutter on the paravane, which instantly functioned. The mine then came to the surface clear of the ship. A modified form of this apparatus was fitted in merchant vessels; and, by the end of the War, 2,740 merchant ships had been fitted. Paravanes in H.M. ships cut 55 mine moorings, but the number cut by merchant ships was less.

The number of German submarine minelayers increased in 1916, and there were larger boats operating over a still wider area. These carried 18 mines. As further construction improved, the number of mines carried rose to 24, and in 1917, to 36. The larger boats worked from the Elbe, and the smaller from Flanders. On May 29 1916, U75 laid her 18 mines close to Marwick Head, off the northwest coast of Orkney. The operation was part of the pre-Jutland submarine actions of the enemy. It is understood that a mining operation on the western exit from Scapa was intended, with a view to crippling the Fleet should it use that exit. The contour of the coast near Marwick and that off the western entrance to Scapa, a few miles to the southward, are very similar, and a mistake in the landmarks was possibly made by the submarine commander. In view of the time elapsing between the laying of the mines and the sailing of H.M.S. " Hampshire " from Scapa Flow for Russia, it would seem obvious that the position chosen is not susceptible of a tactical explanation. Sixteen mines from this batch were swept up directly afterwards in this position, and one was recovered set for a depth of seven metres. (It transpired, after the War, that all these mines were set for this depth.) The tide was appreciable, causing sufficient " mine dip " to insure the mines at this depth being innocuous even to a heavy-draught ship, except at low slack water, and with considerable motion on that ship. The period of slack water was extremely limited. The " Hampshire," proceeding in a sudden gale, and hugging the shore to obtain less sea, struck one of the mines at low-slack water. By this curious conjunction of all these factors, the career of Lord Kitchener was brought to a tragic close. Except for a determined offensive by the Flanders submarines against the Channel Ports, the mine was not extensively used in the latter part of 1916. It would appear that the Germans were then husbanding their resources for unrestricted submarine and mine warfare.

Changes in the British Service.—The reorganisation of the British naval staff in May and June 1917 led to considerable changes in the minesweeping service. The rear-admiral, who had throughout 1916 been very fully employed in concentrating on the paravane and other improvements of minesweeping material, now took over the Dept. of Torpedoes and Mines, which included the technique of minesweeping devices. The control of operations was therefore entirely separated and delegated to a captain on the naval staff, who, in Oct. 1917, became Director of the Minesweeping Div. under the assistant chief of the naval staff. The whole of the minesweeping, then so greatly extending in area, was thus co-ordinated under a central control at the Admiralty.

The intensity of minelaying and expansion of areas in the first half of 1917 was difficult to meet with the minesweepers available; and the climax was reached in April, with a loss of one minesweeper per diem for the greater part of that month. Probably no other service had a more severe strain placed on its personnel during this month and those immediately following. Every available and suitable paddle steamer and motor fishing boat had to be requisitioned; and those incapable of towing a heavy sweep were fitted with a light one, and used for search. Aircraft and motor launches were also used for low-water searches for mines, in order to reduce losses of sweepers; and improvements in traffic organisation and still closer co-operation between adjacent areas were gradually effected. Further protective minefields were laid in certain suitable positions, but the opening of new areas was constantly necessary; and, by the end of 1917, the coastal waters of Great Britain and Ireland, over 1,000 m. in extent, were being swept every day for mines. The war channel was also extended to the Firth of Forth, and merchant ships only released from a night shelter when they could proceed in freshly swept water. One hundred new vessels of the " Hunt " class were laid down, and 300 new drifters put out to contract, so as gradually to replace and release trawlers for patrol and anti-submarine work.

Synchronous mining of adjacent British ports was resorted to by the Germans, which raised many sudden problems in traffic control. The convoy system had now been introduced, and the sweeping of convoys into certain ports often became essential. Particular difficulties arose in regard to Liverpool owing to the shallowness of the channel and narrow entrance; mines swept up, and sunk without exploding, causing serious danger to heavy draught ships by their proximity to the ship when resting on the bottom.

The south coast of Ireland was seriously and continuously mined, and even the bays on the west coast of Ireland did not escape. The year closed with a total of 3,989 German moored mines swept up in home waters, at a cost of 170 Allied and neutral merchant ships sunk and 28 damaged. This total of mines for the year exceeded the combined totals for the previous years of the War. Nevertheless, the outlook was more hopeful. Although the intensity of minelaying had become so much greater, the losses had only been increased by nine ships over those of the previous year: and progressive success in the destruction of submarines and their personnel made it evident that the same intensity and efficiency of the minelayers could not be continued much longer. New construction and greatly improved material for minesweeping had already made their mark. The only fear was that the minesweep would be defeated by some innovation of the enemy. This fear, however, never materialised; although a delayed action (intentional or otherwise) for releasing the mine from its sinker some hours after it was laid was observed on several occasions.

While minelaying had, in home and Mediterranean waters, now been confined to submarines, the " Wolf," a surface raider with 458 mines, succeeded in breaking through the patrols into the Atlantic. Her voyage lasted 15 months. Rounding the Cape of Good Hope, she cruised in the Indian Ocean, then proceeded south of Australia to New Zealand and Fiji; and returning by New Guinea, the Dutch East Indies and the Cape, she reached the Cattegat again in safety. Her mines were distributed all over the globe; and, although the losses caused by them were comparatively light, it was very difficult to obtain suitable sweepers in the various areas to locate and destroy them. It was, in fact, not until the Armistice that all the localities were defined.

End of the Mining Offensive.—The beginning of 1918 saw the defeat of the great mining offensive completed; and by the end of hostilities no more than a dozen efficient German minelaying submarines existed. Their losses had by then completely outstripped new construction, and a well-trained or experienced personnel was entirely lacking. Of the many factors which, taken

together, finally killed the minelayer, the most important were: (1) the great efficiency of relaid Dover barrage; (2) the deep minefields in localities regularly used by minelayers; (3) improvements in anti-submarine methods of hunting; (4) co-operation between the Intelligence and Minesweeping divisions; and (5) the distribution of information. In 1918 the average time elapsing from the receipt of the news of a new minefield to its distribution to every base, and to all vessels within the area of wireless communication, was 75 minutes. As a result of these improvements, the total losses by mine during 1918 in home waters were reduced to an average of just two over Allied or neutral merchant ships per month.

Early in 1918, an appreciation of failure led the Germans to concentrate their efforts in minelaying in two directions only. The first was a grandiose scheme, which, commencing in January, was only concluded in late September. It consisted of batches of 36 mines, laid at regular intervals of 10 m. apart on a semicircle 45 from. m the Bell Rock, the result being a complete ring round the entrance to the Firth of Forth. This operation fulfilled a two-fold purpose. It menaced the exit and entry of Norwegian convoys, which were then working from Methil in the Firth of Forth; it also menaced every possible course taken by the Grand Fleet when leaving or entering its base at Rosyth. The scheme, however, was barren of results to the Germans, although methodically carried out in every detail. It was appreciated and countered after the third batch of these mines was discovered, the result being that each of the successive groups of mines was located and cleared immediately; and this was done without the Germans realising that any of these groups had been removed. The other concentration took the form of a field of 400 mines, also laid gradually by submarines. It was directed against the Dutch convoys, and was laid close to the Dutch coast to cover the approaches to the Maas and Ijmuiden. This position was such that any attempts at clearance exposed the minesweepers to a flank attack from enemy vessels. There were some losses by mine, particularly to destroyers escorting the convoys; but the convoys sailed as before, and the losses, on the whole, were very trivial.

Minesweeping after the Armistice.—When the hour of the Armistice struck, a minesweeping force was waiting at the gate of the Dardanelles; and, within 24 hours, 600 British and enemy mines had been removed to clear the way for the fleet to Constantinople. For one year after the War, mineclearing was continuous in every area where British or German mines had been laid. Under the difficult conditions which immediately followed the War, a special minesweeping force had to be enrolled. It consisted of some 600 officers and 15,000 men. Over 23,000 Allied mines and some 70 German mines were cleared from the sea by British minesweepers. No loss of a merchant ship by mine occurred during that period; and exactly one year to the day from the institution of this force the seas round Britain, her colonies and in the Mediterranean were reported clear. A fine performance in this respect was the clearing by the Americans of the mines laid between Orkney and the Norwegian coast. The Germans also commenced to clear the heavily mined areas in the Heligoland Bight, and later in the Baltic; but this work of clearance was not completed until 1923. Other nations concerned cleared their own coastal waters.

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(L. PR.)

MINERALOGY (*see* 18.509).—During the war period of 1914–8 much attention was given in all countries to the development of home resources of various minerals of economic value, and to meet new circumstances new sources of supply were developed. Further, there was an increased demand for certain kinds of minerals, for example those which yield the rarer metals used in the hardening of steel. Much of the mineralogical literature of the period was therefore of an economic character, and many recent text-books gave prominence to the practical uses of minerals. Fortunately, however, pure science was not altogether neglected. Many new facts have been recorded, and new methods of investigation have been devised.

X-Ray Examination of Minerals.—The X-ray method of investigating the internal structure of crystals has been applied with much success to the study of minerals (*see* CRYSTALLOGRAPHY). The material for examination has usually been prepared as definitely orientated crystal plates, but it is found that the results can be obtained with a fine powder, *i.e.*, an aggregate of minute crystals or fragments of crystals with all possible orientations. The method can therefore be used for the purpose of distinguishing between the crystalline and the amorphous or colloidal states. Since each crystallised mineral gives a more or less characteristic series of bands on the photographic film, the powder method may also be used for the recognition of the minerals present in intimate mixtures, such as fine-grained rocks, ores, clays and soils.

X-rays have also been employed in a method of spectrum-analysis for detecting the presence of the various chemical elements present in minerals. For example, hafnium has been detected, and the amount approximately estimated, in many zirconium minerals.

Microscopical Examination of Opaque Minerals.—A method for the investigation of opaque minerals borrowed from metallography (*q.v.*), in which polished sections are examined under the microscope in reflected light, has proved to be especially useful for the study of metallic ores. It consequently finds an economic application in the valuation of ore deposits. The several mineral species of which the ore is composed can be distinguished, and their relations to one another determined; *e.g.*, the order of their deposition, and whether they are of primary or secondary origin.[1]

The process of grinding and polishing the sections presents certain difficulties owing to the extreme differences of hardness of the several minerals that may be present. The prepared section is illuminated vertically by means of a right-angle prism placed in the tube of the microscope above the objective. Details of structure can be brought out by etching the section with various chemical reagents. The several characters (colour, hardness, relief) of the minerals, together with their behaviour towards reagents, help in their determination. But in many cases ordinary simple tests made on fragments detached from the polished surface are more reliable. Electrical tests can be made with quite simple apparatus: for example, the electrical conductivity can be determined with a dry cell and voltmeter using needles as terminals on the polished surface. Certain optical determinations can also be made in reflected polarized light.

One result of this study of opaque minerals is to draw attention to the extremely intimate association and intergrowth of many of the ore-minerals; this is well shown in the numerous photo-micrographs published by American workers in economic geology. What to all appearances by ordinary methods is a homogeneous mineral may be found by the new method to be really heterogeneous; and, in fact, several supposed mineral species have been proved to be mixtures, and well-developed crystals have in certain cases been found to contain enclosures of other minerals. The method is thus of use for ascertaining the degree of purity of material collected for exact chemical analysis when the formula of a species is to be established. The long-debated question as to how silver exists in argentiferous galena (lead-ore) has been studied by this method. Galena containing 0·10 to 0·35% of silver shows definite spots of tetrahedrite and argentite, whilst specimens containing more silver show evidence of later addition of proustite or pyrargyrite in the form of veinlets.

Mineral Transformations.—In synthetical mineralogy a large amount of experimental work has been done, especially in the Geophysical Laboratory of the Carnegie Institution at Washington. Many minerals and allied compounds have been prepared artificially in silicate and salt fusions. The conditions necessary for their formation and their ranges of stability—either when alone or when in the presence of other compounds—have been studied in detail. One important result obtained by experimenting over wide ranges of temperature has been to show that practically all compounds known as minerals exist in several polymorphous forms.

[1] The technique of the subject (called mineralography or mineragraphy) is dealt with in the text-books: J. Murdoch, *Microscopical Determination of Opaque Minerals* (New York, 1916) and W. M. Davy and C. M. Farnham, *Microscopic Examination of the Ore Minerals* (New York, 1920.)

The work has shown that silica (SiO_2) undergoes a remarkable series of changes in its crystalline structure and physical characters when it is submitted to different degrees of temperature. The changes with increasing temperature are:—

α-quartz (rhombohedral trapezohedral), passing at 575° C. into
β-quartz (hexagonal trapezohedral), passing at 870° C. into
β-tridymite (hexagonal holohedral), passing at 1,470° C. into
β-cristobalite (cubic) melting at 1,625° C.

These transformations are reversible, but with falling temperature they take place very slowly. Molten silica unless cooled very slowly solidifies as a glass. β-tridymite when quickly cooled undergoes a change at 163° C. (β_2-tridymite to β_1-tridymite), and at 117° C. passes over into α-tridymite, which is optically biaxial and probably orthorhombic in crystallisation, being identical with the naturally occurring tridymite. Similarly, β-cristobalite when quickly cooled changes at about 180°–270° C. into α-cristobalite, which is optically biaxial (pseudo-cubic) and identical with the cristobalite occasionally found in volcanic rocks.

Now these and many other similar changes give information as to the conditions of temperature under which various minerals were formed in nature, thus providing a "geological thermometer." For example, the presence of tridymite, or of pseudomorphs of the more stable quartz after tridymite, establishes that the rock in which they occur must have been formed at a temperature between 870° and 1,470° C. The quartz of certain veins and that of granite present differences in structure which indicate that the former was formed below 575° C. and the latter above this temperature. Or again, the presence of orthorhombic copper-glance (β-Cu_2S) as a pseudomorph after cubic α-Cu_2S proves that the ore-deposit in which it occurs was formed at a temperature higher than 91° C.

Chemical Composition.—The chemical composition of many minerals is still imperfectly understood, and even for some quite common species there are doubts as to the correct empirical formulae, especially as to the silicates, a satisfactory classification of which is still wanting. Many attempts have within recent years been made to gain some idea as to the constitution of the silicates; there has been much experimental work and plenty of speculation, but with no very definite results. In certain groups, *e.g.*, the feldspars and the garnets, the composition can be satisfactorily expressed on the assumption of the isomorphous mixing of different chemical molecules. But attempts to extend this principle to all silicates often lead to highly complex hypothetical molecules, the existence of which can only be regarded as doubtful. Alternative suggestions have been put forward, such as the "mass effect" of large molecules and the "solid solution" of certain other substances in the main mass of the crystal. Experiments with silicate fusions show that various substances can be taken up, or dissolved, in certain amounts, giving on solidification apparently homogeneous crystals.

Radioactivity.—The strong radioactivity (*q.v.*) of uranium minerals affords a ready means of recognising these valuable ores in the search for them by prospectors. The mineral may be wrapped up with a photographic plate, which is afterwards developed; but a simpler and quicker test is that with a quite simple (home-made) gold-leaf electroscope. A piece of the mineral to be tested is placed on the cap of the electroscope, which is then charged with electricity, readily developed by rubbing with glass or vulcanite (say the mouthpiece of a tobacco-pipe): if the mineral contains uranium (and consequently radium), the gold leaves will soon come together. It is always well to make a comparative test, timing the rate of collapse, with a piece of ordinary stone.

Determinations of the ratio of the amount of uranium to the amounts of the various products of its decay (radium, helium, lead, etc.) present in various radioactive minerals give (knowing the rate of the decay) some idea of the period of time during which these products have been accumulating. In this way estimates have been made of the age in years of these minerals and even of the age of the earth; but, of course, many unknown factors must have been omitted from such calculations. Lead of radioactive origin, or isotropic lead—the final product of uranium decay—is found to vary slightly in its atomic weight (*q.v.*) according to the uranium mineral from which it is extracted.

To radioactivity is ascribed the well-known "pleochroic haloes"—tiny spots or borders of deeper colour surrounding microscopic inclusions—long ago observed in certain rock-forming minerals (cordierite, andalusite, mica, etc.) when microsections of rock are examined in polarised light. The long and continued emission of X-rays from zircon or other mineral grains has caused a change in colour of the surrounding mineral for distances varying from 0·002 to 0·4 millimetre. A study of these has again given some information as to the age of the minerals. In this connection it may be mentioned that much experimental work on the coloration of minerals has been done within recent years by exposing the minerals to the action of radiations of various kinds, including ultra-violet rays, cathode rays, X-rays and the rays emitted by radium salts. For example, some diamonds acquire a green colour and fluorspar becomes blue when placed in contact with radium bromide.

Some New Minerals.—In descriptive mineralogy a considerable number of new minerals have been named, but unfortunately in many cases not completely determined and described. A few of the more prominent and well-established of these are:—

Carnotite.—Hydrated vanadate of uranium and potassium, $K_2O{\cdot}2UO_3{\cdot}V_2O_5{\cdot}nH_2O$, occurring as a canary-yellow crystalline powder impregnating sandstones over a wide area in western Colorado and the adjoining portions of Utah and New Mexico. In Colorado it has been collected on a large scale for the extraction of vanadium, uranium and radium. It has also been found in South Australia and in Pennsylvania; and an allied mineral (tyuyamunite, containing calcium in place of potassium) is known from Tyuya-Muyun in Russian Turkestan.

Germanite.—A sulphide ore mineral containing copper, iron and the rare elements germanium (5–8%) and gallium ($\frac{1}{2}$–$\frac{3}{4}$%). As a massive, reddish-grey mineral intermixed with tennantite it is found in some quantity at Tsumeb in South West Africa.

Kasolite.—A hydrated silicate of uranium and lead, $PbO{\cdot}UO_3{\cdot}SiO_2{\cdot}H_2O$, forming radiating groups of small, ochre-yellow, monoclinic crystals. Together with several other new but imperfectly defined minerals, it occurs as an alteration product of pitchblend at Kasolo in Katanga, Belgian Congo.

Lorandite.—Sulpharsenite of thallium, $TlAsS_2$, forming transparent, monoclinic crystals with a carmine-red colour and adamantine lustre. It is found with realgar at Allchar in Macedonia, and is one of the few minerals that contain the rare element thallium as an essential constituent (Tl 59·5%).

Mullite.—Recent experiments have shown that the only aluminium silicate that can be prepared artificially is the compound $3Al_2O_3{\cdot}2SiO_2$, and not $Al_2O_3{\cdot}SiO_2 = Al_2SiO_5$ (fibrolite) as formerly supposed. The same compound, as minute orthorhombic crystals, has been found in slates fused by igneous rocks in the Island of Mull, Scotland, and has been named mullite.

Patronite.—Vanadium sulphide, VS_4, forming dark greenish-black compact masses. It occurs abundantly at Minasragra, Cerro de Pasco, Peru, where it is a valuable ore of vanadium. It weathers very readily with the production of various highly coloured vanadium compounds; even on material kept in collections there is a slow growth of blue and green efflorescences.

Spencerite.—Hydrated basic zinc phosphate, $Zn_3(PO_4)_2{\cdot}Zn(OH)_2{\cdot}3H_2O$, forming pearly white, scaly cleavage masses and small monoclinic crystals. It has been found in some abundance forming large stalactites in a cavern near Salmo, British Columbia.

Tarbuttite.—Basic zinc phosphate, $Zn_3(PO_4)_2{\cdot}Zn(OH)_2$, forming colourless, or faintly coloured green or red, anorthic crystals, with a perfect cleavage in one direction. It has been found in considerable quantity at the Rhodesia Broken Hill Mine in Northern Rhodesia.

Thortveitite.—Silicate of scandium, yttrium, etc., $(Sc, Y)_2O_3{\cdot}2SiO_2$, occurring as large orthorhombic crystals of prismatic habit in pegmatite in southern Norway and Madagascar. This is the only mineral known to contain the rare element scandium in large amount.

BIBLIOGRAPHY.—Details of descriptive mineralogy are collected in Appendices 1–3 of Dana's *System of Mineralogy* (New York, 1899–1915); and numerical data respecting the constants of minerals are tabulated in the international *Tables annuelles de constantes et données numériques*, 6 vol. (Paris, 1912 etc.). A work of comprehensive character is C. Doelter, *Handbuch der Mineralchemie*, 4 vol. (Dresden and Leipzig, 1912 etc.). An advanced textbook on new lines is P. Niggli, *Lehrbuch der Mineralogie* (Berlin, 1924, with two more volumes to follow). A number of elementary textbooks have been published, *e.g.*, G. A. J. Cole, *Outlines of Mineralogy for Geological Students* (London, 1912); A. F. Rogers, *Introduction to the Study of Minerals* (New York, 1912); E. H. Kraus and W. F. Hunt, *Mineralogy, an Introduction to the Study of Minerals and Crystals* (New York, 1920); H. Buttgenbach, *Les minéraux et les roches* (Paris and Liége, 1924). A popular book with coloured plates is L. J. Spencer, *The World's Minerals* (London, 1911, 2nd ed., New York, 1916). Books of an economic character are H. Ries, *Economic Geology* (5th ed., New York, 1925); T. Crook, *Economic Mineralogy, a Practical Guide to the Study of Useful Minerals* (London, 1921); B. Dammer and O. Tietze, *Die nutzbaren Mineralien* (2 vol., Stuttgart, 1913–4). *Special Reports on the Mineral Resources of Great Britain* have been issued by the Geological Survey, London, since

1915; and a long series of pamphlets, *The Mineral Industry of the British Empire and Foreign Countries* by the Imperial Mineral Resources Bureau, London, since 1920. New journals are *Fortschritte der Mineralogie, Kristallographie und Petrographie*, issued by the German Mineralogical Society, Jena, since 1911; *Beiträge zur Kristallographie und Mineralogie*, ed. by V. Goldschmidt (Heidelberg, since 1914); *Schweizerische Mineralogische und Petrographische Mitteilungen*, Zürich, since 1921. A review of the recent scientific literature is given in the Mineralogical Society's series of *Mineralogical Abstracts*. (L. J. S.)

MINERS' PHTHISIS (*see* 18.541b).—Almost any dust inhaled in sufficient quantity may cause chest trouble of some kind or another, but certain dusts are related to the occupational disease variously known as miners' phthisis, pneumonokoniosis, grinders' rot, potters' rot, stonecutters' rot, etc.

Phthisis-producing Dusts.—Dusts with this association are often referred to as phthisis-producing dusts because pulmonary tuberculosis plays a more or less important part in this disease and is always associated with a fatal termination and usually with disablement. Prof. E. L. Collis has shown that the phthisis-producing dust of far the greatest importance in industry is dust of free silica (SiO_2) and the disease is often known as "Silicosis." For a dust to be phthisis-producing it must be comparatively insoluble and inert and the particles must be minute, say from five microns downwards, or about the size of the common pathogenic micro-organisms. Owing to their minute size these particles may be present in air in dangerous concentration without being visible to the eye or in any other way noticeable to the senses, so in a phthisis-producing industry it is expedient to sample the air for dust as one samples for gas in a "gassy" mine.

The Lungs and Dust.—The lungs have a very considerable power of ridding themselves of inhaled particles, and some dusts, like coal-dust, are much more readily got rid of than others while, in the case of a phthisis-producing dust, accumulation readily gets ahead of elimination, so quite small quantities of air-borne dust may be dangerous. It is owing to this cumulative factor that duration and continuity of exposure are of importance as well as concentration in the air. While the average incidence of miners' phthisis on the gold-mines of the Witwatersrand is under 3% per annum of the underground population the incidence rises as high as 10% per annum in the case of miners of 13 years' service and over.

Dust Cells.—A certain proportion of the fine dust inhaled runs the gauntlet of the upper respiratory passages and gets right down into their minute blind extremities, the alveoli. In silicosis as in pulmonary tuberculosis "lesion means arrest" and the dust particles are arrested by being taken up by certain cells known as dust cells. The dust cells are a variety of the phagocytes of Metchnikoff and, when dust-laden, they aggregate together forming small masses or pseudo-tubercles. These pseudo-tubercles may be found on the alveolar walls, under the pleura and in the lymphatic channels which they obstruct. The dust-containing cells forming the pseudo-tubercles tend to degenerate and become fibrous tissue thus forming the fibroid nodules characteristic of the early stage of silicosis.

Prevention.—It is the fine dust that matters and, in mines where a phthisis-producing rock is dealt with, the chief sources of fine dust are blasting and rock-cutting with machines. From the point of view of prevention, in industries where blasting is practised, the workers should not return to the working-place until after all dust and fume have been blown away. Ventilation with good currents of dust-free air is the great safeguard because, by treating the air-borne dust as a gas, it can be diluted down towards a safe level. What is a safe level? When one has to deal with daily exposure over many years, perhaps about one milligramme of dust per cu. metre of air. The fine dust is only a small proportion by weight of the total air-borne particles, but includes the majority of particles by enumeration. A sample of air-borne dust of 2 milligrammes per cu. metre as determined by the method in use on the Witwatersrand corresponds to about 350 particles of fine dust per cu. cm. of air (counted by Kitze koniometer). The other great safeguard is "working wet" and the chief source of the dust associated with machine drilling is "sludging" with air. When it is practicable to sludge with water only, machines raise much less dust. Water-sprays should be in continuous use and the roof, walls and floor of the working-place kept wet. All broken rock should be thoroughly wetted before moving (*see* MINING).

A machine may be in good order for rock-cutting and in bad order for dust-control and should be inspected from the latter point of view as well as the former. A hand-drill is more difficult to keep in order for dust-control than is the larger machine and it is doubtful if it is possible to secure safe conditions if hand-drills are used dry when cutting phthisis-producing rock. In all phthisis-producing industries, apart from working wet, it is wise to think of the fine air-borne dust as a gas and make every possible use of exhaust-hoods and abstractors; while sources of dust escaping to the air should, as far as possible, be located and enclosed.

There are two important factors in the severe forms of miners' phthisis:—

(1) The phthisis-producing dust.

(2) The tubercle bacillus.

Carriers.—The modern view of pulmonary tuberculosis as met with in the adult population of civilised countries is that it is related to re-infection by the obvious route of inhalation. Under experimental conditions the presence of dust in the air, together with the tubercle bacillus, renders the susceptible animal much more liable to infection by inhalation. It is on account of this association that, in a phthisis-producing industry, one must strive not only to eliminate dust but also to eliminate the tubercle bacillus. The only practicable step towards the latter ideal is to detect and remove the "carrier," *i.e.*, the sufferer from open tuberculosis. For the sake of others as well as for their own, sufferers from tuberculosis should not be allowed to work at a phthisis-producing industry. Tuberculosis, of course, is not a compensatible occupational disease, but it might well be so regarded in a phthisis-producing industry for, although pulmonary tuberculosis is not miners' phthisis, practically all grave miners' phthisis is associated with pulmonary tuberculosis.

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MINING (*see* 18.528).—Since 1910 there has not been much change or development in the methods of working as applied to the extraction of mineral ores and other substances from veins and stratified deposits. This is, perhaps, more particularly the case in regard to coal and stratified deposits than of metalliferous ores occurring in veins. The development in respect of the former lies chiefly in the direction of the machinery used in the mines and its application, more particularly at the working face, and especially that used in the getting and transporting the coal at the faces.

In the working of metalliferous veins, while the standard methods of extracting the ore by overhand or underhand stoping have changed little, a more definite classification than existed formerly has grown up respecting the application of these methods to given local conditions. Comparatively thin veins, with a steep pitch (dip), are developed by a series of drifts (levels), and above each of these overhand stopes are opened for extracting the ore, the working being advanced upward. The broken ore is run through chutes (mills or passes) to the level below, in which it is conveyed in trams by hand or mechanical power to the shaft or through an adit (tunnel) to the surface. For thicker veins, especially those with a steep dip, underhand stoping is occasionally employed, the advance being forward and downward toward the haulage level. In the case of flat veins or of bedded deposits breast-stoping is used, the details of which much resemble those of underhand stoping. In all of these methods, the roof of the deposit (hanging wall) is supported by pillars of ore, by props, balks of timber (stulls), by "square-set" timbering or by masses of waste ore and rock (filling) carried by stulls. Sometimes stopes are completely filled with waste.

Shrinkage Stopes.—There are a variety of overhand stopes which have been more widely employed than formerly for both narrow and wide steeply dipping veins. In these stopes the broken ore accumulates until the stope is complete, thus making artificial support for the walls of the stope unnecessary. Since rock when broken increases in bulk, from 25 to 40% of the ore is drawn from the stope as it advances to leave room at the top for the miners, who stand on the broken ore while drilling. This method is applicable only to those cases where the inclination and width of the vein are great enough to allow of the broken ore sliding down freely to the stope floor (footwall). Finally, after all the ore has been drawn off, the stope is allowed to cave in or is filled with waste. In principle, the shrinkage stope is identical with the "battery-breast," commonly used in fairly thick coal seams, when the pitch exceeds about 35° to the horizontal.

Caving Systems.—The prototype of these, long employed in certain British iron mines, is known in the haematite iron ore mines of Lancashire and Cumberland as the caving system. In the United States caving was first used for the soft iron ores of northern Michigan. More recently, it has been extensively applied to the iron deposits of the Mesabi district, Minnesota, and to some large copper deposits in the south-west of the United States. The chief requisites for the successful application of caving methods are: (1) massive deposits of relatively cheap minerals; (2) ore-bodies of large horizontal dimensions, overlaid by a capping varying in character from earthy soil or glacial drift to firm rock; (3) large-scale work. There are three distinct methods: top-slicing, block-caving and sub-level caving. The salient features of all are: (*a*) horizontal subdivision of the ore-body into floors; (*b*) subdivision of each floor into small slices or blocks which are mined separately; (*c*) delivery of the broken ore through chutes to the haulage-ways below and thence to the shafts; (*d*) as the ore is removed, the overlying capping must gradually cave in and settle.

The period 1910–25 was marked by a wider application of the slicing and caving methods, especially for large low-grade deposits of disseminated copper ore. More deposits of this type have been developed and worked in recent years than ever before, many variations in details being introduced to suit the dimensions of the ore-body, its depth below the surface and the character of ore and of the super-incumbent strata or capping. All this has brought a more definite understanding of the applicability and limitations of the caving systems, as determined by existing local conditions.

Some prominent examples of the newer mines, in which different forms of slicing and caving have been adopted, follow.

Inspiration Mine, Arizona.—The ore-body is a massive deposit of disseminated sulphide of copper (calcopyrite), containing about 100,000,000 tons of low-grade ore, and overlaid by a valueless capping, 30 to 350 ft. thick. A variation of the caving system is used, known as "block-caving." The ore-body is intersected at vertical intervals of 150 ft. by main haulage levels, connecting with the

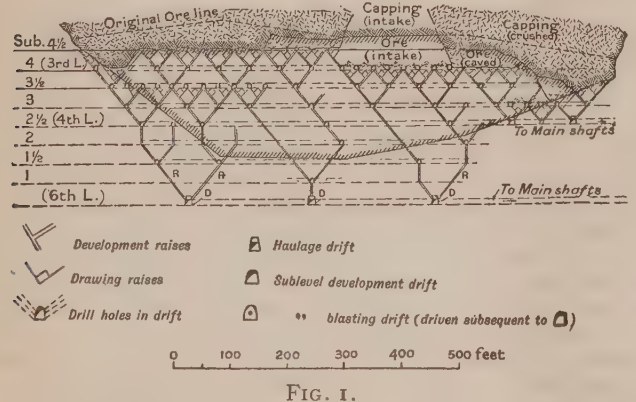

FIG. 1.

winding shafts (fig. 1). Above the haulage levels are long chute-raises, inclined at 50° to the horizontal, from which numerous short secondary raises ("finger-raises") are driven to a system of sub-level drifts, 35 ft. apart vertically and 50 ft. horizontally. The ore developed by the sub-level drifts is thus divided into small "blocks," which are undercut and broken up by blasting out the supporting pillars between the drifts. The broken ore is drawn down through the branching finger-raises underneath, into the main raises and thence to the haulage levels, the flow being controlled by gates. As the upper part of the ore-body is thus removed, the capping caves in on top of the solid unmined ore below. (For full details, see *Trans. Amer. Inst. Mining Eng.*, vol. 55, p. 218: vol. 59, pp. 299, 305; vol. 66, p. 127.) Block-caving, similar to that of the Inspiration mine, is also used by the Ohio Copper Co., Bingham, Utah, and the Nevada Consolidated Copper Co., Ely, Nev.

Arizona Copper Co.—A top-slicing method (fig. 2) is applied to large bodies of soft ore, carrying 2 to 4% copper. A main haulage

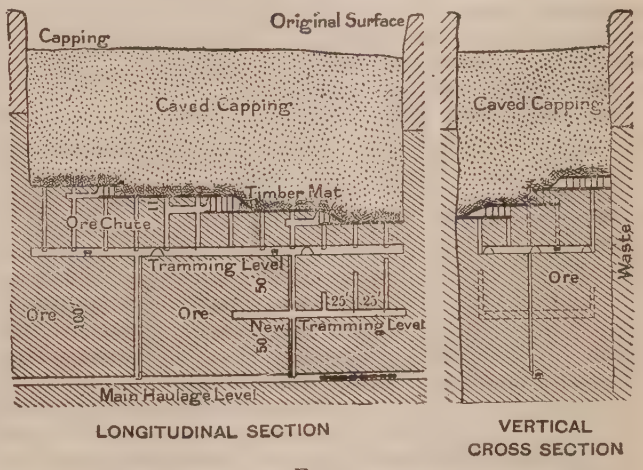

FIG. 2.

road is driven near the bottom of the ore-body, and above it are intermediate working levels, 50 to 60 ft. apart vertically. These comprise a rectangular system of tramming drifts and cross-cuts, from which chute-raises are made into the ore above at 25 to 30 ft. intervals. Starting from the tops of these raises, horizontal slices of ore, 7 to 15 ft. thick, are blasted out and the broken ore is run down through the raises to the tramming level. Thence it is conveyed to the nearest main raise, connecting with the haulage road below. (For details of the slicing operations and the manner in which the overlying capping caves in as the successive slices are removed, *see* 18.532.)

These modifications of top-slicing consist chiefly in making raises from the intermediate tramming levels at short intervals, to minimise the labour cost of handling the ore mined in the slices. In one of the Arizona Copper Co.'s mines a further saving has been effected by omitting the tramming levels and the small raises from them. A main drift is driven longitudinally through the axis of the ore-body, just below the roof or capping, and from it, at right angles, cross-cuts, 40 ft. apart, to the walls. The panels or blocks of ore between the cross-cuts are sliced back from the walls of the ore-body towards the main drift. On each side of the latter a pillar is left, which is finally sliced back from its end, in completing a floor. While one floor is being mined, the next, 11 ft. below, is in preparation. This method of panel slicing has recently been adopted successfully in the Herman gold mine, California. The vein dips 45° to 60°, and the panels are laid out at an inclination of 52°, across the ore-body. Top-slicing is also used in many massive deposits of low-grade copper ore; for example: Cumberland-Ely, Nev.; Cananea, Mexico; Miami, Ariz.; Bingham, Utah; and mines of the Calumet & Arizona Mining Co., Arizona. At the last-named property, the older caving method has been replaced by a modification called the Mitchell top-slicing system, found economical in reducing the shovelling required.

Other Variations.—In a number of important mines working large ore-bodies, special conditions have been dealt with by combining two or more of the methods referred to above. Examples are to be found in the mines of the Braden Copper Co., Chile; New Jersey Zinc Co., Franklin, N. J.; Utah Copper Co. (Boston mine); Ray Consol. Copper Co., Ariz.; Homestake Gold-Mining Co., S.D., and the De Beers Mining Co., South Africa. In most cases, operations begin by shrinkage stoping, after which the intervening pillars are mined by top-slicing, block-caving or sub-level caving, the object aimed at being the getting of as high a total tonnage extraction as possible, that is, obviating loss occasioned by leaving ore in permanent pillars or through mixture with waste material.

Stripping Superficial Ore Deposits.—This old mode of attacking shallow deposits of large horizontal area was oftener resorted to in the period 1910–25 than previously, and was applied to deeper ore-bodies than formerly were considered capable of being mined by stripping.

Standard Methods.—Standardisation of methods of working when practicable probably promotes efficiency and economy of

operation. Seams of coal and some regular bedded deposits of the base metals, owing to their comparative uniformity of geological occurrence, can be worked to a greater degree by standardised methods than most metalliferous deposits, which vary greatly in their physical characteristics. A notable instance to the contrary is perhaps that of the Banket deposits of the Rand, Transvaal, which are in the nature of highly inclined beds of conglomerate. (See the useful discussion by C. A. Mitke, "Mining Methods of the United Verde Extension Mining Company, Arizona," *Trans. Amer. Inst. Mining Engs.*, vol. 61, p. 188.) In the three years 1922–5 a "Committee of One Hundred" of the Amer. Inst. Mining Engs. (comprising 13 sub-committees) collected and published descriptions of the mining methods in the principal districts of the United States. It was planned to classify these data, with a view still further to standardise mining practice for the different kinds and shapes of ore deposit.

In many mining operations there is a stronger tendency toward standardisation of details. Thus, some mining companies have adopted standard "rounds" of holes for shaft-sinking, drifting, cross-cutting, raising and stoping. The foremen are furnished with instruction sheets which specify the position, depth and charge of explosive for each hole. The miners are required to follow these instructions instead of doing their work in accordance with their own individual ideas. The adoption of such methods has been assisted by the greater attention now given to what may be termed efficiency engineering. Many large mines have "efficiency engineers," who study in detail the performance of both men and machinery, thus improving the quality and amount of work done. In Great Britain too, quite lately, attention is being directed in some enlightened quarters to the psychological side of mining with a view to ensuring greater efficiency.

Directed toward this end also are the movements inaugurated by several mining companies to instruct their employees in the best methods of doing their work. Thus, an education department is maintained by the Phelps-Dodge Corp., of New York, which operates a number of mines in the southwest of the United States. Lectures are delivered to the miners on practical mining topics, followed by examinations. The North Butte Mining Co., of Montana, has also standardised the details of many underground operations. The cost of these education departments is considerable, but is amply justified by the results. A wholesome spirit of rivalry is encouraged amongst the miners and their ambition is aroused; hence, better work is done, the *morale* of the whole force is raised, and better relations are established between the employees and the mine management. The principles of standardisation have also been increasingly applied to the design of mining appliances and machines.

Blasting.—Explosives for blasting rock and ores underwent considerable change in composition during 1915–25, and tests have supplied valuable data respecting the disruptive and propulsive forces and the sensitiveness of the types and grades of dynamite, leading to a better understanding of their suitability for different kinds of service. Explosives for coal-mines, especially those in which dangerous gases occur or which are dry and dusty, must be so constituted that ordinary charges will not produce a flame of sufficient intensity and duration to ignite explosive mixtures of gas and air. These comprise the tested "permitted explosives," lists of which are published in coal-mining countries and revised from time to time, to keep them up to date. In Europe their use under certain conditions—conditions which exist in the majority of the coal mines—is required by law. In the United States the lists appear in publications of the Bureau of Mines. The bureau can only recommend them, though legal requirements exist in some of the states.

"Permitted explosives" have certain characteristic ingredients: (*a*) ammonium nitrate; (*b*) salts containing water of crystallisation, which, being liberated and vaporised by the heat of explosion, reduces the flame temperature; (*c*) organic nitrates other than nitro-glycerine, *e.g.*, nitro-starch; (*d*) nitro-glycerine, mixed with free water or an excess of carbon. It was formerly assumed that nitro-glycerine compounds and other detonating explosives were not suitable for collieries, because, due to market requirements, excessive shattering of coal is undesirable (except for coke-making); but low-strength, "short-flame" dynamites are now being satisfactorily used. While no explosive can be absolutely safe in gassy mines, those in the "permitted" lists are relatively safe. The standard tests vary as between countries; that of the United States, which is now given, is less drastic than that operative in Great Britain. In the U.S.A. an explosive is accepted for the list when a charge of 680 gm. (1½ lb.) does not ignite gas or coal-dust; it is not accepted if a charge of 250 gm. does cause ignition. In 1912 the permitted list of the U.S. Bureau of Mines comprised 96 kinds and grades of safety explosive; in Jan. 1924 the number had increased to 158, many being almost identical in composition. The United States is the largest user of "permitted explosives" in the world, the quantity consumed having more than doubled in 1912–25.

Blasting methods in the United States have been improved by the introduction of "delay action" electrical fuses. In work like tunnelling (cross measure or stone drifting) and shaft-sinking, where rounds of charged holes are best fired in volleys, these special fuses save time, as the miners need not return to the working place after each volley to prepare for the next. The entire round is wired, as if all the holes were to be fired simultaneously, and there is but one application of the current. The groups of holes explode successively, in the desired order and at intervals of about one second, by using "no-delay" fuses for the first group and "first-delay" and "second-delay" fuses for the following groups. In British coal-mining, volley firing of charges is not permitted by the laws regulating the industry.

Construction of Delay Fuses.—The platinum bridge in the cap shell, between the terminals of fuse wires, is not embedded in the fulminating charge itself, so as to explode it directly, but ignites a short piece of slow-burning ordinary fuse, which in turn explodes the fulminate. The delay interval depends on the length of ordinary fuse used. Another new device for the same purpose is the electric fuse-igniter. A special electric cap contains a small charge of fine-grain black powder, beyond which is a piece of ordinary fuse, with a cap on the end to be placed in the dynamite cartridge. For blasting with black powder, no cap is put on the ordinary fuse.

Mine Hygiene.—Improvements made in the years 1910–25 were chiefly in five directions: (1) better ventilation of mine workings; (2) enforcement of dust-prevention regulations and of regulations requiring the adulteration of coal-dust in the mine by the admixture therewith of inert dust; (3) introduction of new types of blasting explosives, so constituted as to minimise the quantity of deleterious gases evolved; (4) adoption of precautions with the object of producing more perfect combustion of explosives, and the consequent reduction or prevention of the formation of the poisonous carbon monoxide; (5) study and better understanding of special miners' diseases and their treatment. (*See* INDUSTRIAL WELFARE.)

Ventilation.—Formerly, artificial ventilation by fans or blowers was provided only for collieries, to dilute and sweep out gases emanating from the coal and surrounding strata. In recent years, mechanical ventilators have been increasingly applied in the ventilation of metalliferous mines also.

About the year 1902 the high mortality amongst the miners of some districts, especially on the Rand, South Africa, began to attract attention. Investigation showed that acute lung trouble ("miner's phthisis" or silicosis) is caused by inhaling dust from drilling in dry silicious rock or ore. In 1903 a Government Commission was appointed to study the conditions in the Transvaal gold-mines. Their report led to a demand for better ventilation of the mine workings, and the adoption of water-spraying devices to allay the dust arising from the operation of drilling. Revised and more stringent regulations were enacted in 1913. Other governmental investigations were made in Cornwall and the ganister mines of the Midlands, England, Australia and New Zealand, and in the United States by the Bureau of Mines. In 1911 one of the large gold-mining companies in the Transvaal, the Rand Mines (Ltd.), established a department of sanitation, to deal in general with miners' living and working conditions and diseases. The department's activities now cover a large number of the mines of the district, employing between 55,000 and 65,000 men, and marked benefits have resulted from this important movement, which is gaining in strength.

Tests of the gases from blasting explosives have revealed the extent to which they may vitiate mine air. One pound of

standard dynamite produces about 10 cu. ft. of gas, which, due to incomplete detonation, often contains 25 to 30% of carbon monoxide. Since, for safety, this actively poisonous gas should be diluted to about 0·01 of 1%, it is evident that natural ventilation cannot always be relied upon, and mechanical ventilators have been installed for many metalliferous mines. Several new types of high explosives have recently been introduced, so compounded that they produce much less carbon monoxide (CO) and methane (CH_4) than the standard ("straight") dynamites. They are therefore particularly useful in poorly ventilated mine workings, as headings where, in order to secure ventilation (in coal mines), bratticing or air pipes are necessary. Furthermore, there has been increased insistence on the use of high-strength caps or detonators, since imperfectly detonated explosives of all kinds produce an excessive amount of carbon monoxide.

Explosions in Coal Mines.—Advances have taken place in the appliances for fighting mine fires, in the modes of preventing and dealing with gas and dust explosions in collieries and in the design of safety lamps. Coal dust explosions are generally much more serious in bituminous than in anthracite mines. Most explosions in anthracite mines are of gas, sometimes aided by presence of dust. Many investigations of coal-dust explosions have been made in Europe since 1880, but some of the phenomena attending their initiation and propagation have long been imperfectly understood.

Since Professor Galloway (afterwards Sir William Galloway) first drew attention, about 1880, to the dangers arising from coal dust and the brothers Atkinson (Inspectors of Mines) wrote their book on colliery explosives, Sir William Garforth, after the Altofts explosion in Yorkshire, described the arresting effects of stone-dust on the explosive blast, and thereafter the Mining Association of Great Britain established a plant near Altofts for carrying out large scale experiments and did excellent work. Eventually the Home Office took over the plant and, transporting it to Eskmeals in Cumberland, added to it and extended the scale of the experiments.

The results of the elaborate work of the Home Office committees, extending over the period 1910–4, was published before the World War, and after the War a comprehensive set of regulations was established by the British Govt. for the purpose of reducing the accumulations of coal-dust in the mine and rendering such dust as remains uninflammable by reason of the admixture of inert and innocuous dust in stated proportions and of a specified fineness. Experiments were also carried out at the Liévin testing station in France, commencing in 1907, and later in Belgium and in Germany, and by the U.S.A. Bureau of Mines at their testing plant and Brunton experimental mine, near Pittsburgh (since 1909). Amongst the facts demonstrated are:—

(*a*) The blasting of a single hole, charged with long-flame explosive (gunpowder or high explosive), may cause the ignition of coal-dust; (*b*) respecting the initiation of an explosion, if enough dry coal-dust is present, it is immaterial whether the air at the point of origin is quiescent or moving in either direction; (*c*) quantities of dust as small as ½ oz. per cu. ft. of space (or 1 lb. per linear ft. of an ordinary roadway in the mine) will propagate an explosion; (*d*) in presence of sufficient dust, an explosion may be produced at will in a roadway, even when the roof, sides and floor are wet to the touch owing to the presence of dry dust on the timbers, etc.; (*e*) the force of a coal-dust explosion usually increases in violence as it is propagated through a mine working and may reach its maximum after travelling 500 to 800 ft. from the place of origin; (*f*) pressures as high as 120 lb. per sq. in. have been measured at right angles to the direction of movement of an explosion, the pressure in the line of advance being doubtless much greater.

Stone-dust Barriers.—Stone-dust barriers, for checking or preventing the propagation of coal-dust explosions, were devised by J. Taffanel and modified by G. S. Rice, of the U.S. Bureau of Mines, but constitute a doubtful safeguard. They consist of series of wide shelves, set across the mine gangway near the roof, each loaded with rock-dust. The shelves are tripped mechanically by the advance force waves of an explosion, being set to operate at certain air velocities produced by the explosion. From two to three tons of rock-dust are thus discharged in a dense cloud, in front of the advancing explosion wave, and, mixing with the coal-dust-laden atmosphere of the gangway, prevent propagation of the explosion.

It would appear that the only really safe precaution to take is the thorough admixture with the coal-dust of the fine stone-dust. It was until quite recently considered that the presence of 30% of inert dust secured safety, but the most recent experiments of Professor Wheeler, of the British Mines Department of Safety of the Mines' Research Board, shows that this may prove insufficient with coal-dust of high volatile content, and that as much as 50% or more may be necessary in some cases. Great interest in "stone dusting" is now being manifested in mining circles. See the publications issued by the British Mines Department and the U.S. Bureau of Mines, *Bull.* No. 225 (1924).

Gas Helmets, etc.—Gas helmets and oxygen breathing-apparatus, long used in mine rescue work, have undergone considerable improvement in point of construction, though no new principle can be said to have been evolved.

Winding Engines.—Power plants (frequently hydroelectric except in the case of Great Britain) have been established in many mining districts, and supply electric current at cheaper rates than are possible for equivalent steam power. Electric-driven winding engines are consequently used in much greater numbers than formerly and in Great Britain, though electricity is seldom obtainable from water power, electric hoists have increased in use at collieries which have in some instances established large power plants, *e.g.*, at Powell Duffryn Colliery in South Wales. The control mechanism of electric winders is so perfected that these engines are as manageable as the best steam winding engines. The large variations in load, unavoidable in winding operations, and very disadvantageous for electric transmission of power, are successfully dealt with by the "equalising systems" of winding or hoisting, the first of which, the Siemens-Ilgner, was introduced just previous to 1906. Modifications of it, based chiefly on the mode of control, are the Westinghouse and the Ward-Leonard. The design and operation of all of these devices are based on the principle that, when a motor receives electric current, it will deliver mechanical power; conversely, when driven by mechanical power, the motor becomes in effect a generator and furnishes electric current. The alternating current usually supplied to a mine is first reduced to about 500 volts and then goes to a motor-generator set, comprising a shunt or induction motor, which drives a direct-current generator and a heavy fly-wheel, all on a common shaft. This set is in constant motion, though not at constant speed. From the generator the current goes to a winding engine motor, which drives a pair of drums on the drum shaft.

At the beginning of a winding cycle, the winding engine motor receives current from the motor-generator set; but, after the descending cage has reached a point where the trip can be completed by the weight of the rope, the winding engine motor is driven by the drum, and therefore supplies current to the generator of the motor-generator set. Thus, part of the recovered power is stored in the fly-wheel, while the remainder is expended in driving the induction motor as a generator, thereby causing it to deliver current to the external circuit or power service. The fly-wheel cuts down the peaks of the load curve. Since 1915, a number of these plants have been erected; they are costly and suitable only where the hoisting is nearly continuous and high peak loads are heavily penalised in the power service.

Underground Haulage.—For locomotive haulage, the electric trolley system was in 1925 still first in importance, though the use of this system is not permitted in gassy and dusty coal-mines in Great Britain; next to this were the compressed-air locomotives, very rarely used in Great Britain, if at all. Storage-battery locomotives, though invented many years ago, were rarely used until about 1911 and in 1925 were employed to a limited extent only in the mines of the United States and the continent of Europe; their use in British coal mines is at the present time under consideration and a prize was recently offered for a safe and practical locomotive.

Their construction is simple, and, as they carry their power with them, they have the advantage of being able to operate

wherever a rail track is laid, without the necessity of erecting a trolley wire. They are best suited to short distance haulage and light service, as for gathering individual tubs or cars from the working places and making them up into trains or sets on the main haulage roads, or what is termed "secondary haulage." The maximum speed is about five miles per hour and easy track gradients are necessary. Their chief disadvantage is high first

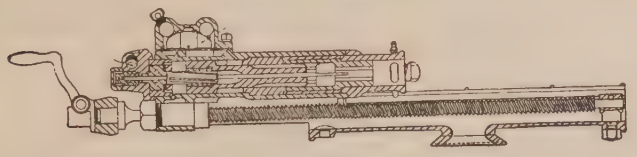

FIG. 3.

cost. A few combined trolley and storage-battery mine locomotives have been built, but they are unlikely to have a wide application. Gasoline locomotives were introduced in the U.S.A. mines before 1905, but were not much used until about 1912. Like storage-battery and compressed-air locomotives, they have the advantage of carrying their own power. Ordinary speeds range from four to ten m. per hour. Although reasonable in first cost and running expenses, gasoline locomotives can be employed underground only where there is freedom from inflammable gas and dust and where there is abundant and active ventilation, because their exhaust usually contains enough carbon monoxide gas to require a large amount of dilution. Their consumption of gasoline at full load is, say, 0·7 to 1·2 lb. per H.P.; considerably more at half speed and load. (U.S. Bureau of Mines, *Bull. No. 74.*)

Shovelling Machines.—These were introduced in the U.S.A. about 1907 for loading broken coal or ore underground. The conditions obtaining in British coal-mines do not permit of the mechanical shovelling of coal at the face. The first was the Thew machine, a dipper shovel of small size, operated by electricity or compressed air and suitable for use in stopes in a flat-lying deposit or in a tunnel. A later design, the Myers-Whaley, consists of a large scoop, which is thrust into the pile of broken ore or rock, then lifted and dumped backward on to a short travelling belt conveyer, for loading into a mine car in the rear. This machine occupies but little space. In 1915 two of them were installed in a long haulage drift, 14 ft. wide by 10 ft. high, in the Crown mines, Transvaal. Interest in the subject has been stimulated by the high wages now prevailing in most mining regions. Where wages are low, however, they cannot compete with hand loading. The use of mechanical loaders has increased enormously in the United States since 1915 and new designs frequently appear. A monograph of 638 pp. on *Mechanical Underground Loading in Metal Mines*, by C. E. Van Barneveld, of the Bureau of Mines, was published in 1925.

Machine Drills.—Important changes were made during 1910–25, especially in the further development of the "hammer" drills

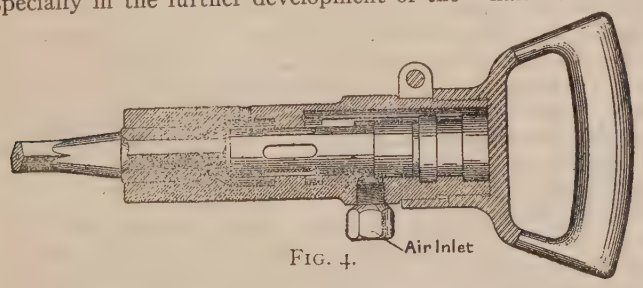

FIG. 4.

which for many kinds of service have largely replaced standard types of piston machines. In the hammer drill, the bit is held stationary in the front end of the machine, and is struck a rapid succession of blows by the reciprocating piston-like hammer. As the bit does not reciprocate, its cutting edge being always in contact with the rock, except during the slight rebound caused by each blow of the hammer, automatic means must be provided for removing the sludge and thus keeping the hole clean while drilling. Hammer drills therefore use hollow bits, through which a jet of compressed air or water is discharged at the bottom of the hole, thus driving out the cuttings. When compressed air is used, and the rock is dry, the dust discharged from the hole is annoying and hurtful to the drill-runner. Hence, a water jet is

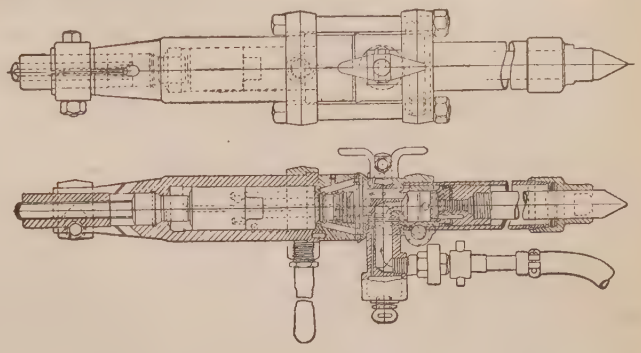

FIG. 5.

in common use. The water is delivered under pressure from a 15-gal. to 18-gal. tank, through a short length of hose. Pressure in the tank is produced by connecting it by another hose with the compressed-air pipe.

Hammer drills are of three types: (*a*) Large machines (fig. 3), corresponding in size and weight with ordinary piston drills, mounted on tripod or column and used for the same kinds of work; (*b*) the small D-handle and cross-handle drills for making holes pointing downward, as in shaft-sinking (fig. 4); (*c*) machines having an automatic air-feed standard, used chiefly for holes directed steeply upward, as in most stoping operations (fig. 5). Machines of classes (*b*) and (*c*) have the advantages of lower first cost, of being operated by one man instead of two, and of eliminating the time lost in cleaning out the hole and in "setting up," as for the standard piston drills and class (*a*) hammer drills. In most rocks and ores, these hammer drills, therefore, do faster work than piston drills. The hammer drill is also applied to the breaking down of coal, and is used with advantage at many European coal mines.

Deep Boring.—In recent years, for prospecting by boring, there has been a great increase in the use of the "churn drill"; that is, a drop drill, suspended by a rope from the operating machinery on the surface, and similar in many respects to the standard oil-well drilling plant. For deep boring, the oil-well "rig," the churn drill and the diamond drill divide the field among them. During the decade 1915–25, many oil and natural gas wells were bored to depths of 4,000 to 5,000 ft., and a few exploratory holes (in Pennsylvania and West Virginia) reached depths of 7,000 to 7,350 feet. For holes of a few hundred ft. in depth, and when cores are desired, the rotary "shot-boring" method, based upon the old Davis Calyx drill, has continued in use to some extent.

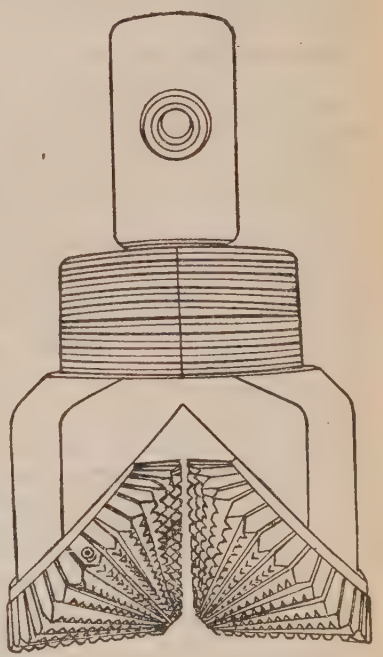

FIG. 6.

For rotary boring in the softer strata, the "fish-tail" bit, with two cutting edges somewhat resembling those of a large carpenter's auger, has come into much wider use for oil and gas wells. In 1908 the Sharp and Hughes cone-bit (fig. 6) was introduced for boring in hard rock, and has been widely used in some of the petroleum and natural gas-fields. It consists of a pair of hardened

steel cones, with serrated or toothed surfaces, revolving on bronze bearings. As the drill rod rotates, the cones roll under pressure upon the rock, crushing and chipping it away. When dull, the cones are readily replaced. These bits in some cases bore as much as 100 ft. of hole in 24 hours. In boring oil wells through soft strata or shattered rock, the sides of the hole often cave before the lining or casing pipe is put in. To overcome this difficulty, "mud-laden" water has been used in the boring operations instead of the ordinary wash-water. Finely divided, clayey material that will remain in suspension for a considerable period of time is employed. The mixture of mud and water should have a specific gravity high enough to afford a counter-pressure that will aid in supporting the walls of the hole; a specific gravity of about 1·33 is usually sufficient. The pressure in the bore-hole is thus kept in approximate equilibrium until the hole can be lined with piping (casing) or screens are set in the oil-bearing strata and cemented in place. This method was introduced in Europe, about 1895, for sinking cylindrical mine shafts in unstable, water-bearing soil by boring. About 1901 it was adopted for boring oil wells in Texas and Louisiana, and since 1906 has been successfully used in a large number of cases. (*See* COAL; COPPER; EXPLOSIVES.)

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MINNEAPOLIS, Minn., U.S.A. (*see* 18.546), increased in population from 301,408 in 1910 to 380,582 in 1920, and 425,435 (Census Bureau estimate) in 1925. Among the 88,248 of foreign birth (1920), Swedes (26,515) and Norwegians (16,389) predominated. The total value of manufactured products was $165,405,000 in 1909; $491,383,000 in 1919; $338,329,208 in 1923. Flour-mills (output, 1924, 11,679,130 bbl.) and grain elevators (capacity, 1925, over 56,000,000 bu. kept their dominating place in the city's industries, but the reduction of freight rates *via* the Great Lakes to approximately the pre-War basis, while all-rail rates to the East remained 65% higher, was resulting in the transfer of some of the milling business to Buffalo and other points in the East.

Ranking next to flour in 1923 were motor vehicles and bodies and parts; linseed oil, cake and meal; bread and other bakery products; and knit goods. The vast lumber industry dwindled, with the gradual exhaustion of the pine lands, from a maximum of 600,000,000 ft. sawed in 1899 until in 1920 the last mill went out of existence. Minneapolis is the seat of the ninth Federal Reserve Bank. Bank deposits on Jan. 1 1925, were $319,388,000. The combined manufacturing and wholesaling market in 1924 was estimated at $1,300,250,000.

Navigation of the Mississippi river up to the heart of the city was opened on July 3 1917, when the first steamer passed through the recently completed lock. In Nov. 1925, seven motor-bus companies, operating over 2,000 m. of state highways to the north and west, were merged in an auxiliary of the Great Northern Railway. The Great Northern passenger station, which is used by a majority of the railway lines, superseded, in 1914, the older union station.

Registration in the University of Minnesota reached 18,722 in 1924–5; its Memorial Stadium, seating 50,200, was opened in 1924. Enrolment in the public schools increased 70% between 1910 and 1925, while the increase in population was 41%. The park system by 1925 included 4,722 ac.; a playground for each sq. m. of residential area; five golf courses; and 56 m. of boulevards encircling the city, the so-called "Grand Rounds," one section of which is the Victory Memorial driveway (dedicated 1921). In the summer of 1925 the stream supplying Minnehaha Falls, which had been failing for several years, gave out entirely. To restore the supply deep wells were dug, from which water can be pumped into the creek when necessary.

Minneapolis has a low general death-rate, a low infant mortality, a high percentage of home ownership and a low percentage of illiterates and of children engaged in wage-earning occupations. Cost of living is below the average for American cities. The non-partisan system of nomination for city offices was put into effect in 1912. A city-planning commission was established in 1919, and a zoning ordinance adopted in 1924. In 1925 a new charter, providing for a city manager appointed by the legislative body (the city council) and for a school and library board, was prepared for submission to the voters.

MINNESOTA (*see* 18.548).—The population of the state in 1920 was 2,387,125 as against 2,075,708 in 1910, an increase of 311,417, or 15% for the decade. The total white population was 2,368,936, of whom 1,882,772 were natives and 486,164 foreign born. Negroes numbered 8,809 and Indians 8,761. The density was 29·5 per sq. m.; 25·7 in 1910. The estimated population in 1926 was 2,651,306. The urban population (in places having over 2,500 inhabitants) was 1,051,593, or 44·1% in 1920; 41·0% in 1910. The rural population was 1,335,532, or 55·9% in 1910. The following table gives the population and the percentage of increase of cities having more than 15,000 inhabitants in 1920:—

Cities	1920	1910	Increase %	Estimate 1925
Minneapolis	380,582	301,408	26·3	425,435
St. Paul	234,698	214,744	9·3	246,001
Duluth	98,917	78,466	26·1	110,502
Winona	19,143	18,583	3·0	19,459
St. Cloud	15,873	10,600	49·7	18,860
Hibbing	15,089	8,832	70·8	17,955

Agriculture.—There were 188,215 farms in Minnesota in 1924. These farms covered 30,040,933 ac., two-thirds of which was improved. The total value of farm land and buildings in 1925 was $2,396,005,328. The final stage in the state's progress from pioneer to diversified farming was marked by the decline of wheat from second to third crop. In the years following 1920 the total corn and oat crop was consistently more than four times as great as the total wheat crop, both in quantity and value. The northern part of the state showed a rapid development in stock-raising and dairying.

Minerals.—About 60% of the output of iron ore in the United States is mined in the three great iron ranges of northern Minnesota. The Mesaba range, 110 m. in length, embraces 130 active mines. The Vermillion and Cuyana ranges combined form an additional iron belt of about 50 miles. A total of 44,556,053 tons of ore, valued at $158,402,788, was shipped from Minnesota mines in 1923.

Manufactures.—In 1923 Minnesota ranked twelfth among the states in the value of its manufactures. In the 3,902 establishments (not including hand industries) then existing, the average number of persons employed was 103,344 and products valued at $968,476,565 were manufactured. There was a falling off in manufacturing from 1919, the peak year. The state's five most important industries, in the order of the value of products in 1923, were the flour- and grist-mill, slaughtering and meat-packing, dairy and creamery, the manufacture of cars and general shop construction and repairs by steam railways and lumber and timber industries. In flour and butter Minnesota's products exceed those of any other state. Following 1910 the slaughtering

and meat-packing industries, centred at South St. Paul, showed rapid growth. Because of the depletion of her forests Minnesota dropped from third place among the states in lumber manufacture in 1900 to sixteenth place in 1920; but, though lumbering declined, timber manufacturing increased. Iron ore is now worked in huge iron and steel plants on the St. Louis river near Duluth, and farm machinery is manufactured increasingly.

Transportation.—The railway mileage in Minnesota in 1924 was 9,096 an increase of 7·8% since 1908. In 1924 there were 180·2 m. of electric lines, exclusive of city street railways. With the growth of motor traffic, the demand for good roads greatly increased, and the state engaged in road building on an extensive scale. An amendment to the constitution (1912) authorised the levy of a one-mill tax, the proceeds to be distributed among the counties and used for road building and maintenance; another amendment (1920) authorised the issue of bonds and provided for the taxation of motor vehicles in order to finance a system of state trunk highways covering 7,000 m.; a third amendment (1924) authorised a tax on gasolene used in motor vehicles and to add the proceeds of the tax to the highway fund. There were in 1922 about 107,103 m. of public roads in the state. The U.S. Govt. completed in 1920 the construction of a dam in the Mississippi between St. Paul and Minneapolis, which by means of locks makes the latter city the head of navigation on the river. An attempt is being made to revive freighting on the river, between Minneapolis and St. Louis; and the Ford Motor Company's northwest plant, established in St. Paul and using hydroelectric power from the government dam, is both shipping and receiving goods by water.

Education.—In 1923–4, there were 431 high schools, 746 grade schools, 354 consolidated schools and 6,607 rural schools with 2,900 teachers and 78,000 pupils, and these schools received, in addition to local support, state aid. During 1923–4, $59,316,000 was expended on public education. There are six state teachers' colleges and 12 private institutions of collegiate grade. The University of Minnesota at Minneapolis comprises 13 colleges and schools. A noteworthy development in the medical school was its affiliation with the Mayo Clinic at Rochester. In 1915 William J. and Charles H. Mayo, the famous surgeons, established the Mayo Foundation for Medical Education and Research, endowed it to the amount of $1,500,000 and gave it to the university. The university was thus placed in control of practically all medical instruction in Minnesota. In 1924–5 the university had 12,736 students, 673 faculty members and 253 buildings. An extensive building programme covering a period of 10 years was initiated in 1919, when the Legislature appropriated $5,600,000 for this purpose.

Government.—In 1925 the state government was reorganised by combining the existing state boards and commissions into twelve departments and creating two new departments, the executive council (consisting of the governor, attorney-general, auditor, treasurer and secretary of state), and the Department of Administration and Finance, under the control of a commission of three appointed by the governor and removable at pleasure. The three commissioners—the comptroller, commissioner of the budget and commissioner of purchases—have general supervision and control of the expenditures and personnel of state departments and agencies. The placing of the state's charitable and penal institutions under the Board of Control was completed in 1917, and the board in 1925 had charge of 18 institutions including the recently established asylum for the insane with a special ward for inebriates at Willmar, the state reformatory for women at Shakopee and the colony for epileptics at Cambridge. The new state prison buildings at Stillwater, completed in 1912, cover 22 ac. in a tract of 1,000 acres. Among the duties of the new Department of Conservation are forest conservation, reforestation, and the management of the 20 state parks, eleven of which have areas greater than 100 acres. In addition this department manages the Pillsbury state forest, Cass county and the Burntside state forest, St. Louis County. Two Federal forest reserves are also located in the state: Superior National Forest in St. Louis, Lake and Cook counties; and Minnesota National Forest in Itasca, Cass and Belltrami counties.

Finance.—On June 30 1925 there were 1,375 banking institutions in Minnesota, of which 1,027 were state banks, 21 trust companies, 7 savings banks and 320 national banks. There are also in the state 85 building and loan associations and one credit union. The Federal Reserve Bank for the ninth district is located in Minneapolis. All banking institutions other than national banks are under the supervision of the commissioner of banks of the State Department of Commerce.

History.—The most important political movement of recent years was the growth of agrarian unrest manifesting itself first in the Non-Partisan League and later in the Farmer-Labour party. From 1919–23 this movement was particularly active and two members of this party were elected to the U.S. Senate—one to fill an unexpired term. In 1924, however, the tide was ebbing; at the presidential election the state was carried by the Republican party, and a Republican replaced one of the Farmer-Labour senators. The membership and power of organised labour fluctuated in a way roughly proportional to the fortunes of the Farmer-Labour party. Two important pieces of legislation in 1910–25 were the primary law (1912), which provides for nomination and election on a non-partisan ballot of all state and local officers except the state executive officers, the railway and warehouse commissioners and the clerk of the Supreme Court and the so-called tonnage tax (1921), a 6% tax on the net value of mined ore. Minnesota ratified the Eighteenth (Prohibition) Federal Amendment Jan. 20 1919. The following governors held office after 1909: Albert Olson Eberhart (Rep.), 1909–15; Winfield Scott Hammond (Dem.) (died in office), Jan.–Dec. 1915; Joseph A. A. Burnquist (Rep.), 1915–21; Jacob A. O. Preus (Rep.), 1921–5; Theodore Christianson (Rep.), 1925– (S. J. B.)

MINORITIES.—Groups of population differing by race or religion from the nation of which they form part. One of the most remarkable characteristics in the evolution of modern nations is their tendency to develop political communities increasingly extensive and increasingly homogeneous. In certain countries, such as France, this assimilation is practically accomplished and there is no longer any question of national minorities. But in some cases fusion does not proceed without resistance, and it may be said that the problem of national minorities arises at the moment of the emergence of important groups of persons differing from the majority by race, language or religion, who aspire to an independent life with regard to that majority. These aspirations may vary from the desire for a simple freedom to develop their own intellectual aims and their own traditions to a demand for administrative autonomy, or even a more highly developed political status, on the model of the Swiss cantons.

Historical Survey.—The modern problem of national minorities is identical with the idea of the " National State " which emerged after the break-up of feudalism. Indeed, from the moment when political unity arose on the basis of national unity, every nation which became conscious of a distinct nationality necessarily aspired to the advantages of a more or less complete political independence. Then at the same period, the exhaustion resulting from the religious wars of the 16th and 17th centuries and the advance of toleration were very favourable to the aspirations of homogeneous people for a certain measure of independence. These aspirations found expression from the 16th century onward in international law in the clauses of certain treaties in virtue of which the contracting parties obtained in favour of subjects whom they had been compelled to detach from their rule, or even for certain peoples of the same religion as their own, guarantees for the free exercise of their religion. (For examples see the Capitulations granted by the Sultan Solyman II. to Francis I. in favour of the Eastern Christians, 1535; the Peace of Augsburg, 1555; Treaty of Westphalia, 1648; Treaty of Oliva, 1660; Treaty of Paris, 1763, etc.). The liberation of the English colonies in America, the Declaration of Independence (1776) and the French Revolution with the Declaration of the Rights of Man (1789), crystallised, to some degree, the modern philosophy of nationality which is translated by the formula, " the right of peoples to self-determination."

In the 19th century this was strengthened by a series of brilliant successes: the achievement of independence successively by the Spanish and Portuguese Colonies in America; the liberation of Greece 1821–30; and of Belgium, 1831–2; the gradual elimination of the Turks from Europe in favour of the Christian peoples of the

Balkans; a series of conferences and of treaties (London, 1830; Paris, 1856; Berlin, 1878, etc.) which contained clauses in favour of certain religious minorities.

The World War and Its Consequences

The War of 1914 caused a formidable awakening of national aspirations. Italy and Rumania entered the War against the Central Powers in order to realise their national demands; Irish agitation was intensified under war conditions. In 1916 an important congress of nationalities met at Lausanne. As early as Jan. 22 1917 President Wilson laid down as the principle of the future peace:—

That no nation should seek to extend its polity over any other nation or people, but that every people should be left free to determine its own polity, its own way of development, unhindered, unthreatened, unafraid, the little along with the great and powerful.

Nevertheless, the distribution of the nationalities in Europe is so complex, notably in certain regions where the ethnical elements vary from village to village, that it was evidently impossible in the peace settlement to apply in its integrity the principle of self-determination; it was inevitable that some minorities should remain under the domination of majorities. On the other hand, some majority populations before the War became minorities.

A summary table of European minorities appears in next column.[1]

In Russia there are some 40 different nationalities the statistics of which are ill authenticated. The Union of Soviet Socialist Republics has granted to many nationalities a large measure of autonomy, and comprises at present a great number of republics and autonomous territories.

The Right of Minorities

In Europe alone the multiplicity of minorities, aggravated by the triumph of certain minorities immediately after the World War, has created an extremely dangerous political situation which is a constant source of disturbance. The Peace Treaties of 1919 sought to alleviate this danger by creating wide and fundamental rights for minorities.

The documents sanctioning these rights are of four kinds:—

1. Special articles in the Peace Treaties concluded by the principal Allied and Associated Powers with Austria (St. Germain, Sept. 10 1919); Bulgaria (Neuilly-on-Seine, Nov. 27 1919); Hungary (Trianon, June 4 1920) and Turkey (Lausanne, July 24 1923).
2. Special Minorities treaties concluded by the principal Allied and Associated Powers with Poland (Feb. 13 1920); Czechoslovakia (Sept. 10 1919); The Serb-Croat-Slovene State (Sept. 10 1919); Rumania (Dec. 9 1919); Greece (Aug. 10 1920). All these treaties have been placed under the Guarantee of the League of Nations.
3. Engagements entered into by certain states with the League of Nations to observe toward their minorities, or certain of those minorities, obligations more or less identical with those laid down in the minority treaties: by Finland and Albania, 1921; Lithuania, 1922; Latvia and Estonia, 1923.
4. Bilateral conventions between certain states: Treaty of Brünn between Austria and Czechoslovakia (June 7 1920); convention between Poland and Danzig (Nov. 9 1920); convention between Germany and Poland (May 15 1922).

The great innovation common to these international engagements is the intervention, for the assurance of the protection of minorities, of a supernational power, hitherto unknown, the League of Nations. Obligations with regard to minorities are henceforth conceived no longer as simple assurances of goodwill of a state towards its subjects of another race, but as international obligations which should be recognised by the state concerned as "fundamental laws," which cannot be contradicted by any other laws, and which are placed under the guarantee of the League of Nations. The Council of the League of Nations has been invested with juridical powers to intervene with the Govt. in case of infringement, or menace of infringement of their obligations with regard to minorities; finally, disputes on questions of law or fact which may arise in the carrying out of the

[1] Figures furnished by a minority rarely agree with those given by the majority. The figures marked with an asterisk in this table are derived from the official statistics of the states concerned. Others are taken from recent authoritative works of reference.

Country	Majority	Minorities
Belgium	7,482,100	Germans, 40,000
Germany	61,000,000	Danes, Poles and Wends
Poland	17,667,000	Germans, 1,550,000 Jews, 2,520,000 Ruthenes, 4,220,000 Russians, 1,135,000 Lithuanians, 72,750 Various, 50,000
Lithuania (incl. Memel)	7,702,000	Jews, 153,700 Germans, 29,200 Poles, 65,600 Russians, 50,500
Latvia	1,159,300	Great Russians, 91,500 Jews, 79,300 Germans, 58,000 Little Russians, 66,000 Poles, 52,200 Lithuanians, 25,500 Estonians, 8,700
Estonia	969,900	Russians, 91,200 Swedes, 7,800 Germans, 18,000 Jews, 4,500 Various, 15,000
Finland	3,500,000	Swedes, 380,000 Russians, 6,000
Austria	5,360,000	Czechs, 245,000 Hungarians, 88,500 Jews, 270,000 Serbs-Croats-Slovenes, 117,500
Czechoslovakia	8,760,000	Germans, 3,123,000 Magyars, 745,000 Ruthenes, 461,800 Poles, 75,800 Jews, 180,800 Various, 260,000
Hungary	7,147,000	Germans, 551,200 Slovaks, 141,800 Rumanians, 23,700 Serbs-Croats-Slovenes, 53,900 Jews, 60,000
Italy	41,000,000	Germans, 280,000 French Vaudois, 85,000 Slovenes, 250,000 Croats, 150,000 Albanians, 80,000 Greeks, 25,000
Yugoslavia (Serb-Croat-Slovene State)	9,971,600	Magyars, 472,400 Germans, 518,400 Albanians, 441,500 Rumanians, 229,000 Bulgars and other Slavs, 174,000 Italians, 12,800 Various, 212,000
Albania	817,800	Some thousands of Greeks
Rumania	11,576,000	Magyars, 1,650,500 Germans, 804,000 Ukrainians, 1,100,000 Ruthenes, 793,800 Jews, 770,000 Bulgars, 251,000 Serbs, 62,300 Turcs and Tartars, 230,000 Various, 579,000
Bulgaria	3,441,000	Greeks, 48,300 Gipsies, 115,700 Jews, 43,500 Rumanians, 78,000 Turcs and Tartars, 454,700 Various, 676,000
Greece	5,157,000	Albanians, 162,000 Jews, 110,000 Rumanians, 486,700 Turcs and Tartars, 59,000 Various (Slavs, etc.), 500,000
Turkey	8,518,000	Armenians, 40,000 Greeks, 220,000 Gipsies, 23,500 Jews, 68,600 Various, 2,413,000

said obligations may be referred to the Permanent Court of International Justice, whose decision is final.

Generally speaking, the treaties, conventions or declarations concerning minorities give these guarantees to the minority populations:—

1. Rights equal to those of any nationals of the country to protection of life and liberty and the free exercise of their religion;
2. A special right to the acquisition of the nationality of the country in question and to the exercise of civil and political rights;
3. Free use of their mother tongue in private life, in trade, in religion, in the Press, in publications, in public meetings and in the courts of law; and
4. The right of maintaining at their own expense charitable, religious or educational institutions.
5. In districts in which the minority constitutes a considerable proportion of the population, instruction in the primary schools of the state shall be given in the language of that minority and the minority shall be assured an equitable share in the sums provided by the state and municipal budgets for educational, religious or charitable purposes.

The conditions under which minorities may raise a complaint, and the procedure to be followed by the Secretariat and the Council of the League of Nations are laid down by precise regulations which have been several times revised (Tittoni Report: Resolutions of the Council of Oct. 25 1920; of June 27 1921; of Sept. 5 1923, and June 10 1925; resolutions of the 3rd and 4th Assemblies). An essential condition is that every application which is admitted as being in order is communicated in the first instance to the Govt. of the state against which the complaint is directed for its observations; the second is that every application definitely admitted as in order is examined by the President of the Council assisted by two members of the Council. But the Council is not assumed to be legally and officially informed until one of its members takes it upon himself to draw the attention of the Council to the case in question. When this takes place, the Council " may proceed in any manner and give any instruction that appears to it appropriate and effective in the circumstances."

As a result of this cautious procedure, many complaints transmitted to the Council have not been considered. This failure has caused serious disappointment and has given occasion for numerous grievances. But on the whole the essential rights of minorities are certainly respected, and even the possibility of the bringing of a complaint of the minorities before the Council or the Assembly of the League of Nations inevitably disposes governments to be prudent and moderate in their attitude towards their minorities. Moreover, certain minorities have obtained important advantages through the procedure adopted by the Council. In conclusion, the modern law of minorities as it emerges from the treaties, conventions and declarations enumerated above, has incontestably exercised on the fate of minorities a moderating influence, the great significance of which can hardly be exaggerated.

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MINSKY (1856–), the pen name of Nicolas Maximovich Wilenkine, Russian man of letters, was born Jan. 21 1856 at Glubokoe, Vilno (Wilna) province, and was educated at Minsk. He graduated in law at St. Petersburg University, but soon devoted himself wholly to a literary career. His first volume of poems was published in 1877, but was confiscated by the Government and was not re-issued until 1887. It was during the 'eighties that he became well known as a poet of social revolt. In the 'nineties, however, he became one of the leaders of the Russian symbolists. In 1905 he edited with Gorky the socialist paper, *New Life*. Minsky's philosophic ideas are expressed in *In the Light of Inner Revelation* (1890) and *The Religion of the Future* (1905). He also wrote many sonnets, lyrics and a number of plays. His poetical works were published in four volumes in 1907 and appeared in German in 1923. A volume of his works entitled *Echoes* has been translated into English by D. MacAlister (1923).

MINTO, GILBERT JOHN ELLIOTT-MURRAY-KYNYNMOND, 4TH EARL OF (1845–1914), British politician (*see* 18.564), died at Minto House, Hawick, Scotland, March 1 1914.

MIRBEAU, OCTAVE HENRI MARIE (1850–1917), French dramatist and journalist (*see* 18.574), died in Paris Feb. 16 1917.

MIŠIĆ, ŽIVOJIN (1855–1921), Serbian statesman, was born July 7 1855 at Struganik near Valievo, the son of well-to-do peasant parents. He passed through the old Artillery school in Belgrade and served in the Serbo-Turkish War of 1877 and the Serbo-Bulgarian War of 1885. During the Bosnian annexation crisis he became assistant chief-of-staff to Gen. Putnik, and in this capacity made his name in the first Balkan War, being promoted general. He further distinguished himself in the Bregalnitsa operations during the second Balkan War of 1912–3. When the World War broke out and the Austrians invaded Serbia in Nov. 1914, Mišić was appointed to the command of the I. Army. Mišić's simple and unaffected heroism inspired his soldiers with confidence: his spirit spread to the whole Serbian Army and found expression in the decisive victory of Rudnik early in Dec. by which the Austrians were driven out of Serbia.

Mišić, who had been created voivode after Rudnik, again served with distinction during the retreat of the Serbian Army in the winter of 1915. After a long interval spent in recovering from the strain of the campaign, he resumed command of the I. Army on the Salonika front in Aug. 1917, and in June 1918 was made chief-of-staff. In this position he played a pre-eminent part in elaborating the plan to which the piercing of the Bulgarian front was due. As a convinced believer in the idea of Yugoslav unity, he did all in his power to promote the efforts of the exiled Yugoslav committee to organise Yugoslav legions on every front. He died on Jan. 20 1921.

MISSIONS (*see* 18.583).—The developments of outstanding interest in missionary work since 1910 have been the new spirit of independence in the churches in the mission field, the growth of the spirit of co-operation, and the new educational demands on missionary schools. The first of these tendencies led to considerable transfers of authority from the missions to the churches established by them. The indigenous church rather than the foreign organisation became increasingly responsible for the direction of Christian activities. In the face of the rising spirit of nationalism, evident in so many quarters, it became essential that Christianity should as little as possible bear the character of a foreign religion.

National Christian Councils.—The impulse of the World Missionary Conference held in 1910 quickly extended itself to the mission field. A visit to Asia by the chairman of its continuation committee, Dr. John R. Mott, in 1913–4 led to the formation in India, China and Japan of bodies representative (with one or two exceptions in the case of Japan and China) of all the Christian forces other than Roman Catholicism. These, by a process of evolution, became national Christian councils, and in China and India, in particular, became an active and influential force. While in their beginning missionary initiative played a considerable part, leadership passed increasingly into the hands of Chinese and Indians, who formed in 1925 half or more than half of the members of the councils in their respective countries. A national Christian convention held in Shanghai in 1922 and attended by Chinese Christians and missionaries of all denominations from every part of China, afforded striking evidence of the reality, strength and indigenous character of the Christian movement in China. It was presided over with remarkable ability by a Chinese Christian, Dr. Cheng Ching-yi, and other Chinese Christians took part in guiding the proceedings.

A corresponding growth of co-operation took place among the missionary societies within their own various political boundaries. The Conference of Missionary Societies in Great Britain and Ireland, meeting for the first time in 1911, united all the principal missionary societies in the United Kingdom and Ireland and led to a marked growth in mutual understanding and fellowship and in practical co-operation in many directions. The Foreign Missions Conference of North America (including the United States and Canada), while of older date, made notable progress on similar lines. National missionary organisations were also formed in the Scandinavian countries, in Holland and in Switzerland, the German Missions-Ausschuss being of older date. Internationally, the continuation committee appointed by the World Missionary Conference gave place to the International Missionary Council, the members of which are appointed by the different national missionary organisations.

Education.—Everywhere in the mission field the position of Christian schools was affected by the rapid extension of Government systems of education. The missionary societies recognised that they had to do with an entirely new situation, and endeavoured to meet it by a thorough examination of the new conditions and the demands made by them. In 1919–20 an education commission was sent to India to investigate the problems of rural education and issued a report entitled *Village Education in India,* which exercised a considerable influence on missionary opinion and policy. Two years later a strong commission under the chairmanship of the late Dr. E. D. Burton, president of Chicago University, visited China and produced a valuable Report entitled *Christian Education in China.* In 1921 and 1924 an Education Commission, under the joint auspices of the missionary societies and the Phelps-Stokes Fund, visited, first, West and South Africa and then East Africa, and its two reports, *Education in Africa* and *Education in East Africa,* were recognised not only in missionary but in Government circles as furnishing much needed guidance in regard to the kind of education best suited to Africa. Effective co-operation in education between missions and Government in the British colonies in Africa was furthered by the appointment by the British Secretary of State for the Colonies in 1923 of a permanent Advisory Committee on Native Education in Tropical Africa, and the setting up in most of the colonies of similar advisory bodies on which the missions are represented.

The World War led to the cessation of the work of German missions in most of the territories under the control of the Allied Powers, but in the British Empire in 1925 the restrictions were being relaxed and German missionaries had begun to return to their former fields. In the *World Missionary Atlas* published in March 1925, the numbers of missionaries were given as follows: ordained missionaries from the United States and Canada 3,713; from Great Britain 2,058; from other countries 1,515; laymen, United States and Canada, 1,963; Great Britain 947; other countries 407; unmarried women, United States and Canada, 4,793; Great Britain 2,593; other countries 1,116. It may be interesting to compare the 1925 figures with those for 1907, though these were from another source: the total number of communicant members was 3,614,154 in 1925 as contrasted with 1,817,450 in 1907, while the total Christian community was returned as 8,342,378 as compared with 4,361,138. The total number under instruction in all types of mission schools was 2,440,148 as compared with 1,302,905. The total income of the Protestant missionary societies was given as £14,958,102 (of which the United States contributed £9,736,084 and Great Britain £2,869,353) as compared with £4,473,933 in 1907. The foregoing figures reveal a remarkable increase in the proportionate share of North America in missionary effort.

Roman Catholic Missions.—The figures for Roman Catholic missions for the year 1908 may be compared with those for 1923 published at the Vatican Exhibition, Rome, the earlier ones being shown within parentheses: European priests 8,617 (7,933); native priests 4,095 (5,837); lay helpers 4,018 (5,270); sisters 24,102 (21,320); catechists and teachers 65,641 (catechists 24,524); number of Catholics 12,964,147 (native membership only, 7,441,215); catechumens 1,534,446 (1,517,909); students and children in schools 1,800,000 (906,000); schools 22,358 (24,000); churches and centres 110,932 (71,000). The World War was the cause of a considerable decrease in the number of missionaries, since the various services claimed many of them and a large proportion of these were killed. The possessions of the Allied Powers being closed to German missionaries in the years immediately following the War, the former fields of German societies thus affected were in nearly all cases transferred to other congregations while fresh fields were found for the expelled societies. A regrouping of Roman Catholic missions thus took place on a considerable scale.

An important encyclical (*Maximum illud*) dealing with missionary work was issued by Pope Benedict XV. in 1919, in which extended directions were given for the conduct of missionary work, exaggerated expressions of nationalism were severely condemned, and great emphasis was laid on the importance of developing a native clergy. The first native bishop was to be consecrated in Japan in 1925.

Considerable changes took place in organisation in Europe. The headquarters of the Society for the Propagation of the Faith, the great collecting society of the Roman Catholic Church, were transferred from Lyons to Rome and put expressly under Papal auspices, while its governing body was made fully international. Two other organisations which were established on an international basis under Papal direction are the Society of St. Peter for the training of a native clergy in mission lands and the Missionary Clergy Union, which in 1925 had a membership of 105,000 priests. A notable development after the War was a wider distribution of missionary support among different countries; the pre-eminence of France being no longer so marked as it was. Increased support for missions was forthcoming in Ireland, Holland, Belgium, Switzerland, Spain and Italy, and there was also a revival of missionary interest in Portugal, Bohemia, Hungary and Poland. The financial contributions of the United States grew remarkably and in 1925 exceeded those of any other country, though the number of American missionaries was considerably below that of a good many other countries. Advantage was taken of the presence of many pilgrims in Rome during the Holy Year of 1925 to organise a great missionary exhibition in the grounds of the Vatican. (J. H. O.)

MISSISSIPPI (*see* 18.599).—In 1920 the total population was 1,790,618, being a decrease of 6,496 from the figures for 1910. The negro population was 935,184, or 52% of the total, as compared with 1,009,487, or 56·2% of the total in 1910. The foreign born whites in 1920 numbered 8,019. The density was 38·6 per square mile. The urban population (in places of over 2,500) was 13·4%. The six cities having a population of over 12,000 in 1920, in comparison with the figures of 1910, and their estimated population as on July 1 1925 were:—

	1920	1910	Increase	July 1 1925
			%	Estimate
Meridian	23,399	23,285	0·5	24,312
Jackson	22,817	21,262	7·3	23,698
Vicksburg	18,072	20,814	−13·2	..
Hattiesburg	13,270	11,733	13·1	14,034
Laurel	13,037	8,465	54·0	15,513
Natchez	12,608	11,791	6·9	13,070

Agriculture.—In 1925 the number of farms in the state was 257,228, of which 107,095 were operated by whites and 150,043 by negroes. There was a decrease both in the number of farms and the farm acreage as compared with 1920, when there were 272,101 farms embracing an acreage of 18,196,972. Farm values also declined during the same period, the total value of farm land and buildings being $459,936,535 in 1925 as compared with $789,896,778 in 1920, giving an average value per farm of $1,788 in 1925, and $2,903 in 1920. The average size of the farms also decreased from 66·9 in 1920 to 62·4 in 1925. Cotton continues the most important crop but the acreage of cotton decreased from 2,948,387 in 1919 to 2,936,766 in 1924. The livestock on the farms on Jan. 1 1925 comprised 141,952

horses, 330,080 mules, 938,024 cattle and 729,165 swine, having a total value of $62,858,000.

Manufactures.—The value of the output from factories increased from $79,550,095 in 1914 and $114,083,861 in 1921 to $178,581,729 in 1923, Mississippi then ranking 34th among the states in the value of manufactured products and 32nd in number of wage earners, the latter numbering 64,452. The capital invested in manufactures increased from $81,005,484 in 1914 to $154,117,337 in 1920, and $197,746,987 in 1923. The chief manufactured articles are lumber and timber products, cottonseed oil and cake, cotton goods, turpentine and rosin and fertilisers. The chief manufacturing centres are Meridian, Jackson, Greenville, Columbus, Laurel, Hattiesburg, Natchez and Vicksburg. The mineral production of the state is small, its total value in 1922 being $1,600,393, composed chiefly of clay products, sand and gravel.

Education and Charities.—Higher education is taken care of by the University of Mississippi at Oxford, the Mississippi State College for Women at Columbus and two Agricultural and Mechanical Colleges. State normal schools are situated at Hattiesburg and Cleveland, in addition to which there are 175 public high schools and 6,800 elementary schools. Separate schools are maintained for the white and coloured children. Education is state supported, being free to all and compulsory between the ages of 7 and 16. The most important development in education was the establishment in 1908 of county agricultural high schools. Every county may establish one for white children and one for negroes, or two counties may combine and create one set of schools for the two counties. These schools receive state aid on the basis of the number of boarding pupils. The total amount expended for education during the year 1923–4 was estimated at $17,837,000, including a state appropriation of $8,837,404. An industrial training school for delinquent and abandoned children was established at Columbus in 1916, and there are also schools for the deaf and dumb and for the blind at Jackson.

Administration and Legislation.—The constitution of 1890, enacted to ensure white supremacy, has been amended with the object of putting the government more within the direct control of the people. In 1916 the initiative and referendum were adopted by an amendment under which an initiative petition must be supported by 7,500 qualified electors, and a referendum petition by 6,000. Any law bill resolution, constitutional amendment or any other legislative measure is a proper subject for such petition. The judiciary consists of the Supreme Court of six judges elected for eight years and circuit and chancery judges elected for four years. A majority of nine jurors may return a verdict in all civil cases in the circuit and chancery courts. The Legislature is elected for four years and meets in regular session biennially. All financial appropriations are made for two years.

The Torrens System of registration of land titles has been in force since 1915. In 1914 a state department of banking was created with a board of bank examiners consisting of three members elected for four years. Bank deposits are guaranteed by the state. A very comprehensive child labour law was passed in 1912. Under its provisions no child under 12 may be employed in any mill or factory and no child under 16 may be employed for more than eight hours per day. No employee is permitted to work in any mill or factory more than 10 hours per day. The enforcement of this law is placed in the hands of the county health officer. In 1916 a pardon board of five members appointed by the governor was created for the purpose of advising on all petitions for pardons. All such petitions must be published for 30 days in the county where the crime was committed. The board can act only in an advisory capacity, the governor being free to follow their advice or not as he may deem best. A state highway commission was also appointed in 1916.

Mississippi was the first state to ratify the Eighteenth (prohibition) Amendment, doing so Jan. 8 1918. The Legislature, however, refused to ratify the Nineteenth (woman suffrage) Amendment in 1919, and it took no action on the proposed Twentieth Amendment regarding child labour.

In 1926 the state was represented in the U.S. Senate by Hubert D. Stephens and Pat Harrison. The following have been governors since 1910: Edmund F. Noel (Dem.), 1908–12; Earl Leroy Brewer (Dem.), 1912–6; Theodore G. Bilbo (Dem.), 1916–20; Lee M. Russell (Dem.), 1920–4; Harry L. Whitfield (Dem.), 1924– .

MISSISSIPPI RIVER (*see* 18.604).—The U.S. Govt. continued work on the various engineering projects connected with the Mississippi and its tributaries, the Missouri and Ohio, during the years 1910–26. On the upper Mississippi the reservoirs at the headwaters numbered six, namely Winnibigoshish, Leech, Pokegama, Sandy and Gull lakes and Pine river, which have a combined storage capacity of nearly 95,000,000,000 cubic feet. Between St. Paul and Minneapolis the original plan for two low dams has been changed to one high dam (36 ft.) with provision for water-power development. The project was in 1925 practically completed, and the power development was leased to Henry Ford for a large assembling plant now in operation.

On the main upper Mississippi river the plan is to obtain a six-foot depth by contracting the width by brush and stone wing dams, by closing chutes and by revetting banks where necessary, supplemented by dredging. Special treatment by locks and dams is given to two localities—Rock Island Rapids and Des Moines Rapids. At the former point a lock and lateral canal at Leclaire, Ia., overcomes the fall of the Upper Rapids, and a lock and lateral canal at Moline, Ill., overcomes the fall of the Lower Rapids. The project at this point is practically completed. The open channel through both rapids is still maintained. At Des Moines Rapids (Keokuk) private interests have built a water-power dam, concentrating the entire fall of the former canal and locks into a single lock. The project is completed. There is little navigation on the upper Mississippi, but prospects for revival appear encouraging. On the middle Mississippi between the Missouri and the Ohio, the plan is for six-ft. depth above St. Louis and eight ft. below, obtained by contraction and by closing chutes with permeable pile dikes, and by revetting banks where necessary, supplemented by dredging. In that part of the river below St. Louis there is considerable revival of navigation. On the lower Mississippi river, from the Ohio river to the Passes, the plan is for nine-ft. depth, to be obtained by revetting banks, supplemented by dredging.

In 1917 Congress passed the Flood Control Act providing a certain amount of money to be expended by the Mississippi River Commission for improving the river between Cairo and Head of the Passes, and for flood control between Rock Island and the Passes. In 1923 a second Flood Control Act extended the commission's jurisdiction to all tributaries between Rock Island and the Passes, in so far as they are affected by floods in the Mississippi river. As regards the Passes, or mouths of the river, the plans adopted in 1902 having proved inadequate, additional works were authorised in 1916, which have secured a channel through southwest Pass with a controlling depth of not less than 35 feet. The controlling depth in South Pass is approximately 34 feet.

The Missouri.—On the part of the river above Kansas City there is no definite depth to be attained, the project being simply to remove snags and boulders, leaving the natural depth and width of channel, and to revet the banks at certain localities where encroachment threatens great damage. On this part of the river there was in 1926 little commerce. On the section of the river below Kansas City, there is a definite six-ft. project, adopted by Congress in 1910 and being regularly carried out. Here too there was little navigation, but prospects for revival were encouraging.

The Ohio.—A comprehensive project for canalising the Ohio so as to provide a channel nine ft. deep was adopted by Congress in 1910. Slight modifications have since been authorised. As it stood in 1926, the project provides for 50 locks and dams, all of the movable type, except the one immediately below Pittsburg, Pa., which is a fixed dam, completed in 1921, for the purpose of improving conditions in Pittsburg harbour. Of these dams 42 were completed and in operation, and the other eight were under

construction, with the probability that the project will be entirely completed by 1929. The type of dam, together with the relatively low head, does not lend itself to the development of power on a commercial scale. There is one exception to this general statement, at Louisville where the existing navigation dam is being replaced by a power navigation dam eight ft. higher, thereby creating a head of 37 feet.

The total tonnage shipped *via* the Ohio river in 1924 was 10,867,000 tons of which 54% was coal. Commerce on the river has been increasing steadily, particularly on the completed part and many terminals for handling coal have been constructed. A destructive flood occurred in March 1913, and, on that part of the river between Wheeling and Cincinnati and on the tributaries entering from the north in this reach of the river, higher flood stages were reached than had been recorded prior to that date. The flood was particularly destructive in the Miami valley, and, to guard against a recurrence, extensive flood-control works have since been constructed. (H. T.*)

MISSOURI (*see* 18.607).—Since 1910 Missouri continued her transition from the period of frontier influences, of rapid growth of population and development of natural resources, to the stage of industrial development and growth of urban population. In 1925, however, the interests of the state were still primarily agricultural. The total population in 1920 was 3,404,055 as compared with 3,293,335 in 1910, an increase of 110,720, or 3·4%. The percentage of urban population (in centres of 2,500 or more) increased from 42·5% in 1910 to 46·6% in 1920. The total population in 1926 was estimated by the U.S. Bureau of the Census at 3,498,143. Of the total urban population 79·7% in 1920 was in the three cities of St. Louis, Kansas City and St. Joseph. The rural population showed an absolute decrease in both 1910 and 1920. The population of the six chief cities was as follows:—

Cities	1920	1910	Increase %	Estimate 1925
St. Louis	772,897	687,029	12·5	821,548
Kansas City	324,410	248,381	30·6	367,481
St. Joseph	77,939	77,403	0·7	78,342
Springfield	39,631	35,201	12·6	42,140
Joplin	29,902	32,073	−6·8	
Sedalia	21,144	17,822	18·6	22,745

Agriculture.—In 1924, 32,637,043 ac., or 79·1% of the total area of the state, was in farm lands. The average size of a farm was 125·3 acres. The number of farms operated by owners decreased during 1920–5, from 185,030 to 174,390. In 1919 cereal and hay and forage crops continued to lead. Cotton gained from 96,527 ac. in 1909 to 110,027 ac. in 1919 and 475,729 in 1925. Fruit, primarily apples, continued an important crop. After 1909 the acreage in Indian corn decreased to 5,567,079 ac. in 1919, and 5,479,379 in 1924, while the acreage in wheat decreased from 4,564,990 ac. in 1919 to 1,441,071 ac. in 1924. The total value of all farm crops in 1924 was $351,017,000. Indian corn was valued at $163,768,000, wheat at $32,756,000 and oats at $21,290,000. Increasing progress is ensured by the extensive drainage operation in the southeast, and by the increased interests in improved farming methods and in co-operative organisations. The Agricultural College of the state university in co-operation with the Federal Govt. has been very active in agricultural extension work; on Jan. 1 1926 farm-agent work was established in 64 counties. On Jan 1 1925 there were on the farms 714,154 horses, 390,046 mules, 1,657,682 beef cattle, 788,311 dairy cattle, 1,181,000 sheep and 3,584,399 swine.

Mines and Quarries.—The slight increase from 1909 to 1919 in the value of these products of only 5·4% to a total of $33,365,694 was due largely to the post-War depression of the latter year, when it was little more than one-third of the production of 1917, the peak of the War-time stimulation. Lead and zinc continued to be the leading products, of a value of $15,879,177 in 1919, giving Missouri second rank among the states in its production. She ranked third in clay products, with a value of $1,420,585, and second in barytes ($527,817). The other important products were coal ($12,077,845) and limestone ($2,355,736). Since 1923 there has been a marked recovery both in amount produced and in value of mine and quarry products, especially in lead and zinc.

Manufactures.—In 1921 the total value of manufactured products was $1,162,006,299, whereas in 1923 the figures were $1,547,167,429, representing an increase of 33·1%. Sixteen industries in 1923 had a product valued at more than $30,000,000 each. Slaughtering and meat-packing continued to furnish the largest single item—$152,916,678 of the total; motor vehicles were second with $137,447,034; boots and shoes third with $121,830,354. Other important industries were foundries and machine shops $44,086,595, railway cars $38,191,307 and bread and bakery products $40,888,216. The two cities of St. Louis and Kansas City gave employment to over half the wage-earners and produced two-thirds of the total values of the state, St. Louis contributing over half the latter item.

Government.—The movements to adjust the conservative constitution of 1875 to the problems of a modern state were the chief developments. Of 42 constitutional amendments submitted 1910–8, only one, permitting pensions for the blind, was adopted. The opposition to state prohibition (defeated in 1910, 1916 and 1918), and to the single tax (defeated in 1912 and 1918), contributed to the distrust of all amendments. But in 1920 nine amendments out of 13 proposed were adopted, including a provision for a constitutional convention; in 1921 all the three proposed, including the soldier bonus of $15,000,000, in 1922 two out of three, and in 1924 one of four, were adopted.

The executive department was expanded by legislation by the creation of a Food and Drug Commissioner, 1909, a Public Service Commission, 1913, a State Highway Dept., 1917 and a Tax Commission, 1917. The Public Service Commission with real powers of regulation marked a departure from the earlier Missouri practice of leaving the regulation of public utilities to local city boards. Consolidation of executive departments, urged by Gov. Hadley and begun in 1917, was enacted on a comprehensive scale, including a Budget Dept. in 1921, but all the laws were defeated by referendum in 1922.

Constitutional Convention.—The Convention, approved by popular vote in 1921, and elected on a bi-partisan basis in 1922, was in session 266 days between May 15 1922 and Oct. 5 1923. It formulated and submitted to a special election on Feb. 26 1924, 21 constitutional amendments, embodying a comprehensive revision of the constitution. All the more important proposals were rejected by the people. Of the seven amendments adopted, all but one dealt with very minor or special problems. This one was a revision of the Article on the Legislative Dept.; the main changes were the division of the state into senatorial districts by the governor, secretary of state, attorney-general, auditor and treasurer, instead of by the General Assembly; increase of pay of state legislators; authorisation of the pensioning of mothers, and (by cities) of disabled firemen and policemen, and of a workingmen's compensation law. Missouri ratified the Sixteenth Amendment to the Federal Constitution (income tax) in 1909, the Seventeenth (direct election of U.S. Senators) in 1911, the Eighteenth (Prohibition) and the Nineteenth (woman suffrage) in 1919. Missouri remained conservative in social legislation; and a workmen's compensation law in 1920 and 1921 was defeated by the referendum. It was again defeated when proposed by the initiative in 1924. A fairly comprehensive but very moderate Act was passed in 1913 for the health and safety of employees, including limitation of hours for women. The compulsory school-attendance law of 1919 incidentally limited child labour.

Revenue.—The revenue, inelastic through constitutional limitations, proved increasingly inadequate after 1910, until the unpaid current obligations in 1917 totalled over $2,000,000. Attempts to secure relief for special purposes such as schools and good roads by constitutional amendments had all failed. The Assembly of 1917 passed new indirect taxes, a state income tax, a corporation franchise tax, a direct inheritance tax, "soft" drinks stamps and wholesale liquor dealers' licences, which yielded together nearly $2,400,000 in 1917–9. To secure

greater uniformity in taxation and increased revenue the basis of assessed valuation was raised in 1921 to a (nominal) 100% of actual value.

Education.—Missouri appropriates one-third of the general revenue to the support of public schools, amounting to $1,618,341 in 1910 and $3,219,163.35 in 1925. To this must be added $187,040, the interest on the state's common school fund of $3,159,000. The estimated total expenditure for public schools from state and local sources rose (1910–25) from $13,905,188 to $48,760,059. The permanent county, municipal and township school funds increased from $9,825,991 in 1910 to $12,720,879 in 1925. The average daily attendance at the public schools rose from 490,374 in 1910 to 595,305 in 1925. Although the public schools continued to lack sufficient revenue, there was much constructive legislation, especially as to the rural schools. Additional aid was given to rural schools (1909, 1911, 1915) and to high schools (1913) in the poorer districts. The requirements for teachers' certificates was raised in 1911 and 1921, and provision made for the training of teachers in the high school (1913). An effective compulsory attendance law was passed in 1919. The enrolment in the state university at Columbia and Rolla increased from 3,083 (165 at the School of Mines at Rolla) in 1911 to 5,604 (506 at Rolla) in 1925. An Extension Division was organised in 1913; and a School of Commerce in 1914, which was expanded in 1916 to include Public Administration.

Roads.—The state highway system dates from the Hawes Act (1917), passed to take advantage of Federal aid, and the Centennial Road Act (1921). The latter outlined the system and provided for the expenditure of a $60,000,000 bond issue approved by popular vote in 1920. Automobile fees (1922) and a gasolene tax (1924) provided additional funds. Of the total mileage of 7,640 projected, on Jan. 1 1926, 33% had been hard-surfaced and 57½% graded preparatory to surfacing. The work completed represents an expenditure of $73,540,686.

History.—Gov. Hadley was a leading supporter of Roosevelt for the Republican nomination in 1912, though supporting Taft in the election. Wilson that year received 330,746 votes, Taft 207,821, Roosevelt 124,371. In 1916 Wilson defeated Hughes by 28,693, but the Democratic candidate for governor defeated the Republican by only 2,263. In 1918, however, Folk, the Democratic candidate for U.S. Senator, ran 35,283 behind Spencer (Rep.). The disorganisation in the local Democratic party was increased by the opposition of Senator Reed to the League of Nations and, with the general national reaction, resulted in 1920 in the election of a Republican state administration and a Republican majority in both Houses of the Assembly for the first time since 1870, and in a presidential majority for Harding over Cox of 152,363. Senator Reed (Dem.) was re-elected in 1922, but in the presidential election of 1924 Coolidge defeated Davis by 75,733, and Baker defeated his Democratic rival for the governorship by 5,872.

Recent governors have been Herbert S. Hadley (Rep.), 1909–13; Elliot W. Major (Dem.), 1913–7; Frederic D. Gardner (Dem.), 1917–21; Arthur M. Hyde (Rep.), 1921–5; Sam A. Baker (Rep.), 1925– (J. Vi.)

MISSOURI RIVER: *see* MISSISSIPPI RIVER.

MISTRAL, FRÉDÉRIC (1830–1914), Provençal poet (*see* 18.616), in 1906 published a Provençal translation of *Genesis* and *Olivades* in 1912, a collection of Provençal poems. His memoirs appeared, under the title *Mes Origines*, in 1906. He died at Maillane, near Marseilles, March 25 1914.

See P. Brousse, *Frédéric Mistral* (1903); E. Lefèvre, *Bibliographie mistralienne* (1903); H. J. Boeken, *Frédéric Mistral* (1910); J. Brochet, *Frédéric Mistral* (1910); J. Charles-Roux, *Le jubilé de Fr. Mistral* (1912); E. Ripert, *La versification de Frédéric Mistral* (1917); P. Lasserre, *Frédéric Mistral* (1918); J. Vincent, *Frédéric Mistral: sa vie et son influence* (1918).

MITCHELL, PETER CHALMERS (1864–), British zoologist, was born at Dunfermline Nov. 23 1864, and was educated at Aberdeen University, Christ Church, Oxford and at Berlin and Leipzig. From 1888–91 he was university demonstrator in comparative anatomy at Oxford, and for the next two years was organising secretary for technical instruction to the Oxfordshire County Council. He subsequently occupied posts as lecturer in biology at Charing Cross Hospital and at the London Hospital, and was in 1903 appointed secretary to the Zoological Society of London. He also did much useful work as a member of the committees on fishery investigations and on sleeping sickness. During the World War he was attached to the Imperial General Staff and in 1918 acted as liaison officer to the War Office and to the British War Mission. He was elected F.R.S. in 1906. His publications include *Outlines of Biology* (1894), *The Biological Problem of To-day* (1896), *Thomas Henry Huxley* (1900), *The Nature of Man* (1904), *The Childhood of Animals* (1912), *Evolution and the War* (1915) and various scientific memoirs in *The Anatomical Journal, The Quarterly Journal of Microscopical Science,* etc.

MITCHELL, SILAS WEIR (1830–1914), American physician and author (*see* 18.618), died in Philadelphia, Pa., Jan. 4 1914. After 1910 he published *John Sherwood, Iron Master* (1911), *Westways* (1913) and *Complete Poems* (1914).

MODERNISM: *see* FUNDAMENTALISM.

MODJESKI, RALPH (1861–), American engineer, was born at Cracow, Poland, Jan 27 1861, his mother being the actress, Helena Modjeska. He graduated at the École des Ponts et Chaussées, Paris, with high honours, and settled in the United States. From 1892 he practised as consulting bridge engineer at Chicago and as a designer and builder of bridges he did distinguished work. Among his best known bridges are the Govt. bridge over the Mississippi at Rock Island; the McKinley bridge at St. Louis; the bridges over the Mississippi at Thebes, Ill., and at Memphis, Tenn.; the Northern Pacific bridge over the Missouri at Bismarck, N.D.; also bridges over the Columbia and Willamette rivers in Oregon. He was a member of the Quebec Bridge Commission, and consulting engineer for the Ohio river bridge at Metropolis, Ill., for the Chicago, Burlington and Quincy Railroad, and the Thames river bridge at New Haven, Conn., for the New York, New Haven and Hartford Railroad. He was chosen chief engineer and chairman of the board of engineers on the Philadelphia-Camden bridge over the Delaware river, which, on its completion, in 1926, was the longest suspension bridge in the world.

MOHAMMEDANISM: *see* CALIPHATE; MAHOMMEDANISM; PAN-ISLAMISM.

MOHN, HENRIK (1835–1916), Norwegian meteorologist, was born at Bergen May 15 1835, and was educated at the Cathedral School in that town and at the University of Christiania (Oslo). In 1861 he became observer at Christiania University, where in 1866 he was elected professor of meteorology and from 1866–1913 was director of the Norwegian meteorological institute which he had been largely instrumental in founding. He carried out much valuable meteorological work, collaborating in 1876–8 with the mathematician Guldberg in a study of the dynamics of the atmosphere and subsequently extending his investigations to the subject of storms, the meteorology and oceanography of the northern Atlantic, the climate of Norway, and use of the hypsometer. Mohn also worked out and published the meteorological observations of various polar expeditions, including those of Nansen and Amundsen. He died at Christiania Sept. 12 1916.

MOLESWORTH, MARY LOUISA (1839–1921), British writer (*see* 18.660), died in London July 20 1921.

MOLNÁR, FERENCZ (1878–), Hungarian dramatist, was born Jan. 12 1878 in Budapest. After studying in that city and at Geneva, he entered journalism and attracted notice by writing short stories, novels and some brilliant farces. His best novel is *The Pál-street Boys* in which child life is portrayed with much humour and power of characterisation. His chief *métier*, however, was the drama. His first successful play, *The Devil* (1907), was exported and, produced in Turin by Zacconi, led to a great demand abroad for modern Hungarian plays. The principal features of Molnár's dramatic works are a keen romantic sense of composition, brilliant technique and a witty and satirical representation of humble life. During the World

War Molnár was a prominent war correspondent of the Central Powers. His plays include *Liliom* (1910); *The Lifeguardsman* (1911); *Carneval* (1917).

MOLTKE, HELMUTH VON (1848–1916), German soldier, was born in Gersdorf, Mecklenburg, May 23 1848, being the nephew of the famous Count von Moltke (*see* 18.677). From 1902 to 1904 he commanded the 1st Div. of the Guards Corps and in 1906 became chief of the general staff of the army. At the beginning of the World War he was the principal director of the German operations, and it is now known that his plans were based principally on the teachings of his predecessor, General von Schlieffen. His modifications of the latter's plans seem to have been, on the whole, unwise, and on him has been placed the responsibility for the German defeat at the battle of the Marne. On Nov. 3 1914 his health being seriously impaired, he was relieved of his post to make way for General von Falkenhayn and was appointed chief of the home general staff in Berlin. He died suddenly, during a function in the Reichstag building, Berlin, June 18 1916. The following works by him were published after his death: *Erinnerungen, Briefe, Dokumente, 1877–1916* (1922), *Aufzeichnungen, Briefe, Schriften, Reden* (1923).

MOMBASA (*see* 18.682), the chief port of Kenya Colony, East Africa, had a population (1921) of 36,846, of whom 656 were Europeans and 7,574 British Indians. In 1924 the population had increased to 42,000 (821 Europeans). Mombasa harbour takes vessels up to 30 ft. draft, but is used mainly by coasting steamers and dhows; the principal harbour is Kilindini, at the southwest end of Mombasa island.

Spacious and land-locked Kilindini accommodates vessels of any size and takes all the traffic of the Uganda railway. A deep-water wharf with two berths provided with all facilities for loading and unloading, built by the Government at a cost of over £1,000,000, was completed in 1926. Much of the cargo had still, however, to be handled by lighters and the administration acquired large areas for development purposes. Steamers entering Kilindini in 1924 numbered 372 (226 British); over 1,400 sailing vessels, mostly Arab dhows, entered Mombasa harbour. See *The East African Red Book* (Nairobi, 1925).

MONACO (*see* 18.684), had a population in 1913 of 22,956. In 1911 Prince Albert of Monaco granted the principality a constitution, providing for a national council of 21 members, elected for four years by universal suffrage and *scrutin de liste*. Government is in the hands of a Ministry assisted by a council of state, acting under the authority of the prince; and legislative power rests with the prince and the national council. The territory of Monaco, which has an area of 8 sq. m., is divided into three communes: Monaco, La Condamine and Monte Carlo, each of which is administered by a municipal authority. On June 26 1922 Prince Louis II. (b. 1870) succeeded his father, Albert, as Prince of Monaco.

The principality exports olive oil, citrons, oranges and perfumes, importing in exchange coal and wine. The principal part of its revenue still comes, however, from the gaming tables. In 1917 £80,000 was paid to the Govt. by the concessionaires; and a scale was arranged providing for the payment of £90,000 in 1927 and £100,000 in 1937.

MONASH, SIR JOHN (1865–), Australian soldier, was born in Melbourne June 27 1865, and educated at Scotch College and Melbourne University. He graduated in arts, engineering and law, and became a successful engineer. He was also interested, as a volunteer, in military work, and at the outbreak of the World War held the rank of colonel. He went to the front in command of the 4th Bde. of the A.I.F.; took part in the landing at Gallipoli on April 25 1915, being thrice mentioned in dispatches; and after the evacuation on Dec. 19 1915, served in the Suez Canal zone till April 1916. He was then given a brigade in France and commanded the 3rd Div. which fought at Messines and Passchendaele. In May 1918 he succeeded Sir William Birdwood as commander of the Australian Army Corps. Although not a professional soldier, he showed a thorough grasp of the principles of the new warfare, and by his brilliant leadership materially contributed to the failure and final collapse of the German offensive of 1918. This campaign he lucidly described in *The Australian Victoriesin France, 1918*. He was made K.C.B. in 1918 and after the War became manager of Victoria's Morwell electricity scheme.

MOND, SIR ALFRED MORITZ (1868–), British politician, was born at Farnworth, near Widnes, Lancs., Oct. 23 1868, the son of the famous chemist Ludwig Mond (*see* 18.693). He was educated at Cheltenham and St. John's College, Cambridge, and afterwards at Edinburgh University. In 1894 he was called to the Bar, and afterwards joined the North Wales and Chester circuit. He entered the firm of Brunner, Mond and Co., becoming a director in 1895, and also became chairman of the Mond Nickel Co. and a director of the South Staffordshire Mond Gas Co. and various other companies. He was elected to Parliament in 1906 as Liberal member for Chester, losing his seat in 1910, but the same year was elected for Swansea and created a baronet. In 1913 he was sworn of the privy council. On the formation of Mr. Lloyd George's Ministry in 1916 Sir Alfred Mond became First Commissioner of Works, and in 1921 Minister of Health. He lost his seat at the general election of 1923, but was returned for Carmarthen in Oct. 1924. In Jan. 1926, owing to his profound disagreement with the principles embodied in Mr. Lloyd George's land policy, Sir Alfred Mond seceded from the Liberal party and declared his intention of transferring his allegiance to the Conservative party. He published many articles on the alkali trade in scientific and economic journals, besides a volume of essays, *Questions of To-day and To-morrow* (1912).

MONEY MARKET (*see* 17.732).—In no direction were the effects of the World War more striking or far reaching than in the London money market: the great increase in banking deposits, partly as the result of inflation, was but one of the many effects produced by the War upon its dimensions, machinery and general status. Even at the end of 1925 the market was still in a transition state, though in such matters as the size of the floating debt and the value of sterling as related to New York currency there were not wanting signs of a return to more normal conditions.

It has always been regarded as an essential point in the London money market that the Bank of England, while constituting the centre and pivot of the system, should remain a private and independent central institution without State control. In principle, that position was still maintained in 1925, but there were many influences operating during the War which at times made the distinction between a state bank and a private central bank somewhat difficult to determine. The introduction of currency notes, the great size of the floating debt, the growth in the National Debt, and, not least, the fact that shortly after the outbreak of war the State, through the Bank of England, discounted practically all foreign commercial bills in Lombard Street "without recourse," were all developments tending in that direction, as leading to a domination of the money market by the State owing to the magnitude of its financial operations. Some idea of the closeness of relations between the State and the Bank during the War and post-War periods may be gathered from the fact that on more than one occasion the Chancellor of the Exchequer was asked questions in Parliament relating to Bank Rate policy, as though that policy had been inspired by the Government rather than by the Bank Court. On each occasion the Chancellor very definitely disclaimed such responsibility, but it was none the less recognised that of necessity the connection between the Treasury and the Bank of England was more intimate than it had been before 1914.

Following the virtual disappearance of the commercial bill during the war period came the huge flotations of Government Treasury Bills. The effect of this was to make Government operations still further dominate the course of the money market at the expense of the normal power of the Bank of England. The potential power to create credit through borrowings on "Ways and Means" was among the factors which, during the War, gave the Government almost complete control over the money market, and which in the post-War period greatly retarded its return to normal conditions. The *de facto* abandonment

of the gold standard at the beginning of the War and the unrestricted issue of currency notes were further circumstances materially affecting the London money market, particularly the power of the Bank to exert its normal control over the situation through movements in Bank Rate. With the inflation of the currency the Bank Rate lost its power to attract gold, and the exchanges fluctuated widely.

Market Conditions.—While no actual change took place during the period 1910 to 1925 in the general construction of the money market, and while the Bank of England continued to be the pivot of the monetary system, there were many important respects in which the money market was still abnormal at the end of 1925. In at least three important respects money market conditions were wholly abnormal when compared with the pre-War period. In the first place, the volume of commercial bills in Lombard Street was small as compared with the pre-War period. This was only partly due to trade depression, for the disarrangement of international credit machinery by the War, the fact that for many years international commercial transactions were conducted more or less on a cash basis, and, in smaller measure, the growth of the New York money market, were also responsible.

In the second place, there existed an outstanding volume of Treasury Bills to the amount of about £635,000,000 as compared with a standing total in the pre-War days of under £20,000,000. This huge volume of Government floating debt, together with the annual service of the National Debt, which approached £400,000,000 (including the sinking fund) as compared with the pre-War figures of about £23,000,000 and the greatly increased national expenditure, which was about £800,000,000 as compared with £200,000,000 previous to the War, exercised a dominating influence upon the course of the money market. This, in its turn, brought the State and the Bank of England into still closer relation, and heavy borrowing by the Government at certain periods of the year to pay interest on debt increased the difficulty of making the Bank Rate effective. In the third place, although Great Britain had returned to the gold standard, there was, in addition to the Bank of England note circulation regulated by the Act of 1844, a Government currency note issue to the extent of about £300,000,000, of which only a small part was covered by Bank of England notes, which exercised a disturbing influence upon the normal relations between the Bank of England and the outside money market.

The Position of London

Previous to the War London held unchallenged the position both of the leading monetary centre and of the world's banker. Three-fourths of international bills of exchange were drawn upon London, but, by reason of Britain's wealth and the supremacy of her banking system, London was the centre in which foreign countries raised their permanent loans. As a result of the War these conditions were greatly modified, and for the time being America may be said to have challenged London's position of chief lender to foreign countries. During the War dealings in bills of exchange were almost suspended, international transactions being effected on a cash basis through the foreign exchanges, and, with New York as the one free gold centre during the War, there was a tendency for international transactions to take dollar rather than sterling form. Also, by reason of the favourable trade balance obtained during the War years, her gold accumulations and her improved banking system, the United States not only became independent of banking aid from London, but, with the return to more normal conditions after the War, became the country with the largest margin of surplus resources available for foreign investment.

Nevertheless, it was the London money market which took the lead, under the auspices of the League of Nations, in financing the reconstruction of certain of the Central European States. With a view to maintaining the level of sterling exchange, however, a semi-official restriction was placed for a period upon British loans to foreign countries, and it was not until the end of 1925 that the embargo on foreign loans was completely removed. It was, however, more in the direction of long-dated loans than in general money market facilities that relations between London and other centres were temporarily modified; and, while there was a great reduction in bills of exchange dealt in in Lombard street, foreign exchange dealings, which assumed colossal dimensions in the post-War period, tended to centre in London.

Relations with other Money Markets.—A further circumstance, however, which materially affected the relations of the London money market with other centres, and more especially with European centres, was the chaotic condition in many of the European countries after the War. This naturally disturbed the whole international credit system throughout Europe, of which London may be said to have been the centre. Not only, however, were there indications at the end of 1925 of an increase in the general volume of European international trade, but it was also clear that the London money market was holding its old premier position in financing such operations. It should also be noted that, in unison with New York, London was responsible for reconstructing and setting in motion once again the banking and financial machinery at other European centres, notably in Germany and Austria.

Results of the World War

In considering the conditions under which the money market was working after the end of the World War, the changed economic position of Great Britain in relation to other nations, and especially in relation to the United States, must be borne in mind. With a large visible adverse trade balance, with huge gold accumulations in the United States, with an improved banking system in America as compared with the pre-War period, and with America as a large lender to other countries, it had yet to be demonstrated how far and how quickly the London money market would be able to resume its position, not only as the leading monetary centre but as the centre most able to control the foreign exchanges by movements in the Bank Rate. Viewed from the standpoint of actual figures as measured by the wealth of America and of Great Britain, and measured also by the general movements of trade, the task seemed to be an impossible one. Measured, however, by the actual progress made by Great Britain during the post-War period, in spite of the enormous strain suffered, the problem wore a more hopeful aspect. Great Britain is still in the position of one of the largest, if not the largest, holders of foreign securities, while her shipping and financial activities contribute powerfully to her invisible exports. By general consent a great step forward towards a return to normal conditions in the money market was achieved by the return to the gold standard in 1925; but much depended upon whether, in addition to the activities of the London money market and Lombard street, the industrial activities of the country were so organised and arranged as to enable Great Britain to hold the position in international trade which she had occupied before the War and upon which the prosperity of the money market was largely based.

The Discount Houses.—The discount houses and the bill brokers remained a very important part of the money market, though their business, especially as regards the discount houses themselves, was somewhat less strictly confined to bills even before the outbreak of the World War. The deposit business of the discount houses grew materially in the post-War years, and in the matter of fixed deposits they competed somewhat keenly with the banks, upon whom, however, they were still largely dependent for regular weekly loans. During the period of the War, and as a consequence of the virtual disappearance of the ordinary commercial and bank bills, the business of the discount houses and bill brokers may be said to have been confined to Treasury Bills, and, owing to that fact and the abandonment for some years of the gold standard the expert knowledge both of bills and of international financial conditions was probably less required than at any time in the history of the London money market. With the gradual diminution of the volume of Treasury Bills, the growth in the supply of commercial bills and

the return to the gold standard, the need for this expert knowledge reasserted itself, and there was little doubt that in the future the discount market would continue to exercise its old and important functions in the London money market. This, indeed, was the more probable by reason of the fact that, in spite of the improvement in the banking system in the United States, the discount market at New York had not assumed any great importance.

Meanwhile, however, owing to the fact that the growth in the volume of commercial bills had not been commensurate with the decline in the supply of Treasury Bills, the London discount market earned no small amount of its profits by jobbing in short-term Government securities on the Stock Exchange. Moreover, the fact that the joint stock banks during 1924 and 1925 charged the bill market for weekly loans at a level of 1% below Bank Rate, whereas for many years the custom was to make the charge 1½% below Bank Rate, somewhat adversely affected the discount houses and bill brokers. In one respect, conditions in the discount market had not altered greatly from the pre-War period, namely in the dependence of the market, and especially of the bill brokers, upon the Bank of England for assistance at the end of each half-year. On these occasions the joint stock banks call in heavily their short loans from the discount market, and, in connection with what has been described as half-yearly window dressing in the shape of the half-yearly and annual balance sheets, it has become customary for the discount market to have to borrow from the Bank of England during the closing days of each half-year something like £30,000,000. The loans are usually for a period of a week to 10 days, and are almost invariably repaid within the prescribed period (*see* also BANKING; CURRENCY; STOCK EXCHANGE).

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MONGOLIA (*see* 18.711).—In inner Mongolia the most important political development is the Japanese claim to the eastern section as part of her sphere of influence. The history of Outer Mongolia, however, has been extremely chequered. In the main, there have been, as for a number of years past, three factors at work: Mongol restlessness under foreign control, and China and Russia. Both of the latter, no matter what their Government, have persisted in an ambition to control the country.

At the time of the revolution in China, in 1911, there was a growing unrest among the Mongol princes against San-to, the Manchu Amban at Urga, for the latter had adopted a vigorous policy of resisting Russian influence and of increasing the power of China through the promotion of Chinese immigration and trade and the strengthening of Chinese garrisons. The Mongol princes therefore took advantage of the disorder occasioned in China by the overthrow of the monarchy to oust the Amban and his subordinate (Dec. 1911), to declare their independence, and to set up the Urga Hutukhtu (Living Buddha) as their ruler. This gave Russia her opportunity, and on Nov. 3 1912 an agreement was signed between the Tsar's Govt. and that in Urga, whereby the former pledged its assistance in maintaining the independence of the latter, and the privileges of Russians in Mongolia were confirmed and extended. China naturally was dissatisfied with this arrangement, and negotiations followed between China and Russia. These resulted, Nov. 5 1913, in an exchange of notes whereby China recognised Mongolian autonomy and Russia recognised Chinese suzerainty over Mongolia. On June 7 1915, after nine months of negotiations, there was signed at Kiakhta a tripartite agreement between Russia, China and the Urga Government. By the terms of this agreement Chinese suzerainty was to be represented at Urga by a resident-general with deputies at three other places, but Outer Mongolia was to remain autonomous under the virtual protectorate of Russia.

Upon the collapse of the old régime in Russia the Chinese took steps to increase their power in Mongolia, and in 1919 Hsu Shu-tseng (" Little Hsu," assassinated Dec. 1925) was appointed " Defence Commissioner." He arrived in Urga in Oct. 1919, and within a few weeks coerced the Mongols into a cancellation of their autonomy. The tyranny of his rule, however, created unrest. Hsu lost his position after the overthrow at Peking of the clique to which he belonged, the Anfu Club, in the summer of 1920, but the feeling against the Chinese continued, and after one unsuccessful attempt in Oct. 1920 Baron Ungern von Sternberg, leading a force made up of several nationalities and professing bitter antagonism to the " Reds " of Russia, early in Feb. 1921 drove the Chinese out of Urga. The Living Buddha now returned to Urga, and an independent Mongol Govt. was proclaimed with the Hutukhtu as ruler and Ungern as chief military adviser. Ungern, who was probably mentally unbalanced, was extremely cruel to his enemies, and it is not surprising that he was defeated by Red forces, suffered from a revolt of his troops, was captured by Mongols (Aug. 1921) and executed by the Soviet authorities. Red troops now organised a government at Urga, and although the Living Buddha (died May 20 1924) was acknowledged as spiritual chief, and Russia technically recognised the new government as independent, Soviet troops remained in Urga. A treaty of Nov. 5 1921 provided for Russian influence. The Chinese naturally objected to this renewal of Mongolian independence under Russian " protection," and the situation became an obstacle in the negotiations between China and the Soviet Government. In the agreement between China and Russia, signed May 31 1924, Russia recognised Outer Mongolia as an integral part of China and agreed to withdraw her troops. In 1925 the Soviet Govt. announced that the withdrawal had been completed, but the influence of Russia was still far greater than that of China. (*See* CHINA.)

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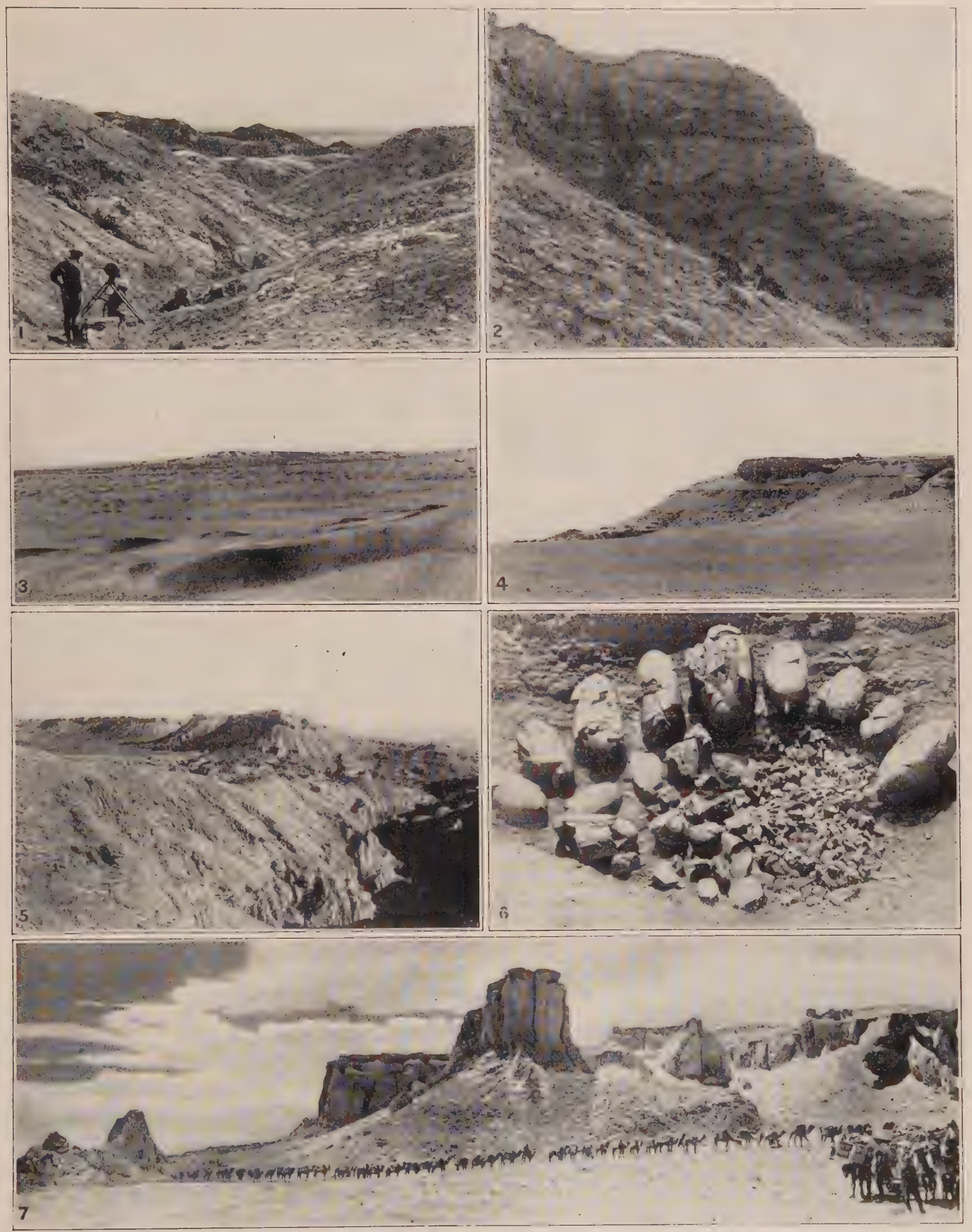
MONGOLIA, PALAEONTOLOGIC DISCOVERIES IN (*see* 20.579).—An important new chapter in palaeontology and geology, in the life history of the earth, has been opened by the discoveries of the Mongolian expeditions of the American Museum of Natural History under the leadership of Roy Chapman Andrews. The most recent discoveries of 1925 reveal Man in three or four culture levels of the Stone Age. During the year 1924 Andrews projected a new five-year expedition, to be known as the Central Asiatic Expeditions of the American Museum of Natural History, adding to the staff a botanist, an archaeologist and three expert topographers. With the full consent of the Mongol officials of the Urga Govt., the Expedition of 1925 completed a survey of outer Mongolia, extending their reconnaissance northwest in the direction of Uliassutai.

Palaeontologic Discoveries, 1922–5.—Central Asia, especially the region east and south of Chinese Turkestan, had long remained the *terra incognita* of geography, geology and palaeontology. In 1900 the present writer predicted that this unknown region, rather than the well-known Asiatic provinces of the south, such as the Siwalik Hills of India explored by Falconer (1831–42), would prove to be the chief centre of mammalian origin and distribution, from which radiated waves of mammalian life to the continents of Europe and of North America. The explorations of the American Museum of Natural History have not only completely verified this prediction but have revealed the central Asiatic plateau as the chief home of the terrestrial dinosaurian reptiles of Cretaceous time. The epicontinental geologic column of Mongolia, heretofore an entire blank, has been largely filled by the geologists Berkey, Morris and Granger during three seasons of explorations, 1922–3 and 1925, and in the remaining three years of the Central Asiatic expeditions the remaining blanks may be successfully filled. The palaeontologic column, as it is known in 1925, is shown in Table I.

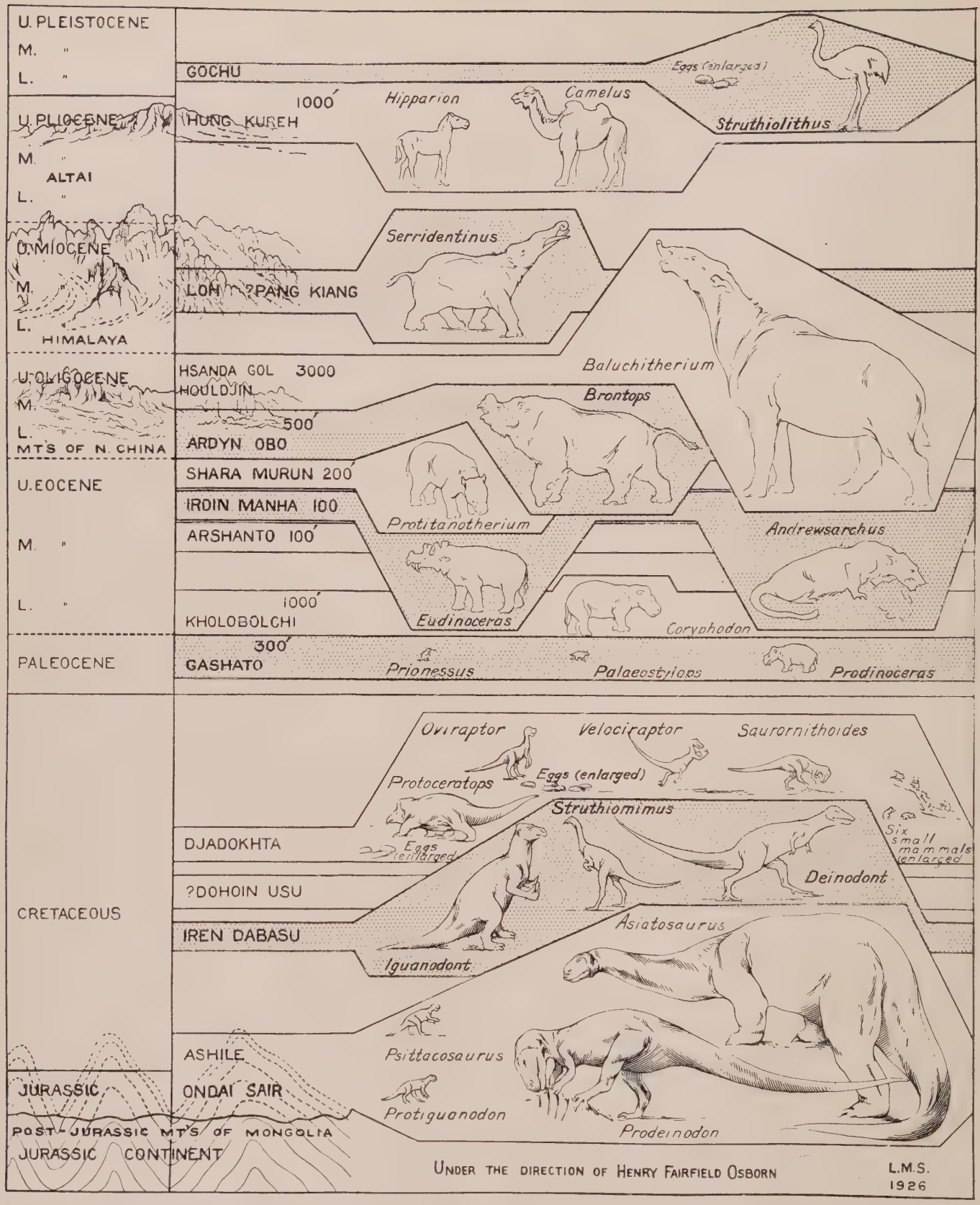
Through these discoveries the Quaternary, the Tertiary and the Cretaceous epicontinental formations, corresponding altogether with the unique " Han-Hai " beds of Richthofen (1877)



CRETACEOUS AND TERTIARY FORMATIONS, GOBI DESERT, AS DISCOVERED BY THE CENTRAL ASIATIC EXPEDITIONS UP TO 1926

FIG. 1. Hsanda Gol formation, Tsagan Nor basin. Altai Mountains in the distance; in the foreground, ravine where skull of the giant *Baluchitherium grangeri* was found. FIG. 2. Ardyn Obo formation of Lower Oligocene age. *Brontops gobiensis* life-zone, on the Uliassutai Trail. FIG. 3. Shara Murun formation, *Protitanotherium mongoliense* life-zone, of Upper Eocene age. Near Ula Usu, on the Uliassutai Trail. FIG. 4. Same as Fig. 2. American Museum camp at the left, at the foot of the escarpment. FIG. 5. Ashile formation, Oshih basin. *Pectinodontosaurus* life-zone of Upper Jurassic age. FIG. 6. Djadokhta formation, *Protoceratops andrewsi* life-zone, of Middle Cretaceous age, where forty nests of fossilised dinosaur eggs were discovered. Eastern Altai Mountains. FIG. 7. The Flaming Cliffs of Shabarakh Usu. Dinosaur beds of the Djadokhta horizon, containing the fossil nests (see Fig. 6 above). Camel transport of the Central Asiatic Expeditions, 1925, in the foreground.

MONGOLIA: Palaeontological Discoveries in



REPTILIAN and MAMMALIAN LIFE SUCCESSION in the GOBI DESERT as discovered by the Central Asiatic Expeditions to the end of the year 1925. Left to right, first column: Four periods of mountain uplift. (1) Post-Jurassic mountains of Mongolia, forming by erosion the chief floor of the present Gobi desert; (2) probable Tertiary uplift of the mountains of northern China bordering the Gobi on the south; (3) Uplift, probably culminating in Miocene time, of the Himalaya Mountains bordering the central Asiatic plateaux on the southwest; (4) Upper Pliocene uplift of the Altai Mountains in the middle of the central Asiatic plateau. Second column: Ten Tertiary formations extending from Lower Pleistocene to Paleocene time, also five Cretaceous formations extending from Middle Cretaceous to Upper Jurassic time. Third column: Animals, reproduced to uniform scale, chiefly characteristic of each formation and life-zone, some of which are represented by complete skeletons, others by skulls, still others by highly characteristic teeth (*e.g.*, the giant sauropod *Asiatosaurus* and the theropod *Prodeinodon*).

TABLE I. *Stone Age, Tertiary and Cretaceous Formations of Mongolia*
In Descending Order

Regions	Formations and Thickness Estimated in Feet		Probable or Estimated Geologic Age	Human Culture, Mammal and Reptile Life-zones
Altai piedmont	Shabarakh Usu	50′+	Upper Palaeolithic	?Azilian-Campignian
Altai piedmont	Orok Nor	5′–40′	Middle Palaeolithic Lower Palaeolithic	?Aurignacian-Mousterian ?Acheulean or ?Eolithic
Orok Nor Basin	Khunuk	27′–120′	Lower Pleistocene	*?Equus. ?Mastodon*
Tsagan Nor Basin	Tsagan Nuru Gochu	50′± 1000′±	Lower Pleistocene	*?Equus.* ?Struthiolithus
Eastern Altai Mts.	Hung Kureh	1000′±	Upper Pliocene to Lower Pleistocene	*Hipparion. Camelus* zone
Iren Dabasu Basin	Pang Kiang	500′	?Miocene; age doubtful	Rodents. *?Ochotona*
Eastern Altai Mts.	Loh	100′–1000′	Middle Miocene	Mastodon (*Serridentinus*) zone
Eastern Altai Mts.	Hsanda Gol	3000′	Middle to Upper Oligocene	*Baluchitherium grangeri* zone
Iren Dabasu Basin	Houldjin	30′–50′	Middle to Upper Oligocene	*Baluchitherium grangeri* zone
Orok Nor Basin	Elegen	0′–200′	?Middle to Upper Oligocene	?Mammals undetermined
Uliassutai trail	Baron Sog	5′–30′	?Middle Oligocene	?Large titanotheres
Uliassutai trail	Ulan Gochu	2′–60′	?Lower Oligocene	?Large titanotheres
Uliassutai trail	Ardyn Obo	500′	?Lower Oligocene	*Brontops gobiensis* zone
Uliassutai trail	Shara Murun	200′±	Summit of Eocene	*Protitanotherium mongoliense* zone *Amynodon mongoliensis*
Shara Murun Basin	Tukhum	50′+	Upper Eocene	?Titanotheres
Iren Dabasu Basin	Irdin Manha	?100′	Upper Eocene	Eudinoceras, *Andrewsarchus* zone
Iren Dabasu Basin	Arshanto	40′–100′	?Middle Eocene	Lophiodonts, *Schlosseria* zone
Kholobolchi Nor Basin	Kholobolchi	1000′±	?Lower Eocene	*Coryphodon* zone
Eastern Altai Mts.	Gashato	300′	Basal Eocene (Paleocene)	*Prodinoceras* zone, *Palaeostylops*
Eastern Altai Mts.	Djadokhta	500′	Middle Cretaceous	*Protoceratops Andrewsi* zone
N. E. of Shabarakh Usu	Dohoin Usu	200′±		*Dinosauria, Crocodilia, Chelonia* ?zone
Iren Dabasu Basin	Iren Dabasu	180′	Lower Cretaceous ?Wealden	*Iguanodont. Ornithomimidae*
Oshih Basin	Ashile	2000′	Upper Jurassic	*Psittacosaurus* zone *Asiatosaurus* *Prodeinodon*
Tsagan Nor Basin	Ondai Sair	500′	Upper Jurassic	*Protiguanodon* zone

and the " Gobi Series " of Obruchev (1892–1909), have been subdivided by the American Museum party into from 15 to 23 distinct geologic formations more or less rich in animal life, connected with either Western Europe or North America, the Tertiary with a total estimated thickness of from 6,500 to 9,000 ft. and the Cretaceous with an estimated thickness of 3,380 ft., as shown in Table I. This table includes results up to the end of the season of 1925, in which the most welcome discovery was abundant evidence of the Stone Age in Mongolia, below the Iron, Bronze and the Neolithic, namely, culture levels of Upper Palaeolithic (?Azilian-Campignian), of Middle Palaeolithic (?Mousterian) and of Lower Palaeolithic (?Acheulean) time. No

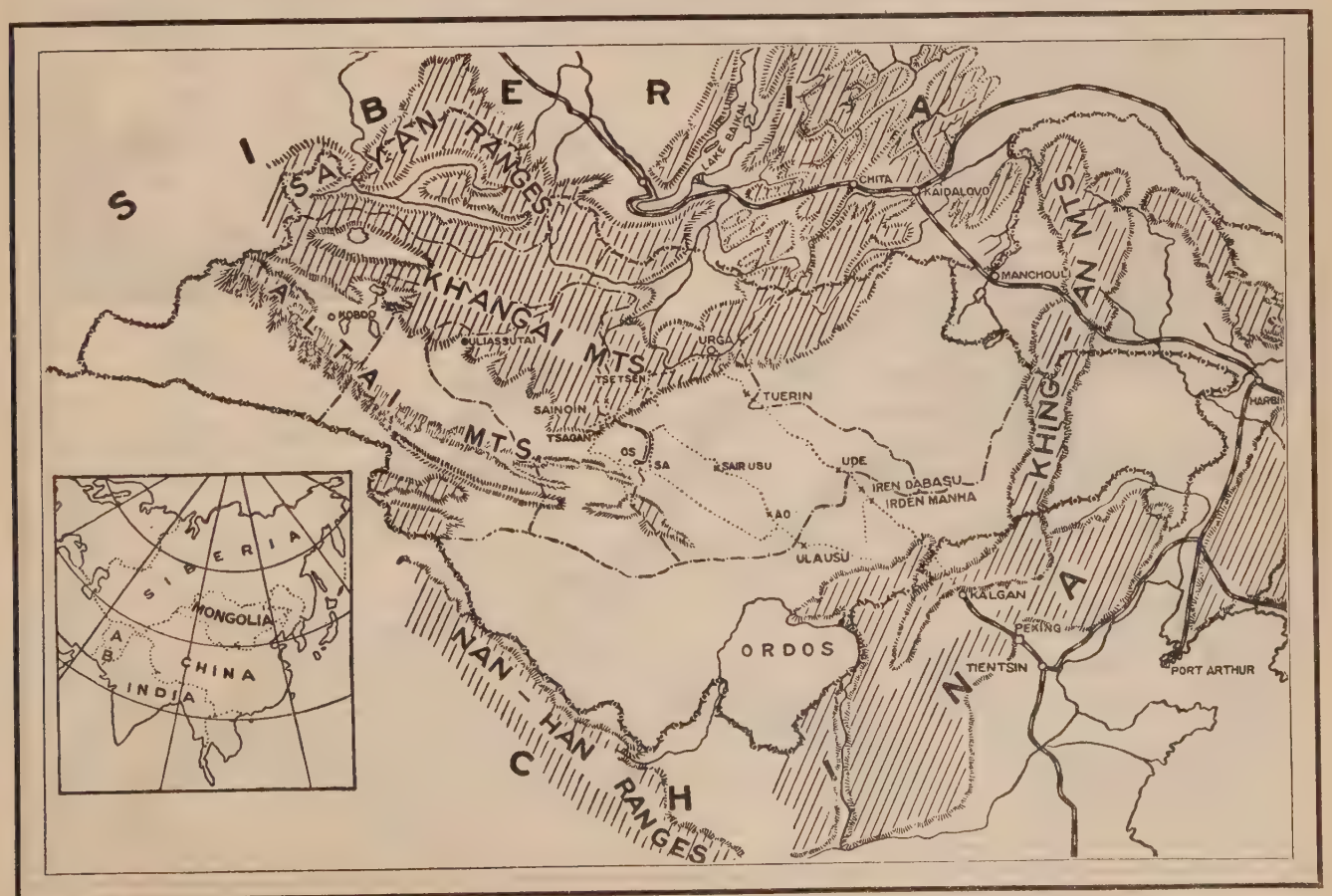


FIG. 1.—Map of Mongolia showing the routes of the Central Asiatic Expeditions of 1922–3. Slanting lines indicate mountain areas; the unshaded area is the Gobi desert.

human fossils were found; the industrial levels are not as yet precisely determinable, but the chief anthropological fact is established that Stone Age tribes spread over the southern Gobi Desert region during Pleistocene time. This accords with the prior discovery (1923) by Licent and Teilhard of the Mousterian industry in the Ordos region of China.

FIG. 2.—GOBIA (Grabau), a theoretic Upper Jurassic Continent in the heart of Central Asia. To the extreme south, the GONDWANA Continent (Suess). To the north, the theoretic Continent of ANGARA (Suess).

Equipment, Personnel and Itinerary.—It was in 1920 that R. C. Andrews first crossed the broad level Mongolian plains and conceived the plan of a camel caravan for heavy transportation of gasolene and supplies, with light and heavy automobiles for detour and reconnaissance work. The camel caravans, composed of from 150 to 250 animals under Mongol drivers, averaged from 12 to 15 m. a day; the automobile trains proved capable of 10 times this speed, carrying an American party of from eight to 12 members, 12 Chinese helpers and an equal number of Mongols. The expedition had the advantage of speed over the work of previous explorers, who had entered or crossed the desert with camels only, namely, Raphael Pumpelly (1864), Ferdinand von Richthofen (1871–2) and V. A. Obruchev (1892–1909). The American palaeontologists and geologists, Granger, Berkey and Morris, also had the advantage of prolonged experience in the fields and geologic formations of the western United States, which between the 50th and 40th parallels of latitude present conditions remarkably similar to those in the desert of Gobi (*see* map on p. 943).

In the easterly region of the Gobi desert, previously declared unfossiliferous, in which Obruchev found only a single fragmentary "rhinoceros" tooth, the expedition, leaving Kalgan April 15 1922, discovered on May 3, 260 m. northwest of Kalgan, rich strata near Iren Dabasu of probably Lower Cretaceous age, full of large iguanodonts, megalosaurs and also ostrich-mimicking dinosaurs. Overlying this deposit (Iren Dabasu formation) were discovered much more recent Tertiary formations of Upper Eocene (Arshanto and Irdin Manha formations) and Upper Oligocene (Houldjin) age, which correlate very closely with the classic Upper Eocene formations of Cuvier in France and similar fossil beds in Utah, Wyoming and Nebraska of the Rocky Mountain region. These Mongolian formations immediately established the Gobi region as a great central life zone, half-way between Europe and the Rocky Mountain region, according to the theory of 1900.

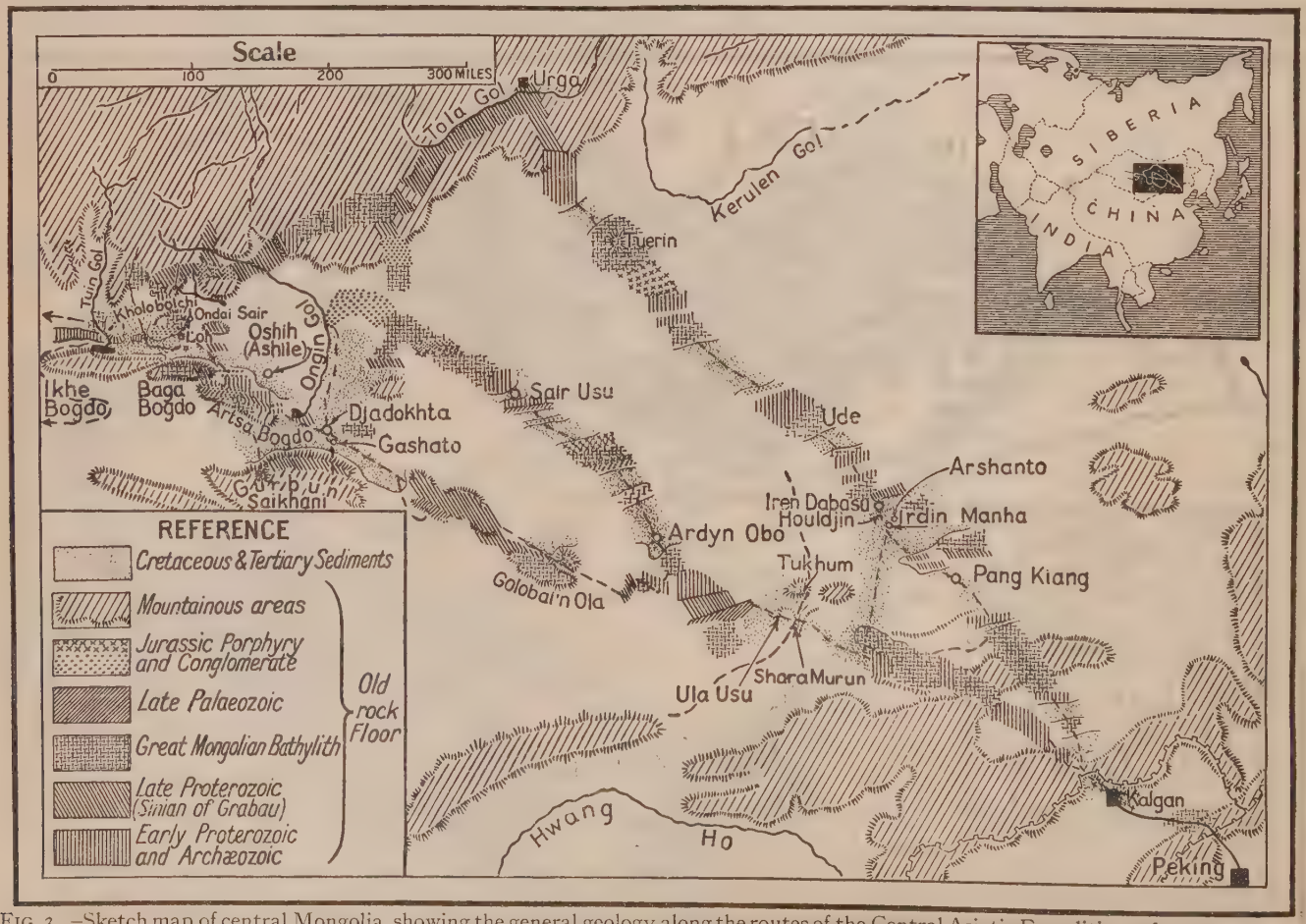


FIG. 3. –Sketch map of central Mongolia, showing the general geology along the routes of the Central Asiatic Expeditions of 1922, 1923, 1925, the main and side routes indicated by long dashes. The arrows west of Baga Bogdo indicate northern routes along the Uliassutai Trail. Finely stippled areas indicate location of chief Cretaceous and Tertiary formations listed in Table I. Hung Kureh and Gochu lie S.E. of Loh.

Encouraged by this brilliant initial success of 1922, the American Museum party made a 3,000-m. reconnaissance to the north as far as Urga, the capital of Mongolia, and southwest to the Altai mountains where five additional fossil horizons (Ondai Sair, Ashile, Hsanda Gol, Loh and Hung Kureh formations) of Upper Jurassic, Upper Oligocene, Miocene and Pliocene age were discovered; then southeast along the Altai mountains, where in the Djadokhta formation of Middle Cretaceous time the now famous dinosaur eggs were found, together with marvellously preserved series of dinosaur skeletons, chiefly of herbivorous types such as *Protoceratops* and of small carnivorous types. Thus the 1922–3 expeditions virtually circled the entire desert of Gobi east of the Altai mountains (fig. 1). On the return, toward Kalgan in north China, three additional Tertiary fossil horizons (Gashato, Ardyn Obo and Shara Murun) were discovered and a few representative fossils from each were brought back.

The types of dinosaurs, and of mammals which chiefly characterise these formations or horizons, are diagrammatically

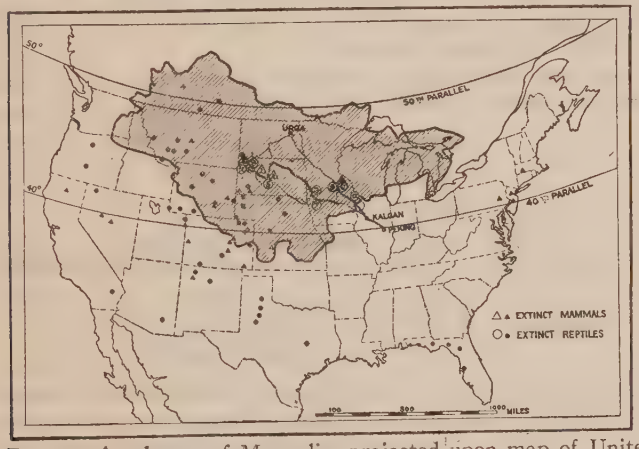


FIG. 4.—Areal map of Mongolia, projected upon map of United States of America. Similar 50° and 40° parallels of latitude. △, ○, = chief fossil localities of central Mongolia discovered to the end of the year 1925. ▲, ●, = chief fossil localities of terrestrial dinosaurs and mammals of the United States. This map demonstrates that the Mongolian and North American faunas occupied similar isothermal regions in central Asia and central North America from Upper Jurassic to Tertiary time.

shown in Plate II., which displays the ancient "life zones" of Mongolia as we descend from Lower Pleistocene into Upper Jurassic time. The animals represented in this life zone chart are known either by complete skeletons (*e.g.*, *Protoceratops*, *Protiguanodon*, *Psittacosaurus*) or by complete skulls (*e.g.*, *Baluchitherium*, *Protitanotherium*) or, finally, by highly characteristic teeth (*e.g.*, *Asiatosaurus*, *Prodeinodon*). In all of the Cretaceous horizons the correlation with Europe and with North America is provisional; in all the Tertiary horizons, excepting the ?Miocene Pang Kuang, the correlation is either absolute or fairly close.[1]

In the season of 1923 the expedition explored intensively the fossil beds visited in 1922, and returned with the camel caravan heavily loaded from the 15 or more horizons extending from the Upper Jurassic (Ondai Sair, Ashile) to the very summit of the Upper Pliocene (Hung Kureh).

These discoveries have established Mongolia as a treasure house of the life history of the earth from the close of Jurassic time onward to the close of Pleistocene time, *revealing especially the hitherto unknown high continental life of Cretaceous and Tertiary times*. Consequently, the outstanding geologic discovery of the expedition is, first, that *GOBIA* (fig. 2) since Jurassic time has been a central Asiatic continent extremely favourable to the evolution of reptiles, mammals, insects and plants hitherto known only along the Cretaceous shore lines of Europe and the Cretaceous sea borders of the centre of America, and second, that this now terribly desert region, traversed by the gazelle and the wild ass, was certainly luxuriant with life throughout Cretaceous and Tertiary time, sparsely forested, with limited rain supply like the high plateau region of Africa to-day.

These upland conditions of Mesozoic and Caenozoic time, also favourable to the origin of the human race itself, led to the further generalisation by H. F. Osborn, on returning from Iren

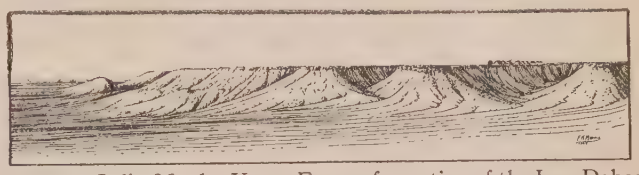


FIG. 5.—Irdin Manha Upper Eocene formation of the Iren Dabasu Basin, eastern Mongolia. Rich in titanotheres and other large mammals of American Upper Eocene affinities. (Compare fig. 3.)

Dabasu in 1923, that the ancestors of man occupied this region during Caenozoic time and are likely to demonstrate the central Asiatic theory of human origin. This generalisation was partly verified during the year 1925.

TABLE II. *Human Culture, Mammalian and Reptilian Life Zones in Descending Order*

1. *Mongol graves* of early historic time.
2. *Iron and Bronze ages* represented by monuments and graves in the Gobi desert.
3. *Neolithic* represented in the upper levels of Shabarakh Usu deposits; pottery, etc., ostrich eggs (*Struthiolithus*).
4. *Uppermost Palaeolithic of Shabarakh Usu.* Indurated sands containing flints, resembling those of the ?Azilian and Campignian industries of Europe; eggshell ornaments made of *Struthiolithus* and of fossilised dinosaur eggs. The "dune-dwellers" of prolonged occupation. True Upper Palaeolithic not found.
5. *Lower Palaeolithic.* Near Orok Nor, 20 m. from Kholobolchi Nor. Flint industry of possible Aurignacian age; flints certainly of Mousterian age, of IV. Glacial and pre-Glacial time resembling those of the Ordos.
6. ?Acheulean or ?Eolithic flints of uncertain age.
7. *Tsagan Nuru, Gochu.* Regarded as base of the Pleistocene. The Gochu, 1,000 ft. in thickness, overlies the Hung Kureh at the foot of the Altai range Baga Bogdo. The sands of Tsagan Nurud contain *Equus* and *Struthiolithus*.
8. *Hung Kureh.* Lower Pleistocene and Upper *Pliocene.* Containing in lower levels, a true Upper Pliocene horizon, *Hipparion*, *?Elephas*, *Cervus*, *Castor*, *Camelus*, *Gazella*, rhinoceros, ?Coelodonta. Compare Plaisancian-Astian of France and Italy.
9. *Loh.* These gravels and clays, directly overlying the Hsanda Gol, are apparently of Middle Miocene age. Containing a mastodont, *Serridentinus mongoliensis*, and a diminutive baluchithere, *Baluchitherium mongoliense*. Compare Lower and Middle Miocene Burdigalian-Helvetian of France.
10. *Hsanda Gol.* Great formation 3,000 ft. in thickness, of Middle to Upper Oligocene, or Stampian to Aquitanian. Containing abundant remains of *Baluchitherium grangeri*, a skull having been found in 1922 and a leg and feet in 1925; small rhinoceros; very large small-mammal fauna, several thousand jaws belonging to 30 genera of rodents, creodont carnivores, true carnivores, insectivores related to *Tupaia* (the tree shrews) and *Macroscelides* (the jumping shrews). The prevailing affinities of this fauna are with the Quercy Phosphorite of France; there are also distant affinities to modern African rodents and insectivores; relationship to North American and the Middle Oligocene White River fauna is less close, except in the wide-ranging carnivores like *Hyaenodon*. The larger rhinoceros *Baluchitherium* resembles that of Baluchistan (Forster Cooper) and the *Indricotherium* (Borissiak) of Turkestan.

A formation of similar age in the Iren Dabasu basin is the *Houldjin*, where Obruchev discovered his "rhinoceros" tooth, probably a baluchithere.

Apparently intermediate between the well-determined Hsanda Gol and the Ardyn Obo formations, there were found in 1925 three other horizons in which the faunas are still to be determined, namely, *Elegen*, Middle to Upper Oligocene, *Baron Sog*, Middle Oligocene and *Ulan Gochu*, Lower Oligocene.

11. *Ardyn Obo.* 500 ft. thick. On the Uliassutai trail. Contains rich Lower Oligocene (Sannoisian) fauna, chiefly of ungulates, including giant titanotheres (*Brontops gobiensis*, *Menodus mongoliensis*) broad-skulled and long-skulled titanotheres similar to those of South Dakota and Colorado; also an amphibious rhinoceros, *Cadurcotherium* mongoliense, intermediate in character between *Cadurcotherium* of the Lower Oligocene of France and the American *Metamynodon*. The creodont carnivores include *Hyaenodon* and aberrant oxyaenids ancestral to Hsanda Gol forms. Compare Infra-Tongrian, Ronzon, Quercy.
12. *Shara Murun.* Richly fossiliferous formation on the Uliassutai trail, representing the very summit of Eocene time. Contains

[1] To clearly understand the above description the reader should carefully examine Plate I., correlation chart, and Table II., faunal succession.

imposing titanothere fauna (*Prototitanotherium andrewsi, P. mongoliense, Dolichorhinus*), quadrupeds extraordinarily similar to those of Utah in the Rocky Mountain region. Here occur the amphibious amynodonts, also a long-limbed rhinoceros ancestral to *Baluchitherium*, and numerous smaller odd-toed ungulates suggestive of *Tapirus* and the cursorial *Colodon* (*Deperetella*), all of strong American resemblance. Most important is the pro-ruminant *Archaeomeryx*, in all respects ancestral to the higher ruminants (*Cervidae*, etc.). The carnivores of this horizon (*Hyaenodon, Pterodon*) are again of Franco-American affinities. Compare Ludian stage of France, Gypse de Montmartre.

Tukhum is another formation discovered in 1925, which has not yet been fully studied. It directly underlies the Shara Murun.

13. *Irdin Manha.* In this great flood-plain horizon, only 100 ft. in thickness but of vast horizontal extent, we again observe very close relationships to the Upper Eocene of the Rocky Mountain region. Outstanding types are the titanotheres (*Dolichorhinus, Protitanotherium, Mesatirhinus*); the giant *Eudinoceras*, four-horned and tusked, comparable to *Dinoceras* Marsh of the Rocky mountains; finally, the giant *Andrewsarchus*, a primitive creodont carnivore named after Andrews, the leader of the Central Asiatic Expeditions.

14. *Arshanto.* A little-known formation directly underlying *Irdin Manha*, probably of Middle Eocene age, containing small lophiodonts.

15. *Kholobolchi.* In this newly discovered horizon occur animals similar to the *Coryphodon* of the Suessonian of France and the Lower Eocene Wasatch of the Rocky mountains.

16. *Gashato.* Rich fauna of Paleocene age, including *Palaeostylops*, an herbivore related to a South American genus as determined by Matthew; also the long-tusked amplypod *Prodinoceras*, ancestor to *Eudinoceras* and related to a smaller form in the Rocky Mountain region.

No horizons have been discovered representing the close of Cretaceous time but the beginning of Upper Cretaceous time is probably represented by the famous *Djadokhta* horizon containing *Protoceratops* and the nests of fossilised dinosaur eggs.

17. *Djadokhta.* These flaming red cliffs of aeolian sand apparently preserve the entire reptilian fauna of this locality, which appears to have been a nesting ground of the primitive horned dinosaur known as *Protoceratops*. The delicate red sand contains in nearly perfect condition nests of eggs varying from 12 to 20 in number, belonging chiefly to *Protoceratops*, representing at least three species or genera of dinosaurs. This primitive horned dinosaur is represented by nearly seventy growth-stages, from the tiny skeleton within the eggshell to skulls about two feet in length. Small carnivorous dinosaurs, *Velociraptor* and *Saurornithoides*, are found, also the ornithomimoid *Oviraptor*, so named because its skeleton rested directly upon a nest of dinosaur eggs. Most remarkable were small mammals of the size of mice and shrews, represented by six skulls, related to small creodont carnivores and to insectivores.

18. *Dohoin Usu.* A fossiliferous basin, the fauna of which has not yet been examined.

19. *Iren Dabasu.* A very rich horizon in eastern Mongolia containing dinosaurs of Lower Cretaceous, possibly Wealden, age; *Iguanodont* equal in size to the *Ibernissartiensis* of Belgium; also a carnivorous dinosaur, possibly resembling *Deinodon* of the American Middle Cretaceous; finally, a toothless ostrich resembling *Struthiomimus* in size.

20. *Ashile.* In the Oshih basin, containing small parrot-beaked iguanodont dinosaur known as *Psittocosaurus mongoliensis;* the giant sauropod *Asiatosaurus*, resembling *Camarasaurus* of the American Upper Jurassic Morrison horizon; and *Prodeinodon*, resembling *Allosaurus* of the Morrison of Wyoming. This fauna appears to be of sub-Wealden age and to represent the close of Upper Jurassic time.

21. *Ondai Sair.* A small parrot-beaked leaf-eating iguanodont *Protiguanodon mongoliense*, more primitive in tooth structure than *Psittocosaurus*, remotely related to Huxley's *Hypsilophodon foxi* of the Wealden of England. This horizon contains a rich insect fauna.

BIBLIOGRAPHY.—The scientific and semipopular literature is already extensive. In *Asia Magazine*, which helped to finance the expeditions and which owns the copyright of many of the photographs, has appeared a series of narrative articles (1922–5) by the leader of the expeditions, Roy Chapman Andrews, which are being republished in his volume, *On the Trail of Ancient Man* (1926). Preliminary scientific papers by the geologists and palaeontologists of the expeditions, Messrs. Berkey, Morris, Granger, Matthew and Osborn, have appeared chiefly in the American Museum *Bulletins* and *Novitates* and are collected in a volume entitled *Preliminary Reports of the Central Asiatic Expeditions*, vol. i., which has been distributed to 100 of the chief scientific institutions of the world. More mature scientific publication is projected in a series of 12 volumes, of which vol. ii., *Geological Reconnaissance in Mongolia*, by Charles P. Berkey and Frederick K. Morris, will appear first.

(H. F. O., R. C. A.)

MONITOR.—Almost immediately on the outbreak of the World War it became apparent that the German occupation of Belgium could be to a certain extent out-flanked along the coast by bombardment of the ports which were being used as bases for torpedo boat destroyers and submarines. As the water is very shallow for a considerable way out, it became necessary to have vessels drawing very little water, and soon after the outbreak of war the British Navy took over three river monitors, built by Messrs. Vickers for the Brazilian Govt., with a view to using them on the Belgian coast. These were only small vessels, renamed the "Humber," "Mersey" and "Severn," mounting 6-in. and 4·7-in. guns, and it soon became evident that vessels of the monitor type, with heavier guns and better protection, would be very useful. An interesting account of how the suggestion arose to add big gun monitors to the fleet in 1914 is given by the then First Lord of the Admiralty, the Rt. Hon. Winston Churchill, in his book "The World Crisis 1911–4."

At a conference with Lord Fisher and Mr. Schwab concerning submarine contracts, Mr. Schwab offered to supply to the Admiralty four turrets, each mounting two 14-in. guns, which had been almost completed for the Greek battleship "Salamis," then building in Germany for Greece. This offer was accepted, and Mr. Churchill, remembering the good work done by the three small ex-Brazilian monitors "Humber," "Mersey" and "Severn" off the Belgian coast, suggested monitors should be built to carry these 14-in. guns close inshore to attack the enemy.

Thus the idea of the 14-in. monitors was born, and in Nov. the four vessels to carry these guns were ordered, the "Abercrombie," "Havelock" and "Raglan" from Messrs. Harland and Wolff, and the "Roberts" from Messrs. Swan and Hunter.

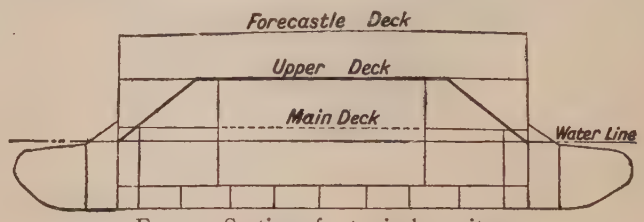


FIG. 1.—Section of a typical monitor.

Main Features.—The characteristics of these monitors were shallow draught and very good under-water protection by means of a complete bulge, and a typical section of a big gun monitor is shown in fig. 1.

The fact that both these qualities diminished very greatly the risk of successful torpedo attack brought to the fore their great possibilities. So highly thought of, in fact, were these possibilities that additional guns were sought to provide the armament for further vessels of this type, and this was done by using two 15-in. gun turrets, which were ready for battleships under construction, stripping the old "Majestic" class of battleship of their 12-in. turrets and the "Powerful" and other vessels of their 9·2-in. guns. With these guns around which to design the monitors swift progress was made.

Toward the end of 1914, eight vessels were ordered to carry the 12-in. guns, followed by further orders early in 1915 for two vessels to carry the 15-in. guns, 14 to carry the 9·2-in. and five to carry the 6-in. guns.

The names of these various types were as follows, and the tables below give the detailed particulars:—

14-in. Monitors: "Abercrombie," "Havelock," "Raglan" and "Roberts."

12-in. Monitors: "Lord Clive," "General Crauford," "Earl of Peterborough," "Sir Thomas Picton," "Prince Eugene," "Prince Rupert," "Sir John Moore" and "General Wolfe."

15-in. Monitors: "Marshal Ney," "Marshal Soult" and two of a later type, "Erebus" and "Terror."

9·2-in. Monitors: M.15 to M.28.

6-in. Monitors: M.29 to M.33.

A typical profile of a big gun monitor with a 9·2-in. gun is shown in fig. 2 and the detailed particulars of the various vessels are given in table on p. 945.

The 9·2-in. and 6-in. vessels were designed for river work and for manoeuvring in closed waters, and were not bulged.

Machinery.—In the construction of all these monitors time was essential, and in several cases the big gun monitors were launched within four months of the keel being laid, and completed ready for service within just over six months. It was

Type	Length between perpendiculars	Length over-all	Breadth ext.	Load draught mean	Displacement	S.H.P. of Engines	Speed at load drght.	Fuel capacity	Armament
	ft.	ft. in.	ft.	ft.	tons		knots	tons	
14-in.	320	334–6	90	10	6,150	2,000	6–7	400 coal	2–14-in. 1–6-in.
12-in.	320	335–6	87	10	5,900	2,300–2,500	6–7	350 coal	2–12-in. 1 to 4–6-in.
15-in.	340	355–8	90½	10¼	6,670	1,500	6–7	235 oil	2–15-in. 8–4-in.
9·2-in.	170	177–0	31	6	540	480–800	12–13	30 oil	1–9·2-in. 1–3-in.
6-in.	170	177–0	31	4	355	400	10	45 oil	2–6-in. 1–6-pdr.
"Erebus" "Terror"	380	405–0	88	11	8,000	6,000	12	750 oil	2–15-in. 8–4-in.

neccessary, therefore, to take, in many cases, whatever machinery happened to be available, and in consequence the machinery installations varied somewhat. The 14-in. and 12-in. monitors all had either quadruple or triple expansion reciprocating engines, but the 15-in. vessels, "Marshal Ney" and "Marshal Soult," had twin sets of internal combustion engines, originally designed for oil carriers. All the 6-in. monitors were twin screw with steam engines and oil-fired boilers. The oil engines in the two 15-in. monitors were never quite satisfactory, and this, combined with the somewhat bluff form of the boats, gave rather a poor speed on service, and after a time it was decided to build two larger and faster vessels to carry these 15-in. guns to better advantage. This decision was modified owing to various other conditions which arose, and it was ultimately decided to take out the guns from the "Marshal Ney" and to provide in addition a new twin 15-in. mounting to complete the two sets of guns necessary for the two new vessels.

The "Erebus" and "Terror."—These vessels had special bulge protection of an improved type, and with their more powerful machinery of 6,000 H.P. and improved form had a speed of 14 knots. Ordered in Sept. 1915, and completed in 12 months, they proved very efficient on service, and although both were heavily struck by German torpedoes, neither was seriously damaged and the repairs were quickly effected.

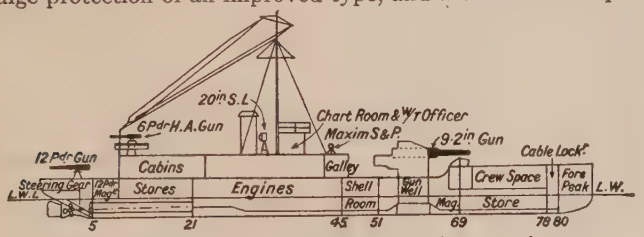


FIG. 2.—Profile section of monitor mounting a 9·2-in. gun.
From Brassey's *Naval and Shipping Annual.*

Two other vessels, although not of the true monitor type, were converted for similar service to that on which monitors were employed.

"Glatton" and "Gorgon."—The "Glatton" and "Gorgon" were armed with two 9·2-in. guns and six 6-in., together with several smaller. Originally the coast defence vessels "Bjorgrin" and "Nidoros," building for the Norwegian Govt. by Messrs. Armstrong and Whitworth, they were finally put into commission toward the end of 1918 after the fitting of bulge protection.

The "Glatton" was unfortunately lost in Dover Harbour soon after her completion owing to an explosion on board causing an outbreak of fire. To prevent possible further explosions it was decided to sink the vessel at anchor, and owing to the bulge protection, it took three torpedoes at close range to do this, and these caused the vessel to sink slowly.

With the exception first mentioned of similar monitors originally designed and built for the Brazilian Govt. which were taken over by the British Govt., none of the foreign powers appear to have developed this type of vessel to any extent during the War, although the Italian Govt. mounted some heavy guns on a kind of barge, but these were much more of the nature of an improvisation than the British vessels, and there appears no question that this type of vessel is only needed for very special work in shallow waters, and no more have been built. During the Gallipoli campaign several of the monitors were sent out there and did good work in bombarding the Turkish lines at long range.

Quite at the end of the War it was decided to mount two very big guns on three of the 12-in. monitors, and an 18-in. gun was mounted on the "Lord Clive," the "General Wolfe" and the "Prince Eugene." Only two of these vessels were completed with their 18-in. mountings before the end of the War, but they fired a good many rounds of this huge projectile into the German lines in the neighbourhood of Bruges.

Of all these vessels produced during the War with such great expenditure of money and concentrated energy, only three of the big-gun type now remain on service. These are the "Erebus" and "Terror" and "Marshal Soult," all of which are the 15-in. gun type, and these are at present being used as drill ships. Of all types of warships carrying heavy calibre guns the monitors were in action far more often and for longer periods than any other type, whether battleship or battle-cruiser, and the losses, as shown below, were correspondingly heavy.

"Raglan," 14-in. type. Sunk by gunfire of the German battle-cruiser "Goeben" in action off Imbros on Jan. 20 1918.

M.15, 9·2-in. type. Torpedoed by a German submarine off Gaza on Nov. 11 1917.

M.21, 9·2-in. type. Mined off Ostend on Oct. 20 1918.

M.25, M.27, 9·2-in. type. Lost during operations on the Dvina river, north Russia, on Sept. 17 1919.

M.28, 9·2-in. type. Sunk by gunfire of the German battle-cruiser "Goeben" in action off Imbros on Jan. 20 1918.

M.30, 6-in. gun type. Sunk by Turkish batteries in the Gulf of Smyrna, on May 13 1916.

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MONOD, GABRIEL (1844–1912), French historian (*see* 18.730), died at Versailles April 10 1912.

MONOPLANE: *see* AEROPLANE.

MONRO, SIR CHARLES CARMICHAEL (1860–), British soldier, was born June 15 1860, and joined the army in 1879. In 1897–8 he saw service at Malakand, in the Mohmand country, in Bajour and in Tirah and he was on the staff in South Africa (1899–1902). He was afterwards commandant of the School of Musketry at Hythe, Kent. Having commanded the 2nd Div. in the first fighting in 1914, Monro was, at the end of 1914, placed in command of the I. Army Corps, and on a III. Army being organised in July 1915, he was given charge of this. He was chosen in October to take over the command of the Mediterranean Expeditionary Force and to decide whether the campaign in the Gallipoli Peninsula was to be continued. Monro acted with rare decision. Although the Govt. was disposed to cling to the peninsula, he insisted upon its abandonment, and he was, after some delay, allowed to have his way, with the result that the forces were withdrawn from a most dangerous position without appreciable loss. He returned to the Western Front to succeed Sir Douglas Haig in command of the I. Army, but in Oct. 1916 he was selected to be commander-in-chief in India.

In his new sphere Sir Charles Monro proved himself to be a military administrator of the first rank. By untiring energy and skilful organisation he succeeded in adding substantially to the strength of the native army, in creating a number of fresh regiments and in greatly developing the non-combatant and hospital services on progressive lines. The consequence was that he was enabled to dispatch considerable and badly needed reinforcements to Mesopotamia and to Egypt and Palestine. In Sept. 1923 he was appointed to the position of governor and commander-in-chief of Gibraltar.

MONS, BATTLE OF: *see* FRONTIERS, BATTLES OF THE.

MONTAGU, EDWIN SAMUEL (1879–1924), British politician, second son of the 1st Lord Swaythling (head of the financial firm of Samuel Montagu and Co.), was born Feb. 6 1879 and educated at the City of London School and at Trinity College, Cambridge. At Cambridge he was president of the Union and acquired a considerable reputation for ability. When he entered Parliament in 1906, as Liberal member for the Chesterton division of Cambridgeshire, he was chosen by Mr. Asquith, then Chancellor of the Exchequer, as his parliamentary secretary, and continued in that position when his chief succeeded to the premiership. Early in 1910 he was appointed Under-Secretary for India, under Lord Morley, and remained in the post, under Lord Crewe till 1914; and so made his first official acquaintance with India under the influence of Lord Morley's reforms and Lord Crewe's Durbar changes of 1911. As both his chiefs were in the Lords, he was the spokesman of the office in the Commons, and he acquitted himself well. That he might equip himself the more completely for his duties, he took the unusual course of visiting India in person.

After holding during the World War the posts of Financial Secretary to the Treasury—where he had much to do with the introduction of War Savings Certificates—Chancellor of the Duchy of Lancaster (1915) and Minister of Munitions (1916), he returned in 1917 to the India Office as Secretary of State and began a tenure of that post which will always be memorable in Indian annals.

He visited India in the following winter for the second time, and held prolonged conferences with the Viceroy, Lord Chelmsford, the leading members of the Indian Civil Service, ruling princes and native politicians, and along with the Viceroy received deputations and memoranda from all classes. Ultimately in July 1918 there was published an elaborate report, signed by the Viceroy as well as by the Secretary of State, recommending a series of constitutional reforms which should give the Indian peoples a large and real share in their own government. The report was received so cordially in the House of Commons that Mr. Montagu was able to claim at the end of the debate as "a remarkable fact" that all speakers admitted the principle of self-government for India. In Dec. 1919 he had the satisfaction of passing through Parliament the Government of India bill, which established in India, in accordance with the report, what was called a "diarchy," a partition of the powers of Government between the civil service and the native population.

Unfortunately, by the time the Act was passed the situation in India had become grave. The Rowlatt Sedition bill had provoked alarm and excitement throughout the country; Mr. Gandhi had organised passive resistance; serious disorders had broken out in Delhi and other places and in the Punjab had become something like open rebellion, in the course of which there had been a tragedy on April 13 1919 at Amritsar, where General Dyer's troops in dispersing a mob had killed nearly 400 persons. Inquiry was instituted and Dyer had to retire; but much ill-feeling remained, and Mr. Gandhi started a non-co-operation movement as the new councils began to work. Mr. Montagu's policy lost its attractiveness for a large section of the House of Commons, and in the debate on the address in 1922 he was attacked on account of the unrest and crimes in India. In March he had to resign his office for having published, without the authority of the Cabinet, a telegram from the Government of India urging the advisability of pursuing, in India's interest, a more friendly policy towards Turkey. He defended his action by maintaining that Cabinet responsibility had been destroyed by Mr. Lloyd George's dictatorial methods. At the general election of 1922 he lost his seat in Parliament, and went into the City, becoming vice-chairman of the De Beers Co. He had married in 1915 Beatrice Venetia, youngest daughter of the 4th Baron Sheffield, and he died in London Nov. 15 1924.

MONTANA (*see* 18.752).—In 1920 Montana had a population of 548,889, an increase of 172,836, or 46%, during the decade. The urban population was 172,011, or 31·3%; the rural 376,878, or 68·7%. In 1910 the ratio was 35·5% urban and 64·5% rural. The relative increase of rural inhabitants over urban was due largely to the immigration of an agricultural population, particularly to the eastern part of the state. The total number of foreign-born whites in 1920 was 93,620. In 1920 there were 12 cities with a population of 5,000 or more, of which six had over 10,000. These six, with their increase in the preceding decade, were as follows:—

	1920	1910	Increase
			%
Butte	41,611	39,165	6·2
Great Falls	24,121	13,948	72·9
Billings	15,100	10,031	50·5
Missoula	12,668	12,869	−1·6
Helena	12,037	12,515	−3·8
Anaconda	11,668	10,134	15·1

Agriculture and Irrigation.—In 1910 there were 26,214 farms with a total acreage of 13,545,603, of which 3,640,309 ac. were improved. In 1920 there were 57,677 farms with an acreage of 35,070,656, of which 11,007,278 ac. were improved. Of the land improved, about 4,000,000 ac. were under tillage. In 1925 the number of farms had decreased to 46,896. In 1920 about 1,700,000 ac. were irrigated; many new projects were under way, and in 1925 nearly 2,000,000 ac. were irrigated. In 1924 about 3,000,000 ac. were planted to wheat, the most important crop, and the crop was estimated at 51,668,000 bushels. Flax, hay, sugar beets, oats, beans, potatoes, corn and peas rank next in order of value, but wheat in 1924 was worth more than all other crops combined. The total value of crops in 1924 was $144,463,000. During the period from 1910 to 1925 the open range was superseded by the fenced ranch. The number of sheep declined from 5,381,000 in 1910 to 2,083,000 in 1920, but increased to 2,536,000 in 1925. In 1910 there were 943,000 cattle; in 1920, 1,269,000; and in 1925, 1,505,000 (estimated). In 1925 there were 220,000 milch cows, and dairying has become an important industry. In 1910 there were 316,000 horses; in 1920, 669,000; and in 1925, 593,000. All livestock in 1925 was valued at $94,000,000.

Forests.—In 1923 the national forests in Montana included 15,881,715 acres. The state owned 566,000 ac. of forest land and there were 5,000,000 ac. in private hands. A part of this forest area is valuable also for agricultural land and will be so used when the timber is removed. The remainder will be reforested as the old trees are cut.

Mines.—The World War gave a great impetus to the production of copper and other metals, but after the Armistice the output declined acutely. In 1910 the production of copper was 283,000,000 lb.; in 1916, 352,000,000 lb.; and in 1921, 49,000,000 pounds. Since then it has increased to 224,000,000 lb. in 1923 and to 249,000,000 lb. in 1925. In 1918 the production of zinc was 104,624 tons; and in 1922, 59,535. The production of lead dropped from 18,568 tons in 1918 to 11,565 tons in 1921, increasing to 21,226 tons in 1924. Silver production has remained steady at about 12,000,000 oz. per year, but gold dropped from 158,704 oz. in 1918 to 80,145 oz. in 1922. The output of coal in 1924 was estimated at 2,700,000 net tons. In 1915 oil was discovered in the state, and the output has steadily increased until in 1924 it was estimated at 2,781,000 barrels.

Manufactures.—The vast supplies of water-power in Montana give hopes of great industrial development. The hydroelectric plants in 1923 had a capacity of 400,000 H.P., an increase of 120,000 in three years. Much of this was used for the operation of electric trains. The potential hydroelectric development is estimated at 4,000,000 horsepower. In 1920 Congress passed a bill authorising the Secretary of the Interior to lease the undeveloped power-sites, and the completion of such enterprises will add greatly to the electric power available. In 1909 the total value of manufactures was $73,000,000; in 1923 it had increased to $174,874,000. In 1920 there were 195 lumber-mills, 75 flour-mills, 31 creameries, 7 cheese factories, 2 canning factories. The most promising field for manufacture appeared to be products of copper and wood. One plant for turning out copper rods and wire had a capacity of 6,000,000 lb. of copper per month.

Education.—In 1920 the Russell Sage Foundation of New York ranked the Montana schools first among all the public-school systems of America. The public-school fund belonging to the state amounted in 1924 to about $20,000,000, the income to nearly $1,000,000 per year. The total expenditures for schools in 1924 was $14,878,000. In 1924 there were 118,000 pupils in elementary and high schools out of a school population of 157,745. In 1912 President E. B. Craighead, of the State University, started a campaign for the consolidation of all the state institutions of higher education into one university. His plan was defeated, but all the institutions were placed under one administrative head called the chancellor.

Legislation.—The state has made steady progress in labour legislation. In 1911 the Legislature provided an eight-hour day for miners. In 1914 the state limited the working day for women in factories, laundries and stores to nine hours, and in 1917 reduced this to eight hours. In 1915 a Workmen's Compensation bill was enacted. In 1915 provision was made for state inspection and grading of grain, and a Farm Loan Act was passed. In 1917 the state provided insurance against hail for farmers. In 1911 the Legislature authorised cities to adopt the commission form of government, and in 1917 sanctioned the commission-manager plan. In 1912 the people established through the initiative a system for direct primaries to nominate all state and local officials and to express their preference for presidential candidates. They also passed a rigid Corrupt Practices Act limiting campaign expenses, providing for their publicity and forbidding electioneering on election day. In 1914 the people ratified a constitutional amendment for woman suffrage. The important social legislation in recent years included a Mothers' Pension law; a Teachers' Retirement Pension law; and an Act to provide for the establishment and maintenance of county libraries. In 1921 Gov. Dixon proposed an income tax, an inheritance tax and a tax on the production of oil wells and of coal and metal mines. The Legislature opposed these recommendations as radical, but finally agreed to a small tax on oil and coal production. In 1924, however, the people passed an initiative measure providing for a graduated tax of from 0·25% to 1% on the gross product of metal mines. In 1923 the Legislature passed an effective inheritance tax law.

History.—Montana entered upon the second decade of the 20th century under very prosperous conditions. A new railway had just been built across the state. Mines were operating successfully, and there was a growing demand for Montana lumber. Great irrigation projects were under way, and in many sections of the state dry-farming was proving a success. The World War stimulated the mining and lumber industries, but it put a stop to the great reclamation works. During the later years of the decade drought seriously hampered the dry-land farmers and there was a decline in farm production. State politics have largely hinged upon matters of taxation, particularly the taxation of mines. The constitution provides that mines "shall be taxed at the price paid the United States therefor," although the "net proceeds . . . shall be taxed as provided by law." The mining interests maintain that, since mining is a speculative business and the mines are being gradually exhausted, the net proceeds should be taxed at no higher rate than real estate or personal property. Their opponents maintain that since practically no tax is imposed on mines as such, the tax on "net proceeds" should be much higher than the property tax. The constitution limits taxes for state purposes to two mills on the dollar unless increased by special vote of the people. This was adequate during the early years of the state's history. Since 1910, however, due to greater demands upon the state government, this constitutional restriction has produced a serious deficit. In 1920 the deficit amounted to about $2,500,000; June 30 1924 it was $3,595,558; and June 30 1925 it was $3,817,402. In the fall of 1925 the metal mines tax provided an income of approximately $500,000, and through the death of W. A. Clark the inheritance tax produced about $900,000.

In 1914 Jeanette Rankin was elected representative to Congress as a Republican, the first woman to be a member of that body. During the World War the Non-Partisan League spread over the state. It started first among the farmers, but soon extended among the labour groups. In 1918 it elected a number of members of the state Legislature. In 1920 the farmers and labour men went into the Democratic primaries and nominated a former U.S. district attorney, Burton K. Wheeler, for governor. The merchants and other business interests organised the Montana Development Assn. to oppose the Non-Partisan League. This organisation supported Joseph M. Dixon, former Senator and manager of Roosevelt's campaign in 1912, for governor on the Republican ticket. The Republican platform declared for a conservative programme, and the entire Republican ticket was elected. Gov. Dixon's demands for the taxation of mines, and for other special taxes, however, lost him the support of the larger business interests. In 1924 he was defeated by John E. Erickson who announced a programme of economy and no increase in taxes.

The governors of Montana after 1910 were as follows: Edwin L. Norris (Dem.), 1909–13; Sam V. Stewart (Dem.), 1913–21; Joseph M. Dixon (Rep.), 1921–5; John E. Erickson (Dem.), 1925– .

See Helen F. Sanders, *History of Montana* (3 vol., 1913); Tom Stout, *Montana, Its Story and Biography* (3 vol., 1921); Montana Dept. of Agriculture, Labor and Industry, *The Resources and Opportunities of Montana* (9 vol., 1912–22); *Montana Farm Review* (1922–). (P. C. P.)

MONTELIUS, OSKAR (1843–1921), Swedish archaeologist, was born in Stockholm Sept. 9 1843. He studied at the University of Stockholm, and took the degree of Ph.D. in 1869. In 1888 he was appointed a professor in the Museum of National Antiquities, Stockholm, and in 1913 became state archaeologist. As an archaeologist his aim was to utilise and develop the typological method explained by him in his book *Die Typologische Methode* (1903). His numerous other works are devoted principally to Swedish and Italian archaeology and include *The Civilisation of Sweden in Heathen Times* (1888); *Les temps préhistoriques en Suède et dans les autres pays Scandinaves* (1895); *Kulturgeschichte Schwedens* (1906); and *La civilisation primitive en Italie depuis l'introduction des métaux*, 3 vol. (1895–1910). Montelius died in Stockholm Nov. 5 1921. See *Oscar Montelius in Memoriam* (Stockholm, 1922).

MONTENEGRO (*see* 18.766), a territory included in Yugoslavia, formerly an independent kingdom. The area of the district which corresponds to the old Kingdom is 3,733 sq. m. and the population (1921) 199,857.

Montenegro as a Kingdom 1910–8.—In 1910 Prince Nicholas took advantage of an apparent lull in the Balkan situation to proclaim himself King, a step welcomed in Vienna as a reversion to the old position of two competing Serb dynasties. But the unrest in Turkey soon forced Montenegro once more into close alliance with Serbia, and Nicholas, so far from resisting the current, was the first to embark on war in Oct. 1912. His lack of heavy guns and the imperfect discipline of his gallant troops compelled him to resort to Serbian military aid on a considerable scale before Scutari could be reduced in April 1913. Austria-Hungary insisted upon the surrender of Scutari to the new Albania, and threatened war. Nicholas only yielded to an international naval blockade of the Montenegrin coast, and Serbian troops were withdrawn from the Adriatic. The first Balkan war gave Montenegro and Serbia a joint frontier, the former Sanjak of Novi Pazar being partitioned between them; and Montenegrin troops joined Serbia against Bulgaria in the second Balkan war. Early in 1914 the Montenegrin statesman, Miuškovič, began serious discussions with Pašić for a financial and customs union between Serbia and Montenegro, a fusion of the two armies, a joint foreign policy and diplomatic representation, but retention of the two dynasties.

These negotiations became known to Vienna, who warned Petrograd that "Austria-Hungary would not remain a silent observer," and regarded union as a challenge to her Adriatic interests. On this, Sazonov advised Pašić to postpone the negotiations. But the movement for union was rapidly becoming

irresistible when the World War broke out and the two States found themselves side by side in resistance to Austria-Hungary. Prince Nicholas and his sons were, however, jealous and reserved, blocking the action of the Serbian General Janković, who had been sent at Russia's instance to reorganise the Montenegrin Army. In May 1915 Prince Peter had a secret meeting in Dalmatia with the former Austro-Hungarian military attaché, Hubka, and in Nov., during the invasion of Serbia, Crown Prince Danilo, through his friend Baron de Kruyff in Sofia, made overtures to the Central Powers, offering to cut off the Serbian retreat to the coast in return for territorial concessions to Montenegro in western Serbia and northern Albania.[1]

During the retreat the attitude of the Montenegrin dynasty remained highly equivocal and the key position of Mount Lovćen was surrendered to the Austrians almost without a struggle. Parliament voted unanimously in favour of holding out to the end with Serbia, but the King negotiated on his own initiative without authorisation from his government, and on Jan. 1916 addressed a telegram of submission to Francis Joseph. Failing to obtain the terms which he had hoped, he and his family, with the Premier Miuškovič, fled to Italy. During the next two years his second son, Prince Mirko, intrigued in Vienna and was connected with various Austrophil projects for a vassal Yugoslav state under the Petrović dynasty; he died in 1918 in an Austrian sanatorium. Meanwhile, King Nicholas resided in France and tried to silence criticism from the Left by making Radović his Premier. But when the latter advocated the formal proclamation of union and a simultaneous abdication of Nicholas and Peter in favour of the Prince Regent Alexander, Nicholas threw himself definitely into the arms of the anti-unionists, and by the end of the War found his court reduced to a tiny clique of personal dependents and adventurers.

Union with Serbia.—When Austria-Hungary collapsed in Oct. 1918 and national councils were erected in all the Yugoslav provinces, the current in Montenegro set more strongly than ever in favour of union. A National Assembly was convoked on Nov. 12 at Podgorica and proclaimed the deposition of the Petrović dynasty and the union of Montenegro with Serbia. On the death of Nicholas the royal title fell into abeyance, as Crown Prince Danilo did not wish to assume it and his nephew Michael was a minor.

Even before the Balkan wars Montenegro was desperately poor, and in normal years had to import grain for its scanty population; only the dynasty had grown rich by its arbitrary methods. The long strain of war increased the misery tenfold, and acute discontent was aroused by the bad administration, favouritism and centralist tendencies of Belgrade. There were numerous cases of brigandage and party vengeance which were conveniently misrepresented abroad as a movement for independence. In 1924, however, a marked improvement began. In the summer of 1925 King Alexander paid his first official visit to Montenegro, and the remains of his great-great-grand-uncle the Vladika Peter (the greatest of Serbian poets) were transferred to a mausoleum built at the King's expense on the summit of Lovčen by the Dalmatian sculptor Meštrović. (*See* BALKAN WARS; SERBIA.) (R. W. S-W.)

MONTERO RIOS, EUGENIO (1832–1914), Spanish politician, was born at Santiago de Compostela, Corunna, Nov. 13 1832. He was originally intended for the priesthood, but became a barrister and a teacher of ecclesiastical history. In 1864 he was appointed professor of canon law at the University of Madrid, and in 1869 entered the Cortes. He followed Ruiz Zorilla and as Minister of Justice in General Prim's Cabinet he introduced a number of important judicial reforms and drew up the act of abdication of King Amadeo. In 1881 he helped to found the Radical party and became Minister of Justice in 1889. From 1894–5 he was president of the Senate. He was chief of the Spanish delegation which negotiated the Treaty of Paris with the United States at the close of the Spanish-American War of 1898. In 1899 he was again president of the Senate. In 1903 he was elected leader of the Liberal party and in 1905 became Prime Minister. He resigned the leadership of the Liberal party in 1906 and was president of the Senate for the third time from 1909–14. He died at Madrid May 12 1914.

[1]Telegram of Tarnowski, to Burián, No. 1449, Nov. 11 1915, transmitting Danilo's wire to Kruyff.

MONTESSORI, MARIA (1869–), Italian educationist, was born at Chiaravalle near Ancona. She studied at the University of Rome and graduated in medicine in 1894, being the first woman in Italy to do so. She then took up the subject of educating defective children. From the experience thus acquired, she came to the conclusion that similar methods might be applied to normal children of a lower age, and after a series of experiments on a small scale she extended them to a large number of children in certain private and public infant schools in Rome. Dr. Montessori encountered a good deal of opposition from advocates of orthodox methods in education who regarded her system as destructive of discipline. At the same time she was warmly supported by a certain number of enthusiastic reformers, experienced and otherwise. Her system was applied on a larger scale in countries where elementary education was not under rigid state or municipal control and not carried out according to fixed programmes. From 1900 to 1907 Dr. Montessori lectured on pedagogical anthropology at the University of Rome and in 1922 was appointed Government inspector of schools in Italy. Her ideas on education are set forth in *The Montessori System* (1912), which has been translated into English and other languages. (*See* EDUCATION; MONTESSORI SYSTEM.)

MONTESSORI SYSTEM.—The Montessori system of education aims at self-education by the pupils themselves. There are no time-tables, no set lessons, no classes. There are no rewards or punishments of the ordinary kind. The pleasure of succeeding and gettings things right is the only incentive. "Each child is doing what, for the time being, pleases him best. When he is admitted to the school he sees small groups of children playing at various 'games,' and he joins the group which happens to take his fancy. Then and there his education begins. All kinds of interesting 'occupations' are going on, and wherever he goes he will get help and guidance from the teachers. If he gets tired of playing at this thing he goes off and plays at that. But he is never idle, for whatever he does interests him." Apparatus, elaborately devised by Dr. Montessori, is provided for the educational games by which the children acquire knowledge; and this "didactic material" constitutes a distinctive part of the originality of the system.

The first stage is to develop the senses of touch, sight and hearing; both by games of various sorts and by guiding the attention systematically to the association of things, names and ideas. When a child washes his hands, for instance, he is given first cold and then hot water, and led to observe and understand the difference; the distinction of rough and smooth is emphasised by the different cards for fingering and sorting. The child to know the words, "hot," "cold," "rough," "smooth," and thus the knowledge of language is extended in all directions ("high," "low," "thick," "thin," "round," "oval," etc.) before any question of writing or reading arises. Ideas of form and colour are given precision by games with blocks, cylinders, etc., of varying sizes, to be fitted into frames, or with shades of silk to be arranged to match; touch is practised by playing the games blindfold; hearing is developed by the "silence" lesson, and by the use of small cylindrical boxes containing stones, sands and different substances to be rattled by the children, who arrange them in order of intensity of sound and so forth. Skill and neatness in the use of the fingers and movement of limbs are stimulated partly by the mobility of the light furniture, which the children rearrange for their own comfort, and partly by games at tying and untying, hooks and eyes, dressing and undressing, waiting on one another at table, washing up and so on. Many of these occupations are preliminary to writing and reading, and lead naturally up to both.

Writing comes essentially before reading, on the Montessori system. Emery-paper letters gummed on cards are provided, with which the child is familiarised by games of hide and seek,

etc., so that, without any active teaching of the alphabet, he knows them by sight, by name and by feeling. He learns how to imitate them, partly by a touch game of passing the fingers over the paper letter, thus making the actual motion of writing, and partly by playing at pencilling and colouring with specially devised cards on which an outline is given. The child learns to write before he knows that "writing" is what he is learning; the sounds and shapes of the letters being known it is a natural transition to build up the letters and their sounds into words.

The next thing is for the child to "read"—not merely to re-translate into sound a word he has translated into symbol, which goes with the acquisition of "writing," but to extract a previously unknown idea from written or printed symbols of the same sort not put together by himself. At any rate in so phonetically spelt a language as Italian, this is very quickly learnt. Numbers of words, well known to the children, are written on cards, and various games are played in identifying them with their objects; and from single words the children pass to phrases and sentences, the teacher writing on the blackboard, for instance, questions or orders which form part of a game. Arithmetic is introduced to the children's minds by the employment of counting games, in which an apparatus of striped poles, counters, etc., is used. The whole curriculum is devised for the content and happy employment of the natural energies of the child, who is left free to respond to his own impulses, under the influence of "didactic material," rather than under the discipline of a teacher.

BIBLIOGRAPHY.—Report to English Board of Education, by E. G. A. Holmes, *The Montessori System of Education* (Education Pamph., No. 24, 1912) contains a critical examination of the system. See also M. Montessori, *The Didactic Material for the Education of Children from 7 to 11 Years; The Advanced Montessori Method* (1917–8); *The Montessori Method* (Eng. trans. by A. E. George, 1919). (H. CH.)

MONTEVIDEO (*see* 18.778), the capital city of Uruguay, had a population on Dec. 31 1923 of 407,249. The municipal revenues increased from $2,850,000 in 1916 to $4,590,000 in 1921, and for 1924–5 were estimated at about $5,342,000. Extensive port improvements by the Government deepened the entrance and part of the harbour in order to admit the largest ocean-going vessels, which formerly had been obliged to anchor outside. Docks, warehouses and loading equipment also were much improved. Three large meat packing plants (*frigoríficos*), two of them American and one British, were added to the industrial establishments of the city. Manufactures, though still relatively unimportant, included flour, paper, cigars and cigarettes, soap, candles, shoes, textiles and knitted goods; there were also tanneries, breweries and a sugar refinery. The general appearance of the city was improved by new buildings and the extension of paving and lighting. The University of Montevideo had in 1922 344 teachers and an enrolment of 1,615 students.

MONTREAL, Canada (*see* 18.790), the commercial metropolis and the largest city of the Dominion of Canada, had an area of about 50 sq. m. and a population of 836,304 in 1924. The population at the Dominion census in 1921 was 607,063, and was more than half French and about three-quarters Roman Catholic; Jews, who have increased largely in number in recent years, number about 6%.

The port is the second largest in America, with eight miles of deep water and wharfage with berths for a distance of 17 m.; 18 vessels of 1,000 ft. in length can berth at the same time. A large scheme of harbour improvements has been undertaken in recent years, including the reclamation of 30 ac. of land for a new dry dock, the electrification of the water front, the building of a huge elevator, wharves, warehouses, etc. The improvements to navigation in the gulf and river of St. Lawrence have resulted in a large increase of tonnage; 1,194 ocean-going vessels of 3,932,637 tons passed through the harbour in 1922, as compared with 820 of 2,690,535 tons in 1913. Over a quarter of the total export trade of Canada passes through Montreal, which is the greatest grain port of the world. There were 2,820 factories in the city in 1924, including very large flour-mills. The form of municipal government underwent several alterations in the decade following 1911, and eventually the control of municipal affairs was placed in the hands of an administrative commission of four, appointed by the provincial government.

The construction of a tunnel under Mt. Royal and the centre of the city by the Canadian Northern Railway Co., was an important engineering feat completed in 1918. The company (since merged in the Canadian National railway system) built an imposing new terminal station in the centre of the city at the tunnel head, supplanting its old Moreau street station. Electric trains running through the tunnel to the northwestern side of Mt. Royal caused the growth of a new suburb on that side of the mountain.

Education.—Important educational buildings erected since 1911 include the McGill Medical building, a magnificent structure that replaced the building destroyed by fire in 1907, the Macdonald Engineering building of McGill University; a large and finely equipped technical school in connection with Laval University; a new high school; a public library; an art gallery, and a fine pile of buildings to house Loyola College, a Jesuit school of high standing.

McGill University, benefiting by gifts from Sir William Macdonald, was able to develop further its faculty of music, to establish new degrees in law, commerce and household science, and to extend some of its departments. A school of physical training was opened in connection with the university, and a department of social service was inaugurated. The McGill stadium, one of the finest athletic amphitheatres in North America, was opened in 1918. After the death of Sir William Macdonald in 1919, provision was made for the further endowment of Macdonald College at Ste. Anne de Bellevue, the university's agricultural centre, and in 1924 Lady Strathcona gave £24,000 for a zoological department. The administrative buildings of the Montreal branch of Laval University were destroyed by fire in the autumn of 1919. A movement, that had been gaining strength for some years, to separate the Montreal branch from Laval University at Quebec, culminated in the foundation of the University of Montreal, the buildings of the old branch of Laval being taken over by the new institution. A number of new courses were added, including social and political science, and the faculty of applied science was further developed. Considerably over $3,000,000 was raised by public subscription as a building fund.

MONYPENNY, WILLIAM FLAVELLE (1866–1912), British journalist, was born in Ulster Aug. 7 1866. Educated at Trinity College, Dublin and Balliol College, Oxford, in 1893 he joined the editorial staff of *The Times* (London), and early in 1899 became editor of the Johannesburg *Star* in the Transvaal. He played a useful part, as a publicist, on the side of the Reform party there, and when war came he joined the Imperial Light Horse and was one of the defenders of Ladysmith. Returning afterwards to his position on the *Star*, he did much to promote Lord Milner's work of reconstruction, but resigned in 1903 owing to his hostility to the introduction of Chinese labour into the mines. He was then entrusted by *The Times* with the task of writing the official biography of Disraeli, and also did other work for that paper, becoming in 1908 a director of the company. Owing to ill health the first volume of the *Life of Benjamin Disraeli, Earl of Beaconsfield* (ultimately extending to six volumes) did not appear until 1910, and the second shortly before his death. It was completed in 1920 by Mr. G. E. Buckle, formerly editor of *The Times*. Monypenny died in the New Forest, Hampshire, Nov. 23 1912.

MOODY, WILLIAM VAUGHN (1869–1910), American poet and playwright, was born at Spencer, Ind., July 8 1869. He was educated at Harvard University and was assistant in English there 1894–5. From 1895 to 1907 he was at the University of Chicago as instructor and, after 1901, as assistant professor. He died at Colorado Springs Oct. 17 1910. Moody was the author of the *Masque of Judgment* (1900); *Poems* (1901); *The Fire-Bringer* (1904); *The Great Divide* (1907) and *The Faith Healer* (1909). He compiled (with Robert M. Lovett) *A First View of English and American Literature* (1902), and edited *The Complete Poetical Works of John Milton* (1899, Cambridge ed.) and (with George Cabot Lodge and John Ellerton Lodge) *The Poems*

of Trumbull Stickney (1905). His complete works were edited with an admirable introduction by Prof. John M. Manly (1912).

MOOKERJEE, SIR ASUTOSH (1864–1924), Indian jurist and educationist, son of a medical practitioner, was born at Bhawanipur, Calcutta, on June 29 1864. Graduating at the Presidency College, Calcutta, in 1885, he gained the doctorate in laws in 1894. He wrote much for learned societies on mathematical subjects, and his "Geometry of Conics" (1892) and other papers were incorporated in text-books for Cambridge University. He became a fellow and syndic of Calcutta University in 1889, and was appointed to the Tagore law professorship in 1898. From 1904 until his resignation in 1923 he was a judge of the Bengal high court, and won a great reputation as a jurist. He was knighted in 1911. His spare time from the Bench was devoted with unflagging zeal to the affairs of Calcutta University. He was a member of the Calcutta University Commission 1917–9, and signed the report without dissent, but afterwards offered strong opposition to the projected legislation. Though advanced in some matters of social reform, he lived very simply as an orthodox Brahman. He died at Patna on May 25 1924. His *Addresses, Academic and Literary*, were published in 1915.

MOORE, GEORGE (1853–), Irish writer (*see* 18.808), broke fresh ground in 1916 with *The Brook Kerith*, a work of fiction based on the Gospel story. He had professedly taken leave of literature in three remarkable volumes of quasi-reminiscences, entitled *Ave* (1911), *Salve* (1912) and *Vale* (1914). Later he produced two privately printed volumes de luxe, *Avowals* (1918) and *A Story Teller's Holiday* (1920), and retold the story of *Abélard and Héloïse* (1921). In 1922 he published *In Single Strictness* and 1926 *Ulick and Lorachal*.

MOORE, JOHN BASSETT (1860–), American jurist, was born at Smyrna, Del., Dec. 3 1860. He graduated at the University of Virginia in 1880, studied law in an office in Wilmington, Del., and was admitted to the Delaware bar in 1883. Two years later he entered the Dept. of State as a law clerk, and in 1887 was appointed third assistant secretary of state. He was secretary to the conference on Samoan affairs in that year and U.S. secretary at the conference on the North Atlantic fisheries, 1887–8. He was appointed professor of international law and diplomacy at Columbia University, 1891, frequently being granted leave of absence to accept appointments in the national interest. On the outbreak of the war with Spain in 1898 he was appointed Assistant Secretary of State, and he acted as secretary and counsel to the U.S. Peace Commissioners at Paris at the close of the War. Among the later official positions which he filled were those of U.S. agent before the United States and Dominican Arbitration Tribunal, 1904; U.S. delegate to the Fourth International American Conference at Buenos Aires, 1910; special U.S. plenipotentiary to the Chilean Centenary, 1910; U.S. delegate to the International Commission of Jurists, Rio de Janeiro, 1912; counsellor to the Dept. of State, 1913; a member of the Permanent Court of Arbitration at The Hague, 1913; U.S. delegate to the Pan-American Financial Congress, 1915. He was appointed in 1921 a judge of the Permanent Court of International Justice. He was also the U.S. delegate and chairman of the International Conference on rules for aircraft and radio in time of war held at The Hague 1922–3.

Moore's publications include *Extradition and Interstate Rendition* (1891); *History and Digest of International Arbitrations*, 6 vol. (1898); *American Diplomacy: Its Spirit and Achievements* (1905); *Digest of International Law*, 8 vol. (1906); *Four Phases of American Development* (1912); *Principles of American Diplomacy* (1918); *International Law and Some Current Illusions* (1924); and *The Permanent Court of International Justice*, a pamphlet (1924).

MORALE: IN WAR.—Modern conditions of war are gradually extending the domain of *morale* and increasing its influence. For, among belligerent nations, war affects a greater number of people and does so with methods of increasing violence.

I. THE SOLDIER IN THE RANKS

In battle, an enemy's long-range guns make their effects felt as far back as 5, 10 or 15 m., and, as they are capable of rapid firing, their effects become formidable to troops even at those distances. Difficulty in seeing their objective does not limit their powers, for they are aided by aeroplanes which inform them concerning the situation of their objective and the results of their fire. At lesser distances they are supported by light artillery in large numbers, mobile, and capable of making the most advantageous use of chance features of the ground over the whole of the area at their command; and further support comes from machine-guns, which, of light weight and slender dimensions, can penetrate everywhere to equip in a short time the whole of the terrain.

Range of Fire.—It follows, then, that the soldier who approaches the battlefield and advances to carry the enemy position, finds that, at great range and over an extremely wide extent, that is to say during a long space of time, he is exposed to a heavy fire, the effects of which are multiplied in severity the further he advances to the position. Frequently, before being able to advance, he is forced to wait until, thanks to supplies of material, cannon, trench mortars and machine-guns, his army has gained a mastery of the fire, and the destructive capacity of the adversary has been thus reduced.

In this time of waiting hours succeed hours, nights follow days and weeks go by, always under the rain of steel from the enemy. It is under incessant bombardment that the march to victory has to be resumed and continued. Rarely is the battle decided in one day. And the nervous tension, the crisis imposed on the combatant, lasts the same time. During all this wearing period he must fulfil, automatically and often left to his own resources, his function as soldier, marksman, machine-gunner, pioneer, link in the chain of intelligence, carrier of supplies and so on. That is to say this function must be part of his own nature, and to fulfil it he must have received a serious training.

Interception of Supplies.—Furthermore, bombardment spreads its havoc no less widely on the rear of the battle-front, cuts communications, prevents the arrival of supplies. Not only has the combatant to show a bold face to the danger which threatens him, but he often finds himself reduced to a most precarious existence; along with the rigours of nights in the open, he has to put up with shortage of supplies. And thus physical exhaustion comes to be added to nervous shock, and the severity of the ordeal is heightened.

Tenacity and Endurance.—In the wars of the past, movement and enthusiasm, the qualities of dash and courage and personal pride, could suffice the soldier in a moment of intoxication to meet, with brilliance, the crisis of collision with the enemy. But to-day, if he is to traverse the long road of the hell which is the modern battle and reach a decision, he must possess an unbreakable tenacity and an energy ready for any sacrifice, and both must be unwavering for long days on end. To what greatness of soul must we not appeal, then, to see the emergence of virtues so solid, so tenacious, so generous? We must leave the answer to the soldiers of the Marne and Yser, Ypres and Verdun.

Further, who can forget the moving spectacle of the British leave-trains returning to the front during the War? The men were accompanied to the station by a silent throng composed for the most part of women and children. A few handkerchiefs furtively sought the eyes of those who were left behind, especially when the train began to move off. On board the vessel at Dover, the returning men donned their life-saving waistcoats, and stood closely crowded together on deck, imprisoned in their own thoughts. If, from a group here and there, came a song or a noisy demonstration, it was from young soldiers going out to the front for the first time. The others remained impassive, silent, gloomy, and their eyes gave token of the cold energy and the spirit of savage resolve on which they had fallen back. It was to the cry of "*Lusitania!*" that they would soon be marching to attack. Experience had taught them that mere knowledge of their duties and a fine, fleeting ardour would not suffice to bear the long and bitter ordeal of the modern battle. They required a spirit which must be imbued with the highest feelings, and, quickened with them, a spirit proved in the crucible of discipline.

The soldier of our national armies has drawn the spirit of sacrifice, the sentiment of discipline and duty, from love of his

country, from attachment to the family as to the race, and from the indispensable military training, which left its strongest impression. Of this he gives proof in action by strict obedience to orders. But let there be no mistake; he conserves and maintains these virtues in lasting fashion only in proportion as the commanders have won his confidence by the care with which they surround his daily life; only in proportion as they know how to conserve that life by their vigilant economy of his blood.

As a whole, the war of the present day demands of the soldier a moral greatness, and a professional training, both developed in very high degree. The conservation of those forces, a conservation which alone can assure victory, is incumbent on the commanding officers. And in this way the rôle and responsibility of the officer expand in an exceptional degree, and grow sharply defined, especially in battle.

II. THE OFFICER

In the course of any action of necessarily long duration, the officer can conserve the value of his unit, section, company or battalion, only by protecting it from the disasters which are continually menacing it, and by leading it step by step to the goal, to the final objective which has been assigned to it by the higher command, and the gaining of which constitutes for it the victory. He cannot confine himself to being a daring soldier, superior to his subordinates by his courage and personal example. He must show himself to be constantly dominated and impelled by a double preoccupation: to avoid the destruction of his unit and to bring it nearer its objective.

Avoidance of Loss.—To avoid its destruction, because he is in the presence of an armament capable, by suddenly inflicted losses, of destroying the unit, or at least of shattering its *morale* for a long time, if adequate precautions have not been taken in time. Hence springs the necessity that he should be familiar with the dispositions appropriate to this continual menace, and that he should be able to order and put readily into practice these dispositions, which by his selection of rendezvous, his tactical formations, by hastily constructed earthworks or by any other procedure, keep the troops halted under cover from the observation, projectiles or poison-gas of the enemy.

How many long hours will not troops have to pass in waiting, in preparation, before seeing the moment for action arrive? How often has not the officer to provide for these secure dispositions? Yet in this situation the slightest negligence is unpardonable. At that moment will appear all the vigilance and all the power of decision which the officer must bring to the field of action, in addition to the acquired knowledge and the experience, necessarily incomplete though this be, of manoeuvres. What is required of him, even at these moments, is the all-embracing eye, the sense of fitting opportunity and the gift of decision.

Precision in Attack.—Then, the moment of action having arrived, the operations of the unit must be carried out without hesitation or disturbance, in the presence of an adversary who, flinging all his resources again into action, may be able to regain some of his preponderance, to restore to his armament its formidable strength. That is to say, the operations must have been directed in all their details by a commanding officer who has previously assured himself of the participation of neighbouring troops, and has gauged as exactly as possible the position of the enemy which he is approaching.

To sum up, together with the feeling of readiness for action called up by the receipt of orders, but before the moment for action has come, it is by foresight and precision that an officer should be inspired and guided in his procedure. Without these he steps into imprudence, and he draws his troops along with him. They run the risk of not returning. He, and he alone, is to blame.

Value of Experience.—Without going into the increased need for technical knowledge resulting from the employment of material, at once more various and more potent and also more delicate, the art of bringing troops on to the battlefield has assumed in our day a capital importance. Every officer ought to concern himself with this, and shape himself for it in time of peace as fully as he devotes himself to the instruction of his men, so that he may be able, when the great day comes, to present himself armed with a certain peace-time experience, and armed above all with faculties well maintained, developed, and turned ever on the alert in the direction of the march toward the objective. He must be ready on that day to resolve the difficulties of this march, difficulties which only the actual conditions will reveal to him, for peace gives no complete idea of the effects of modern weapons on a body of troops. War will bring him face to face with new problems, and will demand that he possess, over and above his professional knowledge, the habit of reflection and prompt decision on fresh circumstances. It is a habit which he will need to have acquired during peace-time.

It is needless to remark that these faculties of foresight, of adaptation to new problems, ought to be developed the more fully in an officer the higher his rank and the greater the instruments of control which are in his hands. For in this case his orders cover vast spaces, are laden with more far-reaching consequences, and are more difficult to modify in their execution. The moral forces and the capacities which the commander must bring to war, if he is to act in such a way that negligence or imprudence, both always disastrous, may be avoided, have increased in notable proportions, even for the lower ranks.

III. THE NATION

But war, to pursue the theme further, does not confine its material and moral effects to the battlefields and the invaded regions. It extends them toward the rear, to populations which were formerly kept aloof from it by the barrier of distance. It spreads them overseas in every direction, even to non-belligerents, and produces the most complete upheaval.

The Non-Combatants.—In the rear, not to speak of refugee populations fleeing before the ravages of invasion, and terror systematically loosed in defiance of the laws of humanity, it is the women, the children and the aged who live in the emotions of the struggle, as a result of the facility and speed of communications; who undergo on occasion the stress of hostile bombardment from the air; who in any case suffer privations of every kind. This means that the field is open, in the heart of the country itself, to the most opposed sentiments and passions, as also to nervous shock and physical exhaustion. But, despite these difficulties, the interior of the country must hold firm to the end, and, what is more, must maintain in foodstuffs, arms, and munitions and support in energy of spirit, those who fight at the front. In its united aspects, the country becomes and must remain by its sentiments and its productive activity the source of the warring capacity of the armies.

Thus, in the old Europe, each country is perforce the near neighbour of powerful states, sees its warlike resistance measured by the degree of union between the interests and sentiments which it comprises, by its jealous watch over its independence, by its progress toward that moral unity which is the essence of a nation, and consequently by the depth of its national sentiment. Only in these moral factors is to be found the energy which will resist concussions of every kind, and will pursue, through ever-increasing sacrifices and through all the vicissitudes of the struggle, the success of the enterprise which will liberate it, once and for all, from all its anguish.

And if, among the states of the New World, where menace is less direct, the immediate danger does not demand the organisation of territorial defence, a blow struck against the principles whereby they live will awaken the apprehensions of the peoples and, in community of sentiments, will arm them for the safeguarding of their free civilisation. In short, a sturdy sentiment which binds the entire people as one, imposing itself upon them by the justice of their cause and the necessity for defending it, is indispensable to the success of a modern war, for that alone is capable of obliging them to the privations and sacrifices which war entails.

IV. THE GOVERNMENT

To maintain and guide this sentiment during the days of the struggle, to exploit it and to extract victory from out of it—

such is the task of the Government. In these days the Govt. must not be simply the representative of the interests of the country, but rather the expression of the passions which are animating it, and to that end, the organiser of defence, the creator of the material resources, the arms, munitions, foodstuffs essential to the struggle, and the motive and inspiring power and of the forces assembled on the field of operations. It must show itself a " war government," with an active and effective policy, taking a wide view of the ends which it is possible to attain, bearing in mind the means at its disposal. And it must be animated by the will always to augment those means to hasten those ends, while still maintaining, in the interior of the country, the spirit which does not disarm.

It is obvious, then, that war calls for peculiar qualities in the statesmen who preside over it. Without these, it must inevitably end in impotence, or even defeat.

V. CONCLUSION

To sum up, whether we are dealing with the soldier, the high command, the nation or the Govt., in each of these divisions war demands an ever-increasing share of the moral forces whose close union and wise combination are alone capable of producing victory. It is to the insufficiency of certain of these forces, or to the lack of cohesion between them, that we must look to grasp and explain the collapse, in the course of the last war, of certain Great Powers, and likewise of armies of formidable repute, which in themselves certainly did not fall short of that repute.

BIBLIOGRAPHY.—The most important works to be consulted are those of Marshal Foch himself: *Des Principes de la guerre* (1903) with English translation by Hilaire Belloc (1918); *De la conduite de la guerre*, 3rd ed. (1915); *Préceptes et Jugements du Maréchal Foch; extraits de ses oeuvres, précédés d'une étude sur la vie militaire du maréchal par A. Gasset* (Nancy, 1919), with English translation by Hilaire Belloc (1919). See also J. R. (ancien élève de l'école supérieure de guerre), *Foch. Essai de psychologie militaire* (1921), and Émile Mayer, *La psychologie du commandement: Avec plusieurs lettres inédites du Maréchal Foch* (1924). (F. Fo.)

MORANT, SIR ROBERT LAURIE (1863–1920), British civil servant, was born at Hampstead April 7 1863. He was educated at Winchester and New College, Oxford, and on leaving the university was for a few years a schoolmaster. Later he went to Siam as educational adviser, and was entrusted by King Chulalongkorn with preparing a scheme of education for the whole country. In a few years he returned to England, and after some experience of social work in the East End of London, was appointed in 1895 to assist in the direction of the office of special inquiries and reports in the Board of Education. He became private secretary to successive ministers, and on him devolved a great deal of the preparation of Mr. Balfour's Education Act of 1902. In 1903 he was appointed permanent secretary of the Board of Education. In this capacity he proved himself a most efficient administrator, and in 1907 he was created K.C.B. In 1912, on the introduction of the National Insurance bill, Morant was appointed chairman of the Insurance Commission, a position which led naturally to his appointment as secretary to the Ministry of Health on its formation in 1919. He died in London, after a few days' illness, March 13 1920.

MORE, PAUL ELMER (1864–), American author, was born at St. Louis, Mo., Dec. 12 1864. He was educated at Washington University and Harvard, and he was assistant in Sanskrit at Harvard, 1894–5, and associate lecturer in Sanskrit and classical literature in Bryn Mawr College 1895–7. He was literary editor of *The Independent* 1901–3, and of the New York *Evening Post* 1903–9, and editor of *The Nation* 1909–14. In 1915 he was elected to the American Academy of Arts and Letters.

He is the author of *Shelburne Essays* (11 vol., 1904–); *Life of Benjamin Franklin* (1900); *Platonism* (1917); *The Religion of Plato* (1921); *Hellenistic Philosophies* (1923); and *The Christ of the New Testament* (1924), in addition to a number of translations from the Greek.

MORESNET: *see* EUPEN AND MALMÉDY.

MORET Y PRENDERGAST, SEGISMUNDO (1838–1913), Spanish politician, was born at Cadiz June 2 1838. He was educated at the Central University, Madrid, and became professor of political economy there. In 1863 he entered the Cortes as a Liberal, took part in the revolution of 1868 and in the constituent assembly of 1869. Colonial Secretary in 1870 under General Prim, and later finance minister, he was for a few months in 1872 Spanish ambassador to Great Britain, and after resigning this post accepted the directorship of a large London bank. A year later he returned to Spain. He re-entered Parliament in 1879, and helped to found the Democratic dynastic party. He was Minister for Foreign Affairs under Sagasta in 1885 and again in 1893–4, Minister of the Interior 1885–8, and Minister of Colonies 1897. In this capacity he advocated the grant of autonomy to Cuba and Porto Rico, and was opposed to the war with America of 1898. He was Prime Minister in 1905–6 and again in 1909, and at the time of his death in Madrid on Jan. 28 1913 was president of the Chamber. He had a cultivated mind and a noble spirit but was not sufficiently resolute for the difficult political times in which he lived.

MORGAN, ARTHUR ERNEST (1878–), American engineer and college president, was born at Cincinnati, O., June 20 1878. He received his early education in the high schools at St. Cloud, Minn., and then spent three years in Colorado in various occupations, including a short term at the University of Colorado. Returning to Minnesota, he worked for his father, a land surveyor, and studied engineering at night. In 1902 he commenced practice for himself at St. Cloud, making a special study of floods and flood control. In 1907 he became supervising engineer of U.S. Govt. drainage investigations, but in 1909 founded the Morgan Engineering Co., of which he became president. His firm undertook many reclamation projects in the southern states. In 1913, after the Dayton flood, he was consulted on behalf of the sufferers with a view to prevent a recurrence of the disaster, the result being the formation, under special statutory powers, of the Miami Conservancy District, consisting of all cities, towns and land within the flood area, and the necessary work was done under his supervision as chief engineer. In 1921 he acted as chief engineer to the Pueblo Conservancy District, formed to protect Pueblo, Colo., from floods. He planned and superintended a large number of projects for water control, and drafted or assisted to draft drainage codes for a number of states. In 1921 he was appointed president of Antioch College, Yellow Springs, O., which was reorganised, under his inspiration, in order to carry out a comprehensive experiment in the correlation of cultural and industrial education (*see* ANTIOCH COLLEGE).

He was the author, among other works, of *The Drainage of the St. Francis Valley in Arkansas* (U.S. Govt. 1911); and *The Miami Valley and the 1913 Flood* (1917).

MORGAN, JOHN PIERPONT (1837–1913), American financier and banker (*see* 18.834), died in Rome March 31 1913. In Jan. 1913 he sailed from New York for Egypt, where he became seriously ill. He was carried to Italy but never recovered. His will provided that after the distribution of enumerated bequests amounting to about $17,000,000, chiefly to his family, the residue of his estate should pass to his son, John Pierpont Morgan. In 1916 the estate was finally appraised at $69,499,732. He left only some $700,000 to charities; but while living he had been a generous giver, and in his will suggested that his son continue certain accustomed annual contributions. His works of art and books were left to his son without restrictions, although in his will he said: " It has been my desire and intention to make some suitable disposition of them or of such portion of them as I might determine, which would render them permanently available for the instruction and pleasure of the American people." In the summer of 1913 most of the art collection was placed as a loan exhibit in the Metropolitan Museum of Art, New York City. Later, some items, mostly replaceable, were sold. The remainder, consisting of over 3,000 pieces, was presented to the museum by the son in Dec. 1917, and a new wing was added to the building to house them permanently. This was opened in June 1918. This collection covered all periods and included matchless bronzes, enamels,

porcelains and tapestries. The library (dedicated by the son by public charter in 1923 as an institution of research for scholars and provided with liberal endowment, in memory of his father) was appraised at $7,500,000, and consisted of about 25,000 volumes of illuminated manuscripts, early printed books, examples from famous presses and association copies.

MORGAN, JOHN PIERPONT, JR. (1867–), son of John Pierpont Morgan (1837–1913), succeeded his father and continued as active head of J. P. Morgan and Co., and of its associated banking houses in Philadelphia, London and Paris. He was born at Irvington, N.Y., Sept. 7 1867, prepared for college at St. Paul's School, and graduated from Harvard in 1889. He received the honorary degree of LL.D. from Cambridge University in 1919 and from Harvard in 1923. In 1891 he became a member of the firm of which his father was the head, and later spent 12 years with the London house of J. S. Morgan and Co., now Morgan, Grenfell & Co. Within 16 months after Mr. Morgan succeeded his father in 1913, as head of the house, the World War began. Almost immediately the finance department of the City of New York became confronted with a grave situation. Owing to the dislocation of the foreign exchanges, the City of New York found itself unable to meet its obligations maturing in London and Paris, aggregating upwards of $80,000,000. Thereupon Mr. Morgan undertook the organisation of a successful bankers' syndicate for $100,000,000 gold, through the operation of which the city's credit was maintained intact.

Within a year the British Govt., followed by the French Govt., enlisted the services of Mr. Morgan and his partners to undertake the vast work of co-ordinating and finally purchasing in the United States their all-important supplies of foodstuffs and munitions. The purchases which the firm made for the British and French governments aggregated several billion dollars, and the work which the Morgan firm accomplished in organising sources of industrial supply in America proved of great service to the United States Govt. when, two years later, in 1917, it undertook to secure its supplies upon a huge scale for the prosecution of its part in the War. Before America's entry into the War, Mr. Morgan undertook the work of financing a great part of the Allies' requirements for credits in the United States of America, and prior to April 1917 had arranged total loan issues to the British and French governments of $1,550 million. During the period of world reconstruction following the War, Mr. Morgan continued active; the publicly issued loans which his firm arranged to Great Britain, France, Belgium, Italy, Austria, Germany, Switzerland, Japan, Argentina, Australia, Cuba and Canada aggregating between April 1917 and April 1926 approximately $1,700 million. During America's participation in the War, Mr. Morgan served as a member of the Liberty Loan and other important committees. For five years he was a member of the advisory council of the Federal Reserve Board. In 1922, at the request of the reparations committee, he served at Paris upon a committee of bankers whose report, laying down the essentials of the German reparations problem, was an important preliminary to the work of the Dawes committee two years later.

In 1920 Mr. Morgan presented his residence at Prince's Gate, in London, to the U.S. Govt. for an embassy. In 1923, by public charter, he dedicated his father's library (to which he had made important additions) as an institution of research for scholars, at the same time providing liberal endowment for it. Under the terms of the gift it will be preserved intact as a complete unit for the period of 100 years from March 31 1913, the date of his father's death.

MORLEY OF BLACKBURN, JOHN MORLEY, VISCOUNT (1838–1923), British statesman and author (*see* 18.840), continued to hold the seals of the India Office till Nov. 1910. One of his last official acts had been to resist the appointment of Lord Kitchener to the vice-royalty, pressed strongly upon ministers by King Edward just before his death. Lord Morley remained in the Cabinet in the less onerous position of Lord President of the Council, and was one of the four counsellors of state to administer the kingdom during King George's visit to India for the Delhi Durbar in the winter of 1911–2.

In the critical period of domestic politics which began with the budget of 1909 he played a somewhat prominent part. He defended that budget in the great debate of Nov. 1909 and, while admitting that the Lords had the legal right of rejection, said that to assert it was a "gambler's throw." Owing to the temporary failure of Lord Crewe's health, Lord Morley led the House of Lords during most of the session in which the Parliament bill, which he warmly supported, was passed; and it was he who read out to the House on the last night of debate that definite assurance from King George of his assent to a creation of peers which finally secured the exiguous but adequate majority of 17. He not only took charge of the India Office during Lord Crewe's illness, and of the Foreign Office in Sir Edward Grey's short holidays, but he was an outstanding figure in the Home Rule debates of 1913 and 1914.

The entrance of Great Britain into the World War brought Lord Morley's official career to an abrupt termination. He felt that his pacifist outlook was sufficiently well-known to make it unnecessary for him to give reasons for resigning; and he withdrew to the retirement of his Wimbledon villa, where he occupied himself with writing two most interesting volumes of *Recollections*, which were warmly welcomed on their publication in 1917. In 1921 his publishers brought out a complete edition of his works in a handsome *format;* and he was generally regarded, during his last years, as sharing with Mr. Hardy the position of *doyen* of English men of letters. He died at Wimbledon, London, after a somewhat long period of ill health, on Sept. 23 1923. See Viscount Morley, *Recollections*, 2 vol. (London, 1917).

MOROCCO (*see* 18.850), a state of Northern Africa. The district of Tangier (*q.v.*) is internationalised; the northern zone is a Spanish protectorate; the remainder a French protectorate. The approximate area is 231,500 sq. m. (Spanish zone, 18,360 sq. m.; Tangier, 200 sq. m.). The estimated population (1925)is: French zone, 4,410,000; Spanish zone, 500,000; Tangier, 70,000. The reigning Sultan in 1925 was Mulai Yusef.

I. POLITICAL HISTORY

In Oct. 1910 there was a general rising of the tribes round Fez against Mulai Hafid, who had become unpopular owing to his dependence on the French and the exactions of his grand vizier. Fez was besieged in March 1911. In April and May French troops were sent to occupy Fez and pacify the district. This action, although its necessity had been notified to the Powers, was resented by Spain and Germany. In June Spain occupied El Qsar and Larache (El 'Araish). On July 1 the German Govt. suddenly dispatched the gunboat "Panther" to Agadir, nominally to protect the interests of German subjects (*see* EUROPE). The situation was so critical that war seemed imminent; but Great Britain declared her intention of standing by the entente, and her formal objection to Germany's obtaining territorial influence in Morocco. France and Germany signed a treaty on Nov. 4 1911; in return for territorial cessions in the Congo, Germany recognised France's political protectorate (the word was used in the letters accompanying the treaty, although not in the treaty itself) over Morocco, economic equality between the two countries being reaffirmed.

The Franco-Spanish Treaty.—On Nov. 27 a Franco-Spanish treaty was concluded. This arranged such debated points as customs, the management of the projected Tangier-Fez railway and the appointment of the Sultan's *khalifa* (deputy) at Tetuan. It slightly revised the Franco-Spanish boundaries determined by the convention of Oct. 3 1904. The boundary of the northern Spanish zone follows the Muluya from its mouth to near Meshra 'Klila; thence, turning west, it runs immediately north of the Wad Wergha R. to Jebel Mulai bu Shota; thence it strikes northwest to the Wad de Kkus, follows its course, and, afterwards, Lat. 35° N., to the Atlantic coast. Both banks of the Lekkus and El Qsar and Larache fall within the Spanish zone. The treaty also recognised the rights of Spain in the south over the enclave of Ifni, bounded to north by the Wad bu Sedra,

to south by the Wad Nun, to east by a line about 15 m. from the coast. The negotiations of 1911–2 between the Powers resulted in the internationalisation of the Tangier zone, consisting of Tangier, its environs and the territory of the El Fahs tribe to south and west of it—about 100 sq. m. in all. By this understanding Tangier was "to be given a special régime to be agreed upon later."

In 1913 a commission sat to determine the nature of this régime; but its findings were not accepted by Spain, and the outbreak of the World War shelved the question. A convention determining the new régime was drawn up on Dec. 18 1923 (*see* TANGIER). On March 30 1912 Mulai Hafid signed a treaty with France accepting the protectorate, which was subsequently recognised by the Powers, who withdrew their diplomatic representatives. General Lyautey was appointed resident-general.

On Aug. 12 1912 the Sultan Mulai Hafid abdicated, appointing as his successor his brother, Mulai Yusef. (E. G. S.)

II. ADMINISTRATIVE HISTORY

General Lyautey's Administration.—The history of French Tangier from 1911 to 1925 was largely military (*see* MOROCCO, CAMPAIGNS IN). France was fortunate in possessing a remarkable administrator in the resident-general, General Lyautey, who was assisted by remarkable subordinates: Generals Poeymiran, Henrys, de Sumothe, Colonel Huot, etc. Instead of evacuating the interior of Morocco during the War, Lyautey was able to extend his control in it, and even to continue public works and hold fairs and exhibitions to maintain confidence. By the end of the War he was well on the way to becoming master of "le Maroc utile," that is, such parts of the country as possessed a real military, political or economic interest. The pacification was complete in 1923; but in April 1925 the Riff outbreak in the Spanish zone extended to the French zone. Lyautey resigned on Sept. 29 1925. Regret was unanimous, and was freely expressed by Sultan Mulai Yusef and the natives, who remembered the "generosity and broadmindedness" which had been the ideal and practice of his policy. Few, if any, Christians had enjoyed such a privilege as he: all Morocco prayed for him in the mosques during his illness in 1923. His successor, M. Theodore Steey, who had successfully filled the post of Governor-General of Algeria, was appointed on Oct. 3 1925.

The Sultan's Govt.—In his difficult task Lyautey enjoyed the loyal co-operation and help of the Sultan, who generally resided at Rabat, the seat of government. Close attention was paid to the maintenance of the Sultan's prestige, and his authority and initiative were carefully respected in internal affairs, the measures decided by him being, however, always taken in accord with the French authorities,[1] by application of the treaty of Fez (March 30 1912). Mulai Yusef, on succeeding to his brothers Abdel Aziz and Hafid, immediately continued and completed the reforms, already begun, of the *Maghzen* (Central Govt.), especially in the matter of native justice and religious land property (habus). He worked regularly with his viziers (the Grand Vizier and the ministers of Justice, Domains, Habus, Public Instruction, and the presidents of the High Sherifian Tribunal and the Tribunal of Appeal of the Chraa (Mussulman law), seven in all, taking a special interest in educational matters. The competency of the local judge, the Kadi—*i.e.*, in reality, a religious magistrate, civil matters relating to marriage, the family and inheritance, etc., being regulated by the Koran—has been maintained towards Europeans in the matter of the acquisition[2] of land property (Articles 11 of the Madrid Convention, July 3 1880) and 60 of the Algeciras Act (April 7 1906). Hence the importance of the Ministry of Justice and of the tribunals.

The Sultan remains the head and tutor of all the members of the Sherifian house. He appoints a special Sherif (the "mezuar" or "naquib") in all the principal towns, who settles disputes between the Shorfa Alauites (*i.e.*, the above members) and watches over their conduct. He has four "Khalifas" in Fez, Marrakesh, Tiznit and the Spanish zone, whose rôle is of a representative character. The civil list amounts to 5,250,000 fr., *plus* 2,200,000 fr. for the Sultan's special negro bodyguard.

Pashas in the towns and Kaids among the tribesmen in the country represent the temporal authority of the Sultan, as opposed to the Kadis (*see* above), and are in charge of criminal justice and judge also in cases where movables and commercial matters are concerned. In the principal towns they are controlled by the French officials of the Protectorate acting as commissaries of the Government. Care has been taken to preserve as far as possible among the Berber tribes the customs (izref) to which they are deeply attached. Their Kaids are judges in penal and commercial matters; disputes as to personal status, property, etc., being settled by the djemaas (popular assemblies) according to custom and not by the Kadis.

Native Representation.—Arrangements were made for taking the advice of the natives on certain questions. The programme of the monthly meeting of the Council of Government is communicated not only to the Maghzan but, through the French "contrôleurs," a week beforehand, to the native sections (created by a *dahir* of Jan. 20 1919) of the chambers of commerce and agriculture, who, as occasion offers, deliberate either separately or concurrently with the French sections. They are also represented in the municipal councils presided over by the pashas in the principal towns. In both cases they are appointed by the Government.

French Administration.—The administration is under the authority of the "Commissaire" Resident-General (decree of June 11 1912), assisted by a delegate and a secretary general of the Protectorate. The central government comprises the secretariat general, to which are attached the following services: civil control, personnel, legislative studies, general security, general administration, penal justice and the special direction of native affairs and the intelligence service. The other central services are divided up between the following Directions générales: 1. Finances and public domains; 2. Public works (with the mines, ports, mercantile marine and the post, telegraph and telephone office; 3. Agriculture, commerce (and industry) and colonisation (with the forests and the land registrations and survey); 4. Public instruction, fine arts and antiquities; 5. Public health. The "exterior services" are classed by regions, Shawiya, Rabat, Gharb, Ujda, etc.), and distributed between 22 controls (and their annexes) or municipalities in the civil territory; and eight regional bureaux, with their 14 circles, in the military zone. The French judicial organisation, which comes into play whenever Frenchmen or Europeans are concerned, comprises 12 civil courts; three tribunals (Casablanca, Rabat, Ujda and a court of appeal (Rabat).

In order to ensure "a constant and regular collaboration between the Government and French colonists," the presidents of the chambers of commerce and agriculture of Rabat, Qnitra and Casablanca, and of the mixed chambers of Marrakesh, Mazagan, Ujda, Safi, Meknes and Fez (whose members are elected), assemble once a month in a Council of Government, the agenda of whose sittings is always communicated a week in advance. There is a municipal commission in each important town (the same as above), theoretically presided over by the Pasha, representing the Sultan, and practically by the French chief of the municipal services. They have a consultative voice, except in Casablanca, where it is deliberative.

Public Instruction.—In 1916 there were 140 schools under French supervision, with 470 masters and 14,834 pupils. In 1924 the schools numbered 199 (90 French; 67 Franco-Arab; 42 Franco-Jewish and Jewish), the masters 938 and the pupils 29,030—417 for higher instruction; 2,822 for secondary education; 23,327 for primary education; 1,029 for the technical schools and 1,435 for the evening courses in two or three big towns. A distinction is drawn between the primary schools for the sons of "notables" and the other primary schools. The teaching of housekeeping (Écoles menagères) has been started for native girls. There are two Mussulman colleges, in Rabat and Fez, where selected pupils from the special schools for the sons of notables receive, in a course of studies of six years, higher education in Arabic (language and literature) and Mussulman religion and law, with the elements of French, mathematics, general geography and practical science. Those studies are completed in the institute for higher Moroccan studies at Rabat (also open to French pupils), where Arabic literature and language are taught thoroughly, as well as the special history and geography of Morocco, the Berber customs and dialects, ethnography, French and Mussulman law, and lectûres on the administrative organisation of the country. It is the seminary for officials and interpreters. There is also an important Sherifian scientific institute (10 laboratories) in Rabat. An industrial and commercial school exists at Casablanca (232 pupils) with evening courses (360 pupils). There are official workshops (ateliers) for apprentices in the principal towns, and also a few for girls (carpet-making, etc.), and technical schools for Europeans in Casablanca and Ujda. A special service is in charge of the historical monuments, both Roman (Volubilis, etc.) and Moorish. Local laws, inspired by the French director of the service, protect the artistic remains in the towns, and some restorations have been undertaken. Special lodgings and studios have been provided in the most interesting towns for European painters and architects, who can come and study in the country.

[1] The link is secured by the French councillor to the Sherifian Govt. (decree of May 19 1917).

[2] After they have been *immatriculated*, land properties fall under the new land laws and French tribunals.

III. ECONOMIC HISTORY

Population.—The 1921 census, completed (1924) by the latest official statistics, gives an urban population of 612,987 for French Morocco. The rural population is not really known, certain parts of the country being still outside French administration, and others very lightly administered. The estimated total is 4,410,000 inhabitants. There are three principal towns: Marrakesh (145,000), Fez (124,500), Casablanca (110,900). The next in order of importance are Meknes (38,000), Rabat (33,000) and Safi (25,800). Then come Sali (24,300), Ujda (22,200), Mazagan (22,000) and Mogador (19,500).[1]

Frenchmen numbered (1924) 51,889 (24,799 in Casablanca, 7,218 in Rabat, 4,400 in Ujda, 2,800 in Fez, 1,700 in Marrakesh, etc.); Europeans 32,320 (17,487 in Casablanca; 5,000 in Ujda, etc.). The Jews total 73,400 (in the towns, descendants of immigrants from Andalusia). There are also a few Jewish converts among the Berbers in the country. Spaniards rank first among the Europeans, Italians come next.

In 1923 (official figures) 23,473 passengers arrived at Casablanca, of whom 5,133 came to stay (3,682 Frenchmen, 532 Spaniards, 382 Italians, 63 British, etc.) Of these, 660 came for commerce, 424 as engineers, contractors or as workmen for the building trade, etc.; and 1,200 tourists visited Morocco. On the other hand, about 30,000 natives (including a certain number of Riffans) crossed over to Algeria as harvest labourers; 4,596 Moroccans went to France as labourers; 1,250 returned the same year, bringing back over 2,000,000 fr. savings.

French Colonisation and the Land Question.—At the end of 1913 French properties numbered 1,127, representing 1,073,000 ac., lying principally in the El Gharb region (north of Rabat—about 250,000 ac.); the Shawiya (south of Casablanca), the environs of Rabat and Ujda coming next. Other European properties numbered 117 (Spanish 28, Italian 39, English 20, etc.), covering 52,700 acres. Farms of less than 100 hectares (250 ac. represent 44·8% of the total surface in European hands; large farms (over 1,250 ac.), 14·3%. The rest (40·9%) varies between 250 and 1,250 ac. (*colonisation moyenne*). Of the total surface, 179,000 ac. had been given away by the official colonisation system (sales), and the rest bought directly from the natives. About half the French colonists come from Algeria and Tunisia and are already familiar with local conditions.

The establishment of French power brought about a great change in economic and social conditions in agriculture as elsewhere. Both the soil and the climate are, in many parts of Morocco, far more favourable to settlement than to nomadism. The feebleness of the central native power (Maghzen) and continual intertribal strife used to render private property (*melk* lands) almost illusory. But, especially since 1919, in the pacified parts, the natives have settled on the land which was, before, "common" land (*arch*), inalienable according to Mussulman law and custom. It is both wise and just to reserve a part of them (it is estimated that about 5,000,000 ac. can be cultivated instead of being left for sheep grazing) for French and other colonists, who can put them into far better value.[2] There are also maghzen and habu (religious property) lands that can be better utilised. Land registration has been introduced in Morocco since 1913, and 5,826 titles had been registered at the end of 1923, on which, at that date, 186,000,000 fr. had been borrowed on mortgage. Natives are also beginning to register their lands.

The colonists cultivate the same crops as the natives: wheat (durum principally), barley, oats, beans, etc.; the olive tree, flax (for seed). There have been a few experiments in growing castor-oil seed and in cotton and hemp since the War. Orange culture in the regions of Meknes and Marrakesh is promising. Vineyards only occupy a few hundreds of acres; and for the moment the raising of early vegetables (so successful in Algeria) is confined to the suburbs of a few big towns for their European inhabitants. Stock raising (sheep especially) is also carried on, sometimes in association with natives; the number of sheep was estimated in 1924 at about 10,000,000, of which 7,200,000 paid the tax tertib, and about 100,000 were in European hands. The amelioration of the local breed, both from the point of view of the flesh and the wool,[3] is being steadily pursued; as also the study of several other important agricultural problems in the official farms and experimental fields.

Budget.—The 1924 budget foresaw 312,629,000 fr. ordinary receipts; of which, customs produced 83,000,000 fr.; tertib, 66,000,000; taxes on consumption (sugar, tobacco, etc.), 60,000,000. The 312,442,000 fr. of expenses were principally distributed as follows: public debt, 62,000,000; justice and general administration, 72,000,000; services of economic interest (public works, agriculture and commerce, etc.), 91,000,000; services of social interest (education, health, etc.), 29,000,000, etc. The total actual debt of the Protectorate amounts to 705,624,000 francs. Morocco contributed (1924) 46,000,000 fr. to the French military expenses in the country. At the end of the same year France had spent 4,271 million fr. since 1907 in Morocco. But if the ordinary garrison expenses (not special to Morocco) are deducted—2,501 million fr., or 63·6% of the total—the total cost proper of Morocco to France represented at that date 1,431,000,000 francs.

Railways and Public Works.—The 1,300 km. of narrow gauge military railways existing in 1923 registered that year 61,620,000 kilometric-passengers and 67,750,000 kilometric-tons of merchandise. They are gradually being replaced by the standard gauge, 400 km. of which were already in operation in 1926, and which will be partly electrified when the Casablança central power station is finished. Including the Tangier-Fez line (310 km.), the new system will have a total length of about 1,000 kilometres. The admirable phosphate region of El Boruj-Wed Zem is already linked up with the port of Casablanca, which now possesses a length of 425 metres of quays for big ships (depth 48–50 ft.) under the protection of a jetty over a mile long (2,000 metres). The other ports are Qnitra, Rabat, Fdala, Mazagan, Safi and Mogador.

The network of roads consisted (end of 1923) in 2,665 km. of principal and 577 km. of secondary roads, and 933 km. more were being constructed or projected. There existed at the same date 12,300 km. of telegraph lines. Besides the sea postal service, Casablanca is in daily postal connection by aeroplane with Toulouse, by Algeciras, Barcelona and Perpignan.

The year 1925 marked important progress in the value of Moroccan commerce: 1,754,000,000 fr. (imports, 1,189; exports, 565), as against 139,0,000,000 fr. in 1924, and 850,000,000 in 1923. Figures in tons are still more decisive.

	1923	1924	1925
Exports	339,236	815,160	982,921
Imports	448,293	426,572	569,640
Total (tons)	787,529	1,242,732	1,552,560

The great growth in exports is due to the progress in the exploitation of the magnificent phosphate beds of Wed Zem (finer than those of Tunisia): 720,000 tons exported in 1925. By far the greater part of Moroccan commerce is centred in Casablanca (1,135,600 tons, 1,082,000,000 francs). The two ports ranking next are Qnitra (138,700 tons) and Safi (90,600 tons). Fdala is last on the list. Commerce by land with Algeria (Taza-Ujda) amounted to 77,860 tons. On Jan. 1 1924 there were 615 industrial establishments in European hands in Morocco, employing 7,223 hands and 22,868 horsepower. The capital invested amounted to 273,600,000 francs. Electricity heads the list; flour-mills, slaughter houses, lime and cement factories come next. Casablanca comes first (140,000,000 fr. invested). Rabat, Marrakesh, Fez, Qnitra and Ujda rank afterwards, in the order named.

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III. SPANISH MOROCCO

The Spanish zone in Morocco extends over an area of 18,360 square miles. Accurate returns of the population are impossible. The civil population in the towns in 1923 was estimated at 118,305, of whom the majority were Mahommedans. Tetuan, the capital of the Protectorate, had an estimated population of 23,447 in 1923. Other towns were Melilla, 60,000; Larache, 15,430; Alcazarquivir, 12,368.

Education in Spanish Morocco is conducted under the auspices of the different creeds. Catholics, Mahommedans and Jews have their own schools. The budget of the Protectorate provides the salaries of professors at the university in Tetuan. There were 175 primary schools, of which 74 were specially for Moorish children. The total number of pupils attending the primary schools in 1923 was 24,679.

Administration.—By a royal decree of Jan. 18 1924 the direction of affairs in Spanish Morocco was entrusted to the Premier

[1] "Urbanism" was a great feature under Lyautey. If Casablanca is certainly an overgrown town, the plans for the extension of the principal towns (drawn up by M. Henri Prost) are remarkable, and carefully preserve the native quarters.

[2] In Tunisia, for instance, in 1921, the 190,000 ac. cultivated in wheat by Europeans produced 68,000 tons, whereas the 1,250,000 ac. in native hands only gave 120,000 tons. In Morocco, where a French colonist loses 7% of his sheep stock, a neighbouring *Kaid* will lose 48%—a case of direct observation.

[3] Wool of the *Abudia* commercial type, of the Beni Hassen, is already of a superior quality; it is perhaps the original *merino*.

of Spain, with the exception of military matters, which were confided to the Ministry of War. The Spanish Govt. is represented in the Protectorate by the High Commissioner, who presides over the Civil Services. A royal decree of March 1925 fixed the limit of the Spanish forces in the Zone at 80,000—65,000 Europeans and 15,000 natives. The intermediary between the higher command and the Moorish troops is the officer known as the *Caid Interventor*.

The reverse suffered by the Spanish arms in 1921 through the defection of a friendly tribe, when Gen. Silvestre was killed, precipitated a political crisis in Spain, which culminated in the proclamation of the Military Directory in Sept. 1923. The policy of the President of the Directory, Gen. Primo de Rivera, was to establish a single front, to effect which the army was withdrawn from portions of the occupied territory and a number of positions were evacuated.

Spanish subjects in the Protectorate enjoy all the civil rights recognised by the law in Spain; foreign residents enjoy the same rights subject to certain provisions. All residents, whether Spanish subjects or not, must conform with regulations relating to the police and public security. The budget for the Zone for 1924–5 was 15,607,500 pesetas. The total trade values, in pesetas, for 1922 were: imports, 4,367,401; exports, 7,080,413—a favourable trade balance of 2,713,012 pesetas. Agriculture in the Spanish Zone has made progress since 1923, and of the 330,000 hectares of land available for cultivation in the eastern zone 120,000 have been taken up for production. Lemons, oranges, olives and many cereals are grown. The *Agrupación agraria* at Alcazarquivir has inaugurated a new era of agricultural progress.

The Spanish Zone is served by three railways: Ceuta-Tetuan, Nador-Titztutin, Larache-Alcázar, with a total mileage of 90 miles. Public highways have been constructed in the central, eastern and western regions.

MOROCCO, CAMPAIGNS IN.—The colonisation of Morocco has always been attended by violent encounters with the numerous tribes inhabiting that country. Since 1910 France and Spain, the two protecting powers, have both had to contend afresh with native hostility, encouraged and assisted to some extent by agents of Germany. The following account of this aspect of Moroccan history is given under three headings, namely, I. Spanish Campaigns; II. French Campaigns; and III. Franco-Spanish Campaigns. The last deals with the combined action of France and Spain against the tribes of the Rif.

I. SPANISH CAMPAIGNS

The history of Spain in the Rif has been one of intermittent warfare ever since, at various dates in the Middle Ages, she obtained possession of and occupied her "Presidios" on this coast of North Africa—Melilla, the Zaffarin Islands (Islas Chafarinas), Alhucemas, Peñon de la Gomera and Ceuta. Confined to the narrow limits of these possessions, it was ever Spain's desire to obtain more breathing-room so as to be able to put them to a greater utility than mere penal settlements. At various periods, for instance after the Spanish Moroccan War of 1859–60, the Spanish Government had demanded and obtained some territorial expansion at Ceuta and Melilla; but the other points, rocky islands off the coast, remained at the mercy of the tribesmen of the mainland and could only with difficulty be provisioned. As was only natural the relations between the Spanish and the Rifis were difficult.

Spanish Expansion.—The loss of her colonies at the end of the 19th century caused Spain to seek compensation in Africa; and the Franco-Spanish Treaty of 1912, to which Great Britain was a consenting party, gave her the opportunity she sought. By this treaty the Spanish zone in Morocco was delimitated and Spain's hands were freed to undertake its occupation. Already in 1909 she had fought a costly campaign in the Melilla district which had left a comprehensible desire in the Spanish Army for revenge. In 1912 the occupation of various parts of the Spanish zone was begun and in that and the succeeding years Tetuan, Larache, El Qsar (Alcazar), and Arzila were reached and the neighbouring districts occupied. At the same time Spanish forces marching south and westward from Melilla succeeded in penetrating some distance into the Rif without meeting with serious resistance.

Effect of the World War.—The Spanish task was at first much facilitated by the World War, during which the Spanish zone was used by the Germans as a base of active propaganda and action against the French Protectorate. Money was lavishly distributed amongst the tribesmen for the purpose of raising Rif forces for inroads into French territory, and Rifi attention was largely withdrawn from the more imminent danger of Spanish invasion. The end of the war put a stop to this anti-French action and the Rifis, who had received from the Germans large sums of money and no small quantity of arms, turned against the Spaniards. In 1919 General Berenguer, the Spanish High Commissioner, was forced to open a campaign in the Jibala highlands which led, in the following year, to the occupation of Sishawen (Sheshuan). Raisuli, sherif and ex-brigand, whose influence amongst the tribes was great, facilitated on this occasion Spanish action.

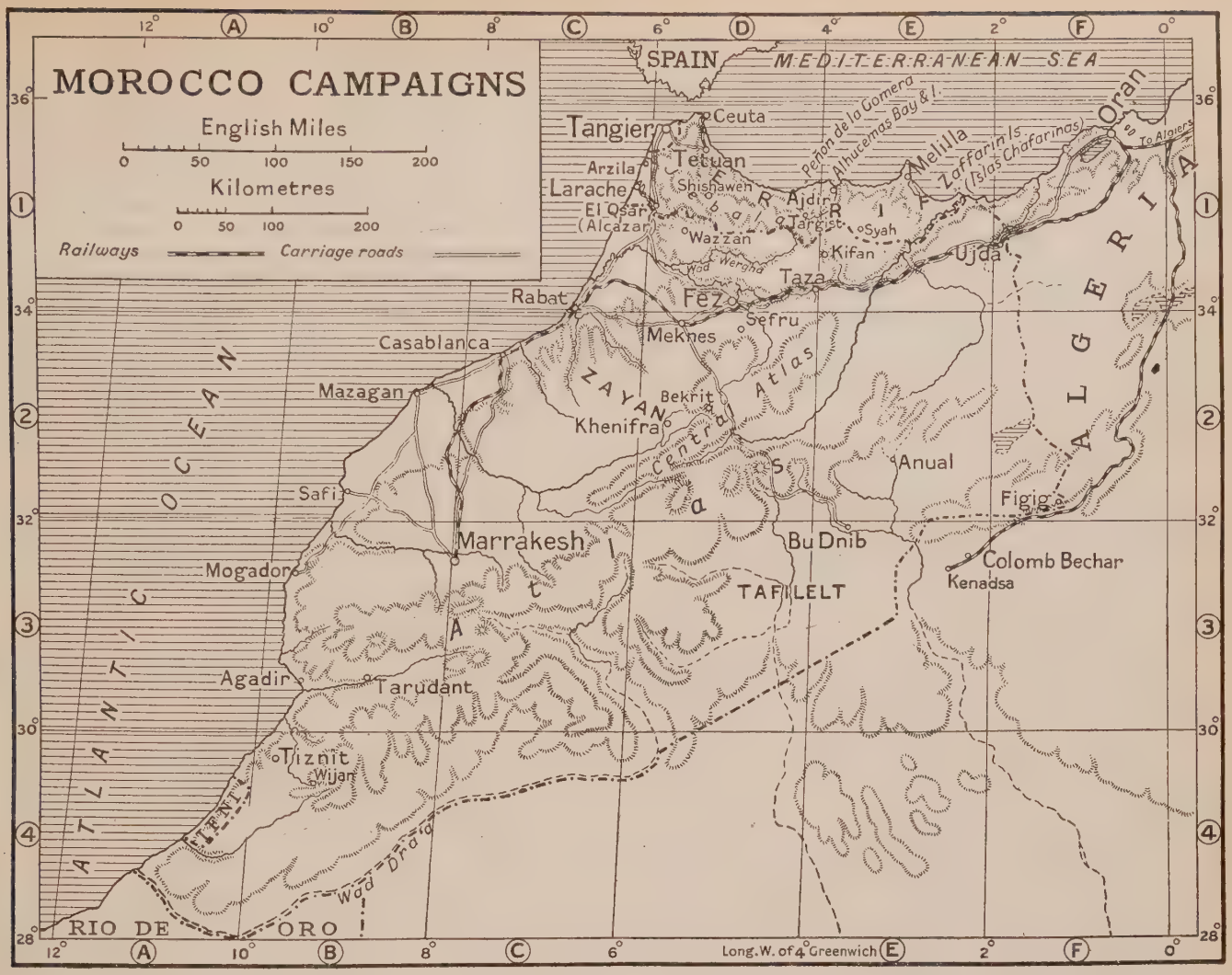
'Abdel Krim.—Further east 'Abdel Krim, the son of a Beni Uryaghel (Ouriaghel) chief, had deserted the Spanish service and was stirring up resistance to the Spaniards in the Rif. In 1921 a Spanish Army of nearly 20,000 men holding the country between Melilla and Alhucemas was annihilated by the Rifis. This disaster, which began with the fall of the advanced post of Anual and the death of General Silvestre, leading to a subsequent panic, ended in the loss to Spain of all that had been acquired in several years of campaign and diplomacy. At least 16,000 soldiers were killed, after the perpetration upon many of them of every kind of atrocity. Melilla itself was for a time at the mercy of the tribesmen, but for some unexplained reason they did not enter the town.

These Moroccan events led to a crisis in Spain and in Sept. 1923 the Constitutional Government was replaced by a Military Directory under Gen. Primo de Rivera. The situation in Africa was serious. The outlying Spanish positions, often cut off altogether, were threatened in every direction and the president of the directory recognised that immediate action was necessary if the Spanish garrisons and Spanish prestige were to be saved. He decided upon the wise and courageous course of a general withdrawal from the front, including the evacuation of Shishawen. It was not until the autumn of 1924 that this difficult manoeuvre was accomplished, after considerable loss in men, in artillery and in arms and ammunition. New lines were occupied, passing from the immediate south of Tetuan to the frontier of the Tangier zone and thence southward to near El Qsar and the frontier of the French Protectorate. The road from Tangier to Tetuan was preserved as a couloir, strongly guarded on both sides, through enemy country. The evacuation by the Spaniards of those extensive regions added not a little to 'Abdel Krim's influence and prestige. Raisuli, ill and bedridden, was taken prisoner by the Rifis and died a few months later, a captive at Adir, 'Abdel Krim's headquarters. (W. B. H.)

II. THE FRENCH CAMPAIGNS

The Fez rising which took place in Oct. 1910 (*see* MOROCCO, was followed by continued trouble in the Fez-Sefru district during the autumn of 1911. A new pretender, Hamed el Hiba, occupied Marrakesh in Aug. 1912, but he was expelled in Sept. and therepon fled south. In Oct. Gen. Lyautey occupied Agadir. Fighting in Western Morocco continued for some months; but this district and that of Fez were occupied by the spring of 1913, and the French concentrated their attention on Eastern Morocco. The important strategic point of Taza, which commands communications with Algeria, was occupied in May 1914, Khenifra captured in June.

The World War Period.—On the outbreak of the World War, the French commander received telegraphic orders from the Ministers of Foreign Affairs and of War (July 27–28 1914) "to reduce the occupation to the principal points on the coast," as "the fate of Morocco would be settled in Lorraine," and asking



Lyautey to send all available men and material to the French front. Lyautey immediately dispatched 37 battalions and other troops; but refused to evacuate the interior. The tribes round Taza, and the Zayan in the west, promptly rose, but the *kaids* of the Atlas and the *bashas* of Tarudant and Tiznit in the south near Agadir remained friendly, the latter keeping El Hiba's forces in check. The Spanish zone was used by the Germans as a basis of active propaganda and action against the French Protectorate. The tribesmen received lavish donations of arms and money from the Germans. Throughout 1915 and 1916 chiefs in German pay conducted a campaign along the Wad Wergha. Nevertheless, the small French force more than held its own. In May and June 1917 Abd el Malek was driven from Taza. On March 24 1917 El Hiba was severely defeated at Wijan; his force was finally dispersed in the following spring. The Tafilelt was definitely occupied at the end of 1917. In Aug. 1918 a revolt began among the Aid Atta, which was suppressed by April 1919 with the help of El Glawi.

French Activity, 1918-23—After the War the French continued their operations, taking the offensive, now on one, now on the other, of their four fronts: the Northern (Spanish zone; Djebala and Rif tribes), the Berber (Central Atlas), the front of the big *kaids* (El Glawi, M'tongi, Goundafi) and the Southern front (Kut Aissa, Tafilelt). In 1919 the 80,000 French troops were successful in the Bu Dnib territory in the southeast (Jan.–March), on the Wenah (northwest) in April, in the Taza Corridor (June–Oct.). In 1920 the chief activity was in the Central Atlas until Sept., when Wazzan, in the north, was taken, and operations began in Nov. north of Agadir. For 1921 the main operations were again planned for the Berber front, but in Feb. the Djebalis, headed by Kacem ben Salah and Abd el Malek, again rose unexpectedly. Though reinforced by the Beni Mestara and the Beni Mesguilda, they were put down by General Poeymirau in April. General Aubert settled the Beni Waghrain question in June, and Poeymirau once more filled up the Bekrit "pocket" in the Zayan country in the autumn. By the end of 1923 the French zone was pacified, 1923 being especially devoted to wiping out the Taza "stain" (*la tache de Taza*). The last French operations were largely dictated by the need of gaining control, for irrigation and other purposes, of the "Water Castle" of the Central Atlas. Meanwhile the anti-French subventions ceased and the Rifi, now well-armed and financed, turned against the Spaniards. (H. Br.*)

III. THE FRANCO-SPANISH CAMPAIGN

Until April 1925 the Rifi had been at war with Spain alone; but the gradual occupation by the French of the northern limits of their Protectorate, which reaches as far as the southern borders of the Rif, brought a new factor into the field.

'Abdel Krim's Offensive.—'Abdel Krim considered that his country was threatened by this advance and in April he launched a furious attack upon the French front to the north of the Fez-Taza-ujda road, the great highway between the Moorish capital and Algeria. Under this unexpected blow the French front collapsed. The Rifi penetrated far behind the lines, forced or persuaded the surrounding tribes to rebel and pillaged and massacred when obedience was refused. The situation became critical. For some reason the French Govt. hesitated to send the reinforcements necessary until the campaign had taken an importance which might have been avoided had more troops been at once available. Wazzan and Taza were threatened and European women and children were withdrawn to places of safety.

By the end of June, Fez, the capital, was in danger. The Sultan, in order to give confidence by his presence, arrived there in the latter days of that month. The efforts to save Fez were successful but many of the rich agricultural districts of this northern part of the French Protectorate were overrun and pillaged. Wherever it was possible the more distant military posts were evacuated, but many, with their garrisons killed, fell into the hands of the enemy with such artillery and arms and ammunition as was in them, immensely increasing the Rifis' war material. In July the French Govt. decided to send Marshal Pétain to take supreme command of the French Army, which now numbered over 160,000 men. Marshal Lyautey remained in charge of the political and administrative Government. A month was lost in the reorganisation which this new decision necessitated. Meanwhile immense quantities of material, artillery, mechanical transport, aeroplanes and all the implements of modern warfare arrived on the front.

Franco-Spanish Alliance.—Realising the common danger the French and Spanish Govts. held a conference at Madrid and drew up a programme for combined political and military action in Morocco. Monsieur Painlevé and Gen. Primo de Rivera offered peace to 'Abdel Krim on generous terms. The Rifi leader refused, demanding in return the absolute independence of the Rif. It was agreed at the conference that while the French Army should advance northward from its base the Spaniards should undertake a landing in Alhucemas Bay and thus occupy the region of Ajdir, which formed 'Abdel Krim's headquarters. On Sept. 8 and subsequent days a Spanish Army of 15,000 men was successfully disembarked while, at the same moment, French forces marched northward from their base at Taza, via Kifan. A junction was carried out at Syah between these French columns and Spanish contingents advancing westward from the Melilla district.

There is no doubt that the objective of this combined force was to reach Ajdir by land and join up with the Spanish troops which had been disembarked at Alhucemas, but the autumn rains broke and the united columns found themselves in difficulties. The tracks through this inhospitable country became quickly impassable and there was an imminent risk of isolation. The French troops retired 18 m., and all along the front winter-quarters were prepared. Pétain returned to France and Lyautey resigned. M. Steeg, who had been Minister of Justice and Governor-General of Algeria, was nominated high commissioner.

The active phase of the Franco-Spanish combined action against the Rif came to a close with the advent of winter weather and such French troops as could be spared from the front were sent to more hospitable quarters—Fez, Meknes and Rabat. The campaign had been marked by no incidents of military importance. The French had succeeded at great cost and at considerable loss of life in retaking the districts they had evacuated, but neither security nor tranquillity were assured. The mobility of the Rifis made them largely immune from the results of artillery attack, and long experience in the Spanish zone had taught them how to take cover from aerial bombardment. Their losses were thus comparatively small. The absence of all war impedimenta rendered their mobility most disconcerting to troops educated on the European battlefield. In short the methods employed by the French were in many respects quite unsuitable to this kind of colonial warfare, and the hoped-for results had not been achieved when rain put an end to the autumn campaign. The constant penetration of the French lines by groups of natives who, uniting in the rear, became formidable bands, caused constant anxiety. Convoys and posts were attacked; peaceful country was invaded and farms and villages burnt.

Rifi Activity: Winter 1925.—It had been 'Abdel Krim's desire and intention, by intense propaganda to raise rebellion amongst the Protectorate tribes further south; but although at one moment there were signs of hesitation, and even of disloyalty, amongst some of the nearer Berber tribes, the spirit of rebellion was suppressed almost before it had become apparent. It was a proof of France's admirable administration in Morocco that with the exception of the tribes which inhabited the borderlands of the Rif, and thus fell directly under Rifi influence, the rest of Morocco remained loyal.

As soon as the French and Spanish troops, on the breaking of the weather, withdrew to winter quarters, 'Abdel Krim began the reorganisation of his forces. The Spanish disembarkation at Alhucemas was a heavy, but apparently only temporary, blow to his prestige, though it necessitated the abandonment of his village capital of Ajdir. But he was able to withdraw to a place of safety within the mountains his artillery and stores of war material. Only a very few of his guns fell into the hands of the Spaniards on their landing. Moving his headquarters to Targist, south of Ajdir, he set to work to prepare for a renewal of the campaign. His first action was to obtain a moral revenge for the Spanish landing at Alhucemas, and for this purpose he despatched four cannon to the mountains that overlook Tetuan, the capital of the Spanish zone and the residence of the high-commissioner.

By almost superhuman efforts the Rifis dragged these guns over the rugged mountains to a spot within nine km. of Tetuan and set them up in caves situated at least 2,000 ft. above the town and valley. From this vantage ground they opened on Sept. 28 a desultory bombardment of the capital, which was still being continued in December. The skill with which these guns had been mounted and could be withdrawn into the caves after every shot protected them from the fire of the Tetuan batteries. To send an expedition to destroy them was considered unduly costly. The moral effect, however, was important and a large number of the civil population left the town.

Close of 1925.—In Dec. 1925 the French and Spanish armies were in comfortless and insecure winter quarters, difficult to provision, and very trying to the health of the troops. 'Abdel Krim was organising his army in preparation for a continuance of attacks upon his enemies during the winter and for a new campaign in the spring of 1926, which appeared inevitable unless meanwhile a settlement by negotiation could be brought about.

Peace Negotiations: April 1926.—Early in 1926, however, the prestige which 'Abdel Krim had established over the tribes of the Rif began to wane and his position was much weakened by the readiness with which various tribes contemplated the cessation of hostilities. In these circumstances 'Abdel Krim, in the first days of April, offered to negotiate with the Franco-Spanish Governments. An unofficial armistice came into being, and a meeting of French, Spanish and Rifi delegates was arranged for the third week in April. The French and Spanish Govts. reached an agreement as to the terms on which they were prepared to negotiate for peace. (W. B. H.)

On May 30, 'Abdel Krim surrendered unconditionally at Taza to General Boichut, the French commander in Morocco. In a manifesto addressed to the Rifi tribes, M. Steeg said that his fate would be decided by Mulai Yusef, the Sultan of Morocco. The French losses during the campaign were 2,162, exclusive of the casualties among native troops.

The close of the Rif campaign left some questions for solution between France and Spain, and conversations began at once between M. Steeg and the Spanish high commissioner, General Sanjurjo. Apart from the future of the Rif itself, the two tribal federations in the west, in the Djabala and the Chomara, remained to be dealt with; even the French zone had not been fully occupied. (*See* 'Abdel Krim.) (Ed. *E. B.*)

MORRIS, EDWARD PATRICK MORRIS, 1st Baron (1859–), Newfoundland statesman, was born at St. John's, Newfoundland, May 8 1859. Educated at St. Bonaventure's College and the University of Ottawa, in 1884 he was admitted a solicitor, and in 1885 was called to the bar. The same year he was elected to the legislature of Newfoundland as the representative of St. John's in the Liberal interest. From 1890 to 1895 he was acting attorney-general for Newfoundland, and from 1893 to 1906 was a director of the Newfoundland Savings Bank. In 1898 Morris left the Liberal party and was leader, first of the Independent Liberals and later of the People's party (1908–19). In 1902 he became attorney-general and subsequently Minister for Justice. He was knighted in 1904. In 1909 he became Prime Minister, retaining this office until 1918, and representing Newfoundland

at various Imperial and other conferences. In 1913 he was made K.C.M.G., and in 1917 was a member of the Imperial War Conference. He was raised to the peerage in 1918, having been since 1911 a member of the Privy Council. Lord Morris edited an edition of the Newfoundland law reports from 1820 to 1905, usually called *Morris's Reports*.

MORRISON, GEORGE ERNEST (1862–1920), British journalist and traveller, was born at Geelong, Australia, and educated at Melbourne University. From 1882 he travelled extensively in the South Sea Islands, where he studied the Kanaka labour question; in Australia, which he crossed on foot from the Gulf of Carpentaria to Melbourne; and in New Guinea. He took his M.D. degree in 1887 and after journeys to the United States and the West Indies he worked in his medical capacity in Spain, Morocco and Australia. In 1893 he abandoned medical work and set off on extensive travels in the Far East. In 1895 he was special correspondent of *The Times* (London) in Siam and two years later became Peking correspondent of the same journal. In this capacity he visited every province and dependency in the Empire, with the exception of Tibet, and gained an intimate knowledge of men and affairs. In 1911 at the outset of the revolutionary movement in China he proclaimed his sympathy for the programme of Dr. Sun Yat-sen and the Cantonese Radicals. In 1912 after the abdication of the Emperor he resigned his *Times* appointment and became political adviser to Yuan Shih-K'ai, president of the newly formed Chinese Republic. Dr. Morrison's published works include *An Australian in China* (1895). He died at Sidmouth, Devonshire, May 30 1920.

MORTON, LEVI PARSONS (1824–1920), American banker and politician (*see* 18.882), died at Rhinebeck, N.Y., May 16 1920.

MOSBY, JOHN SINGLETON (1833–1916), American soldier (*see* 18.890), died in Washington, D.C., May 30 1916.

MOSCOW (*see* 18.891), the capital of the Union of Socialist Soviet Republics, called by the Russians Moskva, had in 1925 a population of 1,845,000. The great increase in population was due to the transfer of the seat of government from Petrograd to Moscow after the Revolution. It fell during the famine period, but increased by 716,000 from 1920 to 1924 owing to the return of many who had left the city and to the increase in the number of officials and of traders. The natural increase (the excess of births over deaths) is about 25,000 per annum. The records showed in 1925 270,000 persons engaged in government offices, schools, trade unions and co-operative organisations, etc., 35,000 employees in private trading concerns, 150,000 factory and mill workers, and about 37,000 home craft workers.

The great influx of population created a serious and dangerous housing situation, intensified by the circumstances of the famine period when many wooden houses were destroyed for use as fuel, and by the cessation of building and of ordinary repairs. In 1920–1 25% of the already inadequate houses were derelict. Quarters were requisitioned, and the great apartment houses of central Moscow were run by house committees which allotted floor space to occupants, charging only the costs of repairs, lighting, cleaning, etc. The New Economic Policy was followed by a return to a more normal rent system. Houses were put in order, pavements restored, and a considerable amount of new buildings was put in hand in 1923 and 1924. In 1912, with a population of 1,618,000 Moscow had 281,500 apartments; in 1925, with a population nearing 2,000,000 she had 200,000 apartments. The pressure of population led the Soviet Govt. to transfer certain commissariats to Leningrad in 1925. The streets of Moscow, radiating from a common centre, have an excellent tramway system which makes the suburbs easily accessible; in 1925 a certain number of English motor-buses were running. The tramways carried 394,000,000 passengers in 1925 as against 257,000,000 in 1913. Part of the suburban train service is in process of electrification. Power is supplied to Moscow from a power station burning the soft coal of the Moscow district. A new electric power station, the largest in the U.S.S.R., which burns peat fuel, has been erected at a cost of 28,000,000 rubles, and began to supply power to the Moscow industries in 1926. The principal industries of Moscow, textiles, engineering, food, had not recovered their pre-War output in 1925.

Moscow has always been an important trade centre, and its position in the home market became steadily more important after the establishment of the headquarters of the various state trusts in the city. The Moscow Goods Exchange, established by the Trade Commissariat registered a turnover of 2,991,000 rubles in 1924–5. It is stated that only 5 or 6% of this is private capital.

Even with the opening of private shops and the repair of streets and buildings Moscow had not recovered its former busy aspect; the general poverty of the people prevented that. Some of the former palaces of the Moscow aristocracy and merchants have been turned over for public purposes, or for the use of foreign legations and missions. Many of the principal streets have been renamed after revolutionary personages. The city still remains an important literary and artistic centre, and the Moscow theatres are still among the first in Europe in the variety and beauty of their productions.

MOSELEY, HENRY GWYN-JEFFREYS (1887–1915), British physicist, was educated at Eton and Trinity College, Oxford. As lecturer in physics in Rutherford's laboratory at Manchester University, and subsequently as John Hartling fellow, he carried out a brilliant series of researches, proving the existence of a simple relationship between the X-ray spectrum of an element and its atomic number, and establishing a new and valuable method of chemical analysis. He was killed in Gallipoli Aug. 10 1915.

MOSLER, HENRY (1841–1920), American artist (*see* 18.898), died at New York City April 21 1920.

MOSUL (Vilayet) (*see* 18.904).—This former vilayet of the Turkish Empire now forms part of 'Iraq. It includes the hivas of Mosul, Arbil, Kirkuk and Sulaimaniya making an area of 35,130 square miles. Its boundaries are Syria on the west, 'Iraq on the south and southwest, Persia on the east and on the north the disputed Brussels Line dividing it from the Bitlis vilayet. As regards the ethnographical details of the population, the estimates provided by a pre-War Turkish census and those compiled by British officials in 1921 differ widely. The total population appears to be roughly 750,000, nine-tenths of the inhabitants being Moslems. In the town of Mosul and the surrounding plain the Arabs are the predominant race; in the mountains, the Kurds. The League of Nations Commission (1925) stated that the district was inhabited by Kurds, Arabs, Christians, Turks, Yezedis and Jews in that order of importance. Upon the corn grown in the plains round Mosul a wide area extending to Lakes Vrumia and Van depends for its sustenance, while the almost impregnable mountain ranges give Mosul a strong strategic position in regard to 'Iraq. The great rivers of 'Iraq have their headwaters in Mosul, and he who is master in Mosul is also master of 'Iraq's most vital necessity, being capable of threatening the safety of the vast oil resources of 'Iraq.

By the Armistice of Mudros, hostilities were suspended between Great Britain and Turkey from midday Oct. 31 1918. Nevertheless on Nov. 3 General Cassels informed the Turkish authorities that he had been ordered to advance beyond the Armistice line and occupy the town of Mosul. This apparent violation of the Armistice terms was subsequently declared to be justified by Article 7 of the Armistice—" dans le cas oú il surgirait une situation qui menacerait la sécurité des Alliés, ceux-ci auront le droit d'occuper tout point stratégique." The Turks on the other hand maintained that no such menace existed, and protested strongly against this action on the part of Great Britain. Later on further advances were made by the British forces; on Sept. 30 1924 a provisional frontier, known as the Brussels Line, was proposed by the League of Nations and accepted by both Great Britain and Turkey, pending a final settlement of the dispute. This Brussels Line was at its nearest points no less than 150 km. north of the Armistice frontier. It ran from the Hazil to the Khabur river, then across the mountains north of the valley of the Great Zab and then due east to the Persian frontier. Roughly speaking it runs on the crest of the mountains cut through by the three rivers named.

The question of the vilayet figured prominently in the discussions at the Lausanne Conference. Clause 3 of the Treaty of Lausanne provided that the dispute between Britain and Turkey should be brought before the League of Nations unless settled by agreement within nine months; the Turks had agreed to this on Lord Curzon assuring them that " the decision of the Council, upon which the Turkish Govt. will be represented, will have to be unanimous, so that no decision can be reached without your consent."

Sir Percy Cox carried on fruitless negotiations in Constantinople (May 19–June 15 1924); but the Turks refused to abate their claim to the whole of the former Mosul vilayet. In Aug. the matter came before the League, which appointed a commission to study the question. In Sept. the Turks crossed the provisional frontier and drove some 8,000 Assyrians to take refuge in 'Amadiya where they were supported by the 'Iraq Government. Thereupon at a special meeting in Brussels in Oct. the League defined a provisional frontier, the Brussels Line, which Turkey agreed to accept as a *status quo*. The Commission reached Baghdad in Jan. 1925 and reported in Aug. that the historic right was with Turkey; but suggested that Mosul should be left to Turkey if Britain intended to withdraw from 'Iraq in 1928, but assigned to 'Iraq if Britain was willing to undertake a mandate for 25 years.

Turkey contended that the League could not give a binding decision; the question was referred to the Hague Court, and was still pending when further military movements by the Turks in the neighbourhood of the Brussels Line in Sept. 1925 resulted in the violent deportation into the interior of Turkey of Christians living immediately to the north, and in some cases even to the south of the provisional frontier, while some 3,000 Chaldeans took refuge in a destitute condition in 'Iraq. The League appointed a second Commission to examine the complaints on both sides and report any violations of the frontier.

This report was presented to the League in Dec. and left no doubt as to the harshness with which the refugees had been handled by the Turks. The ruling of the Hague Court—that an arbitral decision was binding—had already been received; but the Turkish delegate refused to accept the decision of the League and withdrew. Turkey, however, renewed her proposal of a plebiscite of the Mosul population, and further offered (1) a four-nation Pact (Britain, Turkey, 'Iraq and Persia) which should guarantee the integrity and independence of 'Iraq, (2) the cession of the valuable Syale basin containing some of the oil-fields of the vilayet and the main sources of 'Iraq's irrigation. In the absence of the Turkish delegate, the League awarded Mosul to 'Iraq under certain conditions which were accepted by the British House of Commons five days later.

The inclusion of Mosul in 'Iraq was finally agreed by the treaty signed on behalf of Great Britain, 'Iraq and Turkey at Angora on June 5 1926. By this treaty Turkey accepted the Brussels line with small modifications as the frontier between Turkey and 'Iraq, the exact line to be determined by a mixed commission on the spot. A pact of security for ten years was agreed between Great Britain, Turkey and 'Iraq. Turkey enjoys a share in the royalties on Mosul oil for a period of 25 years. Subsequently an agreement was reached on the compensation to be paid for Turkish public works in the former vilayet. An exchange of notes following the treaty gave Turkey the option of capitalizing her share of the oil royalties at a present value of £500,000. This was an important event both for politics and oil. (*See* LEAGUE OF NATIONS.)

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MOSUL (City) (pop. 40,000), capital of the former vilayet of Mosul (*see* 18.904), has acquired importance since the World War. On Nov. 18 1918 (that is, 19 days after the signature of the Mudros Armistice), the city was occupied by British troops. The advent of the railway, which now reaches a point only some 70 m. distant, Sharqat, will doubtless help to revive the industrial prosperity of Mosul, which at present possesses practically no industries, not even its once famous manufacture of muslin, deriving its name from the town. The population exhibits an amazing intermixture of races and creeds; but in the city of Mosul the Arabs have a clear preponderance.

Several churches of great architectural interest are found amongst those belonging to the various sects, Nestorians, Jacobites, Uniate Chaldeans, Syrians, Catholics (also Uniate) and that strange remnant of the Gnostics, the so-called " Christians of St. John." A promising field for antiquarian research lies in the great mound of Nebi Junus, on the opposite bank of the Tigris, which covers the ruins of Esar-Haddon's palace. This site, hitherto closed to the excavator, may probably be rendered more accessible under the new Government. The exploration of the neighbouring mound of Tell Quoyunjuk produced under Layard and others the well-known relics of Sennacherib's palace now in the British Museum. See H. C. Luke, *Mosul and its Minorities* (1925).

MOTION PICTURES (*see* 6.374c).—This article will deal, first, with the rise and development of motion pictures, second, with the technology of film production and the exhibition of the picture and, third, with the motion pictures as a distinctive form of art.

I. HISTORY

While the commercial history of the motion picture covers only 30 years, beginning in 1894–5, the screen springs from roots which reach into the unrecorded past, with the earliest efforts at the re-creation of events. This effort, guided and controlled chiefly by the facilities and tools available, led variously to the evolution of pantomime, sign languages, rituals, drama and literatures. The motion picture, as the complete visual re-creation of the desired event, came as soon as adequate materials and technology were evolved.

Early Investigation of Scientific Principles.—Scientific investigation leading up to the motion picture was definitely begun by Peter Mark Rôget, secretary of the Royal Society of Great Britain, who in 1824 investigated the laws of vision with reference to objects in motion. That year he read before the Royal Society a paper entitled *Persistence of Vision with Regard to Moving Objects*. Several scientifically minded persons were interested, including Sir John Herschel, and among them was evolved a device consisting of a bit of cardboard bearing a picture of a bird on one side and a cage on the other, so mounted on a string that when the card was twirled the bird appeared in the cage.

Michael Faraday followed Rôget's observations with a long series of experiments. On the Continent Dr. Joseph Antoine Ferdinand Plateau, at the University of Ghent, and Dr. Simon Ritter von Stampfer, in Vienna, engaged in experiments on the persistence of vision. Simultaneously they arrived at an identical device for viewing hand-drawn pictures representing successive phases of motion. The pictures were mounted in sequence on the rim of a disc and were observed through corresponding slits in a parallel disc revolving on the same axis. This was the first motion-picture machine. Baron Franz von Uchatius, an Austrian artillery officer, in 1853 combined the disc device with the magic lantern and projected the pictures on a screen. William George Horner, of Bristol, England, built a toy on the principle of Plateau's machine, mounting pictures on the inside of a cylinder in such a manner that they could be inspected through slits in the opposite side of the revolving cylinder. In 1860 one Desvignes improved upon it and patented a similar device.

The Kinematoscope.—In 1860 Coleman Sellers, of Philadelphia, a mechanical engineer, attempted to apply photography to the creation of motion-picture effects. He photographed poses of motion and presented the resulting pictures on the blades of a paddle-wheel device, viewed directly by the eye. This machine was patented in the United States as the Kinematoscope Feb. 5 1861. Louis Arthur Ducos du Hauron, in France, April 25 1864, filed a patent application which was in effect an almost

complete anticipation of the motion picture. Ducos' ideas were all on paper; he did not achieve material results.

The Phasmatrope.—Henry Renno Heyl, of Philadelphia, on Feb. 5 1870 presented projected photographic pictures, made by the Sellers method of posing the figures for the camera, which still required time exposures. Heyl's machine was called the Phasmatrope. It carried small prints of the successive pictures, transparencies made on glass plates, mounted on the rim of a wheel which presented them, with an intermittent motion, to a beam of light cast by a magic lantern. Heyl used 6 poses, repeated 3 times, giving 18 images, or the equivalent of slightly more than one foot of modern film pictures. Photographic projection had come, but the camera could not yet record rapid motion.

Rapid Motion Photographs.—In 1872 Leland Stanford, a railway magnate of California, determined to investigate the gaits of the horse. He engaged Eadweard Muybridge to endeavour to make photographs recording the postures of the horse in motion. Muybridge's first efforts, made at Sacramento, were unsuccessful, due to the inadequacy of the camera and the photographic materials then available. His labours were interrupted for the time by a domestic tragedy. Meanwhile Stanford, impatient with the unsatisfactory results, had assigned the photographic problem to John D. Isaacs, a young engineer employed on the technical staff of the Central Pacific Railway. Isaacs contrived a system using a battery of cameras with shutter controls actuated by a series of electrical circuits. The shutter mechanisms were improved and the speed of the photographic emulsions increased. His device permitted the making of the first real photographic records of objects in rapid motion. Exposures as brief as one two-thousandths of a second were made. When Muybridge resumed activity he used the Isaacs' equipment installed at Palo Alto. Subsequent writings and tradition have erroneously credited the method and machinery to Muybridge.

Stanford while visiting Paris met Jean Louis Meissonier, the painter, then engaged in a controversy with French academicians over the postures of horses in his pictures. Meissonier found vindication in Stanford's photographs from Palo Alto and prevailed upon the latter to send Muybridge to France. Meissonier confronted his critics with these pictures. He also synthesised the appearance of motion by projecting transparencies made from these pictures on a machine similar to the Heyl Phasmatrope. Muybridge renamed the machine the Zoopraxinographoscope and hastened to Great Britain to deliver lectures. The name suggests a relation to the similar contemporary machine invented by Émile Reynaud, a French physicist, under the name of the Praxinoscope. Reynaud used hand-made pictures.

An era of motion-picture photography on glass plates followed, with slight refinement of methods but no important increase in scope. All motion-picture records, made with series of cameras, when projected, gave the illusion of the moving object standing still with the adjacent scenery sweeping past. Wallace Goold Levison, of Brooklyn, N.Y., devised a camera which obviated this difficulty by presenting successive plates in one camera, making all the pictures from a single point of view.

Edison Kinetoscope.—In 1887 Thomas A. Edison, of New Jersey, having perfected the phonograph, wished to supplement it with an accessory device which should present an optical record together with the sound. The first efforts recorded pictures of microscopic size in spirals upon a cylinder, after the manner of the phonograph record. Later strips of film were constructed of collodion, and experiments were made with strips of heavy celluloid. In Aug. 1889 samples of the first Eastman Kodak film made on a nitro-cellulose base were obtained by Edison. This material resulted in the completion of the motion-picture machine. On Oct. 6 1889 demonstrations of the Edison Kinetoscope were made in the laboratory at West Orange. It was the peep-show device for viewing the motion pictures recorded by the Edison camera, named the kinetograph. The film strips were about 50 ft. in length and an inch in width. Each photographic image occupied one-sixteenth of a foot of this film. Forty-eight exposures were made to record each second of action. In the kinetoscope the pictures were viewed by transmitted light through a magnifying lens in the peep-hole of the machine Only one person at a time could view the picture.

The Edison machine was commercially presented to the public for the first time in New York, April 14 1894. Hundreds of these machines were sold in the open market, and they carried the motion picture to the principal capitals of the world. The first motion pictures made at the Edison plant were records of portions of prize-fights, fencing matches, dances and vaudeville skits. The camera was immobile and limited in its range. The pictures could record only about 15 sec. of action.

A demand then arose for a machine which would project the film pictures on a screen, making them available to a large audience. Edison demurred for commercial reasons, believing that screen showings would exhaust the novelty market too rapidly. Meanwhile experimenters in other parts of the world were engaged in the problem of combining the kinetoscope with the magic lantern to produce screen pictures. Edison held dormant the projection efforts of his own laboratories. He failed to patent his motion-picture devices in foreign countries.

The Cinématographe.—Feb. 22 1895, Woodville Latham, father of Otway and Gray Latham, kinetoscope exhibitors, demonstrated a projector using a kinetoscopic film in New York City. The device was highly imperfect and was given prematurely to the public, May 20 1895. A better projector known as the *Cinématographe* was produced by Louis and Auguste Lumière, photographic manufacturers, of Lyons, France, who were inspired by an Edison kinetoscope exhibition in Paris. They took out a French patent Feb. 13 1895, and demonstrated their machine March 22 1895 in Lyons.

The Modern Projector.—In June 1895 Thomas Armat of Washington, with whom C. Francis Jenkins was for a time associated as an experimenter, arrived at the principle of the modern projector, a device in which the film, moving intermittently, has periods of rest and illumination in large excess of the period of movement from image to image. This machine was shown to the public first in Sept. 1895 at the Cotton States Exposition at Atlanta, Georgia. In London, Robert W. Paul, maker of scientific instruments, was called upon to make duplicates of imported Edison kinetoscopes, and in sequel made a camera early in 1895 to supply the machines with film. In Feb. 1896 he demonstrated a projection machine. Several other projectors of slightly later date and less influence on the development of the art were evolved, resulting in an endless conflict of claims of priority. The new projection machines introduced the screen motion picture largely through the vaudeville theatres beginning in London and New York, and by lecture and demonstration tours in which the Lumières were especially active. The motion picture was still only a novelty.

In the autumn of 1897 the young industry in America was thrown into a complex and violent war of litigations over patents, which continued for a decade. In Europe the art long suffered disfavour as a result of the Charity Bazaar fire in Paris, May 4 1897, in which 180 French notables died. The fire was traced to the motion-picture machine.

Improvement of Films.—Films gradually attained greater length than the 50 ft. of the peep-show subjects. March 17 1897, Enoch J. Rector exposed 11,000 ft. of film photographing the Corbett-Fitzsimmons fight at Carson City, Nevada. In the autumn of that year Rich G. Hollaman, of Eden Musee in New York, staged a version of the "Passion Play" on a roof and pictured it in about 3,000 feet. Important elements of camera technique were evolved in the pictures of feats of magic made by George Melies of the Theatre Robert Houdin in Paris, involving expedients of double exposure, fade-outs, dissolves and other now familiar optical effects used in photoplay construction.

In 1903 Edwin S. Porter of the Edison studios in New York produced "The Great Train Robbery," about 800 ft. in length, which, with some latitude of interpretation, may be considered the parent photodrama. In this picture the screen achieved narration. It produced a sensation in the yet small world of the motion picture. Many similar screen narratives followed, known

to the trade as " story pictures " to differentiate them from the mere record and novelty pictures of the earlier period.

The Nickelodeons.—" Story pictures " resulted quickly in the rise of the motion-picture theatre. Sporadic efforts at the operation of theatres devoted solely to the screen had appeared for several years. In Nov. 1905 Harry Davis of Pittsburgh, real-estate operator and proprietor of a stage theatre, opened a five-cent show in that city with " The Great Train Robbery " as the first programme. It was tremendously profitable and a wave of five-cent theatres, commonly called " nickelodeons," swept over the United States, with the foci of development in the polyglottic foreign labour centres of the manufacturing zones, where the universal language and art of the screen found its most eager and abundant market.

Increased demand from the screen theatres forced the picture-makers to the erection of large studios and the organisation of stock companies of actors to enable an increased output and steady flow of film. Commercial expediency resulted in a truce in the patent wars and the ultimate formation of the Motion Picture Patents Co. in New York, Dec. 18 1908. It was in effect a cross-licensing system, and included all American producers.

The standard motion picture of the period was a sensational action story of one reel in length. Pictures were rented to theatres on a quantity and age basis, a normal programme being about 28 reels a week supplying a daily change of programme of four reels.

Censorship.—The motion picture early began to encounter censorship restrictions. In 1895 the police of Atlantic City, New Jersey, forbade the exhibition of a film showing a dance, brought to the United States from Cairo. Occasional local agitations occurred in later years. In 1907 national attention was attracted to the matter, and in Nov. of that year Chicago put motion pictures under police censorship control. In New York in the same period the Children's Society prosecuted exhibitors for showing pictures of " The Great Thaw Trial " to audiences of young children. In Dec. 1908 New York's motion-picture theatres were ordered to be closed pending an inquiry by the mayor, with subsequent injunction litigation. The result of this controversy was a licensing system and the establishment of the National Board of Censorship by Charles Sprague Smith and others of the People's Institute, a disinterested civic organisation. This censorship body continues, in unofficial status, as the National Board of Review of Motion Pictures, to which the picture-makers voluntarily submit their films. Beginning in 1911 with Pennsylvania, a number of American states, including Kansas, Ohio, Maryland and New York, passed motion-picture censorship laws. As a sequel to the defeat of James Jeffries for the heavyweight championship of the world by John Arthur Johnson, a negro, at Reno, Nev., July 4 1910, the Sims Bill forbidding interstate traffic in prize-fight films was enacted by Congress in 1912.

Sweden established a national censorship in 1911, Spain in 1912, Italy in 1913–4 and France in 1916. Russia and Japan exercise film censorships. Canada has various provincial censorships. In Great Britain the Cinematograph Exhibitors' Assn. established a censorship, with the approval of the Home Secretary, following the Cinematograph Act of 1909 which put screen theatres under licence, and in 1920 made submission of pictures to the Board of Censors compulsory for members.

The direct influence of censorships upon motion pictures has been on the whole slight as compared with the extent of the agitation. As internal standards of the art have improved, censorship movements have tended to lose vigour.

Development of Stage-craft.—In 1908 D. W. Griffith, an actor from the stage, entered the service of the American Biograph Co. in New York, as a writer of scenarios, and in the ensuing four years had an important influence in the development of the art of screen narration. He wove the facilities of the camera and its effects of manipulation, such as close-ups, dissolves, fadeouts and the like, into the syntax of screen story-telling. In 1909 Gladys Smith, a child actress from the melodrama stage, now known as Mary Pickford, was employed by Griffith.

By 1911 a tendency to increase the scope of the picture beyond its orthodox one-reel length of 1,000 ft. began to appear, notably through the importation of some pretentious European efforts, among them Homer's " Odyssey " and " The Fall of Troy." A kindred American effort was made with a like saga in " The Life of Buffalo Bill," pictured in three reels. In 1912 Adolph Zukor, a New York motion-picture exhibitor, in alliance with Edwin S. Porter, Daniel Frohman and others, imported " Queen Elizabeth," a four-reel picture with Sarah Bernhardt in the title rôle. This picture, made by Louis Mercanton of Paris, was the forerunner of a new era of longer and more pretentious multiple reel dramas, known in the trade as " features," to differentiate them from the one-reel programme pictures of the nickelodeons. George Kleine, a member of the Patents Co. group, in this period imported and exploited with sensational success an Italian production of " Quo Vadis." In the next few years the " feature " movement remade the screen industry and increased the screen audience. The motion picture now became a real competitor of the drama of the stage.

Picture Theatres.—The first large and pretentious screen theatres arose in California and Australia because there the film art, shipped in a can, could overcome the obstacles of geographical remoteness. In 1914 with the opening of the Strand Theatre, on Broadway in New York, a new order of film presentation and showmanship appeared. Late in 1913 Charles Spencer Chaplin, a British actor and pantomimist, was employed in California for Keystone comedies under the direction of Michael Sinnott, better known as Mack Sennett, founder of the slapstick school of screen comedy. Chaplin's extraordinary ability made him world-famous within a few months. In 1916 he was employed by John R. Freuler of the Mutual Film Corp. at $670,000 a year. Chaplin with other major stars, including Miss Pickford and Douglas Fairbanks, outgrew pay-rolls and presently became independent producers. D. W. Griffith in 1915 presented " The Birth of a Nation," a tale of the American South of Reconstruction days, based on *The Clansman*, a novel by the Rev. Thomas Dixon, and again a new standard of screen narration and spectacle presentation was set.

American Dominance.—The cessation of production activities in Great Britain and on the continent of Europe resulting from the outbreak of the World War left the screen art and industry almost entirely to America, where it developed intensively with an increasingly War-prosperous public. The post-Armistice period found the American film industry with a 90% domination of the world market, with the corporation interests of the industry extending themselves in terms of theatre control in the more important foreign fields, including France, Germany, England and the Far East.

The prestige value acquired by pictures shown in the metropolitan theatres of the Strand type early led the picture-makers to the acquisition of theatres for " Broadway first runs," extending presently into key cities in all parts of the United States. Competitive results led in turn to the acquisition of chains of theatres, pooling booking power and taking box-office profits direct. This development found its most marked expression in the formation of Public Theatres, Inc., in New York, a federation of the theatre interests of Balaban & Katz of Chicago and those of the Famous Players-Lasky Corporation, headed by Adolph Zukor, which is credited with control of approximately 800 theatres in the United States. The motion-picture industry, like other industries, as a whole tends toward vertical trust formations, beginning with the plays and novels and ending with the screen and theatre box office. A group of three major corporations dominates the world industry.

Organisation of Trade Interests.—The early era of violent competition found those engaged in the industry slow to recognise a common interest. The first efforts in this direction were expressed in the formation of the Motion Picture Board of Trade in New York in 1915, followed two years later by the National Assn. of the Motion Picture Industry; this soon lost power within the industry and status with the public. Growing abuses of the trade, involving credits and contracts, salacious productions, destructive competitive selling and the like, together with

a series of disastrous scandals involving allegations of grave misconduct on the part of important screen figures and executives, led at last to the formation (March 5 1922) of the Motion Picture Producers and Distributors of America, Inc., headed by Will H. Hays, who resigned as Postmaster-General of the United States to take the post. The Hays organisation is in effect a trade association with broad powers which affect merchandising practice, selection of photoplay subjects, international trade policies and public relations in general, with special attention to problems of taxation and censorship. Its activities have exerted a marked effect in improving the status of the motion picture in the public mind and the clarification of internal problems. A minority organisation, opposed to the Hays organisation, was formed under the name of the Independent Motion Picture Assn. of America with I. E. Chadwick as president.

Economic Effects.—A new international phase of the motion picture began to be apparent in 1925 with the discovery that American control of the screen with its presentation of the fashions and equipments of American life was exerting an important influence on world trade in fields as varied as the adoption of American shoes in France and American motor-cars in Java. Various national agitations followed, marked by parliamentary debates and proposals for embargoes, tariffs and ratio laws governing importation of the American screen product, all calculated to encourage indigenous screen industries. Great Britain, Germany, France and Italy, were the countries most concerned.

To meet this condition American producing interests showed a tendency to internationalise their productions both by the importation of foreign stars and directors and by the making of pictures for the world with American stars working on foreign locations. It was planned in this way to evade the quota and ratio restrictions in other countries, while still retaining the American market. With this development a readjustment of picture values began. From the beginning of the World War, for a period of nearly 10 years it was the accepted basis of film calculations that the United States market represented 80% of the value of a picture. With the economic readjustments of Europe a new world-market for the screen developed with the prospect that the foreign rights of a picture might ultimately equal the domestic American value.

Trade Figures.—In 1925 it was estimated that there were in the whole world 50,000 screen theatres, of which 20,000 were in the United States. Statistics prepared under the auspices of the Hays organisation gave, 1924:—

Total number of persons permanently employed	300,000
Average number of feature pictures produced yearly	700
Admissions paid annually at theatres	$500,000,000
Salaries and wages at studios, annually	75,000,000
Annual advertising expenditure in newspapers and magazines	5,000,000
Expenditure for posters, photos and like accessories of advertising	7,000,000

Few foreign productions have proved successful in the American market. In 1922 a total of 425 foreign features were offered the American trade, but only six were accepted. The American success of a European film has always been followed immediately by American acquisition of the star and director concerned, as in the adoption of Pola Negri as an American star following her success in the German-made film "Du Barry," retitled "Passion" in the United States.

A steady increase in the working life of motion pictures has characterised the evolution of the art, from the days of the nickelodeon theatres, with their programmes of single-reel pictures changed daily, to the feature period where in typical theatres in large centres week runs and more were given to a single picture. In the nickelodeon period films were sold according to their age, depreciating in value day by day for 30 days, after which they were classed as "commercial" and rented at as low as 50 cents a reel a day. Under present conditions theatre runs are often for months, and the working life of a picture may continue several years. "The Birth of a Nation" continues with an earning power more than 10 years after initial presentation.

Present Policy.—Production policy, long dominated by nickelodeon influences, tends away from programme or volume production toward the treatment of each picture as an individual enterprise, separately produced and individually exploited, first as a "road show" following metropolitan presentations in New York, London and Paris, after the pattern of stage-play practice, with subsequent "release" for general distribution to screen theatres, as in the instances of "The Covered Wagon" and "The Ten Commandments."

The motion picture which began in 1894 as peep-shows in films 50 ft. long costing $25 each has reached the length of a full evening's entertainment of perhaps 12,000 ft. of film, with costs ranging into the millions.

Technological Improvements.—Technological developments in the art of the motion picture have added little save refinement to the product since the years of invention. Edison produced so-called talking pictures as early as 1895 with a synchronised peep-show and phonograph. Various devices have appeared periodically since, but with no evidence of public interest. Stereoscopic motion pictures were produced in the first decade of the screen and several systems of producing the steroscopic result have been achieved, all entailing the use of a viewing device which limits the effect and appeal. Coloured motion-picture processes were begun in the Edison plant in 1896 with hand-coloured prints. Various artificial tinting processes have been evolved, the most successful being the Pathé stencil colour method used in France. Natural colour photographic researches for the motion picture were begun in England by Edward Turner, under the patronage of Charles Urban. Turner died in the midst of his labours and the work was carried on by Urban and G. Albert Smith, of Brighton, resulting in kinemacolor, presented in 1910. Kinemacolor pictures used a two-colour process of recording through filters and reproduced by projection through corresponding filters, the process resulting in a screen synthesis of the colours. More recent processes, notably Prizma, evolved by William Van Doren Kelley, and the Technicolor process which now dominates colour work for the screen, translate the camera's colour record into pigments and tones embodied directly in the film, making it available in any standard projection machine.

The use of panchromatised negative film, which is sensitive to a greater range of colour and tonal gradation than ordinary film stock, has markedly increased, thereby improving photographic quality on the screen. Also especially sensitised film reacting only to the infra-red rays of the spectrum became available in 1925, enabling various special manipulations, important among them the production of "night effects" by daylight.

The cost of making motion-picture positives for projection has decreased with lowered cost of raw film and the development of machine-finishing processes replacing costly hand labour until prints in 1926 cost approximately one-half the production price of the early years. An increased use of motion-picture films outside the amusement field for general commercial purposes and in the home tends to follow this development.

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II. TECHNOLOGY

Motion-picture work is technically a branch of photography. The general principles which cover the production of photographic images therefore apply to it, and the article on PHOTOGRAPHY should be consulted. The manufacture of the film is dealt with under PHOTOGRAPHY.

The Film.—The film is supplied in rolls 35 mm. (1·38 in.) wide and 200–400 ft. long in the case of the negative films, which is used in cameras. The positive film, on which the prints are made, is frequently supplied in rolls 1,000 ft. in length in order to diminish the necessity for making joins. Negative film is generally sup-

plied in two speeds, known as *Par-speed* and *Super-speed*, while a variety, sensitised by means of dyes, is known as *panchromatic* film. On the edge of the film are perforations by means of which it is moved through the apparatus, and the exact dimensions of the film and of the perforations are very carefully standardised. Fig. 1 shows the standards adopted by the American Society of Motion Picture Engineers.

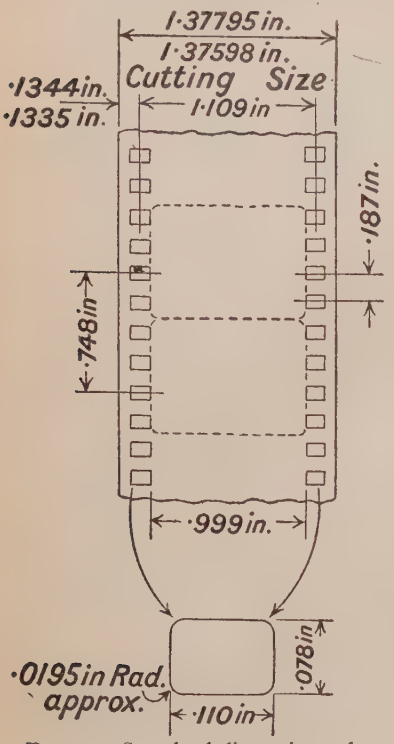

FIG. 1.—Standard dimensions of 35 mm. film. Specifications, with tolerances, allowed for cutting and perforating standard motion picture positive film.

The Camera.—The motion-picture camera (fig. 2) is arranged to move the film step by step through the *gate*, in which it is exposed to the light coming through the lens, the intermittent movement being accomplished usually by means of a claw, which is operated by a cam. The commonest form uses a triangular cam known as the *Lumière* cam because of its introduction by A. and L. Lumière of Lyons, France. By means of a sprocket, the film is fed continuously from the magazine in which it is held to the claw, and after passage through the gate is wound on to another magazine by the same or a second sprocket. Between the lens and the gate there is fitted a rotating shutter which protects the film from the light while it is being pulled down by the claw and then exposes it while it is stationary.

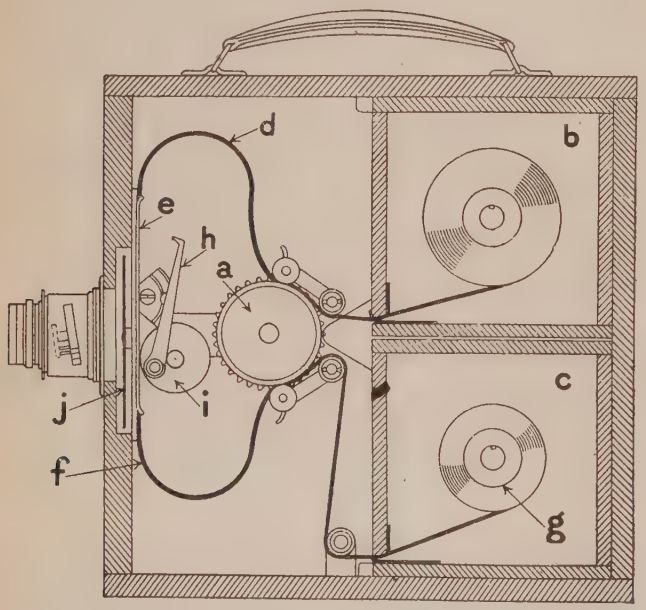

FIG. 2.—Diagram of motion picture camera, and Lumière cam. *a.* sprocket; *b.* upper film magazine; *c.* take-up magazine; *d.* unwind loop; *e.* film gate; *f.* lower loop; *g.* take-up (driven by belt); *h.* pull down claw; *i.* crank (operating pull down claw); *j.* shutter.

Lenses.—The lenses used on motion-picture cameras are of short focus and large aperture, the general focal length being 50 mm. (1·97 in.), with a relative aperture of f/3·5. Not infrequently apertures approximating f/2 are used. The operator can thus control his exposure by adjusting both the opening of the shutter and the aperture of the lens. By using these lenses the pictures are taken at a uniform speed of 16 pictures a second, so that if the shutter opening is 180°, the exposure of each frame is $\frac{1}{32}$ of a second.

Development.—After exposure the negative film is developed, each scene being usually treated separately so that the best possible results can be obtained. It is customary to cut a short length from the end of the scene, which is purposely made too long, and to develop this by trial. The film is then wound on a rack and developed for the time which has been found best.

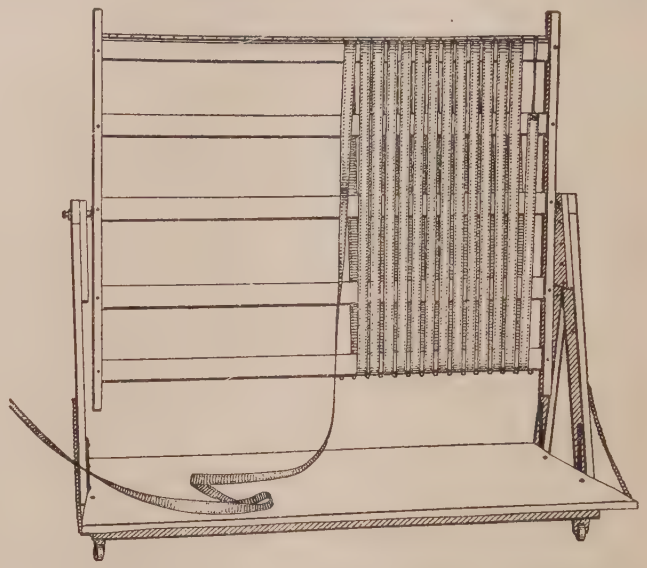

FIG. 3.—Developing racks. Wooden rack with the film being wound on it between the separator pins.

In this way exposures corresponding to different contrasts in the subject may be developed to give uniform negatives. The racks on which the film is developed are of the type shown in fig. 3. The development is carried out in deep tanks, the film being moved carefully in order to reduce possible marks to a minimum and prevent air bubbles remaining on the film. The fixing, washing and drying of the negatives are carried on with the greatest care, since they are extremely valuable owing to the cost of the production and must be preserved for many years. It is usual to use two cameras for each scene.

Printing.—After development a first print is made from the negative. These first prints, known as *rushes*, are viewed as soon as possible so that any scenes that have to be remedied can be retaken at once. The negatives are then assembled and a first print is made which is passed over to the producing company to be *cut* and assembled in a form corresponding to the finished picture.

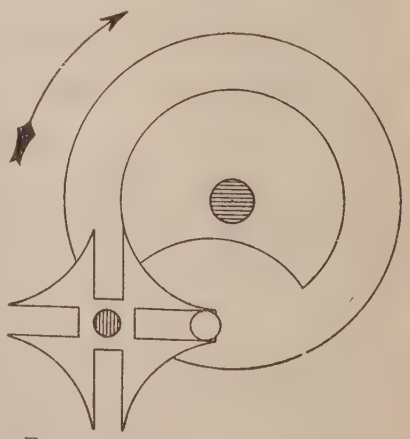

FIG. 4.—Enlargement showing the Maltese cross movement. The continuously moving wheel pulls the cross through 90°, when the pin on the wheel enters the slot on the cross. The cross is attached to a sprocket, over which the film passes, and as this sprocket moves intermittently it pulls the film down in the gate.

The printing of the negative is performed on a printer which may take one of two forms: in one, the two films are moved intermittently through a gate just as in the camera, the positive film being printed through the negative by means of a

light which is cut off by a shutter while the films are being moved. In the other form of printer, the negative and print are moved continuously past a narrow opening and are printed in contact while moving. In both forms it is necessary that the intensity of the printing light should be modified from scene to scene according to the density of the negative. To effect this, a chart is made showing the exposures which it is necessary to give to each scene, and the negative is notched so that as the notches come into place in the gate they will operate a contact mechanism which, acting through a solenoid system, will change the intensity of the printing lamp. Sometimes these changes are produced by the operator.

Automatic Development.—The positive film can be developed in the same way as the negative, being wound on racks for this purpose, but in modern practice it is more usual to develop it on an automatic machine, of which there are several types. In one the film passes through a number of tubes in which it travels from the top to the bottom and then up again, tubes being assigned in succession to the operations of developing, fixing, rinsing and washing, after which the film passes through a drying cabinet, from which it emerges ready for projection. In another form of continuous machine, tanks are used in place of the tubes, the film travelling in a spiral through the tanks. These continuous machines have a great capacity, it being quite usual for a machine to process as much as 20,000 ft. a day. Machines are generally erected in batteries.

After processing, the film is usually treated with wax or other lubricant to facilitate its passage through the projector. Much of the film used is made upon tinted base, the colour being applied to the base during its manufacture. This use of tinted base has supplanted the older method of dyeing the finished print, partly because it was difficult to apply the dye evenly and partly because many of the dyes used made the gelatine brittle. Not infrequently also the image is toned by different processes, so that by a combination of tinting and toning very pleasing results can be obtained upon the screen. A small proportion of film is coloured either by hand or by the use of stencilling machines, while a growing amount is produced by the processes of natural colour photography (*see* PHOTOGRAPHY).

Projection Machines.—The projection machines are essentially of the same type as the camera; that is, they evolve an intermittent movement of the film during which the light is cut off by a shutter, but this intermittent movement is usually accomplished by means of what is known as the Maltese cross or Geneva movement (fig. 4). This moves intermittently when the operating wheel carrying the pin which enters the cross is moved continuously, and the movement has the advantage over the claw and cam system that it is very robust and can be made to work immersed in oil. The shutter has three blades, only one of which is used to cut off the light during movement of the film, the other two interrupting the light while the film is still and thus diminishing the flicker seen on the screen.

Sources of Light.—The light sources used for projection are chiefly arc lamps. In modern theatres either high intensity arcs having carbons loaded with chemicals are used or mirror arcs in which the crater of the arc is turned away from the gate and the light from it is thrown forward by a large concave reflector. For projection at a short distance or with small screens good results are obtained by the use of high intensity incandescent lamps. The projectors are installed in a special projection-room fitted with ports through which the light beams are thrown and with arrangements for protection against fire. A great deal of work has been done on continuous projectors in which the film moves through the gate continuously and the image is kept stationary upon the screen by means of some optical system of rectification, such as a rotating ring of lenses which compensate for the movement of the film or a prism or mirror which holds the image still. These machines have not come into general use though some of them appear to be satisfactory mechanically.

After projection the film must be rewound and should be examined carefully and all damaged portions or weak places repaired. (C. E. K. M.)

III. THE MOTION PICTURE AS ART

From a toy, the motion picture developed into an industry in accordance with two major principles: the scientific, leading to perfection of the instrument; and the commercial, tending to the maximum of financial return in the shortest possible time. There was little energy to spare for the consideration of the third, the aesthetic, principle. The two preceding divisions of this survey have discussed those phases of the motion picture which created it and made it popular. It is the function of this third section to deal more with possibilities than with actualities; what the motion picture can become, artistically, being of far greater significance than what it is.

Natural Potentiality.—A logical critic, observing the machinery in complete ignorance of its history, would say that the name itself, especially in the common form of "moving pictures," told nearly the whole story; a camera taking pictures and a projector giving to those pictures the sense of action—movement governed by light. Assuming that the result was to be an art, this critic would hold essential the independence of the motion picture; just as music cannot always be "incidental music" or painting only illustration, the motion picture would have to develop a separate existence, drawing inspiration, perhaps, from the other arts, but fundamentally independent. It would share with painting its communication through the eye; with sculpture its power to create forms; with the dance the interest of movement. These three relations, it is understood, derive from the nature of the instrument rather than from any use to which the instrument may be put; they do not imply that the motion picture must be sculptural, pictorial or choreographic; only that it may be all of these without violence to its inner nature. They do imply as the essence of the picture that it must be all visual: the use of light and movement in the creation of visual images is the essence of the motion picture as an art form.

The Value of the "Absolute" Film.—Thirty years after the birth of the motion picture this essence is the goal of a few experimenters, chiefly in France and Germany. Theorists and experts are trying to create the absolute film, as far removed from the commercial film as a fugue of Bach is from "Il Trovatore" or a cubist painting from "The Doctor." The variation in rapidity as groups of inanimate objects or forms are shown in movement is calculated, in these experimental films, to produce a psychological effect; the relations between geometric figures, changing their proportions, fading into and displacing each other—abstract visual effects—intend the same. In the reel made by Fernand Léger and Dudley Murphy (1924) the most effective portion, emotionally, was that showing a woman carrying a burden up hill; at the final moment, as she reached the crest, the scene shifted back again to the bottom of the hill, and this was repeated again and again. There was no suggestion of narrative; the effect was purely kinematographic: but it was notable that the presence of a human figure more readily evoked emotion than any pure relation of forms. Yet there can be no doubt that the absolute film, abstract to the last degree, like music without melodic interest or like abstract painting, is a legitimate end for the motion picture. It is, in fact, the only goal so far suggested which proposes to utilise the instrument in all of its capacities and does violence to none; it is also the only one which makes proper use of the science, and is unaffected by the industry, of the motion picture.[1]

If between the absolute and the commercial, there should occur a third type, the art film, the absolute film will have the function of annulling the errors made necessary by commercial exploitation, the first error being a misconception of the nature of the instrument itself. The machinery of the motion picture was quite properly accepted as a supremely credible record of the

[1] The abstract film created by Comte Etienne de Beaumont and his collaborators lacked "human interest" entirely, but managed perfectly to convey emotions. Changing shapes, changing speeds, and objects seen out of their normal relations, gave both thrill and beauty to *A quoi rêvent les jeunes fille.* It is notable that these, the advance guard of films in one direction, are psychologically very close to the early melodrama; so more obviously is "Caligari." Speed is substituted for pursuit, and so on, the abstract for the specific, but the appeal to the eye is essentially the same.

actual; scenes, events, phenomena, were made visible and the screen became an aid to education, an invaluable record of history, and even an instrument of discovery in the natural sciences. It was put into the service of phenomenal truth, and functioned perfectly.

It was only when this service, in all its perfection, was employed in place of the imagination, in the domain of art, that it became a disservice. The motion picture always transposes its material, either mechanically, as a phonograph does, or imaginatively, as an artist does. The impressive fact that the camera could reproduce the actual, led to its use, almost from the start, as an instrument of photographic realism, against creativeness. This was natural in a civilisation devoted largely to mechanical progress and in a country negligent of the imaginative arts; but it neglected a prime value in the instrument itself, to wit, its capacity to transpose, to distort, to displace the object upon which its eye was trained. The motion picture was, in its very beginnings, used by magicians as a new trick, a new way to create "illusion." Almost at once, however, this use was abandoned; the real magic of the picture was suggested—and forgotten.

Persuasiveness, a Prime Quality.—The power of the picture lay in its exceptional persuasiveness. It gave its spectators the primary pleasure wrongly called recognition—the ordinary sense of identifying known things presented without disguise. The actual pleasure of recognition which implies that the artist has rendered, and the spectator penetrated to, an object is one of the qualities we associate with the arts; and these, lacking mechanical perfection, fail, if they ever try, exactly to reproduce the object. The motion-picture machinery comes close to this perfection in reproducing, and the response of the spectator was a natural consequence. "This is so" was followed by "this must be so" when the motion picture took its decisive step and, by false analogy, entered into rivalry and collaboration with the theatre.

The Place of "Story."—In the absolute film, "story" is anathema; in the commercial film it is everything; the art film can only ask that the story be appropriate to the instrument and be rendered entirely by the instrument. When, as early as 1908, the French Academy and the *Comédie française* collaborated for the screen, it was in the sense of filming an actual stage production; later the idea of famous players (stage actors) in famous plays became the basis of the organisation now pre-eminent in the manufacture of commercial films. Materials consecrated by public approval were taken over with almost complete disregard of their suitability to the new medium and the motion picture became an illustrated supplement to novels and plays. Acting, a form of expression adapted to the stage, using gesture in direct relation to the spoken word, was reproduced with slight modification, in the soundless medium of the film. An acted plot became the accepted definition of the moving picture—the fusion of two borrowed elements in a crucible which was itself, if one were aware of it, a magic cauldron.

These acted plots remain in 1926 the chief interest of most producers, although the close relation between stage and screen has been interrupted. The motion picture had so much vitality that in spite of the ignorance of its masters it asserted itself. The famous players (none of whom was a player specifically for the screen) failed and an obscure actress, without developing a real screen technique, yet more naturally adaptable to the screen by reason of her meagre experience of the stage, became a world's favourite: Mary Pickford. At the same time the melodrama, the thriller, the spectacle and the slapstick comedy all succeeded; in a small way the motion picture began to develop its own resources. It is this process which at present holds the greatest promise; and makes one regret that the lapse into association with the stage should so irremediably have left its mark on the motion picture in the form of scenario and acting.

Importance of Movement.—The melodrama and the thriller were important because, whatever their story, they expressed it all in movement, rather than in gesture, facial expression or subtitles. The scenarios were such as needed movement, utilising the screen's capacity to present simultaneous parallel activities, bringing them together in climax. The formula was lacking in adaptability, the material was intellectually contemptible; but the expression was completely kinematographic, not literary, not theatrical. This was true also in the spectacle films. The difference between the poetic beauties of "Cabiria" (on a scenario by Gabriele d'Annunzio) and the non-literary, kinematographic excellence of "The Birth of a Nation" (which was adapted with exceptional propriety from a bad novel) is marked. In the latter (1915) D. W. Griffith exploited the characteristic quality of the American spectacle film; its use of the melodramatic element of suspense in direct connection with the spectacle itself. The "last minute rescue" has always been well managed by American directors, generally by subdividing it into parts—the victims, the attacker, the rescuers—and alternating these in scenes of accelerating rhythm. This is "good movie" and distinguishes the American spectacle from the German, which often handles masses better, creates the sense of multitudes or expanse with none of the gross lavishness of second-rate American directors, but lacks excitement proportionate to its duration and scope. The spectacle had little to learn from the stage; from fiction (specifically from Dickens, if one accept the Griffith version) came alternating sequences, cutbacks and other devices for keeping several incidents simultaneously in development.

From the still camera came the close-up, an unhappy device not only because of its inherent ugliness, but because it definitely breaks the precious continuity of a picture, whereas the other devices, even the subtitle, only suspend continuity and allow interest to remain cumulative.

Economy and Effect.—It was in the thriller and the melodrama that the American moving picture learned also to unroll its plot succinctly. Padding is common enough; but no one comparing the average American and the average European film can fail to note that, when they want to, American directors are able to present their effects with superior conciseness and economy. There is also, in American films, an appreciable working up to climax and, their chief virtue, a neatness of execution, in which phrase may be included a multitude of technical devices, cleverness in general methods, discovery of settings which lend themselves to dramatic action, expertness in camera work, absolute clarity of the projected film, ingenuity, inventiveness. Even in their sum these qualities fall short of the meanest artistic stature; they are good qualities none the less. They were, or most of them, inherent in the silly Westerns and serials of the picture's earliest day.

The Right Road.—It is the writer's belief that the first halting steps of the motion picture were along the proper, the kinematographic, road from which it has since been diverted, to which it must return, enriched by experience, if it is to have a future. Another early type fortifies this belief: the slapstick. It is no accident that the one figure in the pictures to which some degree of immortality is universally accorded should have come from slapstick: Charlie Chaplin. These comedies, especially in their beginnings, were close to the type of the *commedia dell'arte;* they were almost all improvised before the camera. In them developed a type of playing which was purely kinematographic, and could be related to the stage only by way of American burlesque. Slapstick was remarkable also because it instantly saw the motion picture as a medium for fantasy, grotesque no doubt, but in essence fantastic. The properties of the physical world, all reality, were annihilated by the tricks of the camera for specific comic effect; retarded and accelerated motion, the repertory of the stopped camera, all suspended the mind of the spectator, as a pun might or a paradox, between the intellectual certainty that a thing is impossible and the visual certainty—it is here that the credibility of the camera becomes significant—that it has just happened. The thriller employed what was hazardous or difficult; slapstick brought to the film the impossible and the unreal. Fantasy appeared elsewhere as dream and as fairy-tale, with no impropriety but, except in rare instances (Crainquebille among them), without imagination. In slapstick, fantasy was built out of the elements of common life and flourished with extraordinary imaginative vigour. Whether the material was

worthy of this treatment has been debated; to some observers slapstick shows an honest vulgarity far more endearing than the pretentiousness, the intellectual fatuity, the errors of taste, the bad manners of its more serious counterparts in the films.

Dangers of Realism.—The use of indifferent materials in the usual American feature film was made doubly dangerous by the pedestrian realism of the direction. The motion picture seemed in 1920 to be destined forever to photography, to lack all bearing on created art. (It is worth noting that except for scientific purposes the motion picture cannot be exact; absolute fidelity in photographing " He walked six miles before breakfast " would result in unbearable tedium.) Fore-shortening, indirect suggestion, the creation of images capable of evoking the desired emotion—all the processes of the arts must find their counterparts in the films and will be governed, after the ruling direction of the mechanism, by the physiology of the eye, and by the psychology of attention; that is, if the picture is an art in the old sense. There are critics, wholly favourable to the motion picture, who consider that its real future is in developing outside of the sphere of the fine arts and in conscious hostility to their precepts. The break in 1920 came with the exportation of a German film, the famous " Cabinet of Doctor Caligari."

Without immediate effect on public or producers, this film is memorable because of its effect on the critics; it may be said that " Caligari " created motion-picture criticism in England and America. French critics hold it in low esteem because of its elaborate scenario; yet even they allow its chief virtues: that it worked chiefly through the camera (although the subtitles in the American presentation were lengthy and frequent) and broke entirely with realism on the screen. The change was marked by the use of cubist and expressionist settings in place of actual built or discovered " locations." The settings were psychologically correct for the story; the picture was perfect in the moments when its chief players, Conrad Veidt and Werner Kraus, so played before the distorted backgrounds as to give the whole picture a logical, complete, acceptable rhythm of its own, a life of its own, recognisable not as reality, but as a possible reality, an escape from or transposition of reality. " Caligari " was notable because it was artistically right in showing that the picture was most effective when it was not photographic; it was psychologically right because it brought the imagination of the spectator into play. It has been shown in Europe for six years (and finally made into play); it is in no sense a failure. That it failed in America may be ascribed, by critics hostile to the naturalistic film, to the stultification of popular taste in the preceding 10 years of the film's wanderings on the wrong road. " Caligari " means that the motion picture must be created, not photographed; painted backgrounds are incidental.

Five years later another German film, superficially less striking, claimed universal attention: " The Last Laugh " (" The Last Man " is another name for it). Films without subtitles had appeared before; the distinction of this one was that everything the picture had to say, and it said some subtle things, was said by means of the camera. What is more, the correlation of scenes was perfect, the separate sequences held together, and needed no connection or explanation. The American director, aware of American distaste for long series of pictures without subtitles, is prone to let his story hang loosely, trusting to its titles to draw it together. The slower-moving Scandinavian and German films are closely knitted in the sequences of the picture and can give psychological explanations which the faster American films skip or explain in words.

Importance of Imagination.—The artistic film will be characterised by imagination and will express itself visually, *i.e.*, through the camera. Ingenuity has already used the camera, notably in the excellent trick films presented for the trick alone; the news pictures have also learned kinematographic methods well. Creation has lagged behind, partly because there have been so many temporarily acceptable substitutes. The imaginative communication of emotions in " The Last Laugh " may prove a failure; but a few thousand dollars invested in a railway wreck is likely to make a picture a success. The director, at present the most interesting figure in the motion picture, has always known this. The future of the picture depends upon his capacity to free himself from tricks, from detailed scenarios, bad acting, " screen personalities " and other misfortunes. More, it depends upon his intelligence to see that the completed film must be a unit, not a series of separate scenes which a scenario-writer has invented and an editor-cutter will piece together for a title-writer to render reasonable as a plot. The motion picture conceived as a unit will have internal growth, development, rhythm; the relation between its parts and between the durations of its parts will have purpose; the bearing of the parts on the whole will be effective; the picture will have both style and form. At present few directors have manners so definite that their work can be identified without recourse to their tricks. Actual style, a personal way of expressing something experienced or observed, is almost entirely lacking, and that a picture as a whole should have form is a heresy still unheard in Hollywood.

Style and Form.—The future of the picture as an art depends, nevertheless, on the growth of elements of style and form, such as, with natural differences, distinguish the other arts: economy of means, sobriety, seriousness of purpose—all the other tests for an artistic creation are certain to vary with the individual artist, but the moving picture will not begin to be an art until it is conceived as the communication of a precise emotion or experience (communication by a group of artists or by a director through a group of interpreters of his vision). The expression of such a personal vision in a highly personal style distinguishes Chaplin as actor; a bluntness of perception, an imperfect sense of form, make him less than supreme as a director. But one looks vainly elsewhere for more than the beginnings of his qualities. Perhaps a half-dozen directors in America, twice as many in all Europe, seem at moments to approach the question of the motion picture as an art, but none offers a solution to it.

Except for striving for the film which shall have the illusion of depth, science seems satisfied with the motion picture. (The twin mistakes—the film synchronised with a talking-machine and the colour-film—may be perfected; but as each relieves the director of an obligation, instead of compelling him to fulfil one, they are not necessary developments of the film as art.) At the same time, the film as commerce may become stabilised; the pioneer days when companies were hastily organised to make the most of a nine days' wonder are over. With these two effective agencies reduced to secondary places, the moving picture as an art may flourish. So long as it remains a popular art, it will require novelty. Its greatest novelty, at the moment, must be an artistic one. (G. Se.)

MOTORING.—From 1910 onwards the development of all types of motor vehicles was wonderfully rapid. In 1911–2 the charabanc, the motor omnibus and the smaller passenger and goods van, used in town and country alike, began to make an impression on the travelling public of Great Britain, and though before the outbreak of the World War such traffic was of small dimensions compared with its present volume, the tramways and railways had already begun to feel the competition. The public at once showed its preference for the new method of locomotion, and students of transport admitted that free-wheeled vehicles, flexible in traffic, able to put passengers down on the pavement and not in the middle of the road, less noisy and more comfortable, more convenient and cheaper, would become formidable rivals to transport on rails. The railway companies were at first contemptuous of the new competition, but year by year not only were more and more passengers travelling by road, but much of the short distance goods traffic began to leave the railway. Between large centres of population not more than a few miles apart, such as the numerous large towns existing in the north of England, and between London and its immense suburbs, the public found it cheaper as well as quicker to go by road rather than by rail to their daily work.

In 1910–1 the dust nuisance became really acute throughout the United Kingdom. The main roads, which had been repaired for years with friable stone or dusty gravel, broke up under the increasing strain of traffic, resulting in muddy surfaces in winter

and much dust in summer. Roadside dwellers, who complained with reason, had a real grievance in that they had to keep their windows shut most of the day, while their food was liable to become gritty and their children were smothered in dust while playing by the roadside or in the cottage gardens. The Road Board, first established in 1910 in accordance with the Budget of 1909, devoted its first efforts to making roads dustless, and a year or two later much of the mileage of the main roads near or in towns and villages had been tarred or bituminised. Various local authorities all over Great Britain began to send in applications for grants for making roads dustless and for special purposes. By the Act of Parliament establishing the Road Board the money raised from motor-car taxation was to be allocated solely to improvements, and it was specially stipulated that no ordinary maintenance was to be considered. The Road Board's revenue for the first year was estimated at £750,000. Sixteen years later (1926–7) the revenue from motor vehicles was estimated at £21,600,000, and it is likely that even this huge sum will be exceeded every year for many years to come, though there are already nearly 2,000,000 motor vehicles on the roads, and 2,250,000 driving licences issued.

Improvements in Design.—In the motor-car trade, the years 1911 and 1912 were memorable for the beginning of the " American invasion." As the American cars were cheap in virtue of mass production and the elimination of every needless part, and were fitted with new and attractive devices in the shape of dashboard fittings, screens, self-starters, etc., they rightly scored a success in Great Britain and all over Europe. They taught British makers a much needed lesson, and stimulated the brains of British inventors, designers and constructors. In the earliest days of motoring covered cars did not exist, but a tendency towards closed instead of open bodies soon developed, and became more pronounced year by year. Nowadays (1926) the open car is the exception rather than the rule, and though in the smaller classes there are still many open cars, all are provided with efficient hoods, which have been much improved. Bodywork also has become much more comfortable, and in the more expensive types the luxurious interior of closed cars is a credit to the motor coachbuilder.

The development of cylinders from 1910 onwards is also interesting. Originally (1898–1900) De Dion built his engine with only one cylinder. Then two, and in a few cases three, cylinders came into use. Eventually the four-cylinder engine became the usual type, and by 1919 was practically the only kind to be built. With the Otto cycle (*i.e.*, one power stroke for every four movements of the piston) the four-cylinder engine gives an even torque. But Napier and Rolls-Royce preferred six cylinders, and for the more powerful types this system soon prevailed. Even eight cylinders have sometimes been used, but the six-cylinder engine has been found by experience to be the best type for everyday use. The four-cylinder car is still commonest, however, on account of its cheapness and its light weight.

The gradual development of British automobilism from 1910 up to the beginning of 1914 was much helped by successive shows at Olympia and in many of the provincial towns, which became every year more popular. Racing, too, has played its part in developing speed and reliability. Year after year new speed " records " were set up, and with each year came the destroying of the previous year's recorded speeds. The chief long distance race was for the Gordon Bennett Cup, held on the European continent (except in 1903 when it was run in Ireland), but a road race has never been run in Great Britain owing to the tortuousness of the roads, the congested state of the traffic and the strong public sentiment against speed contests on highways. Brooklands, the first great motor racecourse in the world, was constructed in 1907, entirely through the public spirit and enterprise of Mr. Locke-King. Here regular meetings on the lines of horse-race meetings were organised, provision was made for scientifically accurate timing, and Brooklands began to be one of the most useful institutions in the development of the motor-car.

The motor-car with its internal combustion engine has been the pioneer of many inventions. The aeroplane, of course, is by far the most notable of these, but among land-travelling vehicles the first place belongs to the " caterpillar " type of machine, which includes many varieties adapted to widely different purposes, from the little Citroens which have crossed the sands of the Sahara desert to the gigantic tanks that came into being during the World War. The " caterpillar " system, where the vehicle runs on an articulated endless steel band attached to the vehicle itself, is likely to be of great use in undeveloped countries where there are no roads, and where soft ground, dense grass or reeds or sand make ordinary wheeled traffic impossible.

The motor-car engine continues to improve. The super-charger has been evolved, which increases the pressure of any given engine by supplementing the vacuum created by the descending piston by actual pressure, thereby enabling a greater amount of the explosive mixture to enter the cylinder before the explosion and power stroke takes place. In regard to the number of revolutions, at the Paris show of 1902 an engine was exhibited which attained the then unprecedented rate of nearly 2,000 per min. —an impossibility, according to a high scientific authority, who asserted that no engine could ever run at more than about 1,500 revolutions, as the big ends and crank pins would fly apart owing to the great centrifugal force developed, with the result that the engine would be wrecked! Nevertheless, since then in the Grand Prix races engines have been used and have functioned well which attained 6,000 to 7,000 revolutions per minute! Engines of small cubic capacity have been designed which produce great and unexpected power in proportion to their size. Progress in the science of metallurgy has also contributed to the efficiency of modern engines and gears. Steels of wonderful hardness and strength have been produced to comply with the needs of the modern explosive engine, and further developments are taking place. Before long also we shall no doubt have an infinitely variable gear, superior springing and other improvements. There is food for thought in the fact that, while railways have just celebrated their centenary, the motor-car has had at the most 27 years of active life—about a quarter of that time. When our descendants celebrate the centenary of the motor-car it is probable that the vehicles of to-day which we think so wonderful will have been improved beyond our knowledge or imagination.

Goods Transport.—The development of the motor-lorry has also been considerable, and it may be said without fear of contradiction that the British lorry is recognised as the most efficient and convenient, in addition to having a better appearance than the heavy vehicles produced in any other country. An increased road transport trade has grown up between big centres of industry, especially where manufactures are carried on within a short distance of a seaport, such as in Lancashire, where raw cotton from the ship's side is taken up to the mills by lorry, and finished manufactured goods are taken back as a return load. There has also been a considerable development in the lighter loads, most trading concerns using small lorries and vans for the collection and distribution of their goods. In the country districts the old carrier's horsed cart has been replaced by the carrier's motor-car, running the same journeys in far less time, with greater comfort to the passengers than formerly. There is also in many countries a network of village-to-village and town-to-town services. For agricultural purposes also, not only are motor ploughs being used to a greater extent, but mechanical vehicles are taking the place of the farmer's gig and even his wagon.

Another significant increase has been in the number of motor cycles, of which over 500,000 are running on the roads of Great Britain in 1926. The increase, however, has been somewhat checked by the coming of the small cheap car, which is used by all classes of the community.

United States.—As regards the position in other countries, there are now (1926) in the United States about 20,000,000 motor vehicles, or about one to every six of the population. In many of the large American towns the street cars have become almost deserted, and the workman proceeds to work in his own small cheap car. The growth, too, of roads in the United States has been very remarkable, and new highway construction is proceed-

ing apace, tens of thousands of miles being made every year. The Lincoln Highway now extends right across America from New York to San Francisco, via Pittsburgh, Chicago, Cheyenne and Salt Lake City. The Dixie Highway runs South from Sault Ste. Marie on the Canadian border to Miami, Fla., via Chicago. A number of other important main trunk roads were under construction in 1926 and rapidly approaching completion. In the neighbourhood of New York alone £60,000,000 was being spent in 1926 in abolishing level crossings, making bypass roads and in generally improving the exits from the city.

Europe and the East.—In France, though the number of motor-cars has increased since the War, there has not been the same comparative increase as in other countries, the total number being still under 500,000, as against 1,500,000 in Great Britain. In Germany, Austria, Italy, Hungary and the rest of Europe the general increase has been retarded by the comparative poverty of the population over large areas. In India the country roads are being improved for motoring. In China 4,000 m. of main roads have been made to accommodate the increase in motor traffic.

The Future.—The only serious bar to the future increase in motor vehicles in some of the older countries is that all governments are inclined increasingly to consider them as luxury vehicles, and therefore a fit subject for extra taxation. In reality, the day is long past when the ordinary motor vehicle can be considered to be an example of luxury. Ninety-nine per cent of motor vehicles are used for professional, trade, business and other purely utilitarian purposes. There is also the problem which has yet to be solved, namely, how to accommodate in towns the vehicles of those who are employed or occupied for a short or long time during the day. There is no room in the streets, as a rule, to enable this to be done with safety or convenience, and the garage accommodation is wholly inadequate.

(*see* MOTOR VEHICLES: ROAD CONSTRUCTION: TANKS: TRAFFIC PROBLEMS.) (M. OF B.)

MOTOR TRANSPORT, MILITARY.—Transport by motor vehicles has profoundly modified the art of war. Their employment enables a commander, despite the unwieldiness of modern armies, to achieve surprise effects which give him victory. In the following account, illustrated by practical examples taken from the use of motor vehicles during the operations of the Allied Armies on the French front, there will be discussed the general principles underlying (1) transport of troops, (2) transport of *matériel* and (3) intensive traffic on roads.

I. TRANSPORT OF TROOPS

The Vehicle.—Troops have sometimes been carried in ordinary touring cars. During the battle of the Marne (Sept. 9 1914), at the moment when the French Army of Gen. Maunoury was massing outside Paris, there were grouped together all available taxicabs to take direct to the front the infantry of a division which, arriving by rail from the Vosges, was detraining in the stations of the northern suburbs of Paris. This method can only be employed in exceptional cases, because the car or taxicab has so small a carrying power, requiring one driver for every three or four combatants carried, while such vehicles for the most part differ in speed. On the other hand, such motor vehicles as are designed to convey a larger number of passengers in peace-time, *e.g.*, motor-omnibuses or *chars-à-bancs*, are eminently serviceable.

The ideal vehicle is the common motor-lorry (or truck, as Americans call it). It is necessary to adapt it, *i.e.*, to place in it movable benches, which can be very rapidly installed when it is necessary to carry men, and can be removed without difficulty when it is necessary to carry *matériel*. In accordance with the capacity of the body, which itself partly depends on its load capacity, the lorry can carry from 16 to 25 men with their arms and equipment.

During the World War not only were units of infantry transported but also artillery formations; likewise, in some exceptional cases, cavalry with their horses. When horses are to be carried the body of the lorry must be as large and the bottom as low as possible, to make the loading more easy, and the ceiling must be high enough to prevent the horses from being injured by striking their heads. The horses may be placed either lengthwise or crosswise. But they should be close to one another, to save them from bumping; and there should be no difficulty of access to where their heads are, in order that they may eat and drink on the road. These precautions taken, it has been found that horses travel as well by motor-lorry as in a railway wagon.

Organisation of Lorries.—Lorries move grouped in formations of varying importance, but two essential conditions must be observed: efficient control and effective maintenance. The basic unit, the smallest formation to be placed under the orders of an officer, should be formed of 15 to 30 vehicles. The officer who commands this unit is the veritable sheep-dog of his troop of lorries; he must himself have a touring car (which should be open and not too fast), so as to allow him to follow his lorries when they are on the move, and above all when they are formed into a large column. The officer ought not to lead himself, but be able to keep his attention free, and to jump quickly from his car and speak to his drivers. Next above the basic unit, the "section," is placed the "company" or the "group," normally comprising three or four sections. The commander of the group or company is no longer the sheep-dog of his lorries; he is the shepherd. It is he who guides them in their itineraries, places them in billets and allots them to their work.

The second point in an organisation is to ensure effective maintenance. Automobiles require constant care on a long journey, *e.g.*, 200 kilometres. Some will have breakdowns, some even fall out, too seriously damaged to go on. Minor casualties must be attended to, however, as soon as possible. That is the rôle of the workshops. If the workshop is to move with the group, it must be on lorries, and have a stock of tools and spare parts.

As soon as large transport movements have to be carried out, higher control above the group must be organised. The transport of the infantry of a division requires 12 groups. Placed in a column on the road, this would make a file 36 km. in length, a reasonable distance for each group being 3 kilometres. This mass would be formless and incapable of manoeuvring unless vivified by organisation. It is a common saying that the action of a commander ought to be limited to directing four immediate subordinates and no more. Experience of large demands on transport during the War shows, however, that six groups could be united under one control, if the commander in charge was supported by a fully qualified staff. Such was the composition of the grouping in the French Army; such or something very near it was the composition of the "Bus Park" of the British Army. The grouping of six groups had a capacity for 6,000 infantry; the automobile service of the French Army comprised 25 groupings in 1918.

Organisation of Troop Transports.—Let it be supposed that a grouping is ordered to carry out the transport of 6,000 infantry, to take them up in their billeting area, and to bring them to the field of battle some 100 km. from billets. To accomplish this mission efficiently the staff must first fix the embarkation-points, *i.e.*, the points at which the infantry will be loaded into lorries. In order that this operation may be quickly carried out there must be many loading-points functioning at the same time; to embark one battalion (1,000 men) into a group (80 lorries) requires from 20 to 30 minutes.

When the commander of an automobile grouping has prepared the organisation of his embarkation-points, he must come to an agreement with the infantry headquarters concerned as to the time and place of embarkation of each battalion. The work which devolves upon the command of the lorry grouping in the disembarkation of the troops is generally similar to the above; but there is an additional difficulty, caused by uncertainty as to the exact points of disembarkation, which often depend at the last moment on the military situation. Nevertheless, the procedure must be arranged as early as possible, in close touch with the higher staff which has to fix the disembarkation zone; and an understanding must be arrived at with headquarters as to the probable alternatives, between which a decision will be made later, when the lorries are quite near to the arrival zone. The itinerary between the two zones must be reconnoitred and

marked out. This is the duty of the officer assisting the commander of the grouping. The " route officer," with his own staff, marks the itinerary by posting up placards (and, for night work, hanging lanterns) bearing the distinguishing mark of the grouping and an arrow indicating the direction of the march and the route to take. Further, the commander of a grouping must organise the movement of his service lorries, supply lorries, work lorries, etc.

Transport of Complete Divisions.—An interesting example occurs when, together with the infantry of a division, it is necessary to transport all or part of their artillery, with its horses. With horse-drawn artillery it may be a very serious matter for a general of a division not to be able to bring up to the battlefield, in support of his infantry, the artillery who are accustomed to manoeuvre with him. It is thus very desirable to be able to transport artillery with horses. The loading of guns and limbers on lorries does not present any special difficulty; it is sufficient to have fixed rules for putting the *matériel* in place, and these are the same as the loading-rules for the same *matériel* on railway wagons.

II. TRANSPORT OF MATÉRIEL

Lorries are not specialised for the transport of *matériel*. The same type is employed as for troops, and therefore, the organisation is similar. A lorry-group capable of moving a battalion of infantry can alternatively move 100 tons of *matériel*. Experience in the World War has shown that, during the periods of active operations, a division requires an average of 200 tons per day in foodstuffs and ammunition. This is equally true in the case of defensive areas, as at Verdun; in offensive actions of the type of the Somme battles in 1916; or those of July, Aug. and Sept. 1918, on the Marne. Two groups are therefore required for the supply of a division, subject to the distance from the railway being, at furthest, within a radius of 40 kilometres. Four groups are necessary if the division is 70 km. from a railway. An average of 3 hours must be reckoned for loading at the stations; with allowance for difficulties arising amid intensive operations, 7 or 8 hours are taken up on the journey and 2 hours in unloading. This gives about 13 hours for work, and leaves 11 hours per day for the maintenance of *matériel*, feeding and rest. If the traffic operations are to be continued for a number of days, any more than this cannot be demanded of the personnel or of the *matériel* without risking excessive wastage. On the day after a journey with loads the vehicles return empty, and on the day after that they recommence the journey loaded. As 200 tons a day are required for a division there must be a double set of two groups, with a total capacity of 400 tons.

Non-Specialisation of Matériel.—At a general mobilisation like that at the opening of the World War, the resources available for transport are necessarily limited not only by financial conditions, but by the number of vehicles in existence in the country capable of being requisitioned, and by the maximum production of the manufacturing firms. On the other hand, there is no limit to the requirements in lorries, because no general worthy of the name thinks he has a large enough stock of transport at those critical times when every addition means an increase in his power of manoeuvre. During the 20 days which intervened between May 27 and June 15 1918, the lorries of the French Army had to transport about 800,000 tons of foodstuffs and munitions, in order to ensure the supplies of those armies which were making headway against the German attack. And yet, during this same period, the French Headquarters Staff had transported by automobile the infantry of 63 divisions. It was necessary also to make numerous evacuations of public records, civil populations, hospitals and engineer parks. This wonderful effort was only possible because in the French Army the principle of non-specialisation was adopted. Every lorry was controlled by the motor transport service of the armies, and was utilised by it for any form of transport needed. No vehicle was specially or permanently attached to this or that higher or lower formation. When a higher formation, such as a division, had need of transport, the automobile service arranged the transport, but as soon as it was finished the lorries employed on this service returned and were available for other transport services. In short, the lorry capital never remained unproductive.

The Use and Duties of Depôts.—The reasons for avoiding the wastage of lorries apply likewise to avoid wastage of movements. The carrying-out of " detail " transport is the principal cause of low efficiency. In the battle of Verdun, March 1916, the supply of munitions was taken by rail to Bar-le-Duc and to Baudonvilliers. Trains of munitions arrived daily at these two stations to supply the artillery of the 10 divisions deployed around Verdun, some 60 km. from the stations. If, to supply each of these divisions, there had been allotted a motor formation, which could come to load up at the stations and go as far as the batteries, bringing munitions, the efficiency would have been mediocre and uncertain. An accident at a depôt, an interrupted road, an advance or a check at the front, would set back the whole time-table of the formation, and one would have seen them arriving in the station for loading their lorries in twos and threes in disorder, and at different hours. There can never be efficiency unless there is regularity of movements. It is never possible to have regularity unless the traffic of the back areas, which can be regular, is definitely separated from the traffic of the front areas, which is always uncertain. This separation can be effected by the creation of depôts depending on the lines-of-communication authorities, and supplied by them where the formations from the front areas come to refill exactly as they would refill from the railway if there were stations at these fronts.

III. INTENSIVE TRAFFIC ON THE ROADS

The Route Gardée.—For the organised employment of automobiles on the roads, like that of railway trains, the essential condition is to be master of the road. If all and sundry are permitted to put columns of troops or vehicles on a road, it is useless to attempt to carry out important movements. It is an absolute rule, based on experience, that it is not possible to launch a big transport movement involving several hundreds of lorries without being absolutely certain of the complete freedom of the road, during the whole time that the movement will last. Hence the organisation of the *routes gardées*, with their personnel of guards and their traffic orders.

A *route gardée* is not necessarily reserved exclusively for automobiles. But in every case there must be a responsible authority, having power to give orders and have them carried out. In the French Army, during the War, this authority was a motor regulating staff (C.R.A.). In the British Army, the control of traffic in France was part of the duties of the provost marshal (A.P.M.). The organisation of the route, on a railway model, is based on the block system. The route is divided into a series of districts, each of which is under the direction of a district chief, having assistants for supervision. The district chief is in constant touch by telephone with the neighbouring districts, and with the office of the C.R.A.; he knows all the movements which affect his district, and also keeps a record of all movements which occur there and all the incidents of the traffic. Thus at the office of the C.R.A. it is always known what the state of the traffic may be on every *route gardée*, and the necessary arrangements for launching an important movement can be made in given time. The route orders for the *routes gardées* are more or less drastic according to the breadth of the road, and whether or not there are relief routes.

The length and the importance of the districts on a *route gardée* depend, obviously, on special difficulties to be overcome, *e.g.*, the number of adjacent routes, the localities traversed, narrow passages, etc. Between Bar-le-Duc and Verdun there were six "districts" varying in length from 5 to 10 kilometres. It is quite unnecessary to control in this permanent fashion a route over which there is not continuous traffic. Whenever such a road is needed, for the time being, for an intensive transport, it is sufficient to occupy it immediately and transform it into a *route gardée*. This requirement leads to the C.R.A. (or any corresponding organisation) being given a territorial zone of operation. In each zone it is the immediate business of the C.R.A. concerned to guard any portion of the road over which the transport will

be moving. For this purpose the C.R.A. had at its disposal specially organised personnel, which may be fairly accurately designated "mobile districts," and which, being in the habit of operating in this way and supplied with the means of rapid installation, can, in two or three hours, make themselves masters of the traffic on whatever part of the road is entrusted to them.

Maximum Efficiency over a Road System.—When one is master of "circulation" throughout a given region, one is free to aim at maximum efficiency. Formerly, when the staff proposed to carry masses of troops to a theatre of operations it traced the greatest number of parallel and serviceable roads which led to the zone of action decided on, and there was thrown on each of these roads a column of all arms scientifically echeloned in depth. Thus it was that Napoleon moved from the Rhine to the Main in 1805; thus, also, Moltke moved from the Sarre to the Moselle in 1870. When this system is applied to present-day conditions the efficiency of the road system is low, because the increase of speed due to the automobile is not turned to account. All modern armies have tractor-drawn heavy and automobile light artillery, and possess the means of transporting the bulk of their infantry by motor lorry. There remain the horse columns, on which it is no longer necessary to impose the speed limitations of marching infantry. In consequence, in co-ordination with the movements made by railway, the movements by road ought to be organised in the form of special itineraries, on each of which move columns of elements that are homogeneous from the point of view of speed. Thus combination of movements can be worked out in which much time is saved, as compared with the old methods.

The existence of regulating commissions in charge of zones of movement and masters of the traffic, considerably eased the French problem. But the regulating commissions must have control not only of automobile traffic, but of all traffic; in their zones no movements must occur without their having received notice and taken the necessary measures to facilitate the execution of the movements in question. They must be able to arrest all false movements in good time. And they must be in close touch, so as to form a complete network, covering the whole area over which it may be necessary to move any column. It was by the functioning of an organisation of this nature that the French Army was able to make its concentrations of considerable numbers of troops at very short notice in March, May and July 1918.

Strategic Transport by Road.—As the automobile has brought on the road again the tourist who had deserted it since the middle of the 19th century, so transport by motor lorry has brought into use again strategic movements by road. And, for the production of surprise effect, by adding the roads to the railways, it has been possible to put to full use all available means of communication. The air alone has not been utilised; but in the future it may be utilised for the quick transport of combatants. In order that movements by roads should be serviceable, it is necessary for them to be rapid and powerful; this is attained by applying the same principles as in rail movements—that is to say, the temporary break-up of large units for transport.

Combined Use of Railway and Motors.—In the majority of cases use is made of railways and roads in combination. The end to be attained is always a rapid move of powerful forces; the staff should therefore make use simultaneously, and as efficiently as possible, of every means of transport which it possesses. One must never lose sight of the fact that the efficiency of the railway is much superior to that of the road; a train of 50 wagons is equivalent to 150 lorries. At a speed of 30 kilometres an hour, and with four departures an hour, one has four trains in a length of 30 kilometres, or the equivalent of 600 lorries. We have seen that 600 lorries form on the road a length of 20 to 25 kilometres. Railway and road have therefore very nearly the same output. But the lorries, going 15 kilometres an hour, are only half as quick. Further, at the end of 100 kilometres it is necessary for the lorries to stop in order to rest the drivers, for, save in exceptional cases, relief crews are out of the question. The weak point in transport by rail really lies in the necessity of having stations for embarking and for disembarking. Save in quite exceptional cases it is an absolute technical necessity to load and unload in stations, and, even so, only in those where there are sidings sufficient to take the military trains so as to leave free the main line during the times of embarking and disembarking. Without this precaution all the traffic will be blocked. Further, when it is a question of loading *matériel* it is necessary to place it on the platforms. While special platforms or docks are indispensable on the railway, it is always easy, on the road, to find or organise quickly loading-places for lorries.

Big movements by railway can be made only from a zone A to a zone B, if the two zones A and B are equally rich in loading-places. But—apart from those points which come into the initial concentration scheme, and on which, therefore, work can be done in peace—it is impossible to ensure, in the large movements which military operations may necessitate at any given moment, that the beginning and the end of rail transports shall take place in zones that are rich in loading-places. On the other hand, it is generally possible to find, within a radius of 50 to 100 kilometres in the zones A and B under consideration, one or more regions rich in loading-places. The normal combination consists therefore in utilising motor transport to prolong railway transport, and to carry the troops or *matériel* (1) from their stationary zone to the places of embarkation, and (2) from their places of disembarkation to the zone of operations. The relatively short movements (50 to 100 kilometres) it requires are those in which the efficiency of the lorry is at its greatest. And between the two zones of loading thus actually used, the efficiency of the railway will equally be a maximum.

Naturally, other combinations are also practicable; for example, that by which, on Nov. 20–21 1917, three French divisions were to be carried from Meaux and Château-Thierry to Péronne; the infantry, with their machine-guns and cooking-carts, being conveyed in motor lorries, and the artillery by train. The object of these movements, very quickly ordered on Nov. 19, was to reinforce the successful British attack in front of Cambrai with the first use of tanks in mass, and had overwhelming results. While the embarkation of the artillery was proceeding at railway stations in proximity to the divisional billets on the Marne, the C.R.A. of Meaux and Château-Thierry loaded up on 3,000 lorries the infantry, etc., of the three divisions.

There are many details which complicate considerably the task of the transport officials; such as the question of food supply for the troops during their transportation and at their disembarkation, and the question of moving troops simultaneously with the building-up of the munition dumps which they will require. One last remark should be made: transportation by automobile and by railway, which, we have seen, supplement one another happily in regard to distance, is equally satisfactory in regard to time. Large movements by railway require concentration of *matériel*, often difficult to achieve; and, in the case of moves decided on in a hurry, the possibility of motor transport on a large scale assumes very great importance, since it takes four or five days for the railway to show its full powers.

Conclusion.—The experience of the War shows the rôle which transport by motors is called upon to sustain becoming more and more important. The Allied Armies, together, placed on the French front about 20,000 motor vehicles in Oct. 1914; four years later the number exceeded 200,000. At the time of the Armistice, the inter-Allied transports reserve, the creation of which had just been decided on, was of a size to transport simultaneously 10 divisions of infantry complete, with all their means of fighting, machine-guns and artillery included. This was a fighting mass of more than 100,000 men, which the Higher Command was able to pick up at short notice and carry at the speed of 100 kilometres a day to any point where it was required.

As regards the transport of *matériel* at the end of the War, it had become possible—independently of the resources just mentioned—to keep supplied with food and munitions 40 divisions at a distance of 100 kilometres from the railways.

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MOTOR VEHICLES (*see* 18.914).—The greatest industrial development of the first quarter of the 20th century was that of the motor road vehicle. Development of the self-propelled, petrol-engined vehicle began in Germany in the eighties with the work of Daimler and Benz, and was carried forward particularly energetically in France for more than a decade, from 1895 on.

I. HISTORY OF MOTOR VEHICLES

About 1910 the United States assumed the leadership in the production of this type of vehicle. Transport and other conditions naturally favoured the use of motor vehicles there. American manufacturers cut down their production costs materially below those in Europe, in spite of the higher wages paid by them, and thus sold their cars at very reasonable prices. By 1925 more than one half of all the families in the country had their own car and more than 83% of all the cars in the world were owned in the United States. Registration figures showed that on Jan. 1 1926, there was one vehicle to every 5·7 persons in the whole country, while in California, the state with the greatest "motor density," there was one to every 2·8 persons. Motor-vehicle manufacture had become the greatest manufacturing industry in the country, in point of value of output.

Economic Reasons.—While the World War accelerated production of motor-cars in the United States and retarded it in those European countries which were engaged in the conflict from the start, the chief reasons for the pre-eminence of the United States as a motor-using country are of an economic nature. America is a land of magnificent distances; in many sections towns and cities are far apart, and long trips must often be made over the public roads, for which purpose horse vehicles are quite unsatisfactory. Petrol (in the United States called gasolene), the fuel commonly used for motor vehicles, is a native product, comparatively cheap and plentiful. The *per capita* wealth is greater than in most countries and well distributed.

Not all conditions were favourable to the introduction of motor-cars, however. The industrial countries of Europe had magnificent systems of hard-surfaced roads, which were practically non-existent in the United States at the beginning of the motor era. This, though a handicap, did not prove a serious obstacle. In the early years of motor-car development the private passenger car was generally regarded as a means of pleasure, and in Europe this remained its chief function. But in the United States and Canada (where the proportion of motor-cars to population was not much less than in the United States) it became a great factor in business life. In New York City, for instance, a very large proportion of the street traffic in 1925 was by motor, and in the main thoroughfares horse vehicles were almost a rarity. Such agricultural states as Iowa and Nebraska had relatively more cars than the industrial states, and the farmers used their cars chiefly for business purposes. As the substitution of the motor-car for the horse came about gradually, it did not greatly impress the general public; nevertheless, it profoundly influenced modern life.

Bus and Jitney Services.—In the cities of the United States the once familiar horse cabs and hansoms had disappeared before the motor-propelled taxicab by 1925. Numerous bus services competed with the tram services, particularly in outlying districts, and even cut heavily into the local passenger business of the railways. About 1915, many owners of private cars began carrying passengers in competition with tram lines, their vehicles being known as jitney buses (jitney, a Russian coin about equal in value to five cents, then the common tram fare). These jitneys did much business, especially during the "rush" hours when people go to work and return home, as their passengers avoided the crowding of the street-cars and the annoyance of frequent stops. In some sections of the country conditions were made rather hard for the jitney owner by legislation, and the business shrank or ceased entirely; while in others, and particularly in Detroit, it was still thriving in 1926.

Freight Haulage.—Motor-trucking and the haulage of freight by motor vehicle began to assume importance in the United States only about 1910. This branch of the industry up to then had been more successful in Great Britain and Germany. From 1910, however, it consistently increased in the United States, where under war conditions the motor-lorry even entered into competition with the railways. An enormous amount of motor freight traffic grew up over certain routes between important industrial cities, as between Detroit, Mich., and Toledo, O., and between Akron and Cleveland, Ohio. One large tire manufacturing company in Akron, O., with cotton mills in Boston, Mass., over 600 m. away, established a fast freight service, between these two cities, of motor-trucks on pneumatic tires. Some of this development was evidently due to the abnormal conditions which made railway freight service inadequate during and immediately after the World War. Military operations gave a great impetus to motor-truck development. In addition to the urgent demand for trucks for military purposes there was also a strong demand for business purposes, owing to the intense industrial activity and to the breakdown of the railways under the war strain.

Advantages.—The substitution of the motor-car for the horse was beneficial in various ways. In the first place the car is much more speedy and more comfortable for transport. With a motor-car a physician, for instance, can extend his practice over a much wider territory; contractors can oversee more thoroughly a number of projects under way at the same time; stores and factories can deliver goods in the country, at distances of 30 m. or more, in their own vehicles, while horse delivery was limited to the city. Stables, always a nuisance and a breeding place of disease, have been practically eliminated from cities, and street-cleaning has been rendered much easier. Real estate remote from railways has in many instances considerably appreciated in value as a result of the advent of the motor-car, rendering it accessible to the city man.

In the foregoing the utilitarian aspect of the motor-car has been specially emphasised. While cars are still being built that can properly be classed as vehicles of sport and luxury, they form a small proportion of the whole production. In New York City an annual show was established for this class of car; it started as the Importers' Salon, but during the World War, when the importation of European cars was very difficult, it gradually changed its character and became a show of high-grade domestic as well as imported cars. At the salon in Nov. 1920, there were exhibited cars selling at upward of $20,000, whereas a serviceable five-passenger car could be bought for as low a price as $550. The luxury cars exhibited at these shows were characterised by high power and high speed, elegant body finish, fine upholstery and superior equipment.

European Conditions.—In 1910, Great Britain had the leadership among European countries as regards the number of cars in use, whereas France led in respect to volume of production. About one-half of the number of cars produced in France at that time were exported. In continental Europe the introduction of motor-cars was hampered by heavy taxation on the cars themselves and on the fuel. The use of motor-trucks, on the other hand, was encouraged by the so-called subsidy system, by which purchasers of trucks suitable for military purposes were offered by their governments a bonus on the purchase price and also on the upkeep cost, in consideration of their keeping the trucks always in fit condition and agreeing to turn them over to the Govt. in case of war. Great Britain, France and Germany had such subsidy systems before the war; Japan adopted the same policy later. As soon as war was declared the motor-car factories were set to work for the war departments, either making trucks or other vehicles for the transport corps or else manufacturing aero-engines or munitions. Soon all the petrol available was needed in war service, and the use of motor vehicles by private parties practically ceased.

In England some use was made during the War period of town gas for motor fuel; this was carried in a collapsible bag of rubberised fabric, on the roof of single-deck omnibuses, for instance. With this fuel it was possible to obtain about 85% as much power from an engine as with petrol, and a satisfactory mileage on one filling was secured. Under normal conditions the gas would have

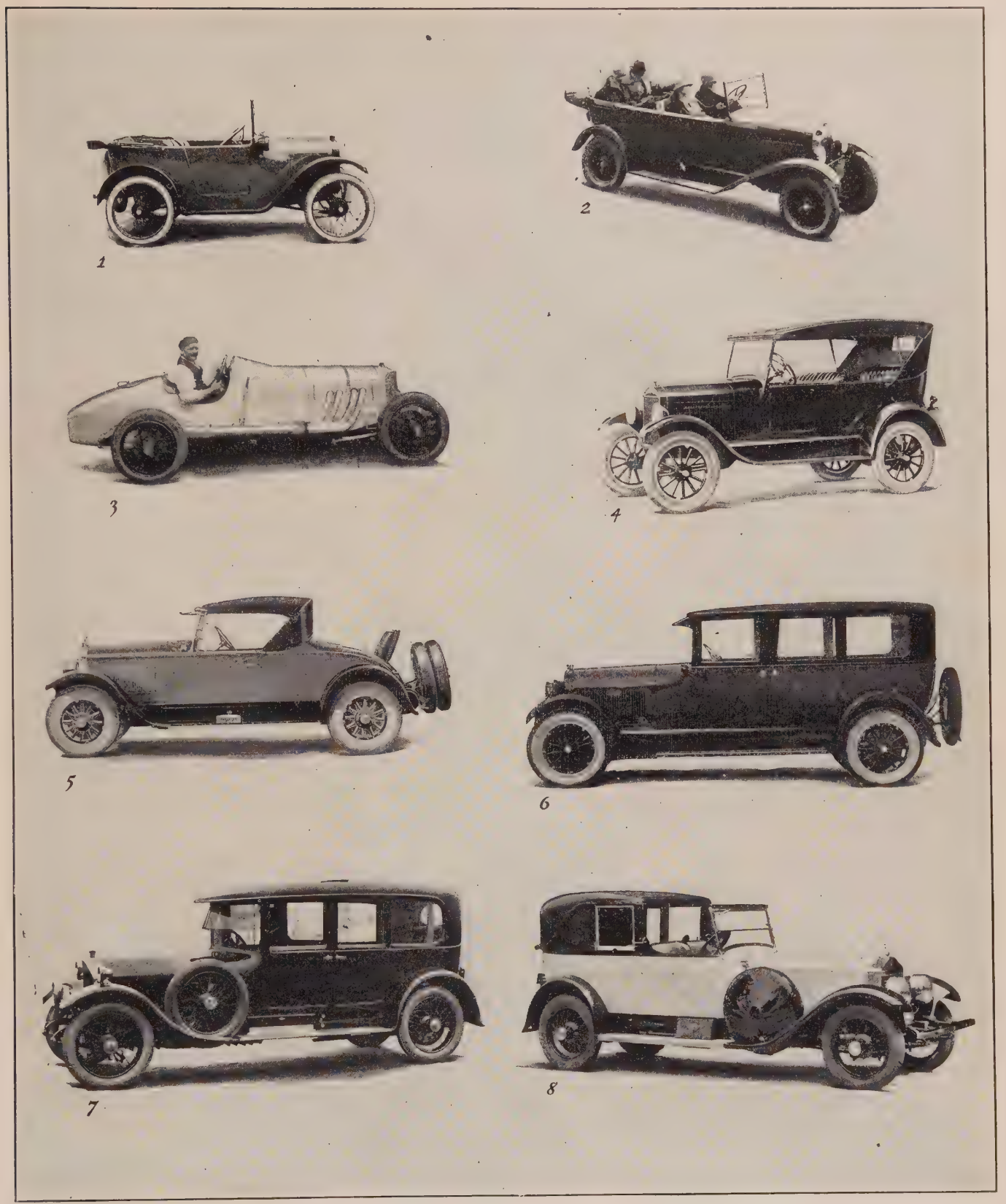
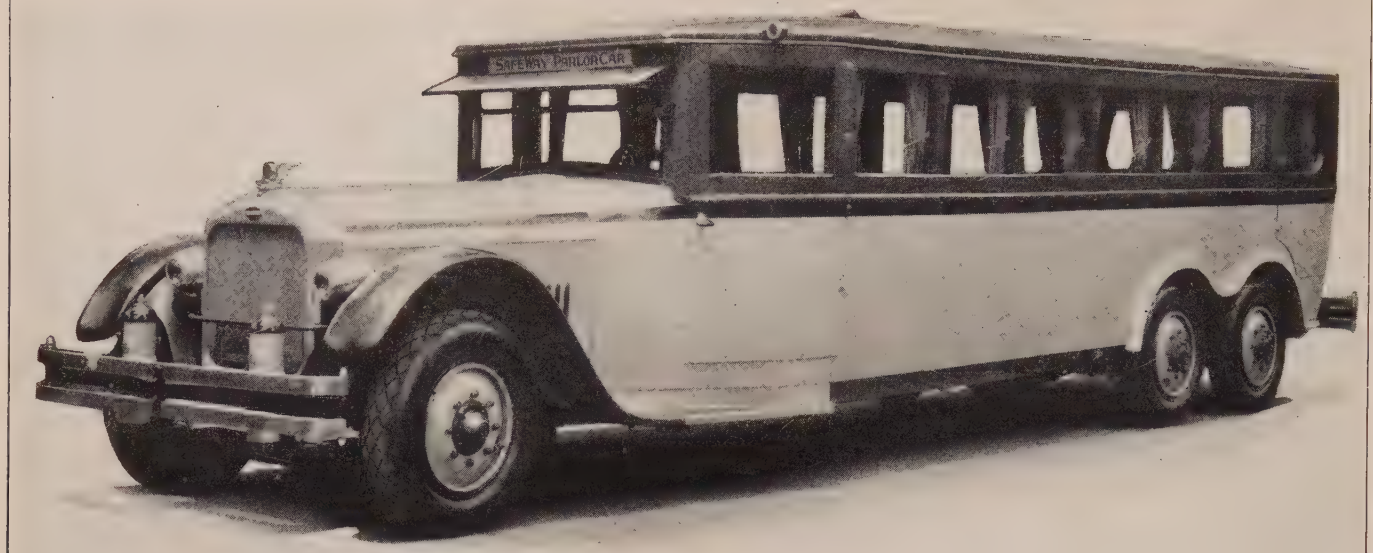


FIG. 1. Austin (British) light car. FIG. 2. Citroen (French) open car. FIG. 3. Mercedes (German) racer. FIG. 4. Ford (American) touring car. FIG. 5. Buick (American) roadster. FIG. 6. Cadillac (American) 7-passenger car. FIG. 7. Napier (British) limousine. FIG. 8. Rolls-Royce (British) Salamanca cabriolet.

MOTOR VEHICLES



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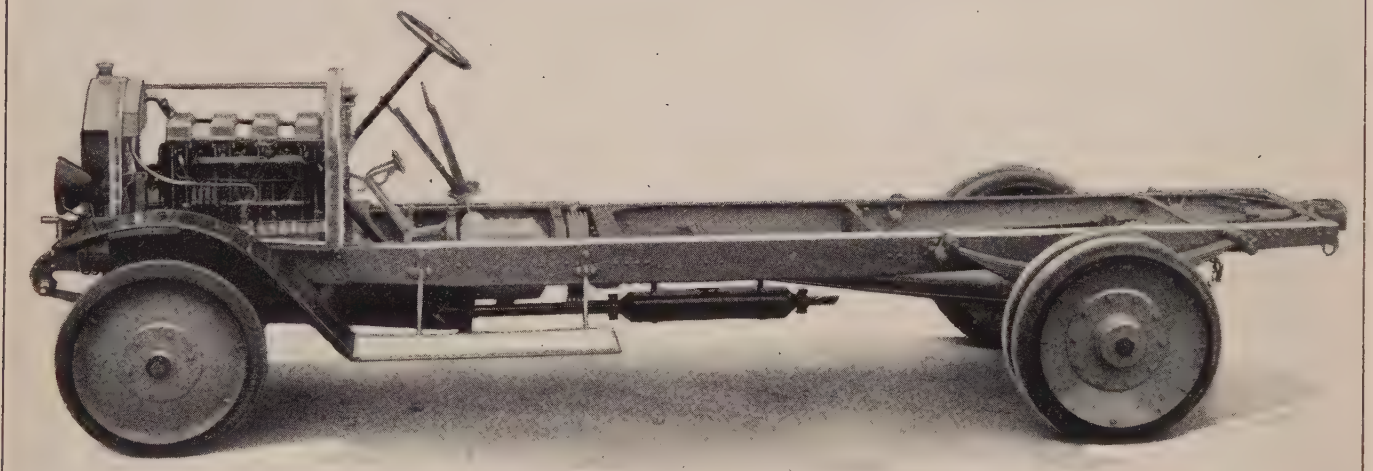

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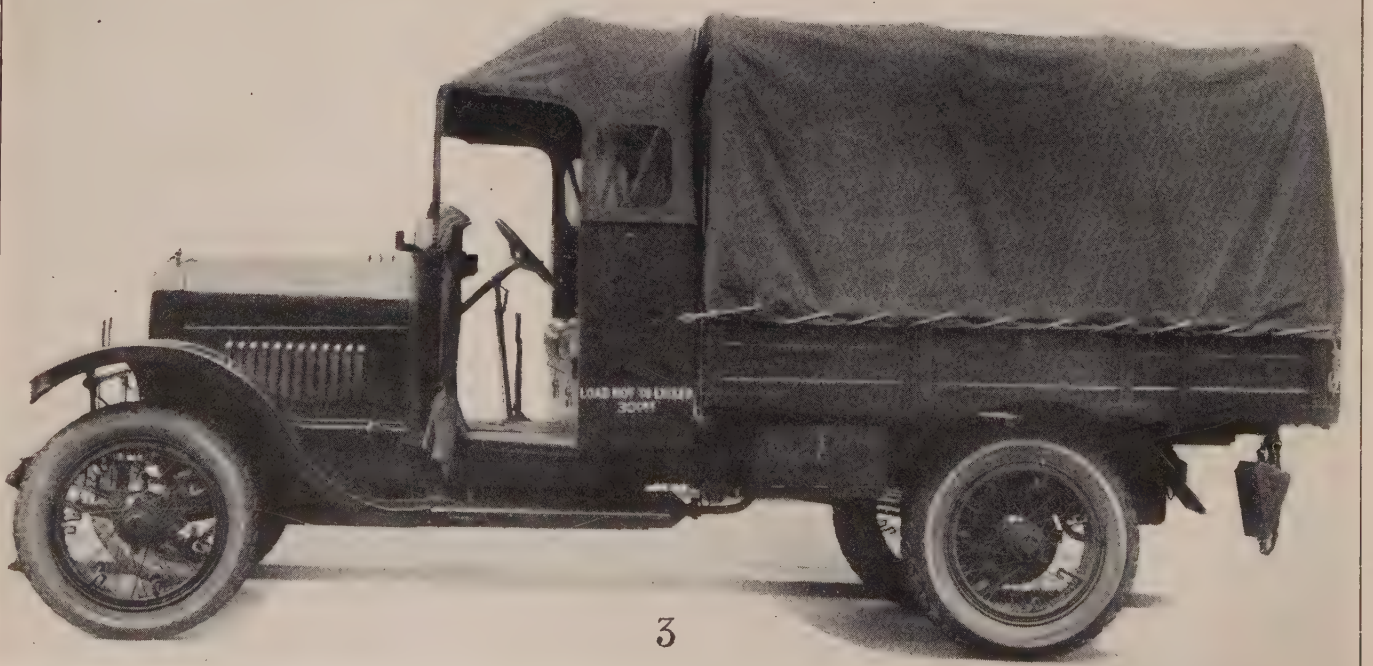

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FIG. 1. Six-wheel luxury type coach. FIG. 2. Benz (German) 5-ton truck chassis with Diesel Engine. FIG. 3. Crossley (British) subsidy type 3500 lb. truck with War Dept. type body.

been carried in steel bottles under high pressure, but owing to military requirements no steel could be spared for this purpose. The Central Powers suffered much more from fuel shortage than did the Allies, and extensive researches on substitute motor fuels were carried out in Germany. After their petrol supply ran low the Germans used benzol, petroleum mixtures, benzol-alcohol mixtures, alcohol, wood alcohol, tar oil, gas oil and shale oil, as well as fuels produced synthetically from water gas by catalytic hydrogenation under high pressure and at high temperature.

Registration in Great Britain.—According to an announcement by the Minister of Transport, Great Britain, on March 31 1920, had 185,700 private passenger vehicles and 71,400 public-service vehicles. The numbers of lorries and motor-cycles in service on that date are not available, but during the period Jan. 1—March 31 1921, licences were issued for 15,000 motor lorries and 278,500 motor cycles. How rapidly the use of the motor vehicle increased during the next four years may be judged from the following figures issued by the same authority as on May 31 1925: licences issued for private passenger cars, 532,909; for motor cycles, 518,457; for commercial goods vehicles, 216,966; for hackneys, 92,024; trade vehicles, 13,018, and official vehicles, 14,912.

Registration in the United States.—The figures given in Table I. are based on information furnished to *Automotive Industries* by the registration officials of the different states. Allowances

TABLE I. *U.S. Registrations*

	1924	1918	1912
Alabama	157,262	46,155	3,385
Arizona	57,828	23,875	1,624
Arkansas	141,983	41,458	2,250
California	1,321,480	337,878	88,699
Colorado	213,247	80,000	8,950
Connecticut	214,318	84,902	24,101
Delaware	35,136	12,955	1,732
District of Columbia	91,726	47,514	1,732
Florida	194,196	47,059	1,749
Georgia	209,300	99,160	19,120
Idaho	69,225	32,282	2,500
Illinois	1,123,724	389,135	68,073
Indiana	650,219	227,160	54,334
Iowa	620,906	327,500	47,188
Kansas	410,891	189,952	22,000
Kentucky	231,784	65,884	5,147
Louisiana	178,000	39,760	7,000
Maine	127,178	44,572	7,743
Maryland	195,581	78,146	10,487
Massachusetts	672,315	193,497	50,132
Michigan	868,587	261,547	39,579
Minnesota	502,987	203,727	29,000
Mississippi	134,547	40,000	2,895
Missouri	544,635	187,646	24,379
Montana	79,695	51,050	2,000
Nebraska	308,713	175,370	33,861
Nevada	18,387	8,160	900
New Hampshire	71,929	24,904	5,764
New Jersey	504,190	154,870	43,056
New Mexico	41,750	16,893	911
New York	1,412,879	457,924	107,262
North Carolina	305,756	72,300	6,178
North Dakota	117,061	71,687	8,997
Ohio	1,244,000	417,400	63,066
Oklahoma	342,982	120,300	6,524
Oregon	192,629	66,607	10,165
Pennsylvania	1,228,586	393,972	59,357
Rhode Island	90,652	30,595	8,565
South Carolina	163,382	55,400	10,000
South Dakota	142,280	86,121	14,481
Tennessee	204,680	65,000	9,973
Texas	834,040	250,201	35,187
Utah	79,233	27,204	2,576
Vermont	61,179	22,550	4,283
Virginia	261,643	72,228	5,760
Washington	294,812	119,905	13,990
West Virginia	190,134	38,600	5,349
Wisconsin	525,221	196,844	24,578
Wyoming	43,639	16,150	1,300
Totals	17,726,507	5,113,999	1,007,882

were made for re-registration of cars sold by their owners during the registration year and for registration of cars by non-residents, and the table is believed to give as accurately as possible the number of cars in service in each state during the years mentioned, by residents of the respective states.

Registration in Canada.—The following table shows that during the period 1910–5 the number of cars registered in Canada increased more than tenfold and that during the following four- and five-year periods, although the proportional rate of increase was less, the absolute increase was far greater.

Province	1910	1915	1919	1924
Ontario	4,200	42,346	144,804	306,770
Saskatchewan	531	10,225	56,855	69,895
Quebec	786	10,112	33,547	82,982
Alberta	423	5,832	34,000	48,255
Manitoba	1,524	9,225	30,118	44,015
British Columbia	1,026	8,360	22,420	52,325
Nova Scotia	148	1,841	10,290	20,610
New Brunswick	299	1,900	8,306	19,794
Prince Edward I.	..	35	790	2,577
Yukon	..	69	89	..
Totals	8,937	89,945	341,219	647,223

TABLE II. *Registration of Passenger Cars, Lorries and Motor cycles in Different Countries at the End of 1924*

(In round number)

	Passenger Cars	Lorries	Motor-Cycles	Total
United States	15,597,000	2,142,000	139,000	17,878,000
Great Britain	625,000	217,000	518,000	1,360,000
France	460,000	115,000	102,000	677,000
Canada	576,000	63,000	8,000	647,000
Germany	132,000	61,000	98,000	291,000
Australia	180,000	18,000	55,000	253,000
Italy	72,000	28,000	38,000	138,000
Argentina	120,000	5,000	3,000	128,000
Spain	56,000	10,000	7,000	73,000
Holland	24,000[1]		36,000	60,000
Norway	13,000	5,000	7,000	25,000

[1] Includes both passenger cars and lorries.

II. TECHNICAL DEVELOPMENTS

A most desirable feature in a motor car is flexibility, that is, the ability to pass from a low to a high speed by merely opening the throttle valve. This is secured by using an engine of great power in proportion to the combined weight of the car and load. American cars have been specially noted for their flexibility, due to the use of very large engines, notwithstanding the fact that the high fuel consumption per mile travelled tends to increase with the displacement of the engine. As motor fuel was much more expensive in Europe, European designers could not ignore the factor of fuel economy as American engineers could.

Engine Design.—In engine design the constant endeavour is to get greater output from an engine of given piston displacement. Horsepower output depends upon two factors, the mean effective pressure upon the piston head and the linear speed of the piston. It was not possible to increase greatly the mean effective pressure; in fact, changes in the character of the fuel used for motor cars, by which some very much less volatile fractions were included than in motor fuel of the earlier period, made it necessary to operate with lower compression, which resulted in a lower mean effective pressure. However, improvements in combustion chamber design and other changes more than balanced this loss. A great gain was made by increasing the speed of operation. In 1905 the average engine speed corresponding to maximum engine output was about 1,000 ft. per min.; in 1926 it was approximately 2,500 ft. per min. for passenger-car engines and over 4,000 ft. per min. for racing engines. The first step to increase engine speed was enlargement of valve ports and passages, enabling the engine to draw in a normal amount of charge at a higher speed. The valve timing was also changed, the exhaust valve being given a greater lead and the inlet valve a greater lag.

Next, the reciprocating parts (piston and connecting-rod) were lightened, so as to reduce the inertia forces on them and the bearing pressures resulting therefrom. This led eventually to the adoption of aluminium alloy pistons. Aluminium has a higher co-efficient of heat expansion than cast iron, so that the aluminium piston must be given a greater clearance in the cylinder, which tends to result in unpleasant piston slap when the

engine is cold, and also in "oil pumping," that is, transfer of lubricating oil from the crank chamber to the combustion chamber, with consequent smokiness of the exhaust. These difficulties were overcome in later designs by the use of the split-skirt or constant clearance type of piston, in which the skirt or lower part is separated from the upper part or ring belt all around and is saw-slotted longitudinally so that when the aluminium expands the saw-slot will become narrower and the clearance between piston and cylinder wall remain substantially the same. In a few instances magnesium alloy pistons and heat-treated duralumin connecting rods were used, magnesium having a specific gravity about two-thirds that of aluminium, and duralumin, an aluminium alloy responsive to heat treatment, having the strength of mild steel with only one-third its specific gravity. Special means were resorted to in attempts to build ultra high-speed engines, as for racing and similar purposes. These included the use of two inlet and two exhaust valves per cylinder, the use of two simultaneous ignition sparks in each cylinder, and the use of crankshafts in which each individual throw was counterbalanced.

Cylinder Development.—By increasing the number of cylinders above the one or two employed in the first machines, engines can be reduced in weight, and the objectionable vibration can be minimised. In 1926 the four-cylinder engine was the foremost type for use on vehicles of a strictly utilitarian character; the six-cylinder was the luxury type in Europe, while in the United States it was the preferred type for passenger cars of intermediate and higher grades. Most of the more expensive passenger cars in the United States then were fitted with eight-cylinder engines. The twelve-cylinder or twin-six engine enjoyed a spell of popularity during and immediately after the War but disappeared from the market as a motor-car power plant in 1923. In a petrol engine the torque impressed upon the crankshaft is always non-uniform, no matter how many cylinders there are, but the fluctuations decrease with an increase in the number of cylinders. In a four-cylinder engine there is, as with one or two cylinders, a reversal of the torque; that is, just before the end of each stroke the flywheel not only supplies all the power delivered by the engine, but also some of the power necessary for keeping the crankshaft and pistons in motion. Six cylinders are the smallest number delivering continuous torque at the crankshaft; but while continuous, the torque is still far from being uniform; with eight cylinders the torque fluctuations are reduced, and with twelve they are still smaller.

Arrangement of Cylinders.—Four and six-cylinder engines were always arranged vertically, with all cylinders in a row; eight-cylinder engines were originally built in V form, but in 1926 the majority of the makes had all eight cylinders in line. In an eight-cylinder V engine with the two cylinder blocks at an angle of 90°, and with a single plane crankshaft there is an unbalanced periodic inertia force in the horizontal plane, the period of which is equal to the time of one-half a crankshaft revolution. By placing the two cylinder blocks at an angle of 60° a uniformly rotating unbalanced inertia force of constant value is obtained, of a magnitude considerably less than the maximum value of the unbalanced force in the 90° V, and this led two makers, Lincoln and Wills, to use this arrangement of the cylinders, which, incidentally, suffers from the disadvantage that the explosions are not evenly spaced but come at 60° and 120° intervals. A method of completely balancing an eight-cylinder 90° V engine was discovered by Prof. Archibald Sharp and described in his book on *The Balancing of Engines*, issued in 1907. It was first practically adopted by the Cadillac Motor Co. in 1923. Instead of having all four throws of the crankshaft in a single plane, the throws are arranged in two planes making an angle of 90° with each other, and the crankshaft is provided with two heavy balance weights, as shown in fig. 1, which represents the Cadillac crankshaft. In deciding upon the form of the crankshaft of a multi-cylinder engine and the angle between cylinders in a V engine two objects are aimed at, namely, to ensure uniform spacing of explosions and inherent balance of reciprocating parts. Both objects can be attained in six and eight-cylinder engines; in a four-cylinder vertical engine there is an unbalanced reciprocating force in a vertical plane, causing vibration of the engine. This can be overcome only by the use of an anti-vibrator, invented by F. W. Lanchester, consisting of an unbalanced mass directly below the crankshaft and driven from the latter at twice its speed.

FIG. 1.—Balanced crankshaft for 90° V-type eight-cylinder engine (Cadillac).

When multi-cylinder engines were first used the cylinders were generally either cast separately or in pairs; later it became the practice to cast all cylinders in one row in one block. This greatly simplified the outward form of the engine, as with such a cylinder block only one pipe connection each need be made for the cooling-water inlet, the cooling-water outlet, the combustible charge from the carburetter and the exhaust. Some manufacturers even cast the top part of the crankcase integral with the cylinder block and made the lower part a steel pressing. This construction lent itself well to quantity production. Most makers of the higher-priced cars, produced in smaller numbers, cast all parts of the crankcase of aluminium. Cylinder heads were generally cast separate from the cylinder block and fitted to the block with a gasket of sheet copper and asbestos between. This construction facilitated manufacturing operations, and when the engine was in service permitted decarbonising the combustion chamber by scraping without removing the cylinder. It also made it possible to machine completely the combustion chambers, and thus to get all the chambers in one engine of exactly equal volume.

Combustion Problems.—As the speed of automobile engines increased it became necessary that the combustion of the fuel mixture charge be completed in a shorter period of time, in order that the maximum fraction of the heat energy might be converted into mechanical work. Racing engines in 1925 operated at speeds above 5,000 r.p.m., at which the time of one complete piston stroke is less than $\frac{1}{180}$ sec., and combustion should be completed before the end of the stroke. Prof. Bertram Hopkinson observed in 1912 that the rate of flame propagation through a combustible mixture can be increased by producing turbulence in the mixture (in the experiment, by means of a revolving fan in a closed vessel containing the mixture). In order to obtain a similar effect in the combustion chamber of an engine, Harry Ricardo has suggested the use of a "turbulence cylinder head," as illustrated in fig. 2. The compression space is in the form of a pocket in the cylinder head, mainly over the valves, which are located in a side pocket, but partly over the cylinder itself. At the end of the compression stroke the piston approaches very close to the flat portion of the cylinder head, and this produces a lateral rush of the combustible gases into the compression pocket, causing turbulence. Compression heads of this general form were widely used in 1926.

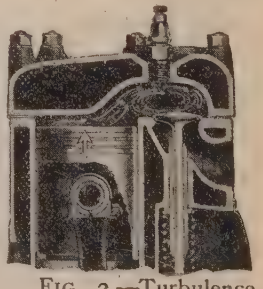

FIG. 2.—Turbulence type cylinder head.

The compression space should be as compact as possible, so that for a given volume its surface area and the distance from the spark points to the remotest portion of the charge are both a minimum, as this tends to promote rapid combustion, to prevent detonation (excessive explosion pressure and resulting phenomena) and to reduce the loss of heat energy to the cylinder jacket. Recognition of these relationships led to the gradual abandonment of the T head type of cylinder (with inlet and exhaust valves in pockets at opposite sides) and to the wider

adoption of the valve-in-head engine, which latter in 1926 was used on racing cars to the exclusion of all other types. Valves in the cylinder head can be operated either from a camshaft in the crankcase through tappet rods extending up the side of the cylinder and tappet levers on top, or from an overhead camshaft. The overhead camshaft design reduces the weight of the valve reciprocating parts, and with given valve spring pressure makes possible the use of higher engine speeds. Racing and air-craft engines (*see* AERO-ENGINES) were generally fitted with overhead camshafts. On the other hand, in passenger car engines valves in the cylinder head were generally operated through long tappet rods, as it was found difficult to obtain the desired degree of silence with overhead camshafts.

Marmon, in the United States, used a cast aluminium cylinder block for a passenger car engine for a number of years prior to 1920, but gave it up because it proved impossible to keep the cylinder bores true. Cast-iron sleeves were inserted in the blocks to form bearing surfaces for the pistons, and the valves were located in cast-iron cylinder heads. The trouble was evidently due to distortion of the aluminium castings under the high temperature of operation. It was later found that distortion of aluminium engine castings in service can be prevented by subjecting them to a heat treatment after machining, at a temperature slightly higher than the maximum they reach in service. Some years after the War, German engineers became interested in aluminium engines, and at the Berlin automobile show of 1923 there were exhibited six makes of car with such engines.

Fuels.—The continual lowering of the volatility of the fuel used caused both manufacturers and users of motor cars a great deal of trouble, particularly between 1915 and 1920. When motor cars were first used, the fuel sold consisted of a comparatively narrow range of highly volatile hydro-carbons. When sprayed into air at atmospheric temperature in the required proportion of about one part by weight of petrol to 15 parts of air it vaporised readily. The fuel supplied in the United States in 1920 had an end point of nearly 475° F., that is, the least volatile constituents, when under atmospheric pressure, boiled only at that temperature. Hence, in order to vaporise this fuel completely it was necessary to supply heat to the mixture or to the components before they were mixed. When trouble from incomplete vaporisation was first experienced the carburetters were provided with a jacket through which hot water from the engine jacket was circulated. When this no longer sufficed, the air for the carburetter was drawn through a muff surrounding a part of the exhaust manifold, and to prevent recondensation after the mixture was formed, the inlet manifold was so arranged that it was completely surrounded by hot water.

This also proved inadequate, and then the hot spot or exhaust-heated manifold was introduced. When the fuel is incompletely vaporised the liquid particles tend to separate out of the mixture at the bends in the manifold, and it is very difficult to insure that all cylinders get mixture of the same composition. Those portions of the manifold wall where the liquid particles tend to accumulate are then made to form parts of the exhaust manifold wall also, so that they are constantly kept at a high temperature, and the liquid particles upon striking them flash into vapour. The change in the character of motor fuel between 1916 and 1919 is strikingly illustrated by the diagram (fig. 3) of distillation curves of the fuels purchased in Detroit, Mich., at various times during that period. Later the fuel improved again slightly and a survey made by the U.S. Bureau of Mines on Jan. 1 1925, showed an average end point for petrols sold in different parts of the country of 425° Fahrenheit.

Carburetters.—Numerous improvements in carburetter design were made between 1910 and 1926. Decreased volatility of the fuel necessitated the provision of special means to facilitate engine starting, particularly in cold weather. American engineers, who were confronted with the problem first, generally made use of a choke valve in the air inlet, which is closed when it is desired to start. This greatly increases the suction on the fuel nozzle and results in a great excess of fuel being drawn in. As only the most volatile part of this fuel will be vaporised, this excess of fuel

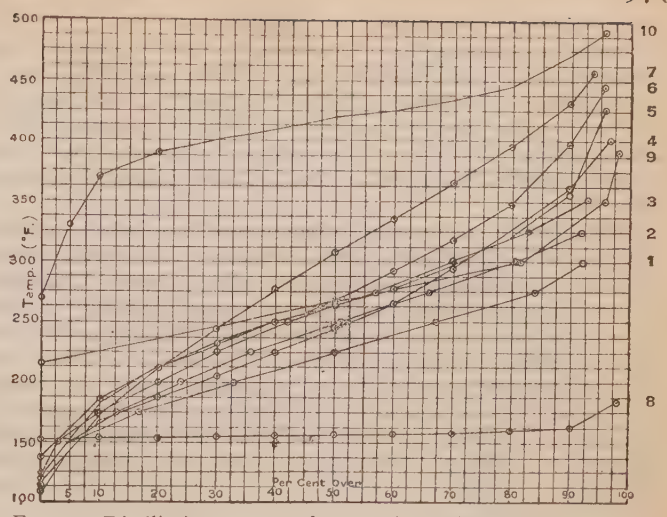

FIG. 3.—Distillation curves of motor fuel sold in Detroit, Mich., from 1916 to 1919. The data for each curve are as follows:—

Curve No.	Fuel	Date of Purchase	Baumé
1	Petrol	4/5/16	60·5
2	Petrol	7/10/16	57·5
3	Petrol	9/11/16	56·8
4	Petrol	6/9/17	56·8
5	Petrol	1/24/19	57·3
6	Petrol	4/30/19	55·7
7	Petrol	6/18/19	55·0
8	Alcohol	10/18	42·2
9	Cal. Dist.	18	51·4
10	Paraffin	18	40·0

assures the formation of an ignitable mixture. Another scheme, which originated in Europe, consists in the provision of a special starting nozzle delivering fuel into the carburetter passage above the throttle valve.

For starting, the throttle is closed and the effect on the starting nozzle is then the same as that on the main nozzle when the choke valve is closed. Most of the earlier carburetters had the fault of delivering an impoverished mixture in case the throttle valve was opened suddenly, causing the engine to halt and even to stop. With later carburetters the fuel-metering orifice is placed at the bottom of the carburetter instead of at the top of the spray nozzle. Between it and the top of the nozzle an accelerating well is provided which filled with fuel when the engine was stopped or throttled down to a low speed. Then, if the throttle were opened suddenly, the contents of the well were discharged into the induction system almost instantly, and the richness of the mixture was maintained.

Another improvement that came into wide use on carburetters between 1920 and 1926 was the economiser. Research work on carburetters and engines showed that for best all-round results the strength of the mixture must be varied with the demand on the carburetter. Maximum power is obtained from the engine with a petrol-air mixture of about 1:12·5, whereas the maximum fuel economy is obtained with a mixture of about 1:16. At extremely low speeds the mixture should be comparatively rich, because the fuel then is not sprayed very energetically and not all of it is vaporised, and only the vaporised fuel counts in the mixture. Throughout the greater part of the range in demand the carburetter should furnish the maximum-economy mixture, for obvious reasons. However, if the throttle is opened wide, the driver wants either the maximum torque (as in ascending very steep hills), or else the maximum power (as in a burst of speed), and in that case the carburetter should deliver the maximum-power mixture. This is accomplished by making the stem of the throttle valve, when approaching the position of maximum opening, change the setting of the fuel metering devices in such a way as to enrich the mixture.

Air Cleaners.—About 1920, American manufacturers began to use air cleaners on passenger car engines, to prevent road dust from getting into the cylinders and causing abnormal wear. The cleaners used were of either the centrifugal or the strainer

type. With the former the air is set in rotation in a cylindrical chamber by being drawn in by the engine suction through tangential or helical passages. Centrifugal force caused the heavy dust particles to collect on the cylinder wall and to drop out into a collector, often a glass jar, while the air, deprived of its dust content, is drawn off at the centre of the cylinder. With the strainer type the air is drawn through a large area of filtering felt.

One difficulty encountered in the use of exhaust heat for vaporising the fuel is that the heat supplied does not vary in accordance with the needs when the load on the engine is varied. When the engine is heavily throttled and runs under light load at low speed, the suction on the spray nozzle is small, and consequently the fuel is not finely sprayed. Relatively more heat is needed to ensure the vaporisation of the larger globules of fuel, but under these conditions of operation the exhaust does not supply a great amount of heat. A device designed to overcome this difficulty was developed by the Packard Motor Car Co., and is known as the fueliser. With this (see fig. 4) a variable fraction

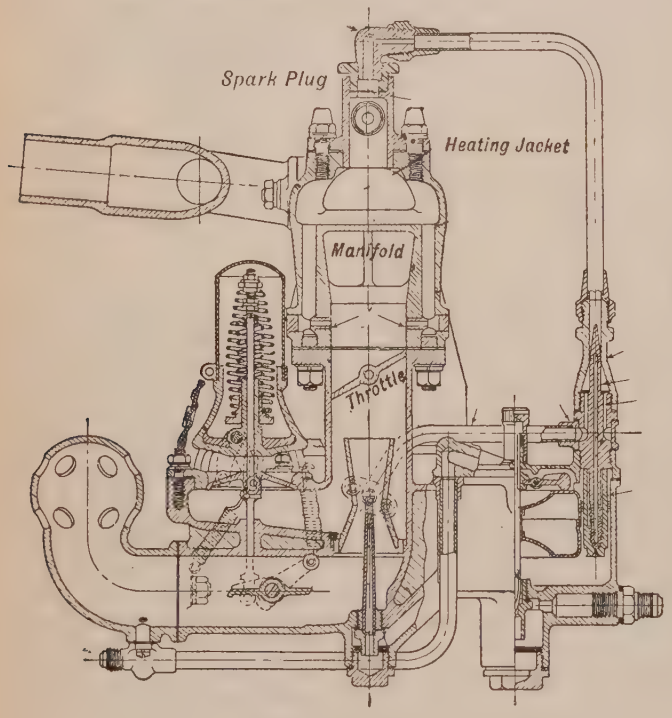

FIG. 4.—Cross section of Packard fueliser.

of the mixture prepared in the carburetter mixing-chamber is shunted around the throttle valve and through a heating jacket of the carburetter, where it is kept burning by a constant stream of sparks delivered by a sparking plug. The products of combustion are combined with the main stream of combustible charge and pass on into the cylinder. When the throttle valve is fully open there is very little resistance to the passage of the combustible mixture past it, and very little then flows through the by-pass or heating jacket; on the other hand when the throttle is nearly closed the passage through it offers much more resistance, and a much greater proportion of the fuel charge passes through the heating jacket, which is in accordance with the requirements.

Feed Systems.—In early cars the fuel tank was almost invariably located in the front seat, and the fuel was fed by gravity to the carburetter. Later the bodies were constantly lowered, partly to secure greater stability and partly for the sake of appearance, and at the same time the carburetter had to be raised in relation to the engine, owing to the lessened volatility of the fuel. The result was that sometimes when the car had to ascend a steep grade and there was little fuel in the tank there was no head on the fuel, and none would flow to the carburetter. Some of the earlier high-class cars were provided with a pressure fuel feed system, by which gas under pressure, taken through an " adapter " from the engine cylinders, was made use of to force petrol from a tank carried on the frame at the rear to the carburetter. There were two major objections to this system of feed: carbon particles from the engine cylinder often got into the fuel tank (in spite of the gas being passed through a fine-mesh wire-gauze strainer) and thence into the carburetter jet, which sometimes became clogged; besides, every time the fuel tank was filled the compressed gas escaped, and to get an initial flow it was necessary to obtain pressure by a hand air-pump. By placing the fuel tank under the cowl instead of in the front seat, sufficient head for gravity feed was generally obtainable, but the cowl tank usually had an awkward shape and was of rather small capacity.

The solution was found in the vacuum feed system, developed by the Stewart-Warner Speedometer Corp., Chicago, by which (fig. 5) the suction or vacuum in the inlet pipe of the engine was used for transferring the fuel from a rear tank to an auxiliary tank mounted on the forward side of the dashboard, as high as possible. The auxiliary tank had two compartments, upper and lower. Into the upper compartment the fuel was drawn by the vacuum, and it was periodically transferred to the lower by a float valve. Thence it flowed to the carburetter by gravity. There was always sufficent fuel in the carburetter float chamber and in the auxiliary tank to start the engine after the main tank had been refilled.

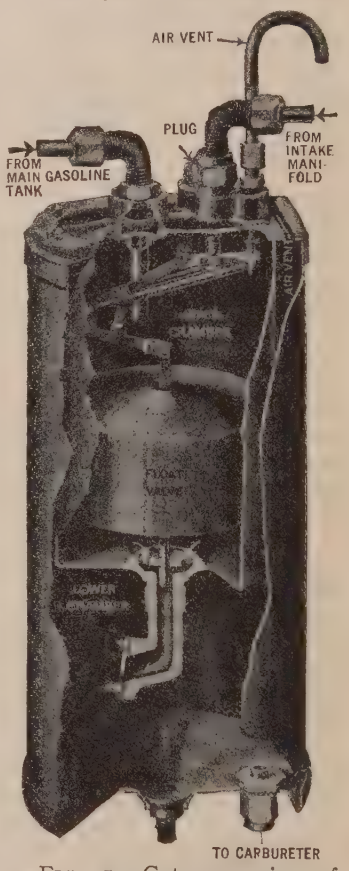

FIG. 5.—Cut-away view of Stewart vacuum tank (fuel feed system).

Ignition.—In 1910 ignition on practically all motor-cars was by high-tension magneto. In 1926 all American passenger cars, with the exception of the Ford (which had a flywheel type of magneto of the maker's own manufacture), had battery ignition. In European countries, on the other hand, although a beginning was made with the replacement of the magneto with the battery and coil system, upon the adoption of electric starting and lighting the movement was soon checked, and in 1925 only 16 out of 133 British models had battery ignition, while in France battery ignition was even less popular and in Germany it was practically non-existent. What led American engineers to change from magneto to battery ignition on passenger cars was the adoption of electric lighting and starting during the period 1912–4. Any car so equipped had an electric generator and a storage battery; consequently there was a constant and plentiful supply of current available, and there was no need for an additional current generator in the form of a magneto. As compared with the early coil and battery systems, the only differences consisted in the use of a plain coil instead of a vibrator coil and of a mechanical interrupter instead of a timer. Sometimes safety devices were provided for automatically opening the circuit or reducing the current flow if the operator should forget to open the switch when the motor stalled.

Use of Thermostats.—No fundamental changes were made in the cooling system, with the exception of the introduction of the thermostat for the control of the circulation. This instrument is connected in the cooling circuit in such a manner that it prevents circulation through the radiator until the jacket water has attained a certain predetermined temperature, generally

about 170° Fahrenheit. The result is that in starting from cold the engine reaches normal working temperature in shorter time, and trouble due to incomplete vaporisation of fuel is reduced. The thermostat used, known as the sylphon, consists of a corrugated copper cylinder filled with a liquid which vaporises at the temperature at which the thermostat is to act (fig. 6). An al-

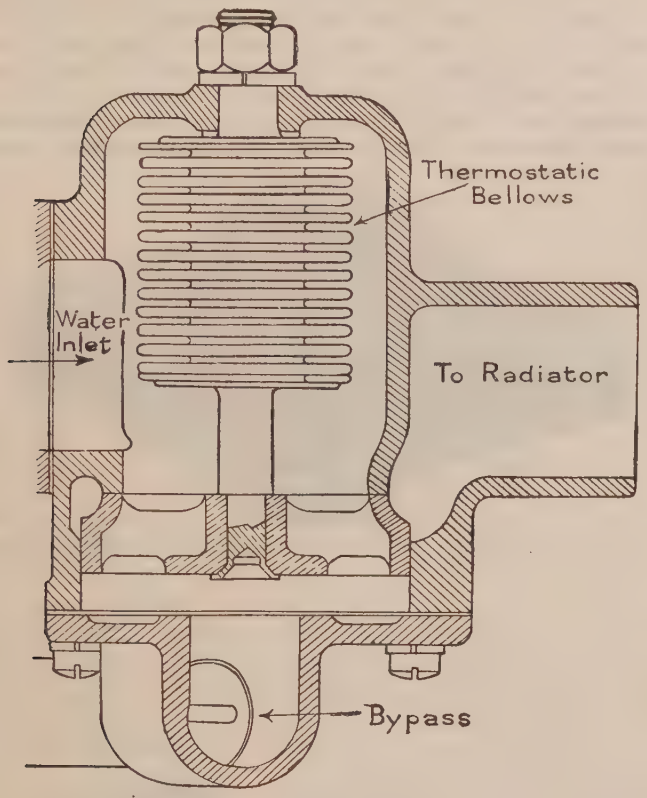

FIG. 6.—Thermostatic valve for control of engine temperature.

ternate system consisted in the provision of a set of radiator shutters, thermostatically controlled. Many passenger car radiators are fitted with a radiator thermometer in the filler cap, which is a help to the operator in trying to keep his engine running at its best temperature and gives an early indication of incipient overheating.

Lubrication.—As regards engine lubrication two basic methods came into use, the circulating-splash and the force-feed or "drilled crankshaft" system, as well as combinations of the two. Both systems were employed on early cars, but the force-feed system came into much more extensive use with the development of the high-speed engine. The problem of engine lubrication was rendered much more difficult by the change in the character of the fuel used. A good deal of the fuel entered the cylinder in the unvaporised state, and some of it leaked past the pistons into the crankcase, where it diluted the lubricating oil. In 1920 it was a common experience to find a fresh supply of lubricating oil lose much of its viscosity, and hence of its lubricating value, during the first 100 m. of running. Heating of the crankcase oil also reduces its viscosity, and to reduce this heating many British engines were cast with cooling flanges on the bottom of the oil sump.

Starting and Lighting Gear.—One of the greatest advances in motor car practice was the development of electric starting and lighting systems. The first such system on a car in regular production was on the Cadillac in 1912, and was the design of C. F. Kettering. Electric lighting alone had been used on petrol cars for some years previously, in fact ever since the advent of the tungsten filament bulb. At first the lamps were supplied with current from a storage battery only, which had to be recharged periodically from electric mains; later they were fed with current from a generator and storage-battery installation. The adaption of an electric generator to storage-battery charging on a motor car presented considerable difficulties, for the reason that the petrol motor runs at widely varying speeds, and that the voltage of the generator, therefore, tends to vary within wide limits, whereas a substantially constant voltage is needed for charging.

Many systems of regulation were used with more or less success, but finally the so-called third-brush system was adopted by a majority of the manufacturers of electrical equipment. In this system the generator field was provided with a winding similar to a shunt field winding, but instead of connecting the positive commutator and negative brushes it was connected between one of these brushes and an auxiliary brush, so that only a fraction of the voltage generated in the armature was applied to the field coils. This system of control did not give a constant generator voltage, but with a storage battery connected to the generator it kept both the voltage and the charging current within permissible limits of variation.

In connection with the electric starter the main problem was that of the drive to the engine crankshaft. After trying various devices nearly all manufacturers in the United States and a good many in Europe settled upon the use of the Bendix drive (fig. 7), developed by Vincent Bendix of Chicago. On an extension

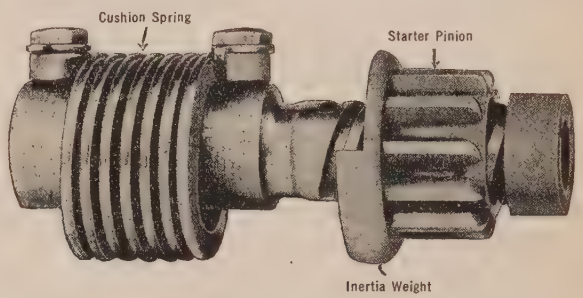

FIG. 7.—Bendix drive for electric starters.

of the starter armature shaft was loosely mounted a sleeve, which was placed in driving connection with the shaft through a coiled spring. The spring had a coarse, square thread cut on its outside, and on this was mounted the driving pinion, the hub of which was cut with a corresponding female thread. When current was applied to the starting motor, which was always of the series wound type, the armature started to revolve at great speed, carrying along the threaded sleeve on its shaft. Owing to its inertia the pinion lagged behind, and was screwed along the shaft and thus shifted into mesh with a gear-ring on the flywheel rim. Upon abutting against a collar it became fast upon the sleeve, and the starter then cranked the engine, the shock being relieved by the coiled spring.

As soon as the engine began to pick up its cycle the flywheel ran ahead of the driving pinion, and the latter was automatically thrown out of mesh by being forced along the screw. Fig. 8,

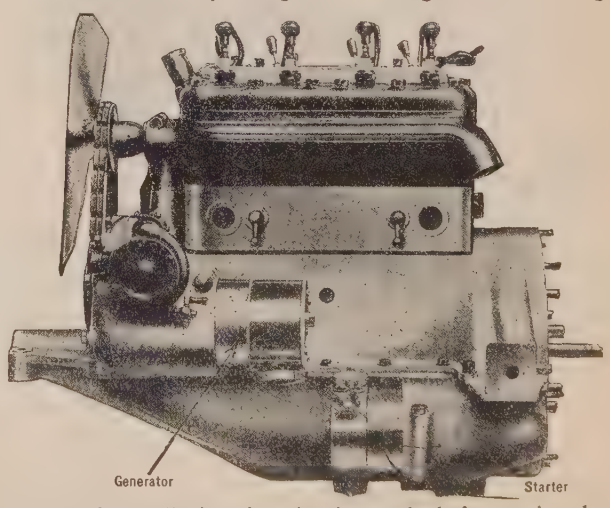

FIG. 8.—Fiat (Italian) engine, showing method of mounting electric generator and starter.

illustrating the Fiat motor car engine, shows one method of mounting the generator and starter. A necessary part of practically all motor car electric equipments was a battery cut-out, which automatically disconnected the battery from the generator when the engine speed dropped so low that the generator voltage was less than the battery voltage, and connected it on increasing engine speed when the generator voltage surpassed the battery voltage. Ground return wiring was very much used, all electric appliances having one insulated and one grounded connection. The standard voltage for motor car electric systems in the United States was 6 v., while in Europe a pressure of 12 v. was much used.

Superchargers or means for forcing into the cylinders a greater mass of charge per cycle than they can draw in by their pumping action received a good deal of attention during the latter part of the War as a means of maintaining the power of aircraft engines at high altitudes. In 1926 the supercharger was commonly used on racing engines and permitted of greatly increased output from an engine of given displacement. On one make of stock car, the Mercedes, the supercharger was fitted as standard equipment. An air-pump of the Roots blower type was mounted at the forward end of the engine and driven from the crankshaft through a friction clutch, which latter was controlled by the accelerator pedal. As long as the throttle was not fully opened the clutch was disengaged and the supercharger therefore idle. A further movement of the pedal after the full-open position of the throttle had been reached, closed the clutch, set the supercharger in action and gave an increase in maximum power of about 65%.

Gears.—Unit-power-plant construction, that is, the combination of the engine, clutch and change-speed gear in a single unit, became very popular, and in the United States was the almost universal practice for passenger cars. About 1910 the dry-disk type of clutch (fig. 9) began to displace the multiple disk-in-oil and the cone type. It was very similar to the lubricated type of disk clutch in construction, but one set of the metal disks was faced with disks of asbestos fabric on both sides. Its advantage over the lubricated disk clutch was that its operation was not affected by changes in atmospheric temperature, as was that of the latter. Most of the earlier dry-disk clutches were of the multiple-disk form, but from 1920 on the single-disk type gained constantly in popularity and in 1926 was used with engines of as much as 70 horsepower. This differs from the multiple-disk form not only in having only a single driven disk, but also in having a set of reducing levers which make the thrust on the throw-out collar about one-quarter the pressure between the disks, whereas in the multiple-dry-disk design illustrated in fig. 9 the two forces are equal. There were no important developments in the design of gearsets or transmissions; nearly all manufacturers of passenger cars used the selective sliding pinion type, and this type was also used on most commercial vehicles.

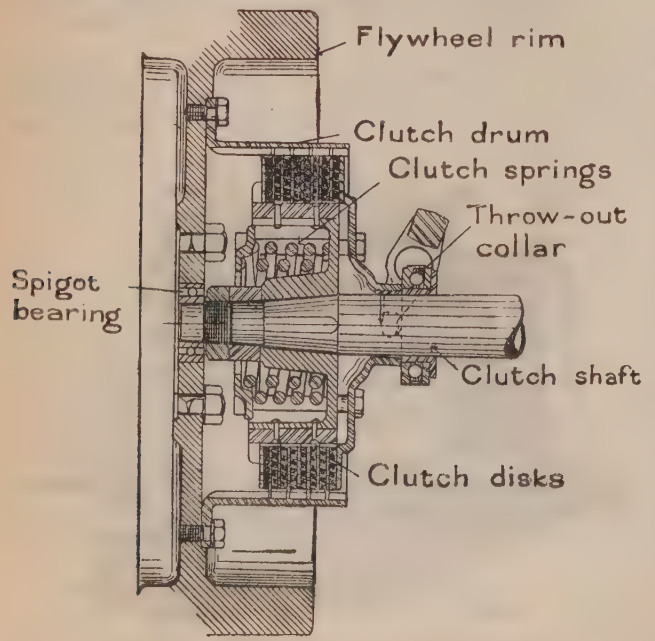

FIG. 9.—Sectional view of dry-disk clutch.

Chain drive was almost entirely discarded, except on trucks in continental Europe, and shaft and bevel-gear drive became the standard for passenger motor cars throughout the world. But two important improvements were made in this drive. One was the substitution of spiral bevel for straight bevel gears, to secure quiet operation, and the other the partial substitution of disk universal joints for the metallic type, the former requiring no lubrication. The spiral bevel gear (fig. 10) was made possible by a gear-cutting machine developed by the Gleason Works of Rochester, N.Y.; and the fabric disk universal joint (fig. 11) by a fabric structure originated by Ed. J. Hardy & Co. of Coventry, England. Practice in regard to final drives for motor lorries remained in a chaotic state in 1920. In continental Europe the chain was still predominant, while in Great Britain and the United States the worm drive was in most extensive use. Of the lorry models manufactured in Great Britain in 1926 50% had worm drive, 5% chain drive, 12% bevel gear drive, 1% internal gear drive, and 25% the double-reduction drive, or drive by one pair of bevel and one pair of spur gears enclosed at the middle of the axle. In the United States the most popular drive next to the worm, for trucks of over 1½ tons capacity, was the internal gear drive, in which there was a first reduction by bevel gears at the middle of the axle and a second by internal gears at the driving wheels.

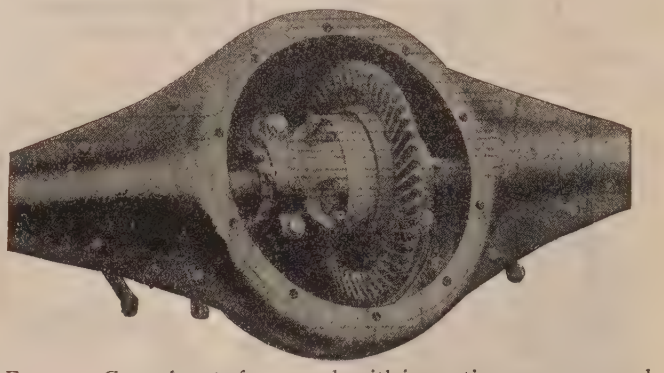

FIG. 10.—Central part of a rear axle with inspection cover removed, showing spiral bevel gear.

FIG. 11.—Thermoid-Hardy fabric universal joint.

Axles and Springs.—In connection with lorry axles, mention should be made of the development and use, mainly in the United States, of so-called non-stalling differential gears. A vehicle fitted with this type of differential would not lose all traction when one driving wheel gets on slippery ground; on the other hand, in turning corners the drive was entirely through the inner wheel. A type of body suspension spring that gained much in popularity between 1910 and 1920 was the cantilever type first used by F. W. Lanchester in England. The most extensively used type in 1926 was the half-elliptic. Many attempts were made to solve the problem of furnishing the springs with effective means of lubrication, to make them as supple as possible and to prevent squeaking, and in England the practice of enclosing the springs in leather gaiters gained some ground. In the connection between the rear axle and the frame, provision must be made for taking up the driving thrust necessary to overcome the air resistance and the resistance encountered by the front wheels, as well as the reaction to the rear-wheel driving torque, which tends to turn the axle housing in the direction opposite

to that in which the wheels are turning. In the Hotchkiss drive, both the drive and the torque reaction were taken up on the body springs, which were securely clipped to the axle housing and directly pinned to the frame at their forward end. This pattern became very popular in the United States for both passenger cars and lorries, and was successfully used even on heavy military lorries.

European designers, on the other hand, favoured the torque-tube construction for passenger cars. In this the propeller shaft was surrounded by a torque tube, which was rigidly secured to the housing at the centre of the rear axle, and at its forward end had either a forked or a spherical connection to a cross member of the frame or the rear end of the transmission case. In the United States one manufacturer after another adopted the plan of mounting the steering post on the left side, realising that in a country where the " right-hand " rule of the road obtains, the balance of advantages rests with the left-hand drive. Left-hand steering fits in well with brake and gear-shift levers mounted in the centre of the car, as the driver can use his right hand to operate them. In Great Britain, where the rule of the road is to " keep to the left," right-hand steering has the same advantages as left-hand steering in other countries.

Wheels.—The wheel equipment of the earlier cars was almost entirely of wood-spoked type. Woods suitable for rims and felloes became rare, however, especially in Europe, and a strong tendency toward the use of metal wheels then set in. In fact, with one exception, all British manufacturers of passenger cars fitted metal wheels as regular equipment on their 1925 models. There were three types of metal wheels for passenger cars, viz.: wheels similar in shape to wood-spoked wheels, made of two steel pressings welded together (chiefly used in England), wire-spoked wheels and disk wheels (figs. 12, 13 and 14). An improvement in wire-wheel design, which was a great factor in rendering these wheels practical for heavy, powerful vehicles, was the triple lacing due to John V. Pugh of England.

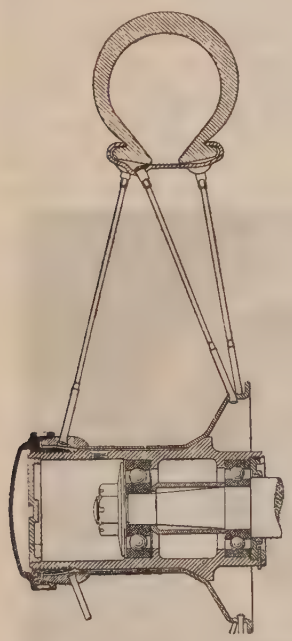

FIG. 12.—Section of Rudge-Whitworth demountable wire wheel with Pugh triple lacing.

Disk wheels came into extensive use during the War; they may be divided into single and double disk types. To secure the necessary lateral stiffness with a single disk it was customary to cone the disk, and, moreover, the disk was usually reduced in thickness from the hub toward the rim, either by turning in the lathe or by rolling.

All motor-vehicle wheels are provided with steel rims designed to take the pneumatic or solid rubber tires (*see* TIRES). The original type of motor-vehicle rim for the double-tube pneumatic tire was the clincher rim, the edges of which are formed into clinchers to hold the beaded edges of the tire cover. This type of rim remained the standard in Europe, but American manufacturers early adopted the detachable rim, which permits of the use of a steel cable core in the edges of the tire cover to make it inextensible. In the earlier detachable rims one flange of the rim was removable, and the tire could be stripped off sideways after the flange had been detached. Some of these detachable flange rims could be used with both clincher and straight-sided tires, and were therefore known as universal rims. Later, when the clincher tire was given up by American manufacturers for all except the smallest sizes, a different type of detachable rim was introduced, in which there is a joint in the circumference of the rim. After opening the locking mechanism of this joint the rim can be contracted sufficiently to pass through the tire. In order that detachable rims may always be free-working the rims must be thoroughly rust-proofed, and care must be taken in handling the rim not to distort it.

Tire Repairs.—In the early years of the motor-car, when a tire was punctured or otherwise defective, the operator was

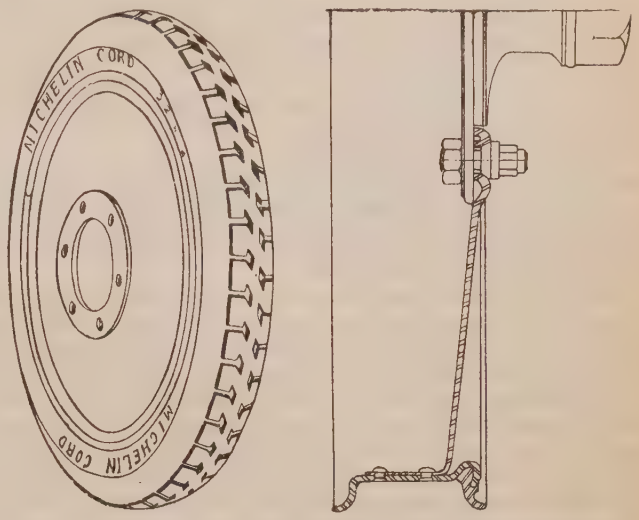

FIG. 13.—Michelin disk wheel, outside view and section.

obliged to make a repair on the spot, or at least remove the tire cover, insert a new tube, replace the cover and inflate the tire anew. The difficulty was overcome by the adoption of the demountable wheel in Europe and the demountable rim in America. American motorists thereafter carried one or two spare rims fitted with fully inflated tires, and in case of a puncture merely removed

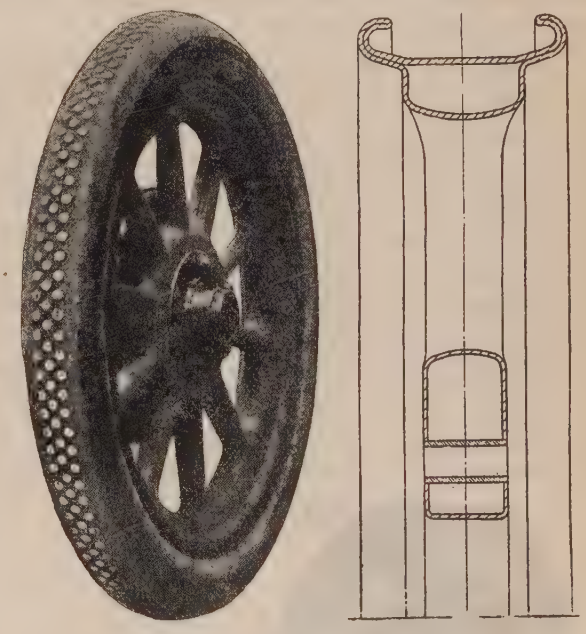

FIG. 14.—Sankey pressed steel wheel, and section.

the rim with the defective tire and replaced it with a spare rim and inflated tire, an operation usually requiring from 10 to 15 minutes, leaving the repair of the damaged tire to be done at home or at a tire service station. European motorists carry spare wheels with inflated tires in the same way. The advantage of the demountable rim over the demountable wheel is that the spares weigh less; the advantage of the demountable wheel is that it weighs less than a wheel with a demountable rim, and especially that with it there is less weight near the circumference of the wheel, where it has a strong flywheel action. Moreover, with the detachable wheel the detaching mechanism is at the hub, farther removed from rust-promoting influences.

The structure of demountable rims may be briefly described as follows: forced over the felloe of the wood wheel is a steel felloe band with a wedge surface on its outside, and an inward flange on one edge through which end the wood felloe pass the felloe band bolts. Over this felloe band is passed the rim carrying the tire, which is formed with a wedge surface on its inside, adapted to engage the wedge surface on the felloe band. Rim lugs with wedge-shaped projections are threaded over the ends of the felloe band bolts, and the nuts on the bolts are then screwed up, forcing the wedges into the space between the felloe band and the rim. In this way the rim is subjected to both radial and lateral pressure and is centred and firmly held on the felloe band. Both clincher and detachable rims can be used in connection with demountable rims.

Solid rubber tires are vulcanised on to the steel base bands, and wood wheels to be fitted with such tires have a steel felloe band shrunk over them. The tires are then mounted on the wheels in a demountable way by means of wedge rings, side flanges and bolts. Cast-steel wheels generally have one wedge ring cast integral and do not need a side flange on that side.

Brakes.—Practically all the cars manufactured up to the end of the War had brakes acting on the rear wheels only, but from that time on a rapidly increasing number were equipped with brakes acting on all four wheels. Four-wheel brakes were pioneered by Henri Perrot, engineer of the Argyll Motor Car Co., of Glasgow, in 1910. They permit of making a stop in substantially one-half the distance as with rear-wheel brakes, thus adding to the safety of automobile travel. The minimum stopping distance depends upon the pressure against the ground of the wheels through which the brakes take effect, and when the brakes are applied there is a decrease in the ground pressure of the rear wheels and an equal increase in that of the front wheels, which tends to make the front-wheel brakes particularly effective. In the application of brakes to the front wheels certain conditions must be met. Setting of the brakes must not prevent steering motion and, *vice versa*, the deflection of the wheels in steering must not change the setting of the brakes. Moreover, it must be practically impossible to lock the front wheels by means of the brakes, because the car will not respond to a steering motion if the wheels do not revolve.

Two general types of four-wheel brake were worked out. In one the power necessary for the application of the brakes was transmitted entirely by mechanical means, which in the case of the front wheel brakes involved some difficulty, owing to the relative motion between brake drum and axle. It was necessary to provide a universal joint in the shaft of the brake-expanding cam or the brake-band-contracting lever, whose centre lay in the axis of the steering knuckle pivot, so that steering motion of the wheels would not affect the setting of the brakes. The brakes on all four wheels were linked to the brake pedal. To obviate the danger of locking the front wheels, some designers divided the force of brake application unequally between front and rear, usually about 40% to the front brakes, while in the Perrot design the linkage was so arranged that as the front wheels were swung around in turning there was a tendency for the brake on the outside front wheel to release automatically, thus preventing locking of this wheel and consequent loss of control. As regards equalisation there was absolutely no uniformity of practice in 1925. In some systems the force of application was equalised between front and rear and between right and left, while others used no equaliser at all. A mechanically operated front-wheel brake is shown in fig. 15. A is the lever to which the brake rod or link attaches; B, the cam-shaft; C, the cam; and H, the means of adjustment for wear.

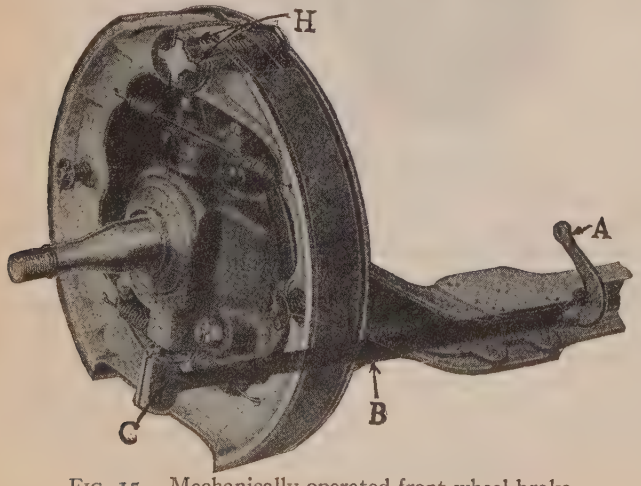

FIG. 15.—Mechanically operated front wheel brake.

In the other type of brake referred to, the force of application was transmitted by means of a confined liquid, this type being known as the hydraulic brake. The brake at each wheel comprised a cylinder in which there were two pistons which acted upon the brake bands, or shoes, through bell cranks. These cylinders communicated through heavy hydraulic hose and copper tubing with a master cylinder within which there was a piston that was connected to the brake pedal. The whole system was filled with a liquid (a castor oil and alcohol mixture) that does not congeal in winter and does not attack the rubber hose. Pressing on the pedal forced some of the liquid from the master cylinder through the tubing into the brake cylinders, thereby forcing the two pistons in each brake cylinder apart and applying the brake. The slight loss of liquid from the system, by leakage, was made up by pumping additional liquid into it from a reserve tank on the dashboard, provided with pump and shut-off valve. One feature of the hydraulic brake was that it was always fully equalised.

With otherwise equal construction four-wheel brakes require substantially twice the effort on the part of the operator to apply them, hence persons of limited physical strength, particularly women drivers, found it hard to apply the brakes to the locking point. This led to the development of so-called servo brakes, in which the momentum of the car was utilised to reinforce the effort of the driver in applying the brake. The simplest form of servo brake is a band brake anchored off centre, and after the adoption of four-wheel brakes most band brakes had the band so anchored that the section which tended to wrap up on the drum when checking forward motion of the car was considerably longer than the other (unwrapping) section. The principle of the mechanical servo brake may be very simply explained as follows: Imagine a drum mounted on a shaft which is positively geared to the rear axle. Let a rope be wound around the drum, one end of the rope being connected to the brake pedal and the other to the lever of the brake-expanding cam. Then, if the operator presses on the pedal and thereby exerts a pull on the forward end of the rope and assuming the rope to be wound around the drum in the right direction, the resulting friction between rope and drum will multiply the tension in the rear end of the rope and the pull on the brake lever will be several times as great as if it were connected directly to the pedal. With internal or expanding brakes a servo effect was obtained by providing a floating shoe, which was pivoted to the free end of the anchored shoe. If only these two shoes were provided the brake would have very little effect in holding the car against reverse motion, and for this reason the Bendix-Perrot brake, illustrated in fig. 16, was made with three shoes, the third shoe being depended on mainly for checking reverse motion. Some cars, notably the Fiat in Italy and the Studebaker in America, were fitted with an hydraulic servo mechanism. This consisted of an oil pump combined with the transmission gear, which was always running as long as the car was in motion. Normally the oil was by-passed from the delivery to the suction port of the pump, and no effect was produced, but by closing a valve between these two ports by means of the brake pedal, a pressure was set up in the system which moved a piston connected by mechanical linkage to the different brakes. If the hydraulic mechanism failed to work for any reason (owing to leakage of oil, for instance), by pressing the brake pedal down farther than required to operate the hydraulic system, the operator could apply the brakes directly by foot pressure. A diagram of the hydraulic servo mechanism used on Fiat cars is shown in fig. 17.

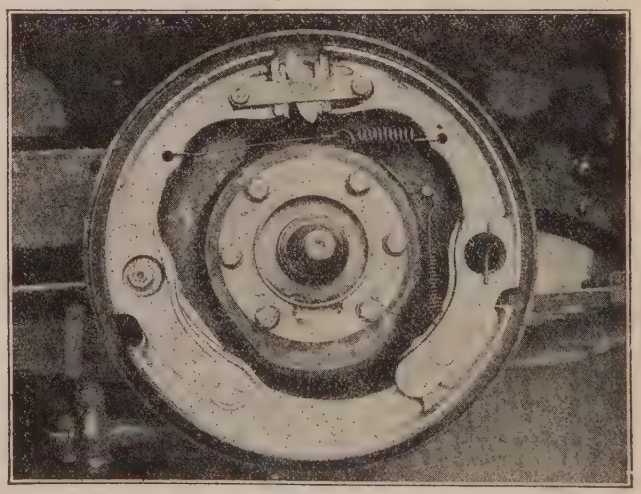

FIG. 16.—Bendix-Perrot three-shoe servo brake.

III. EQUIPMENT

There is one notable difference in the commercial practices of American and European motor-car manufacturers. In the

United States it is customary to sell cars complete with bodies and all necessary equipment, so that upon being filled with fuel and water they can immediately take the road. The equipment usually includes such items as wind-screen, lamps, speedometer, jack, tire pump and tools. European manufacturers, on the other hand, previous to the World War, often made it a practice to sell only the bare chassis and let the customer arrange for the body with a coach-builder and select the equipment himself. After the War they began to follow the American practice, especially with low-priced cars.

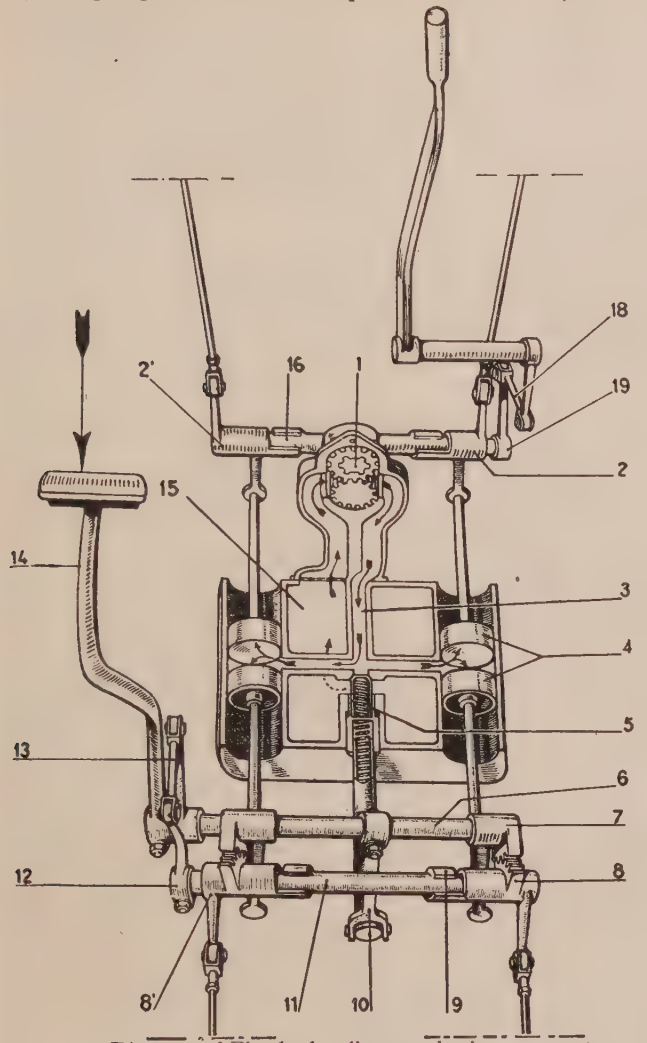

FIG. 17.—Diagram of Fiat hydraulic servo brake: 1, gear type oil pump; 2, 2', floating levers in front wheel brake linkage; 3, delivery passage of pump; 4, servo pistons; 5, servo control valve; 6, brake pedal shaft; 7, gear sector on brake pedal shaft; 8, 8', gear sectors on floating levers in rear wheel brake linkage; 9, nose on shaft 11 which engages with corresponding nose on hub of floating lever; 10, lever on brake pedal shaft to which servo control valve is connected; 11, cross shaft connected to brake pedal through lever 12 and link 13; 14, brake pedal; 15, oil by-pass; 16, cross shaft operated from brake hand lever through link 18 and lever 19.

Mass Production.—Many of the cars produced in the United States were made on what is known as the assembling plan; that is, the various major components, such as engine, clutch, gearset, axles, frame, springs and steering gear, were all manufactured in different factories by concerns specialising in these products, and were assembled into a complete car in the assembling plant. The advantages of this plan are obvious and include the possibility of intensive development of design and the economy of quantity production. The extent to which assembling was practised may be judged from the following figures: Of the American passenger-car models for 1920, 92% were fitted with stock carburetters, 75% with stock steering gears, 66·7% with stock clutches, 65·1% with stock rear axles, 58·7% with stock transmissions and 42% with stock engines, all these stock parts being made by specialists. In the field of commercial vehicles the practice of assembling was even more prevalent.

Bodies.—After the War the use of closed cars increased very rapidly in the United States. Previous to that time a limousine or any other of the closed types then in use cost substantially twice as much as the corresponding open model, and this naturally limited sales. Moreover, most of the earlier closed cars were of the chauffeur-driven type, in which the driver's seat is partitioned off the passengers' compartment. Endeavours to reduce the cost of production of closed bodies resulted in greatly widening the possible market for this type of car. A new low-cost design known as the coach was evolved and popularised by the Hudson Motor Car Company. It promptly met with great favour and was soon offered by a large number of manufacturers. The coach is essentially a five-passenger closed car with only two doors. The seat adjacent to the driver's folds forward, thus giving access to the rear seat through the door on the right-hand side (with left-hand drive). Coaches in some instances sold at prices lower than those of the corresponding open models, this being made possible by the fact that the particular maker had a much larger production on the former than on the latter. The growth in popularity of the closed car in the United States may be judged from the fact that the proportion of closed cars in the total production rose from 1.5% in 1915 to 17% in 1920, and had attained 56% in 1925.

On open or touring cars the collapsible top was to a large extent superseded by the California type or permanent top. It was found that repeated raising and taking down was quite injurious to the folding top, causing it to crease and appear shabby, and this difficulty was eliminated by the permanent construction, which also prevented sagging between bows, a common fault of old folding tops. A number of British and German makers provided a compartment in the body into which the top disappeared when folded, but generally the appearance with the top up was not all that could be desired. Many attempts were made to produce double purpose or convertible open and closed bodies. In the early types the whole superstructure was removable as a unit, but this did not prove successful in the long run. In England the "all-weather" type of body became very popular. One of the first British cars to be equipped with an "all-weather" body was the Standard, and after 1920 many other British makers fitted it.

As made in England, the "all-weather" body comprised a regular open body with folding top and more or less rigid, transparent panels which could be used to close the sides during periods of inclement weather, these panels taking the place of the flexible side curtains with transparent inserts previously used. The transparent medium was either glass or celluloid. Usually there were a number of fairly rigid frames of flat steel, covered with fabric leather and secured to the doors and the sides of the body. The transparent element was of smaller dimensions than the supporting frame and the space in between was filled with fabric leather, hence there was no possibility of the glass being broken by distortion of the body frame communicated to the panel frame. The panels on the doors swung open with the latter, but in some cases they were secured by snap fastenings to valances on the top, and these fastenings had to be loosened first. At the front the panel was joined to the windshield pillar, and endeavours were made to have this joint rain- and draught-proof. Similar joints were made between the upper edge of the panels and the top. Usually there were three panels on each side, but sometimes there was a fourth at the side of the rear seat. Some of these panels were so designed that they could be used as rear wind-screens when the top was down, being entirely independent of the top for support. Provision was made for storing the panels inside the car, either in a tray under the front seat or in a compartment in the rear cowl.

The Weymann Type.—A type of closed body that was distinguished by light weight, low cost of construction and freedom from squeaks was brought out by Weymann in France. It had a framework of 1½-in. square wooden members which, however, were joined together by means of comparatively light metal strips bent to angle shape and secured with wood screws. Thus the wooden members did not come in contact with each other and the cause of squeaks was eliminated. The seats were made separate from the body and supported directly on the chassis frame, which caused the passengers to be seated lower and permitted the body to be lower. The framework was covered with fabric leather, which was painted the same as the metal panelled body. Another advantage claimed for this construction was that it entirely eliminated "drumming," an objectionable feature of practically all closed bodies with metal panels. According to Weymann, a four-passenger saloon body for a 130-in. wheelbase chassis built on this plan need not weigh more than 440 lb., including fenders, valances, running boards, spare-wheel carrier and tool box, which is a great deal less than the weight of the usual open body for a car with this length of wheelbase. A disadvantage of the Weymann pattern limited the designer practically to straight lines, and some of the early Weymann bodies were of rather severe appearance.

Numerous items of equipment added to the comfort and convenience of driver and passengers. In the United States it was customary in 1926 to equip closed cars with exhaust heaters for use in cold weather. Ventilators were provided in the cowl and in the roof, or ventilation was effected by slightly raising the windshield. The windows in the doors and sides of the car could be raised and lowered at will, and with all the windows down the passengers were as much in the open air as with an open car, while under all conditions the

vision was as good as from an open car with the top up. With windows closed it was impossible for the driver to give the usual signals to drivers behind by extending his arm, and this was rendered unnecessary by providing the cars with a stop light at the rear which lit up automatically whenever the brake was applied.

In case of rain or snow a section of the windshield in front of the driver's eyes was kept clear by means of a windshield cleaner, consisting of a swinging metal arm carrying a rubber squeegee, which was operated by hand on some of the lower-priced cars and by a vacuum engine (connected to the inlet manifold of the car engine) or by an electric motor in the majority of the models. A visor over the windshield protected the driver's eyes against direct sunrays. The button for the signalling horn was located at the centre of the steering wheel; depressing this button sounded the horn, and by turning it slightly around its axis the headlights could be dimmed to prevent annoyance from glare to on-coming drivers and could be brightened again when no one was approaching. All control instruments, sometimes including an engine thermometer and a fuel-tank gauge, were conveniently and neatly arranged on the instrument board. Many of the items of equipment enumerated were also furnished on open cars. Many owners had their cars fitted with bumpers at both front and rear, as a protection of the exposed parts, such as headlights, fenders, radiator, etc., in case of a minor collision.

Body Finish.—A new method of finishing motor-car bodies was introduced by one of the large American makers during the summer of 1923, and came into wide use in the industry within a short time. It consisted in giving the bodies a finishing coat of a lacquer of which pyroxylin was the base.

Previous to that time all the bodies built partly or wholly of wood were finished in varnish, which was open to the objections that the process of finishing was very tedious, owing to the fact that a long time had to be allowed for drying after each coat had been applied, and that the surface obtained was not sufficiently proof against scratching. Bodies constructed entirely of metal were generally "flowed" or sprayed with enamel and baked in ovens. This overcame both of the disadvantages experienced with varnish, but most of the bodies had a wooden frame and these could not be enamelled, as the wood would have been injured by the high temperature of the baking process; besides, with enamelling, the finish could be had only in black, as colours would have been affected by the baking heat. Pyroxylin base lacquer had been used previously; but its applications had been limited, owing to certain difficulties which were overcome in 1923.

The first lacquer of this type to come on the market was known as Duco, but it was soon followed by many other brands. When finishing a body with pyroxylin base lacquer, the same priming and surfacing coats are applied as with varnish. Usually the body is given either two or three coats of the lacquer. When the last coat of lacquer has dried it presents a so-called egg-shell finish, and a polish is then obtained by rubbing the surface with pumice and rottenstone and applying a coat of polishing wax. A glossy surface can be obtained by giving the surface a coating with a clear lacquer of a pyroxylin base. To the car manufacturer the advantage of the pyroxylin finish resides chiefly in the cutting down of the time required for the finishing process. Aside from this saving in time and the consequent saving in the manufacturing process, pyroxylin finish makes it possible to obtain a colour finish at a moderate price, and the surface is exceedingly hard and cannot be scratched or chipped easily, while the life of the finish is several times that of a varnish-finished surface.

IV. THE SMALL CAR

Owing to high licence fees (taxes) and the high cost of fuel, European makers after the War paid particular attention to the small car, as a means of reducing the cost of motoring. In the United States in 1926 the smallest car built had an R.A.C. rating of 15·6 H.P. and very few models rated at less than 20 horse-power. Of the 145 British models in production that year six had a rating of less than 10 H.P. and considerably more than one-half rated at less than 15 horse-power. The cars were also built narrower. Practically all American cars, even the smallest, had the standard tread of 56½ in., or at least approached it very closely, while about one-half of the British models had a tread of 50 in. or less, the minimum being about 43 inches. Practice on the Continent resembled that in Great Britain. The average British car of 112–115-in. wheelbase had a H.P. rating of 12, and as the annual tax was £1 per H.P., the saving on this item was quite considerable, as compared with the average American car of the same wheelbase, which had a rating of 22 or 24 horse-power.

With the smaller engine the fuel consumption for the same weight of car is also appreciably less, due to the fact that the load factor of the engine is higher (the average load carried is a greater fraction of the maximum output of the engine), and the efficiency of the engine increases with the load factor. On improved roads very good speeds could be made even with the small engines, which were always of the high-speed type (sometimes called high-efficiency type). Of course, acceleration was not so good, and more of the running had to be done on the lower gears, which involved more frequent gear shifting. Some of the smallest cars, like the Austin 7 H.P., approached a motor-cycle with side-car in power, weight and other characteristics. This vehicle had a four-cylinder engine of 55 mm. bore and 75 mm. stroke and weighed complete with 2-passenger body 790 pounds. The chief demand, however, was for the type of car rating at between 10 and 14 horse-power. Among the most popular smaller cars in 1925 were the Morris in England and the Citroën in France.

Ford Cars.—A unique position in the American motor-car industry has been occupied by the Ford Motor Co., whose annual production for several years constituted about one-half that of the whole industry. This company in 1909 developed a passenger car which sold for the next 17 years without material modifications in design except as regards the body and equipment. This stability of design made possible production on an unequalled scale and at remarkably low cost. In 1925 the price of the two-seater (22.5 H.P., R.A.C. rating) was $260, and that of the open 5-seater $290 f.o.b. Detroit. This, however, was without the self-starter and battery lighting equipment, which were taken by practically all purchasers and which made the cost per car $85 higher. The company operated a plant at Manchester, England, at which 90% of all the work of manufacture on the cars sold in Great Britain was said to be done. It also had a factory in Lyons, France, and assembling plants at Copenhagen, Denmark and Antwerp, Belgium. In 1925 the company stated that it had delivered more than 12,000,000 vehicles, and that it was then producing 7,000 per day.

V. PRODUCTION, STANDARDISATION AND MARKETING

Amazement is often expressed at the enormous capacity of the American market for absorbing cars. Calculations of the limiting market were sometimes made on the premise that a certain minimum income (say $1,500 annually) was necessary in order to enable a person to keep a car, and from income-tax records the supposed number of possible owners was then determined. However, these predeterminations of the so-called "saturation point" practically always erred on the conservative side. Three main factors made it possible for the American people to maintain substantially 20,000,000 cars in 1926—roughly two cars for every three families (1) a great reduction in prices made possible by improved manufacturing processes; (2) the introduction of the time-sales plan and (3) the practice of many

TABLE III. *Statistics of the Development of the American Industry*

	1909	1914	1919	1924	1925
Capital invested	$173,837,000	$407,730,000	$1,802,302,862	$1,691,050,112	$1,888,028,810
Cars and lorries produced[1]	127,731	569,045	1,974,016	3,617,602	4,336,754
Value of products	$249,202,000	$632,831,000	$2,506,834,594	$3,168,588,146	$4,210,174,963
Persons engaged in mfg.	85,359	145,951	651,450	629,563	711,442[2]
Wages and salaries	$58,173,000	$139,453,000	$813,731,856	$547,215,700	$649,668,829[3]

[1] From U.S. Census. Based on statistics of complete car production gathered by National Automobile Chamber of Commerce and on the assumption that the parts and accessories business grew in same proportion. [2] 361,442 in motor-car and lorry plants, the rest in parts and accessories (exclusive of tires) plants. [3] In motor-car and lorry plants alone.

well-to-do motorists of buying a new car every second or third year and trading-in the old machine, which depressed second-hand values to a very low point.

TABLE IV. *Statistics of the American Industry for 1925*[1]

Number of passenger cars produced	3,839,902
Number of lorries	497,452
Number of open cars	1,676,171
Number of closed cars	2,163,131
Wholesale value of passenger cars	$2,523,642,558
Wholesale value of lorries	$454,262,275
Parts sold by motor-vehicle manufacturers	$308,830,130
Replacement parts and tires	$923,440,000
Total wholesale value of vehicles and parts	$4,210,174,963
Number of motor vehicles exported	536,741
Registrations of passenger cars	17,512,638
Registrations of lorries	2,441,709
Total registrations	19,954,347
Number of motor-vehicle dealers	48,555

[1] From *Facts and Figures of the Automobile Industry*, published by the National Automobile Chamber of Commerce. The production figures given apply to the U.S. and Canada combined, practically all of the producing establishments in Canada being branches of U.S. firms.

The large numbers in which particularly the lower-priced American cars were manufactured made possible very economical methods of production. Many parts that were formerly made of sand castings were made in the form of sheet metal pressings or die castings. Both these methods of production are very much more economical, if a large number of duplicate parts is required, although the initial investment for equipment, such as dies, presses, etc., is very high. In drilling the bolt holes in engine blocks, as many as one hundred holes, from top, bottom and both ends, were drilled in a single operation in a multiple spindle drill press. All the cylinder barrels of six or eight cylinder blocks were bored at the same time, and the flat surfaces on the outside of the block were finished in large milling machines, to the tables of which a large number of blocks could be strapped at the same time. Machine tools of the automatic and multiple station type were largely introduced, the latter having indexing tables making it possible to load and unload the machine at one station while work was going on at one or more other stations, so that no stops were required for reloading. All the sheet metal parts, such as fenders, aprons, etc., when finished were hung on a conveyor which automatically dipped them in tanks of japan and carried them through a baking oven, so that the only hand work in the finishing process consisted in hanging the parts on the conveyor and taking them off again.

Assembling of the car also is done on a conveyor, or moving line. The work of assembling begins with the frame, which is pulled along rails by means of the conveyor chain at the rate of 5 or 6 ft. per minute. After the axles, springs and wheels are assembled, the chassis is turned over by means of a hoist, and thenceforward is moved along on its wheels, while the rest of the parts are put on. Some of the major components, such as the engine, transmission, steering gear, etc., are previously assembled on separate lines and brought to the proper point at the side of the main assembling line by means of conveyors. Large use is made of gravity conveyors, that is, inclined planes made up of closely spaced steel rollers, which eliminate the necessity of lifting heavy parts by workmen. This is only a small selection of the methods adopted by American motor-car manufacturers which enabled them to cut down the man-hours required in the manufacture of a complete car from 1,460 in 1904 to 641 in 1914 and to 435 in 1924.

The first two of the foregoing figures are based on U.S. Census reports, while the last is based on statistics of the National Automobile Chamber of Commerce, a work-year in each case being taken equal to 2,500 work-hours. This does not take into account the fact that about one-half of the 1924 cars were of the closed type, as compared with an insignificant proportion in 1904, and all carried much more equipment. The great drop in automobile prices after the War is best illustrated by some figures gathered by the National Automobile Chamber of Commerce according to which the cost of cars at the beginning of 1925 was 71% that in 1913, whereas the cost of living was 167% and the cost of erecting frame buildings 196%.

Standardisation (*see* MACHINE TOOLS; MEASURING INSTRUMENTS).—A great help to the motor-car industry in the United States was the standardisation work of the Society of Automotive Engineers, concurrent with specialisation in the manufacture of parts. One of the first things standardised was fine-pitch screw threads. It was found that the former standard threads, such as the U.S.S., Whitworth, etc., were too coarse for motor-car work, and manufacturers began devising their own fine-thread standards; if this had continued it would have led to the use of many different pitches for screws of the same diameter, which would have been most annoying to the user. In order to obviate this, the S.A.E. screw thread was evolved, and soon came into common use. A great deal of the standardisation work was concerned with the joints or connections between parts made in different factories. Thus the mountings, on the engine, of carburettors, battery ignition units, magnetos, electric generators, starters and tire pumps were standardised, as were flywheel housings, shaft fittings, spring mountings, etc. At the end of 1924 there were more than 200 separate motor-car standards on the records of the S.A.E. Great Britain had a similar technical society, the Institution of Automobile Engineers, but motor-car standardisation work was carried on by a sub-committee of the British Engineering Standards Committee, on which both the Institution of Automobile Engineers and the Society of Motor Manufacturers and Traders were represented. There was also a technical society in Germany, the Automobil und Flugtechnische Gesellschaft, but it had not been active. During the World War engineering standardisation work was begun in Germany by a general organisation covering the whole engineering trade, and after the war motor-car standardisation was continued by the Reichsverband der Automobil-Industrie.

VI. DEPRECIATION AND INSURANCE

A private car naturally is most enjoyable during the first years of its life, while it is still fairly representative of the highest advance of the art, while its finish is unmarred, its mechanism runs smoothly and quietly and while the chances of breakdowns on the road are at a minimum. Therefore, many American motorists "trade in" their cars every second or third year for new ones. The average American automobile built prior to 1920 had a life of about 7 years, so the average depreciation was slightly less than 14%, the car having still some "junk" value at the end of its useful life. However, during the first few years the depreciation was much greater. The "used-car problem" became a great bugbear to the American industry and trade. Very few cars of the better grades were operated by their original owners until worn out, hence in the case of practically every sale of a new car an old one had to be taken in, and in their eagerness to effect a sale, dealers often made a greater allowance than the condition of the car and the state of the market warranted.

This was reflected in the high rate of "mortality" among automobile dealers, which reached 25% in 1922 and 26% in 1923 but declined to 21% in 1924. For the guidance of dealers the Chicago Automobile Trade Assn. published an index of used car values which circulated throughout the country. From this it was found that the values of a car at the end of successive years of service formed substantially a geometrical series and that the value at the end of the year on the average was only slightly more than 50% than at the beginning of the year. After the first few years the higher grade cars depreciated somewhat less rapidly than the lower grades. In the following table are given the valuations of the 1919–24 models of three makes of car—high, medium and low-priced, respectively—during the second quarter of 1925.

Used-Car Values

Year of Manufacture	1924	1923	1922	1921	1920	1919
Original cost	9,000	7,000	7,000	9,000	9,500	..
Value in May 1925	..	2,300	1,700	1,200	850	150
Original cost	965	1,195	1,395	1,795	1,595	..
Value in May 1925	385[1]	275	185	175	75	35
Original cost	510	525	525	525	795	..
Value in May 1925	255	150	90	50	25	10

[1] This exceptionally high depreciation was due to the fact that the particular model was discontinued by the manufacturer. The rate of depreciation in general also was affected by the fact that from 1920 on new car prices decreased materially.

The above table shows that the item of depreciation during the latter years of a car's service is very small.

The life of a car naturally is a matter of considerable moment to both the owner and manufacturer. The assertion has been made that there is no limit to the possible life, as all parts are interchangeable,

and any part that wears out can be replaced by a new one. There is an element of truth in this statement, and it is quite possible to obtain phenomenal mileages if that is desired above everything else. In practice users find that after a car has given a certain amount of service it is best to " scrap " it and get a new one. With increasing age the cost for repairs increases rather rapidly, the car becomes " rattly " and therefore less pleasant to operate, it usually becomes shabby in appearance, and besides, it does not possess the improvements of the newer models making for increased comfort and convenience of the occupants. When a certain state of depreciation and obsolescence has been reached, the car therefore usually goes to the " auto-wrecker," who takes it apart and sells some of the parts for repairs to other old models and the rest for scrap metal.

Since there are available in the United States fairly accurate statistics of annual production, registrations (cars in use), exports and imports, it is possible to calculate quite closely the average age of the cars which have been scrapped. Each year there are newly put into service a number of cars which is equal to the number produced in the country that year, minus the number exported, plus the number imported. If no cars were scrapped, then the total number of registrations would be increased in the course of the year by the number newly placed in service. Actually the increase in registrations will be less, and the difference between the number of cars newly placed in service in any year and the gain in registrations during that year is the number of cars scrapped during the year. The average life is then substantially equal to the interval between the one-year period during which an equal number of cars was newly placed in service and the year during which the cars went out of service. Some correction must be made for the fact that the going into service of all cars does not coincide with the beginning of the year in which they were first registered. By the use of this method it was found that the average life of all cars which were scrapped in the United States during the three-year period ending with 1923 was 6.9 years.

Car Thefts.—After the War the loss of motor-cars by theft became a serious hazard, which is partly accounted for by the fact that by that time cars had become so numerous that practically the whole of the younger generation had the opportunity to learn their operation.

There were two general forms of automobile thievery. One form, indulged in particularly by irresponsible youngsters, consisted in taking a car that was left by its owner at the curb, going for a " joy ride " and leaving it at the roadside wherever the fuel supply ran out, an accident occurred or something else intervened to compel the abandonment of the trip. The more serious form was theft of cars with a view to their sale to the public. The division of the United States into a large number of states, each with its own laws and police powers, facilitated this nefarious business, and there grew up a regular traffic in stolen cars that were driven over the border into a neighbouring state and there disposed of by unscrupulous dealers. The matter became so serious that the Federal Govt. in 1919 passed the Dyer Act, which made it illegal to transport or assist in the transportation of a stolen car from one state into another.

Another measure that hit at the root of the evil was the enactment, by several of the states, of laws requiring an abstract of the title to be filed with the authorities, as in the case of real-estate transfers. All cars were provided with locks, which acted as more or less efficient theft retardants. The ignition type, which came into use first, proved of little value, as a man skilled in electrical work and familiar with the particular car could readily make or unmake the necessary connections to render it ineffective. Locks on the transmission were more dependable, but when these were introduced it was found that owners often failed to lock them, as they were generally rather hard to get at. It was then suggested by the insurance underwriters that " concurrent " locks be fitted, acting on both the ignition switch and on the transmission, which the owner was compelled to lock if he wanted to shut down his engine, and these were coming into use in 1925. In 1924, 10,064 cars were stolen in New York City, of which 7,101 were recovered.

Insurance.—Motor-car insurance had grown to a very large business in 1925. The insurance companies wrote policies covering five principal hazards, namely, fire, theft, collision, liability for personal injury and liability for property damage, but usually several or even all of these were covered by a single policy. Reductions were made on the premium for carrying certain equipment which had been approved by the Underwriters' Laboratories. For instance, a reduction on the premium on fire insurance was granted if a portable fire extinguisher was carried on the car; on theft insurance, if the car had an approved lock and on collision insurance, if it was fitted with approved bumpers. According to *The Insurance Field*, the total premiums paid in the United States under the five principal hazards during 1924 amounted to $297,005,029, and the total losses reported were $123,292,454.

During the period when the " jitney " business was increasing rapidly and many taxi-cabs were operated by individual owners, the operators often caused serious accidents and then were unable to pay the damages awarded by the courts to the injured. Many cities and states then passed legislative measures requiring all operators of public-service vehicles to be bonded or to carry insurance. Later, attempts were made to extend this compulsory insurance plan so as to apply also to drivers of private vehicles, and in 1924 bills to that effect were introduced in the Legislature of six states, but none passed that year. Switzerland and Denmark at that time had compulsory insurance of motor-car operators. In Switzerland any applicant for a driver's licence was compelled to take out first a liability insurance policy for a minimum indemnity of 30,000 fr. to a single person and 100,000 fr. to several persons. For motor-cycles the amount was 20,000 francs. Under the Swiss law the driver and not the owner of the vehicle involved was held responsible for the damage done. However, the burden of proving intention, negligence or imprudence rested with the claimant.

An attempt was made while the bill was under discussion to make motorists directly responsible for all damage done by their cars, the same as in the case of the railways, but this was strongly and successfully opposed by the motoring interests. Tourists when entering Switzerland were compelled to arrange for insurance for the duration of their stay in the country. The Danish law went into effect in 1918 and was amended in 1921. Under it, motorists were compelled to take out a policy for 20,000 crowns and motor-cyclists for 10,000 crowns. The objection was raised to the compulsory insurance scheme that it would have the effect of making drivers careless. Insurance companies opposed it because most of the plans involved the feature of state insurance.

VII. ACCIDENTS AND LEGISLATION

A rather unpleasant chapter in motor-car history is that of accidents. With the constantly growing number of cars on the road and the increasing speed of their operation, it is natural that accidents should have increased, but after the World War the figures became appalling. Many measures were taken to reduce the hazards, and a certain degree of success was achieved, in that the number of accidents in proportion to the number of cars in service decreased, but still the total number increased from year to year. At first a large proportion of the accidents occurred in the cities, as most of the cars were then owned there, and many factors, such as congestion of traffic, lack of playgrounds for children, etc., contributed to the hazards. Means of traffic regulation were introduced which not only tended to prevent accidents but greatly speeded up traffic (*see* Traffic Problems).

In all of the large cities in 1925 a large proportion of the police force was detailed to traffic duty. They were stationed at all main street intersections, and let the traffic pass alternately in the two directions. Safety zones and isles of safety were marked off by lines painted on the pavement, or by other means, where people could wait safely for tramcars or take refuge in crossing wide streets. Some of the narrower streets were reserved for traffic in one direction only. In the smaller places, where the expense rendered it impractical to station traffic policemen at important crossings, beacon lights were placed on the ground at the centre of the crossing, some of them so arranged that they became extinguished automatically in broad daylight, and later automatic traffic signals were installed which, by showing red and green lights alternately in the same direction and simultaneously in the two directions at right angles to each other, served the same function as the traffic officer and were sometimes referred to as silent policemen. A large number of (usually very serious) accidents occurred at railway crossings, and relief from this hazard was sought by the elimination of level crossings and by providing guards at points of intense traffic and more effective warning signals at others.

Notwithstanding all these safety measures and the institution of campaigns of education the number of automobile fatalities in the United States increased from 9,097 in 1917 to 12,370 in 1921 and to 17,345 in 1924. These figures are of the same order as the American losses in the World War, and the comparison was made use of to bring home the seriousness of the situation. Fatalities per 100,000 cars in service in the three years mentioned were 178, 118 and 98 respectively. Automobile grade-crossing fatalities increased from 1,791 in 1920 to 2,149 in 1924, or at a lower rate than automobile fatalities generally. In European countries there was a similar increase in accidents, although, on account of the lesser density of motor traffic there, the figures are less striking. In Paris, for instance, the number of street accidents increased from 70,715 in 1922 to

126,867 in 1924. An analysis of the causes of accidents involving motor-cars was made by the Motor Vehicle Dept. of the State of Connecticut in 1923. Out of a total of 15,170 accidents, 70·5% were the fault of the operator, 22·8% the fault of other persons, 4% were due to defective equipment and 2·7% to all other causes combined. Of 834 accidents in Connecticut in Jan. and Feb. 1924, for which the operators were held responsible, 36·8% were due to failure to give right of way (disregard of the rules of the road); 13·7% to skidding; 13·5% to inattention; 6·7% to failure to signal; 6% to careless backing; 5·4% to excessive speed for the conditions; 5·3% to allowing too little headway; 3·1% to driving on wrong side of road; 2·4% to confusion; 1·8% to cutting in; 1·7% to inexperience; 1·1% to intoxication; 1% to cutting corners; 1.5% miscellaneous. Dr. C. H. Dickinson of the Bureau of Standards suggested as one rule of safe driving that the speed should never be so high that the car cannot be stopped within the assured clear course ahead.

Legal History.—During the first decade of the 20th century the development of the motor-car industry in the United States was hampered to a certain extent by attempts to enforce recognition of an alleged basic patent on vehicles propelled by liquid hydrocarbon engines, which was issued to George B. Selden, of Rochester, N.Y., in 1895, after having been in the Patent Office since 1877, but in Sept. 1911 the U.S. Circuit Court of Appeals for the Second Circuit held that, although the patent was valid, it was not infringed by the defendant, the Ford Motor Co., which implied that it was not being infringed by any of the car manufacturers in production at that time. The Assn. of Licensed Automobile Manufacturers (A.L.A.M.), consisting of the manufacturers who had recognised the patent prior to its defeat in court, then reorganised as the National Automobile Chamber of Commerce, which came to be recognised as representative of the entire automobile industry, although the Ford Motor Co., the largest manufacturing concern, never joined it. All the national motor-car shows in the United States from that time till 1925 were held under its auspices, and it looked after the interests of the industry also in other ways, particularly through its legal, traffic and patent departments. Patent litigation in the industry was practically entirely prevented by a cross-licensing agreement involving all members of the chamber. Similar organisations in other countries are:—

Great Britain.—Society of Motor Manufacturers and Traders.
France.—Chambre Syndicale de l'Automobile et des Industries qui s'y rattachent.
Belgium.—Chambre syndicale de l'Automobile.
Germany.—Reichsverband der Automobil-Industrie.

VIII. MOTOR RACING AND SHOWS

During the years immediately preceding the World War France had the greatest export business in motor-cars, built up by consistent technical development and skilful sales propaganda, chiefly in the form of road-racing. A series of international races held during the first decade of the century, known as the Gordon Bennett Cup Races, came to an end because the French objected to the stipulation in the Deed of Gift of the cup that in the race each country should be represented by a team of three cars, which gave a country with a small industry practically the same chance of winning as a country with a large industry.

In 1911 began a new series of races for the *Grand Prix* of the Automobile Club of France in which each manufacturer was allowed to enter up to three cars, and there was no limit to the number of manufacturers of any one nation. In fact, the race was not on the basis of national team against national team, but on that of manufacturer against manufacturer. This race was held four years in succession (1911–4) and was revived in 1921. Owing to the continued improvement in engines and the increased speeds made possible thereby, it was repeatedly necessary to reduce the limit on the piston displacement of competing cars. Originally the displacement was limited to that of a four-cylinder engine of 110-mm. bore and 200-mm. stroke (7·6 litres), but in 1921 the limit was 3 litres, in 1923 it was reduced to 2 litres and in 1925 to 1·5 litres (for the 1926 season).

In England and Scotland racing on the public roads was prohibited, and the only road races in the British Is. were held in the I. of Man. In the United States a number of important races were held in the East during the early years of the automobile movement, but owing to frequent fatalities a strong public sentiment grew up against them, and race promoters were compelled to shift the scene of their activities first to the South and then to the Middle West and Far West.

Between 1910 and 1914 a number of racing-tracks with high banking, most of them 2½ m. in circumference, were built in the United States after the model of the Brooklands track in England. The first and most successful of these was the Indianapolis Speedway. It was at first attempted to hold races on these tracks at frequent intervals, but they soon began to pall on the public. Later the plan of a single annual race was adopted, European contestants were secured, and large cash prizes were offered to the winners, and from that time the Indianapolis races have always had an enormous attendance. It is worthy of note, however, that practically none of the large manufacturers of America entered cars in the later races. In earlier years competition in races was regarded as a form of sales propaganda, and the expenses were charged to advertising, but the public gradually came to realise that to win a race at close to 100 m.p.h. required an entirely different car from that needed by the average family, and that it would not be safe to base conclusions regarding the quality of a company's stock cars on the performance of its special racing machines. Track-racing then became a form of entertainment, expenses being met out of gate-money. The Indianapolis Speedway 500-m. race held on Decoration Day, 1925, was won by Peter DePaolo on a 2-litre (122 cu. in.) eight-cylinder-in-line Duesenberg racing car with supercharger, at an average speed of 101·13 miles per hour.

Shows.—An important influence on the rapid development of the motor-vehicle industry must be ascribed to the motor-car shows held annually (except for interruptions due to the World War) in such centres as Paris, London, Brussels, New York and Chicago, under the auspices and control of the motor-car manufacturers' associations of the respective countries. The Paris show, the oldest and for a long time the largest as regards number of exhibitors, was resumed after the War, 1919. But in 1920 the show was suspended, because at the time when preparations would have been made trade conditions seemed to make it unnecessary. It was again suspended in 1925. London shows were held at Olympia. Owing to the fact that Great Britain was one of the greatest markets for motor-cars, importing more than any other country in Europe, the Olympia show always had a strong international flavour. There was a special show for commercial cars at Olympia in 1923, shortly after the passenger-car show. In the United States also, truck shows had been held separately for several years. National motor-car manufacturers' associations previous to the World War had an international federation with headquarters in Paris. In 1920 the original international federation was dissolved, and a new allied federation took its place.

The Automobile Association.—A unique organisation of motorists, the Automobile Association, exists in Great Britain, and in 1925 had over 300,000 members. When the association was organised in 1905, motorists were using their vehicles under considerable difficulties, and the police authorities of practically every county in the United Kingdom made a special point of seeing that the speed limit of 20 m.p.h. was strictly adhered to. Among the services which this organisation rendered to members were the following: free assistance by its patrols, which were found on 20,000 m. of the main highways of the country; free legal defence in proceedings under the Motor-Car Act and the Roads Act in any court of summary jurisdiction in the United Kingdom; free use of roadside telephone boxes at any hour of the day or night; free legal advice on any matter arising directly out of the use of motor-cars or motor-cycles; free advice and assistance by the home and foreign touring departments of the association; access to roadside motor fuel supply stations; engineering advice on matters appertaining to the purchase, repair and maintenance of cars and motor-cycles; officially appointed agents and repairers, as well as hotels, in practically every town in Great Britain, where the facilities and accommodation offered

had been inspected and approved by the association. The uniformed patrols of the A.A., which saluted every passing member (but failed to salute if they wished to give a warning or communicate with the member for any reason) are a familiar sight on British highways. The association also had an industrial vehicle section which, among other services, endeavoured to secure return loads for motor-lorries making deliveries to remote points.

IX. MOTOR TAXATION

In nearly all countries motor vehicles are subject to an annual tax based upon the rated horse-power of the engine. Great Britain did not impose such a tax until Jan. 1 1921. The rate was then £1 per horse-power, determined by the following equation:—

$$\text{H.P.} = \frac{Nb^2}{2{\cdot}5}$$

where N is the number of cylinders and b the bore in inches. The same formula, known in Great Britain as the Royal Automobile Club formula, was used in most states of the United States, where it was known as the A.L.A.M. formula. Since the War the U.S. Govt. levied an excise tax on all cars turned out by the manufacturers as well as on repair parts and tires sold. This tax in 1924 netted the Govt. $101,123,621·75 from passenger cars, $10,335,369·14 from commercial vehicles and $27,742,764·12 from parts, tires and accessories. Vehicles for hire also were subject to a Federal tax, which netted $2,013,839·00, making the total Federal receipts from motor vehicles in 1925, $141,215,594·01. Registration fees, including drivers' licence fees, which were collected by the states, totalled $225,492,252·00 (an average of $12·82 per car). Some of the states collected a tax on petrol.

It was estimated by the U.S. Bureau of Public Roads that personal property taxes on motor vehicles amounted to $90,000,000, and by the National Automobile Chamber of Commerce that municipal taxes of $15,000,000 were levied, making the total taxes derived from motor vehicles by the Federal, State and Municipal governments in 1925, $551,442,336·01. Annual taxes are much higher in Great Britain. For a total of 1,393,000 licences current on March 31 1925, aggregate fees of £13,437,000 were paid, or an average of a little less than £10. This average figure, however, is greatly influenced by the large number of lightly taxed motor-cycles licensed. The average fees paid on public-service vehicles amounted to £31 9s.; for commercial goods vehicles, £21 1s. 6d.; for motor-cars taxed on a horse-power basis, £15 8s., and for motor-cycles, £2 13s. 6d. Several other classes figure in the tax records, including motor-ploughs, and motor-tractors, but they are taxed rather lightly.

X. WORLD COMMERCE

During the early part of the World War the American motor industry furnished large numbers of motor-lorries to the British, French and Russian governments, as reflected by the export returns, which showed an increase in the number of trucks exported from 784 in 1914 to 21,265 in 1916. At the same time the foreign demand for American passenger cars increased greatly, because the belligerent European countries could not make deliveries. In 1918, when the United States threw its full strength into the War, motor-car exports suffered a material decline, but they jumped ahead again immediately after the Armistice, an increase of 79% being shown in 1919. That year the exports of passenger cars, lorries and parts together exceeded $100,000,000 in value, yet the passenger cars exported were hardly 4% of the total production, while the exports of commercial vehicles amounted to 4·9%.

After the War the tide of international motor-car commerce showed great fluctuations. As soon as shipping connections became re-established there was a heavy demand, particularly from the neutral countries of northern Europe. In 1919 only the United States was in a position to export large numbers of vehicles, because it took the motor-car industries of the European belligerents a long time to get back to a peace basis. After a short time, however, the low rates of continental exchange and embargoes on motor-car imports in several countries, including Great Britain, France, Germany, Italy, Denmark and Norway, cut down the exports from the United States. Even when the embargoes were lifted, imports were restricted by high customs duties, as, for instance, 70% in the case of France. The German embargo was lifted on Oct. 1 1925 but imports of cars were subject to an import duty, which, starting with rather high rates, was to be reduced every six months until in 1928 it was to be stabilised at substantially the pre-war rates.

For a number of years previous to 1925 Germany had special agreements with Austria and Italy whereby she allowed a certain number of motor-cars to be imported from these countries in return for permission to export to them German motor-car parts, such as magnetos and ball-bearings. Imports of cars from other countries were made possible by special permits, but permits for only four cars per make per month were issued. Imports into France were rendered practically impossible by the high duty, while Great Britain continued to absorb large numbers of foreign cars even during the period the McKenna duties were in force. The removal of these duties by the Labour Govt. subjected the British industry to a severe strain, especially on account of competition from the United States, but it was observed by German commentators in 1925, who then feared a similar ordeal for their home industry, in view of the contemplated lifting of the embargo, that the British industry had successfully met this competition.

TABLE V. *U.S. Motor-car Exports (including Passenger Cars, Lorries and Parts except Motor-car Engines and Tires)*

Exported to	1924	1919	1914
Belgium[1]	9,472,635	364,004	160,659
Denmark[1]	8,930,388	4,443,302	184,951
France	4,980,144	22,243,042	1,103,481
Germany	2,927,029	..	1,272,600
Great Britain	10,305,752	9,760,430	7,159,074
Italy	2,245,575	215,417	293,275
Norway	545,525	2,102,757	124,083
Russia	167,826	8,292	917,859
Spain	6,322,196	1,426,650	71,024
Sweden	3,432,040	689,998	260,228
Canada[1]	27,824,520	22,062,779	9,583,655
Argentina	17,842,193	4,492,522	1,121,474
Brazil	10,204,507	1,033,831	370,043
Chile	2,313,463	2,606,047	192,342
British India	2,363,963	543,393	439,968
Dutch East Indies	1,399,961	4,498,397	238,322
Japan	5,710,461	6,416,928	137,522
Australia	33,594,710	5,358,336	855,637
New Zealand	5,406,913	2,589,166	1,089,951
Br. So. Africa	7,627,583	2,568,790	1,506,668
Other countries	41,765,611	20,272,577	6,215,990
Totals	205,382,995	113,696,658	33,298,806

[1] Exports to these countries in 1924 consisted largely of parts which were there assembled into cars of which a considerable proportion were exported to neighbouring or politically allied countries.

TABLE VI. *British Motor-vehicle Imports*

	1925	1924	1920	1915	1910
	£	£	£	£	£
Cars	6,322,121	3,028,427	10,490,012	3,128,229	1,440,586
Chassis	2,204,443	1,759,321	4,254,949	1,135,146	1,670,969
Parts[1]	2,734,284	3,342,255	8,713,684	2,183,184	2,023,273
Totals	11,260,848	8,130,003	23,458,645	6,446,559	5,134,828

[1] Exclusive of tires.

TABLE VII. *British Motor-vehicle Exports*

	1925	1924	1920	1915	1910
	£	£	£	£	£
Cars	5,065,308	3,685,054	3,929,455	1,129,717	1,380,190
Chassis	2,347,284	1,176,006	2,474,877	186,691	213,378
Parts[1]	2,009,147	1,652,506	1,986,410	557,869	1,012,835
Totals	9,421,739	6,513,566	8,390,742	1,874,277	2,606,403

[1] Exclusive of tires.

The number of motor-cars, lorries, chassis and parts imported into Great Britain in 1925 was 50,339; the number exported 29,051.

According to a report made by the Society of Motor Manufacturers and Traders to the Board of Trade early in 1926, about 1,000 concerns were then engaged in the manufacture and the wholesale distribution of motor-cars in Great Britain, and the amount of capital invested in the British industry was about £50,000,000. The number of retailers was placed at 12,000.

XI. COMMERCIAL MOTOR VEHICLES

Up to 1920 motor-omnibuses were developed chiefly for city transport, and the two largest operating companies at that time were the London General Omnibus Co. and the corresponding

Paris corporation, The Société des Transports en Commun, the former operating a fleet of 2,500 vehicles. Omnibuses for city use are generally of the double-deck type, designed to carry a maximum number of passengers at a moderate speed but to have good accelerating power. In 1926 the London General Omnibus Company, in alliance with the Associated Equipment Company, placed on the streets a new series (200 vehicles) which was fitted into a covered top and was therefore specially designed and sprung to meet the police regulations. This type was 13 ft. $10\frac{3}{4}$ in. high, 25 ft. long, 7 ft. wide and had a wheel base of 15 ft. 6 in. The vehicles are licensed to carry 50 passengers, 24 inside and 26 outside. In the United States the Yellow Coach Mfg. Co. turned out a double-deck 'bus for 67 passengers, which had a wheelbase of 200 in. and a tread of $73\frac{1}{2}$ in., a chassis weight of 7,313 lb. and carried a four-cylinder 4 by 6-in. engine. Omnibuses with petrol engines and electric drive came into extensive use in the United States in 1925. Two hundred of these were placed in service by the street railway management of Philadelphia, and smaller numbers by operating concerns in other cities.

'Buses and lorries with electric drive without the use of a storage battery had long been made by Tilling-Stevens, Ltd., of Maidstone, England, and in the United States the General Electric Co. had been working on the problem. One disadvantage of the earlier designs was that, owing to the slowness of an electric generator to " pick up," that is, to attain its full voltage, if the throttle of the engine were opened quickly the engine would be without appreciable load for an instant and would race, which would result in vibration very unpleasant to the passengers. This was overcome by providing a separate exciter for the generator, the field of the exciter being supplied with battery current. An advantage of the electric drive in urban omnibus service, where frequent starts and stops must be made, is that acceleration is much smoother, there being no interruption due to gear-shifting. The strain on the driver is much less, as practically all speed control is effected by means of the throttle. Shocks to the mechanism due to " grabbing " of the clutch when shifting gears are avoided, and it was also claimed that better schedule time could be made than with a similar omnibus with mechanical drive.

Development in the United States; New Types.—A great extension took place in rural omnibus services between 1920 and 1925. In the United States this was strongly influenced by the rapid extension of the network of improved roads, which made it possible to operate the vehicles at lower cost, but there were parallel developments in many other parts of the world. The earlier omnibuses generally were shod with solid rubber tires, had stiff chassis springs designed to withstand the shocks sustained on rough roads and generally had a high centre of gravity, which features combined to make riding in them rather uncomfortable. About 1923 a new type of omnibus, referred to as a safety coach, made its appearance. It was mounted on pneumatic tires, had a wide tread and a very low-hung chassis, sometimes was equipped with air brakes and had sufficient power for speeds up to 60 m.p.h. on smooth, level roads. Some of these vehicles were as luxuriously equipped as, and afforded all the comfort of, the finest private closed cars, while others, for a different class of service, were of less pretentious construction.

One development in the omnibus field that came to the front in 1924 was the six-wheeler. These 'buses had double axle rear trucks and were driven and " braked " on the four wheels. Distribution of the total weight on six wheels facilitated the use of pneumatic tires. With the increase in size and speed of the 'buses, increased power was required, and whereas most of the earlier omnibuses in rural service had four-cylinder engines (they were actually, for the most part, adapted lorry chassis), in 1925 more than one-half of the omnibus models offered by American manufacturers had six-cylinder engines, which offered advantages also from the point of view of reduced vibration. The frame height of the loaded omnibus from the ground generally varied between 22 and 26 in., and most of the larger and faster vehicles were equipped with four-wheel brakes. Rural omnibuses were generally of the one-man type, passengers entering through a door at the front and depositing their fare in a coin box near the driver, while entering or leaving. The door was of the safety type which could be opened and closed only by means of a lever within convenient reach of the driver's seat. A mirror in front of the driver enabled him to observe the passengers without losing sight of the road ahead for more than an instant. Electric buttons at the sides of all seats enabled passengers to signal the driver when they wanted to get off, and at night the interior of the vehicle was usually brilliantly lighted. In the ordinary low-fare 'buses the seats were often of the plain, cane-covered type, while those for a more exclusive service generally had deeply upholstered or even air-cushioned luxurious seats and sometimes revolving chairs.

In 1925 it was estimated that there were 60,000 motor-omnibuses in service in the United States, including 31,100 by independent common carriers, 3,250 by tramway companies, 20,000 by schools, 1 500 by sight-seeing and tourist undertakings, 2,900 in various lines of business (real estate, department stores, apartment houses, garages and factories), 1,000 by hotels and 250 by railway terminal companies. The motor-omnibus was responsible for important changes in the educational system. In 1924, 1,424 consolidations of schools took place, and that year some 470,000 pupils were daily carried to and from school in motor vehicles.

Lorries.—Motor-trucks must be equipped with engines able to take them fully loaded up the steepest grades which occur on regularly travelled highways. When operated in comparatively level districts they always have a surplus of power, and it was found advantageous when operating under such conditions to use one or two trailers with the truck. The advantage is greatest where the merchandise to be transported is very bulky. This plan results in considerable economy, as from two to three times as much load can be carried on one trip as with the truck alone, with little extra expense. In continental Europe there was usually a helper on each trailer to look after the load and apply the brakes, but the use of helpers greatly reduces the gain in economy, especially where wages are high, and in the United States it was not usual to employ an extra man.

It was realised that in order to make it possible to stop in an emergency the trailers as well as the truck must be braked; but the problem of braking the trailers from the truck had not been definitely solved although at least one system of air brakes and one system of automatic mechanical brakes applied through the drawbar had been worked out. Another combination for heavy merchandise transportation consisted of a road tractor, which was merely a foreshortened truck chassis, and a semi-trailer. This semi-trailer was a two-wheeled construction, the forward end of which was supported on the tractor frame by means of a swivelling fifth wheel. This end of the semi-trailer could be supported by means of jacks while loading and unloading, and the tractor did not need to stand idle while these operations were going on. A particular form of semi-trailer was the pole trailer—the length of which could be varied—used mainly for transporting lumber, pipes, steel sections, etc.

Electric and Steam Vehicles.—In 1925 electric and steam passenger vehicles formed an insignificant fraction of the whole number in use. Previous to the War the electric passenger car had considerable vogue as a ladies' car, especially in cities with comparatively level streets, like Los Angeles, Chicago, Cleveland and Buffalo in the United States, but the introduction of the electric starter, and, to a lesser extent, the demountable rim, removed the last obstacles to the use of petrol cars by women drivers, and thereafter the electric passed into the background. On the other hand, electric lorries had found a definite place in city haulage, particularly in New York, where at the beginning of 1925 3,274 such lorries were in service. Owing to the low power of their motors the depreciation of these lorries was low and the cost of transportation with them on a ton-mile basis was somewhat less than with petrol lorries, but on account of its greater independence and its materially greater speed, most users preferred the petrol lorry even for city haulage.

A new type of electric commercial vehicle, known in the United States as an industrial truck, but perhaps better described as a

floor truck or a low-wheel truck, came into extensive use, especially during the War period. These industrial trucks take the place of hand trucks on steamship piers and railway-station platforms, in factory buildings and paved yards. Petrol industrial trucks have also been developed, but as they are not admitted to steamship piers on account of the fire hazards, the electric has an undisputed field there. There was great inducement in Europe during the War, when petrol was exceedingly scarce, to develop the electric vehicle for both passenger and commercial traffic. In Germany a scheme was worked out for a system of goods transport in large cities by electric lorries with interchangeable batteries, and a few sample trucks were built, but the Armistice intervened and the scheme was dropped.

The steam vehicle also retrogressed as a factor in transportation. In 1925 the manufacture of steam passenger cars had almost entirely ceased, but considerable numbers of steam lorries were still being manufactured in England. The petrol motor had definitely gained the ascendancy over steam and electric motors, and supplies for it could be found and repairs to it had in almost every town. In the United States, for instance, there were, at the beginning of 1925, 65,674 repair shops (besides 58,206 garages), and all these repair shops were equipped to cater to owners of petrol cars, but only a few to owners of steam and electric vehicles, giving a tremendous advantage to the former.

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MOTTA, GIUSEPPE (1871–), Swiss statesman, was born at Airolo Dec. 29 1871. He studied law at the universities of Fribourg and Munich and at Heidelberg and became a successful barrister, establishing an extensive practice in Ticino and the neighbouring cantons. He served on the Great Council from 1895–1911 and was a national councillor from 1899–1911. He led the Catholic Conservative party in the Ticino from 1900 to 1911 and on Dec. 14 of the latter year was elected a member of the Federal Council by the Federal Assembly. In 1915 and 1920 he was president of the Swiss Confederation. He directed the financial administration of the Confederation 1912–9, and in 1920 assumed charge of the Federal dept. of foreign affairs. Motta was chief of the Swiss delegation to the League of Nations in 1920 and presided over the fifth Assembly of the League in 1924.

MOTTL, FELIX (1856–1911), German conductor (*see* 18.931), died at Munich July 1 1911.

MOULTON OF BANK, JOHN FLETCHER MOULTON, BARON (1844–1921), British lawyer, was born at Madeley, Salop, Nov. 18 1844. Educated at Kingswood School, Bath, and St. John's College, Cambridge, he had a brilliant career, becoming senior wrangler and first Smith's prizeman in 1868. He was elected a fellow of Christ's College, and in 1874 was called to the Bar. He specialised in patent law, for which his conspicuous scientific abilities peculiarly qualified him, and rapidly acquired a large and lucrative practice. In 1885 he became a Q.C. and entered Parliament as Liberal member for the Clapham division of London. In the following year, however, he lost his seat and was out of Parliament until 1894, when he succeeded Sir Charles Russell, Q.C. (Lord Russell of Killowen), as member for South Hackney. He was unsuccessful at the general election of 1895, but in 1898 he was elected for the Launceston division of Cornwall, a seat which he retained until his appointment as a lord justice of appeal in 1906. In 1912 he was made a lord of appeal in ordinary with the title of Lord Moulton of Bank. He died suddenly in London, March 9 1921.

Owing to his combination of gifts, Moulton's position at the patent Bar was unique. He had no rival and has had no successor. As a judge his success was less pronounced, perhaps in consequence of the extreme specialism of his career as a practitioner. On the other hand, during his years on the bench, he rendered distinguished scientific service to the country. He was first chairman of the medical research committee under the National Insurance Act (1912) and during the World War he was chairman of the committee on chemical products and high explosives and director general of explosive supplies in the Ministry of Munitions. He also was chairman of the British Dyestuffs Corporation (1919).

MOUNET-SULLY, JEAN (1841–1916), French actor (*see* 18.936), died in Paris March 1 1916. His *Souvenirs d'un Tragédien* was published in 1917.

MOUNTAINEERING (*see* 18.937).—The most important event of the period 1910–25, was, of course, the assault on Mt. Everest, which is the subject of a separate article. Everest, however, did not monopolise the attention of Himalayan explorers. Useful work was accomplished by the Workmans during 1911 and 1912 in the Karakoram, by C. F. Meade in the Garhwal Himalaya and by Kellas who reached a height of 22,700 ft. on Kangchenjhau.

The American continent has witnessed a series of campaigns which for energy and success have seldom been equalled. Outstanding exploits have been the conquest of Mt. McKinley in Alaska (20,300 ft.) by Belmore Browne, A. Aten, M. La Voy in 1925 and H. C. Parker; the conquest of Mt. Logan (19,850 ft.) in 1925 and the ascent of Mt. St. Sandford, the highest peak in the Selkirks by Howard Palmer and Professor Holway with Swiss guides in 1912. In 1924 Canadian climbers registered no less than 30 important first ascents, including Mt. King Edward.

The main exploration of the New Zealand Alps was completed before 1910, but Harold Porter's two expeditions (1923 and 1925) proved that interesting pioneer work still awaits the explorer. The Caucasus have been a closed book to mountaineers since the War. A British expedition in 1914 made a number of new ascents. Norway still offers the prospect of virgin ascents. Stedtind, described by Cecil Slingsby as "probably the most natural obelisk in the world and the greatest prize in all Scandinavia" was climbed in 1910 by C. W. Rubenson and friends. Two Oxford expeditions to Spitsbergen in 1922 and 1923 accomplished some excellent work.

Alpine Climbing.—In the Alps every peak worthy of the name had been ascended by 1910, nearly all of them from various sides. But Alpine exploration is not a closed chapter, and new routes even on well-known peaks may excite as keen an interest as the conquest of peaks in unclimbed ranges. Technically, the best work done in the Alps attains a higher standard of difficulty than elsewhere. The problems which call for solution in great ranges such as the Himalaya, are the problems of exploration rather than of climbing, in the more restricted technical sense of the word. A Himalayan explorer has to organise transport, handle native porters, plan a route through unmapped country, and — in the final stages—struggle against mountain sickness, but cragsmanship and ice-craft of a high order are seldom called into play.

In the Alps, the progressive elimination of unclimbed routes, implies a rising standard of difficulty among those that still resist attack. As an example of the thoroughness of the exploration of the Alps, it is interesting to note that 16 different passes have been made across the range at the head of the Lauterbrunnen Valley on a front of less than eight English miles. The technique of rock climbing has developed more rapidly than the technique of ice-craft. The contrast between modern achievement in the period under review and the period which closed with the seventies, is far more marked in cragsmanship than in ice craft.

Alpine Ascents by Britishers.—Another change is noticeable. The earlier exploration of the Alps was, in the main, the work of Brit-

ish mountaineers with Swiss guides whose technique their employers helped to develop. Since 1910 the prizes have often fallen to continental mountaineers, though no individual climber has a longer list of successes to his credit than G. W. Young. In 1911, with Professor H. O. Jones (killed soon afterwards in the Mont Blanc range), he completed the ascent of the Brouillard ridge of Mont Blanc and achieved the first complete traverse of the great west ridge of the Grandes Jorasses and the first descent of the ridge that stoops to the Col des Hirondelles. With Professor Jones and Todhunter, he made the first ascent of the Mer de Glace face of the Grépon, and just before the War climbed the Gspaltenhorn by the terrible west ridge, perhaps his finest performance. His leading guide on all these climbs was Joseph Knubel of St. Niklaus. Among other first-class climbs by British mountaineers may be mentioned the conquest of the south face of Mont Blanc by Oliver and Courtauld with the brothers Aufdenblatten in 1923, and the first crossing of the north face of the Dent d'Hérens by a guideless party led by George Finch. The direct ascent of this face was achieved by Welzenbach and Allwein in 1925. The guideless conquest by Raeburn and Ling of the north face of the Disgrazia also deserves mention, for the British mountaineers with new climbs to their credit during this period have almost been content to divide the credit with their guides. On the other hand the Everest expeditions were guideless, and some of the work done on the American continent by men of the Anglo-Saxon race has been guideless.

Among other fine Alpine climbs of this period may be mentioned the north Arête of Piz Badile by A. Zurchner, led by the guide Walter Risch, perhaps technically as exposed and difficult a climb as had yet been done. The ascent of the north face of the Lauterbrunnen Breithorn by Chevet and Richardet, and the variation route taken by Lauper and Liniger up the north face of the Mönch, rank among the great mountaineering exploits, involving as they did, difficult work both on rock and ice. Richardet, Lauper and Chervet were members of the Akademisher Alpen Club, Berne. The students of the Berne and Zürich universities have long been known for their mountaineering exploits. One of the last classic problems of the Oberland, the ascent of the Mittellegi ridge of the Eiger, was also solved during this period by a Japanese climber, Yuko Maki, led by the great Grindelwald guide F. Amatter. Artificial aids were employed for this climb.

French Guideless Climbing.—A great feature of post-War mountaineering has been the revival of French guideless climbing. Before the War, French climbers of the type of Fontaine were few. Since the War the "Groupe Haute Montagne" of the French Alpine Club—a guideless group—have to their credit a consistent record of brilliant work, combining the spirit of adventure with the same British tradition. The "Groupe" has been engaged in cairning the last untouched pinnacles of Mont Blanc, and among its most brilliant achievements may be mentioned the ascent of the north face of the Aiguille du Plan by Lagarde, de Lepiney and de Segogne in 1924.

German Mountaineering.—In the Dolomites and the Kaiser Gebirge German and Austrian climbers have done some very remarkable climbs, but their successes have been paid for by an increasing death roll. There is a grave tendency among German climbers to take chances, to risk bad weather and impromptu bivouacs. Their exceptionally heavy death roll is caused by the fact that these young climbers, fired by a spirit of emulation, often forget the penalty for too risky procedure. British climbers, have proceeded with equal skill but with greater circumspection, and if, in the Alps at any rate, they have fewer new ascents to their credit since the War, they have avoided the accidents which have been so common among German and Austrian climbers. The same may be said of rock climbing. There is nothing to choose in severity between the various climbs achieved by the Germans and Austrians and the new routes which have been exploited in Cumberland, but comparatively few lives have been lost on our British hills.

Several of the British climbing clubs have shown great activity since the War. Mention must be made of the imaginative enterprise of the Fell and Rock Climbing Club in purchasing for the nation the summit of Great Gable as a war memorial for those members of the Club who fell in action. Rubber soled shoes have given to the cragsman greater security and made it possible to accomplish more climbs than could ever have been achieved in the nailed boot epoch. During this period, the conquest of the Alps by ski-runners has been practically completed. Scarcely any peak of importance has not been ascended either partially or entirely on ski. The best period for mountaineering on ski is undoubtedly the late spring. Summer ski-ing is growing in popularity and provides mountaineers with the opportunity of making ascents during prolonged periods of snowy weather.

The Canadian Alps.—Exploration of the Canadian Alps has been very active, aided by the Alpine Club of Canada and its very energetic director, Mr. A. O. Wheeler, and the provision of Swiss guides by the Canadian Pacific Railway and later by the Canadian National Railway.

The following are the principal ascents:—

1913. First ascent of Mt. Robson culminating summit in the Canadian Alps (12,972 ft.) by A. H. MacCarthy and W. W. Foster with the Austrian guide Conrad Kain.

1915. First ascent of Mt. Edith Cavell (11,033 ft.) by Professor Holway and Dr. A. J. Gilmour.

First ascent of Mt. Louis (8,800 ft.) the most difficult rock climb in the Canadian Alps by A. H. MacCarthy with Conrad Kain.

1919. First ascent of Mt. King George (11,226 ft.) by V. A. Fynn with R. Aemmer (guide).

First ascent of Mt. Douglas (11,174 ft.), Mt. Joffre (11,316 ft.) by J. W. A. Hickson with E. Fenz, Jr. (guide).

1920. First ascent of Mt. Ferenitz (10,573 ft.) by A. Howard Palmer and Allen Carpe.

1922. First ascent of Mt. Queen Mary (10,600 ft.) and Mt. Birdwood (10,160 ft.) by F. M. Waterman and C. F. Hogeboorn with R. Aemmer (guide).

First ascent of Mt. Apex (10,625 ft.) by Allen Carpe and H. G. Hall.

First ascent of Mt. Barnard (10,780 ft.), Mt. Trutch (10,690 ft.), Nanga Parbat (10,780 ft.) and Gilgit (10,300 ft.) by Howard Palmer and J. Monroe Thorington with E. Fenz, Jr. (guide).

1923. First ascent of Mt. Saskatchewan (10,964 ft.) and North Twin (12,085 ft.) by J. Monroe Thorington and W. S. Ladd with Conrad Kain (guide).

First ascent of Mt. Clemenceau (12,000 ft.) by De Villiers-Schwab's Guideless party.

First ascent of Mts. Brazeau (11,250 ft.), Unwin (10,550 ft.) and Henry MacLeod (10,600 ft.) by Howard Palmer, Allen Carpe and W. D. Harris.

First ascent of Mt. Spring-Rice (10,745 ft.) by J. W. A. Hickson with E. Fenz (guide) and of Mt. Rhondda (10,625 ft.) by the same and A. Geoffrion.

1924. Exploration in the Cariboo group and ascent of eight new peaks ranging from 10,000 to 11,750 ft. by Allen Carpe and R. Chambertin with W. D. Harris and A. L. Withers of Jasper.

First ascent of South Twin (11,675 ft.), Mt. Outram (10,670 ft.) and two other unnamed peaks by W. O. and F. V. F. Field with E. Fenz, Jr. and Jos. Biner (guides).

First ascent of Mts. Oates (10,200 ft.), Kain (10,000 ft.), Hooker (10,782 ft.) and Simmen Peak (10,899 ft.) by J. Monroe Thorington, M. Strumia, A. Ostheimer with Conrad Kain (guide).

First ascent of Mt. Erebus (10,234 ft.) and two other unnamed peaks by L. Coolidge, G. Higginson and J. Johnson.

First ascent of the often attempted difficult Mt. Geikie (10,854 ft.) by the famous Alpine veteran V. A. Fynn, C. G. Water and M. D. Geddes and of Mt. Barbican (10,100 ft.) by the same party.

First ascent of King Edward (11,400 ft.) by H. Palmer and J. W. A. Hickson with Conrad Kain.

1925. First ascent of Mt. Logan (19,850 ft.) by a joint party of Canadian and American mountaineers led by A. H. MacCarthy.

First ascent of Mt. Alberta (11,784 ft.) by Yuko Maki of Tokyo and five other Japanese with H. Fuhrer and H. Kohler, and Mt. Woolley (11,170 ft.) by the same party.

There are still several unclimbed peaks in the Selkirk Range. The following ascents are notable:—

1910. First ascent of Grand Mountain (10,832 ft.) by E. W. D. Holway and Howard Palmer.

1911. First ascent of Mt. Austeritz (10,960 ft.) and Mt. Holway (10,000 ft.) by the same.

1912. First ascent of Mt. Sir Sandford (11,590 ft.) by the same with E. Fenz, Jr. and R. Aemmer (guides) and of Mt. Adamant (10,980 ft.) by the same.

1913. First ascent of Mts. Beaver (10,644 ft.) and Duncan (10,548 ft.) by E. W. D. Holway with E. Fenz and Ch. Häsler (guides).

1917. First ascent of Mt. Moloch (10,198 ft.) by J. W. A. Hickson with E. Fenz, Jr. (guide).
1924. First ascent of Mt. Inconoclast (10,646 ft.) by Dr. Cora J. Best's party with Ch. Häsler (guide).

The Southern group or Purcell range has been much visited since 1910.

1910. First ascent of Mt. Nelson (10,772 ft.) by C. D. Ellis.
1911. First ascent of Mt. Gleason (10,550 ft.) and Mt. Monica (10,060 ft.) by C. D. Ellis and E. W. Harnden.
1913. First ascent of Mt. Sir Charles (10,830 ft.) by E. W. Harnden and party.
1914. First ascent of Mt. Farnham (11,075 ft.), Farnham Towe (10,850 ft.) by Mr. and Mrs. A. H. MacCarthy with Conrad Kain (guide).
First ascent of Delphine Peak (10,975 ft.) by A. A. McCoubrey with E. Fenz, Jr. (guide).
First ascent of Mt. Bruce (11,090 ft.) by E. W. Harnden and party.
1915. First ascent of Mt. Ethelbert (10,450 ft.), Jumbo Peak (11,125 ft.), Commander (10,950 ft.), St. Peter (10,750 ft.), Spearhead (10,500 ft.) and Peacock (10,525 ft.) by Dr. and Mrs. W. W. Stone, the MacCarthys, H. O. Frind with Conrad Kain (guide).
1916. First ascent of Howson Spires (10,900 ft.), Bugaboo Spires (10,250 ft.) by the MacCarthys, Frind with Kain.
1924. First ascent of three peaks of over 10,000 ft. at the head of Hamill Creek by the McCoubreys with E. Fenz, Jr. (guide).
1925. First ascent of Mt. Coppercrown (10,218 ft.) by A. A. McCoubrey with E. Fenz, Jr. (guide).

Generally speaking no mountain in the Canadian Alps approaches in technical difficulty a first-rate expedition in Europe. There is less risk of avalanches and the glaciers are much less complicated—on the other hand long distances have to be traversed, while the arranging of transport and camps is a big and expensive business. There is still much exploration to be done.

Useful work is being done by the Associated Mountain Clubs of America in exploring the less accessible regions, opening trails therein and securing protective legislation for them.

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MOUNTAIN WARFARE.—The difficulties attending the prosecution of a campaign in mountains arise primarily from the physical features of the theatre of operations; and secondly, in a marked degree, from the effect those features have in moulding the character of the inhabitants.

Lack of Communications.—A mountainous district is, as a rule, undeveloped; and the means of communications, where any exist, are indifferent or bad. An invader is tied to certain existing roads or tracks as the only method of advance, and has little scope for effecting surprise by means of alternative routes. The observation which the defender can obtain from the hill tops is as good as, and in some ways better than, can be obtained by the invader from aeroplanes. As a result, the invader's intentions can be grasped almost from the start, and the uncertainty common to war in normal theatres is largely discounted. The country is usually barren, and all supplies and stores for the invading force have to be carried into the country. Since communications usually consist of mere tracks, or of some boulder-strewn dry river bed, "pack" is the only possible means of transport. Consequently the invading commander is burdened with the guarding of long lines of slow-moving pack animals, and, owing to the fact that they have to convey their own and their drivers' food, they are able only to carry a relatively small useful load.

The climatic conditions in mountains tend to extremes of heat and cold. Changes in weather conditions are also sudden. The melting of snows or the bursting of a thunderstorm in the mountains may mean the flooding of the valley forming the route of advance, and the washing away of the line of communications "road," which has often been cut out with great labour.

Characteristics of the Inhabitants.—The nature of their surroundings reacts, as elsewhere, on the characteristics of the inhabitants. Their life consists of a struggle with nature. The ease and luxury of the plains is absent. They live scattered in small hamlets close to such patches of ground as will yield to cultivation. Industries are based on the village system, and the local weavers, potters, carpenters and so on supply the needs of the small community. There is no centralised life as in the plains. The inhabitants of a given area (probably emanating from a common stock) usually own a tribal allegiance to each other, but are often again sharply divided into subtribes, the boundaries of which are the valleys which they inhabit. Life is hard, and the only physically fit survive early childhood.

As a result the characteristics of mountaineers are exceptionally sound physique, bravery, great powers of endurance and ability to thrive on the bare necessities of life. They are, moreover, usually intensely patriotic (for it is a curious and almost universal fact that the wilder a man's country the more attached he is to it). Finally, they fight in mountains in their own element, on ground to which they are accustomed, and which confers on them a mobility twice as great as that of the invading plainsmen.

The above are valuable military attributes. But they are to some extent offset by others. The highly individualistic life in mountains, whilst leading to an admirable independence, also leads to a lack of centralised purpose and interest. Whilst patriotism for the clan is great, patriotism for the sub-tribe is sometimes greater. There is consequently a tendency toward absence of cohesive effort if the operations be going adversely. This lack of cohesion renders them peculiarly averse to night operations, the success of which against mountaineers is noteworthy throughout history, though it must be added only when most carefully organised and prepared. Nevertheless, mountaineers have always been difficult opponents to overcome.

Operations of Two Kinds.—The consideration of operations in a mountain theatre falls naturally under two heads. First are operations in an area such as the Austro-Italian frontier. There, though the mountains exist, the area has been considerably opened up. Communications are relatively good; heavy stores can be brought up. The forces on both sides are possessed of all the appliances of war. Better theatres for operations exist on the flanks of the mountains, and it is there that the real struggle will be fought out. Neither attacker nor defender is in reality a true mountain race, for national armies are taking part. As a result, the operations tend more and more to take the colour of normal operations in the plains, modified, no doubt, but lacking most of the characteristics of campaigns against true mountaineers. Second are operations in an undeveloped mountain theatre against semi-civilised inhabitants. It is in such a case that the true attributes of mountain fighting are best brought out. In describing them the theatre of the North West Frontier of India is taken as an instance.

Frontier Warfare in India.—The inhabitants of this area possess all the characteristics noted above. As regards supply during operations, they normally carry seven to 10 days' food on them, and consequently are untroubled by anxiety about their line of communication. They are armed only with rifles and knives. But the rifles are modern for the most part; and it is for consid-

eration whether the power of mobility conferred by such an armament and supply system does not largely compensate for the absence of artillery and other arms. A commander entrusted with the subjugation of a frontier tribe has a difficult task before him. It may be possible to overawe the tribe by air action alone. But targets for aerial attack are limited in such a form of society, and if the opposition of the tribe be determined, air action alone, will seldom suffice; an advance over the ground will, as a rule, be necessary.

Planning the Campaign.—The first difficulty is to select the objective. It can be said at once that the true objective is to bring the enemy to battle. But how is it to be done? Owing to absence of lines of communication, the enemy's strategical mobility is always superior. Owing to his upbringing, his tactical mobility is also superior, except against the best hill troops. Normally, a threat against an enemy's capital forces him to interpose, and brings on a battle. Here, the enemy may not consider any of his hamlets worth defending resolutely. He may prefer to adopt a purely guerilla attitude, to be ubiquitous, and to worry the advance. That is the most difficult problem to deal with. As a rule he is ready to oppose an advance with resolution in measure as his hopes stand high. If defeated, he tends towards more guerilla methods.

A commander therefore has usually to select the line of advance most likely to produce massed resistance. In doing so he can advance as one column, or by several columns up several valleys. The first method has the advantage of simplicity and of inviting the enemy to concentrate. But the larger the force on one track the slower the movement, and so, if the enemy seeks to avoid decisive battle, the less hope there is of achieving it. A move in several columns has the advantage of speed, and gives greater hope of cornering an elusive enemy. But it involves a series of lines of communication, and is attended by all the difficulties of co-operation and mutual support between columns when separated by mountain ranges.

Progress of Operations.—Whatever the plan the method of conducting operations follows a fairly uniform course. The force advances up a valley protected by a strong advanced guard. This advanced guard throws out detachments to seize and hold tactical points on the hills flanking the valley, and so securing the advance of the column below. These detachments (or " piquets ") are withdrawn by the rear guard when the column has passed. Since all commanding ground within rifle range must be denied to the enemy, it is clear that piquets often have to establish themselves 2,000 yd. from the column, and to climb 1,000 ft. or more. The process is therefore laborious and slow, and limits the length of march possible in a day.

Defence at Night.—For the night, all-round defence is essential against so ubiquitous an enemy. Arrangements therefore take the form of a central camp, protected by self-contained piquets posted on tactical points round the camp. These piquets must be sufficient in number, and be placed far enough out, to prevent the enemy firing into camp at night. But since complete protection against such sniping is impossible, a considerable amount of protection against fire has to be provided within the camp. The camp itself has also to be designed and organised to resist assault. It will be realised that there is, in consequence, an immense amount of heavy work to carry out at the end of an exhausting day's advance. Moreover, it is of primary importance that all movement shall have ceased and the camp be made entirely secure before dark. Because, though (as stated above) organised night operations frequently prove successful, unorganised movements are disastrous in face of a ubiquitous enemy who holds the initiative.

It is frequently necessary to raid and destroy villages in order to induce the enemy to stand and fight. Such raids need careful organisation in order to insure that the work is efficiently done in the time available. Raids are usually carried out in various directions, radially, from some semi-permanent camp, the force going out early and returning to camp before dark. The retirement is almost always followed up, and it is in harrying a retirement that the enemy is most dangerous. A running fight (with all its disadvantages) is unavoidable, because the enemy has no columns or guns moving on a road to deploy, but merely follows up deployed. The art of conducting such a retirement consists in the careful and timely laying out of troops in successive positions, so that the retreat of the rearmost is always efficiently covered and in the skilful co-operation of fighting aeroplanes.

For the defence of the line of communication the system is a chain of piquets in assault proof posts dominating the route. These posts, often 2,000 ft. above the valley, have to be strongly built of dry stone, wired and the garrisons supplied with food and water for (say) 10 days. It is obvious that the work involved is laborious. At suitable intervals on the line of communication larger posts are established capable of accommodating the convoys passing through. These posts also contain the mobile reserve for their section of the line of communication.

An Example.—Perhaps a small example will best illustrate the difficulties which beset a commander in mountain warfare. A force of four battalions (and attached troops) camps for the night. It is found necessary to use one company per battalion for camp piquets. Next morning the advance continues, but owing to the necessity for an early start it is impossible to relieve the piquets before moving. They must be withdrawn by the rearguard and rejoin units later. So the advance begins with all battalions only three companies strong. " A " battalion gives two companies as advanced guard, one available for piqueting. " B " is allotted entirely for piqueting. " C " heads the main body. " D " finds two companies for rearguard and one as baggage escort. In the advance it is found that piqueting is heavy, that an average of a company to a mile is needed. The force advances four miles (which means that the remaining company of " A " and all " B " battalion are used up on piquet) and is confronted by 1,500 enemy in position. In theory, a brigade is confronted by 1,500 men. In practice 1,500 men are being faced by the two advanced guard companies and the three companies of " C " battalion, perhaps actually some 500 or 600 in all; for that is all that the commander has immediately available. The above crude example is typical of the dispersion of resources inherent in mountain warfare.

Two Lessons.—As regards mountain warfare in general, history appears to point to two main lessons: firstly, that the true subjection of mountaineers can only be arrived at by opening up and developing the country. Short of that, they may be overawed and pacified for a time, but a change in the undeveloped and individualistic conditions of life is essential to their permanent pacification. Secondly, that if the operations for their primary subjugation are to be quickly and successfully carried out, the forces engaged must be definitely trained to the task, and the personnel composing the force should, as far as possible, be composed of men bred in mountains. (J. P. V.-S.)

MOUNT STEPHEN, GEORGE STEPHEN, 1ST BARON (1829–1921), Canadian financier (*see* 18.942), died at Brocket Hall, Hatfield, Herts., Nov. 29 1921.

MOZAMBIQUE (*see* 22.163) has a population (1923) of about 3,500,000, including some 10,500 Europeans (mostly Portuguese and British) and about 6,000 Indians. The country is divided into (*a*) the province of Mozambique, governed directly by Portugal, with Lourenço Marques (*q.v.*) as capital, (*b*) the territory of the Mozambique Company (capital Beira), (*c*) the territory of the Nyassa Company. The companies administer their territories under charter. The charter of the Nyassa Company was for a period ending in 1927. Negotiations for its renewal were conducted in 1926.

History.—Although Portugal had been in nominal possession of the country for some 400 years, it was not until 1912 that fairly effective control was obtained over all the hinterland, while in 1915 there was a widespread revolt in the Zambezi valley. In 1918 the region north of the Zambezi was ravaged by the Germans under Von Lettow-Vorbeck. This region had been marked, before the World War, for exploitation by the Germans. Early in 1914 German capitalists had obtained control of the Nyassa Co., the Anglo-German agreement of 1913 (never signed) having recognised German economic interests as

paramount in that area (*see* AFRICA). The World War put an end to this project. In 1919 the "Kionga Triangle," formerly part of German East Africa, was added to Mozambique—it gave Portugal the right bank of the Rovuma to the sea.

The Portuguese since 1910 have made serious efforts to improve the administration. In 1914 a measure of autonomy, enlarged in 1920, was granted to the province. In general the treatment of the natives was satisfactory, but labour conditions left much to be desired. Compulsory unpaid labour in the province of Mozambique was not abolished until 1925. Early in 1926 the Portuguese Government appointed a commission of enquiry with instructions to see that nothing was permitted which gave colour to the charge that slavery in a disguised form still obtained.

Economic Conditions.—Economic development was considerable in the province and in the Mozambique company's territory. The Portuguese, however, lacked capital to carry out large enterprises, while the constant ministerial changes at Lisbon and the financial embarrassment of Portugal reacted unfavourably on Mozambique. Development was most marked where British interests were concerned and British capital was forthcoming. The transit trade was large, Lourenço Marques serving the Eastern Transvaal, and Beira being the chief port for Rhodesia, Katanga and British Nyasaland. A railway from Beira to the Zambezi completed in 1922, was built with British capital to meet the needs of the Nyasaland protectorate. This railway superseded the route by the Zambezi and in consequence the British concession at Chinde, at the mouth of the river, was given up in 1925. The Beira-Zambezi railway also opened up rich tracts suitable for sugar, cotton and other crops. Moreover it brought a step nearer the exploitation on a large scale of the coalfields on the north side of the Zambezi near Tete. Another railway, from Inhambane to Delagoa Bay (280 m. long), built in sections, was nearing completion in 1926. This line also serves fertile regions. Great progress was made in sugar growing, and sisal, cotton and maize were increasingly cultivated. The chief exports are sugar, copra and ground nuts.

The three administrations have different systems of keeping accounts, but, approximately, the trade figures for the whole country in 1911 were: Imports £8,520,000 (including £6,800,000 in transit); exports £2,720,000. In 1923 the value of trade in the province of Mozambique was, roughly £10,000,000, including transit trade valued at £4,800,000. In the same year the external trade of the Mozambique Company was valued at £11,000,000 including goods in transit £2,200,000. In the Nyassa Company's territory imports in 1924 were valued at £90,000 and exports at £111,000. A valuable export, which does not appear in the trade returns, is that of native labourers to the Transvaal mines.

Revenue is derived mainly from Customs, a hut tax (for which in 1925 a poll tax was substituted) and a tax on labourers who emigrate; the last source is not available in the territories of the chartered companies. In Mozambique province in each year between 1908–9 and 1920–3, except in the first two years of the War, there was a surplus over estimated revenue. In 1923–4 the revenue collected was 50,957,000 escudos. In 1925 the exchange problem was acute and the province suffered severely. In the Mozambique Company's territory, where accounts are kept in sterling, revenue in 1923 was £361,000 and expenditure £281,000. (*See* AFRICA).

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MUIR, JOHN (1838–1914), American naturalist and writer, was born at Dunbar, Scotland, April 21 1838. In 1849 he went to Fox River, Wisconsin. When 22 years old he entered the University of Wisconsin, teaching and working on farms during vacation. After finishing his course he began wanderings on foot through the United States and elsewhere. In 1868 he first entered the Yosemite Valley which for many years after formed the base of his continued expeditions. In 1876 he joined the U.S. Coast and Geodetic Survey, and in 1879 discovered the Alaskan glacier that now bears his name. In 1881 he took part in the expedition in search of the De Long party in the Arctic region. It was largely due to his efforts that the Yosemite region was set aside as a national park in 1890. He died at Los Angeles, Cal., Dec. 24 1914.

He published, among other works; *The Mountains of California* (1894); *Stickeen* (1909), the story of a dog; *The Yosemite* (1912) and *The Story of My Boyhood and Youth* (1913). In 1888 he edited *Picturesque California.* The following appeared posthumously: *Unpublished Prose and Letters* (1915); *A Thousand-Mile Walk to the Gulf* (1916); *The Cruise of the Corwin* (1917) and *Steep Trails* (1918).

MULCAHY, RICHARD JAMES (1886–), Irish politician, was born in Waterford, and began his career in the engineering department of the Dublin General Post Office. He took part as a lieutenant in the Irish rebellion of 1916, and was afterwards interned in Frongoch. In Dec. 1918 he was returned as Sinn Fein M.P. for the Clontarf Division of Dublin and retained his seat until 1922. He played a prominent part with Michael Collins in the reorganisation of the Irish Volunteers, of which he had become chief-of-staff in 1918. He sat in the Dáil from 1921–3 as a member for the Northwest Division of Dublin, and after the Treaty of 1922 became minister of defence for the Irish Free State. He succeeded Gen. Michael Collins, after the latter's death in 1922, as commander-in-chief of the Free State forces, and had the chief conduct of operations until the cease-fire order of 1923, in which year he was returned to the Dáil for Dublin city north. He resigned office in the spring of 1924 upon the executive requiring the resignation of three of his principal officers in connection with troubles arising out of demobilisation and reorganisation.

MULHOUSE or MULHAUSEN (*see* 18.960) was restored to France after the World War. The population was 99,226 in 1921, and a later estimate gives 105,000. A busy factory town and port on the Rhone-Rhine Canal, it is thoroughly French in character. The French occupied Mulhouse on Aug. 8 1914, but evacuated it two days later. They were again on the outskirts on Aug. 20, but the reverses in the north compelled a retreat, and the town was ruled as hostile territory by the Germans during the World War. The French re-entered Mulhouse in Nov. 1918.

MÜLLER, HERMANN (1876–), German politician, was born May 18 1876 at Mannheim. From 1899 to 1906 he was editor of the Socialist newspaper the *Görlitzer Volkszeitung,* and from 1906 onwards was a member of the directing board of the German Social Democratic party. From 1916 to 1918 he was a member of the Reichstag. On Aug. 1 1914, he went to Paris with the object of finding out whether international action by the Socialists of France and Germany could be initiated in order to avert the World War. His mission was unsuccessful, and he had great difficulty in making his way back to Germany through the French lines. His report did much to determine the attitude of the German Social Democrats in voting in the Reichstag for the first war credit. On June 21 1919 he was appointed Minister for Foreign Affairs—under the chancellorship of Gustav Bauer—and in this capacity went to Versailles and with the Colonial Minister, Dr. Bell, signed the Peace Treaty for Germany on June 28 1919. After the resignation of the Bauer Ministry, which followed upon the Kapp Putsch (March 1920), Müller was appointed Chancellor of the Reich, an office which he held till the following June, when the result of the general elections for the Reichstag necessitated the formation of a Coalition Ministry with Fehrenbach of the Catholic Centre party as Chancellor. Thereafter Müller continued to play a leading part in the affairs of the Social-Democratic party.

MUMMY: *see* ARCHAEOLOGY: *Egypt.*

MUN, ADRIEN ALBERT MARIE DE, COUNT (1841–1914), French politician (*see* 19.1), died at Bordeaux Oct. 6 1914.

MUNCH, EDWARD (1863–), Norwegian painter, was born Dec. 12 1863 at Löten, Hedemark. He went to Christiania (Oslo) at an early age and studied at the royal school of drawing

under Krohg by whom he was introduced to the naturalistic school of painting. The inborn genius of Munch however reacted against this teaching. He was more inclined to express feelings inspired by a troubled mind than impressions engendered by reality, and did not hesitate to go his own way as an artist. The most famous work of this early period is " Spring " (1899), justly considered one of the gems of the National Gallery at Oslo. In the beginning of the 'nineties, the undercurrent of mental agitation broke through in all its power, and in a number of works (mostly in the Oslo National Gallery), Munch revealed an extraordinary sensitiveness, displayed alike in the subjects of his pictures and the artistic method of execution which he employed. From the beginning of the 20th century Munch's art assumed a more realistic character. This is particularly evident from his landscapes of this period, the outstanding features of which are vigorous plainness and impressive colouring. In 1913 Munch completed the fresco decorations of the University Festival Hall at Oslo; he also established his reputation as an etcher of ability.

MUNDELEIN, GEORGE WILLIAM (1872–), American cardinal, was born in New York City July 2 1872. He received his education at the Manhattan College, and St. Vincent Seminary, Beatty, Pa., subsequently proceeding to Rome and studying theology at the Urban College of the Propaganda in that city. He was ordained priest June 8 1895, at Rome, and became secretary to Bishop McDonnell of Brooklyn, N.Y., being made chancellor of the diocese in 1897. He was appointed auxiliary Bishop of Brooklyn, with the titular see of Loryma, Sept. 2 1909. He became Archbishop of Chicago, Nov. 30 1915, and was created a cardinal by Pope Pius XI, March 24 1924. He was a prominent figure at the Eucharistic Congress held in Chicago in June 1926.

MUNICH (*see* 19.5), the capital of Bavaria, Germany, with a population of 630,711 in 1919, took a prominent part in the revolution of 1918, when Bavaria became a republic (*see* BAVARIA). Housing conditions were very bad after the World War; in 1919 there were 7,919 applications for 23 houses available. A school of infantry is permitted under the provisions of the Treaty of Versailles. The War Memorial was unveiled in 1924; 14,000 citizens of Munich fell in the War. A German museum was opened in 1925, and a transport exhibition was held in the same year. The factory of the Deutsche Werke, formerly artillery workshops of the German Army and subsequently converted to the manufacture of agricultural machinery, has been acquired by the municipality.

MUNICH, UNIVERSITY OF (*see* 19.6).—Between 1910 and 1912 seven new chairs were founded. No further developments took place till 1920, since when 12 new chairs have been created, including those in Egyptology and race hygiene. The number of students averaged 6,800 up to 1914, and remained below this figure till 1916–7, when it amounted to 7,900. It rose in 1918–9 to 9,823, and to 10,333 in the summer of 1921. There has been a decline since that date, and in the summer half of 1925 there were 8,006 students, of whom 938 were women.

MUNICIPALITY: *see* CITY GOVERNMENT.

MUNITIONS OF WAR.—Under this heading the production of munitions during the World War by the United Kingdom and the United States is dealt with.

I. THE UNITED KINGDOM

The Problem.—When the British Army of six divisions took the field in 1914 it possessed about 900 field guns, less than 200 field howitzers, about 60 heavier weapons of 6-in. and upwards and perhaps about 200 obsolescent types, such as the 4.7-in. and the 85-pdr. howitzer, a reserve of ammunition of less than 1,000,000 rounds weighing some 20,000 tons and less than 2,000 machine-guns. By the end of 1918, the army had received 10,000 field guns, 6,000 other light guns, over 3,000 field howitzers and 7,500 heavier guns and howitzers; 217,000,000 rounds of artillery ammunition, weighing 5,500,000 tons and nearly 225,000 machine-guns.

During 1914 the War Office limited its orders to Government factories and the armament firms. In 1915 a few small contracts were placed with other firms, but on the appointment of the armaments output committee at the War Office, and a week later of the Treasury committee under Mr. Lloyd George, further extensions took place. Foreign orders were extensively placed in the U.S.A. and Canada. The passage of the Ministry of Munitions Act in June 1915 and the Munitions of War Act in July 1915 and the transfer Sept. 1915 of the ordnance factory at Woolwich to the Ministry of Munitions placed the Minister (Mr. Lloyd George) in a position to organise effectively production on the largest scale possible—by the most modern means—of the enormous quantities of material required and to deal with labour problems without delay.

Rifles.—The rapid development of the army was impeded by difficulties in supplying rifles—weapons of precision manufactured by highly skilled labour with specialised machinery. Old pattern rifles were repaired and rifles were borrowed from Japan. Orders were placed in America, but the rifles were not available till the summer of 1916 and then needed adjustment. By this time the home supply was adequate.

Guns.—Heavy artillery was needed to break down the German defences, and a programme was drawn up in June 1915 by Mr. Lloyd George on a basis of 100 divisions with proportion to reserves. Wastage was heavier than was expected. Aircraft defence developed; merchant ships had to be armed; tanks (*q.v.*) had to be equipped. Nevertheless at the middle of 1918 the output of guns sufficed to meet all these requirements.

Ammunition.—To provide adequate supplies of shells, with explosives, propellants, fuses, grenades and the score of other elements, national factories were built and proved highly efficient and economical. Large orders were placed in America and Canada. Fitting factories were built, and intensive research at Woolwich produced a satisfactory fuse.

Explosives and Propellants.—Lord Moulton presided over a committee appointed in 1914 to organise the supply of explosives. Cordite was at first a propellant. The supply was fairly ample owing to the foresight and the policy of the Admiralty. The new programme increased the demand for H.E. Trinitrotoluol (T.N.T.) was mixed with amatol (ammonia citrate). Out of about 625,000 tons of explosive supplied, only 210,000 (of which 3,500 tons were imported) was T.N.T., less than 80,000 tons prussic acid and the rest ammonia citrate. The production of cordite was limited by supplies of acetone, and eventually a nitro-cellulose powder manufactured by Messrs. Dupont of America was adopted. The Gretna propellant factory, which cost £8,000,000 to build, made nearly one-fourth of the cordite required at a great saving of cost. Imports and home products are shown below.

Trench Mortars and Trench Ammunition.—The total number of trench mortars delivered during the War period amounted to 19,096, and the output of trench-mortar ammunition to over 17,000,000 rounds. The total number of grenades delivered amounted to 100,103,000, and of aerial bombs to 4,738,000. Of the 5,316,000 rifles manufactured, 3,954,000 were made in Great Britain, and the army was entirely armed with rifles of

TABLE I.

	Trade	National Factories	Imports
Picric acid	92 %	6½ %	1½ %
T.N.T.	21	63	16
Ammonium nitrate	65	30	5
All explosives	53	39	8
Cordite	47	38	15
Nitro-cellulose	..	2	98
All propellants	26	22	52

TABLE II. *Guns and Gun Ammunition*

	New Guns and Howitzers					Filled Ammunition (in thousands)				
	Light	Medium	Heavy	Very Heavy	Total	Light	Medium	Heavy	Very Heavy	Total
Up to June 30 1915	802	242	6	31	1,081	1,877·3	389·0	26·5	14·0	2,306·8
1915 2nd six months	1,895	493	4	33	2,425	4,461·7	976·7	134·4	74·5	5,647·3
1916 1st six months	1,180	969	205	116	2,470	10,287·1	2,919·2	432·1	213·8	13,852·2
2nd six months	1,045	679	495	258	2,477	25,204·3	8,392·6	2,492·7	1,654·7	37,744·3
1917 1st six months	1,547	408	570	253	2,778	30,004·2	9,887·1	4,480·6	2,145·8	46,517·7
2nd six months	2,488	603	762	450	2,303	22,556·7	9,528·8	6,693·1	2,381·1	41,159·7
1918 1st six months	3,990	966	1,164	264	6,384	18,474·6	8,363·1	6,734·6	1,625·4	35,197·7
2nd six months	3,056	797	875	270	4,998	19,067·7	6,421·0	7,647·3	1,479·5	34,615·5
	16,003	5,157	4,081	1,675	26,916	131,933·6	46,877·5	28,641·3	9,588·8	217,041·2

The classification is that adopted by the Inter-Allied Munitions Council. In the case of Great Britain it includes under "light" field guns (13-pdr. and 18-pdr.), mountain guns (2·75-in. guns and 3·7-in. howitzers), anti-aircraft guns (13-pdr., 3-in. and 4-in.) and tank and other miscellaneous small guns. The medium guns include the 60-pdr. gun and 4·5-in. howitzer. The heavy include the 6-in. howitzer and gun and the very heavy include 8-in., 9·2-in., 12-in. and 15-in. howitzers and guns.

TABLE III.—*Production of Rifles, Machine-Guns, Small-Arms Ammunition, Aeroplanes, Aero-Engines and Tanks*

	Rifles	Machine-Guns	Small-Arms Ammunition (Thousands)	Aero-Engines	Aeroplanes	Tanks
Up to June 30 1915	364,246	1,486	507,758	1,025	902	..
1915 3rd quarter	173,317	1,719	395,881	730	692	..
4th quarter	198,641	3,133	570,029	1,015	948	..
1916 1st quarter	217,631	5,582	626,566	1,569	1,137	..
2nd quarter	267,759	7,245	738,355	1,615	1,537	..
3rd quarter	457,732[1]	9,572	811,476	2,054	1,939	110
4th quarter	416,564[2]	10,801	803,607	1,989	2,020	40
1917 1st quarter	793,350[3]	16,637	697,536	2,704	2,730	100
2nd quarter	717,000[4]	19,836	250,878	3,567	3,640	324
3rd quarter	324,423	18,958	355,280	4,342	3,720	506
4th quarter	323,542	24,007	401,408	6,052	4,742	347
1918 1st quarter	294,947	29,124	597,006	8,261	7,154	260
2nd quarter	293,039	33,884	954,362	7,873	7,870	507
3rd quarter	287,096	31,437	866,262	8,016	8,558	369
4th quarter	186,990	26,419	596,241	7,119	7,200	255
Totals	5,316,277	239,840	9,172,645	57,931	54,789	2,818

[1] Including 186,000 "Acceptances" of U.S.A. rifles.
[2] Including 154,000 "Acceptances" of U.S.A. rifles.
[3] Including 462,000 "Acceptances" of U.S.A. rifles.
[4] Including 391,000 "Acceptances" of U.S.A. rifles.

home manufacture. A total of 240,000 machine-guns were delivered. The total number of rounds of small arms ammunition manufactured amounted to 9,172,645,000, nine-tenths of which was manufactured in Great Britain.

The number of aeroplanes manufactured amounted to 54,789. The number of aero-engines was 57,931. The first tanks were delivered in the third quarter of 1916 and numbered 110. Owing to changes in design, etc., only 40 were delivered in the following quarter and 100 in the first quarter of 1917. The total number of tanks manufactured amounted to 2,818.

Mechanical Transport, Railway Material, etc.—The Ministry became responsible for the supply of motor vehicles on Sept. 1 1916. From this date to the end of 1918 there were delivered 33,000 heavy lorries, 2,500 four-wheel-drive lorries, 4,000 light lorries, 4,700 motor-cars, 1,700 ambulances, 4,100 Ford cars, 1,400 Ford ambulances, 12,000 Ford vans, 2,200 caterpillar tractors, 27,700 motor-cycles, 7,000 motor-cycle combinations and 185 armoured cars. The Ministry of Munitions from Oct. 1916 supplied 2,300 m. of 75-lb. rails, 4,200 m. of light rails, 750 standard gauge locomotives, 800 locomotives for other gauges, 13,000 petrol tractors and 33,000 railway wagons of various types.

During the War, Great Britain kept Italy and France supplied with coal, with substantial supplies of iron and steel, with benzol, and Italy with T.N.T., picric acid and other explosives. As regards finished munitions there was a certain amount of interchange between the various countries. For instance, Great Britain receiving aero-engines and some anti-aircraft guns from France and motor-cars from Italy, and supplying heavy artillery and ammunition, incendiary and other special small arms cartridges for use in aeroplanes and machine-guns. British assistance to Russia took the form almost entirely of finished products, including machinery.

II. THE UNITED STATES

No accumulation of war materials in excess of the amounts required for the regular army, which numbered 127,588 on April 6 1917, was made by the United States in anticipation of entry into the World War. The national army, 19 months later (Nov. 11 1918), numbered 3,757,624, of whom 2,086,000 had been transported to France.

War Operations of Americans, 1917–8

Men in France fighting	1,400,000
Men in France behind lines	600,000
Men in army in United States	1,700,000
Men in navy	550,000
Men in War work	7,150,000
Women in War work	2,250,000
Men, women and children not in War work	91,350,000
Total	105,000,000

The total number of American troops placed in the field was larger than could have been equipped with material of American manufacture. The European Allies guaranteed their surplus for the use of American troops, and thus ensured an earlier and more numerous American participation upon the firing line.

A large part of the munitions needed for maintaining an army of 4,000,000 men could be produced in the United States without difficulty. Such articles as shoes, socks, uniforms, blankets, food and food containers, camp utensils and equipage required only the drafting of specifications and the speeding-up of industry to produce the requisite amounts.

The Engineer Corps handled 3,225,121 tons of supplies during the 19 months of War; 1,303 locomotives and 18,313 freight cars were shipped to France; 1,002 m. of standard-gauge railroad track were constructed there. Most difficult of all was the problem of manufacture of delicate or heavy ordnance, siege guns, field artillery, machine-guns, rifles, aircraft, tanks and

Clothing, Etc., Produced and Shipped to the A.E.F. Between April 1917 and Nov. 11 1918

	Produced	Shipped
Blankets	19,419,000	3,127,000
Coats	22,603,000	7,294,000
Drawers	71,884,000	14,701,000
Undershirts	69,764,000	15,693,000
Shirts	22,198,000	6,401,000
Stockings	89,871,000	29,733,000
Shoes	26,423,000	9,136,000
Breeches and trousers	17,342,000	6,191,000
Overcoats	7,748,000	1,780,000

motor transport, in which quantity production depended upon slow and painstaking preparation of the preliminary processes, upon the supply of labour and raw materials, and upon the wise selection of designs and types to be manufactured. Considerable experience in the manufacture of ordnance and other munitions had been gained by private firms during the period of American neutrality through the fulfilment of contracts placed in the United States by the Allied belligerents. Most of the private capacity to make explosives, rifles, machine-guns and cannon was in use. The experience thus gained was an asset for the United States, but few of these resources could be diverted to the supply of American armies without endangering the supply of Allied armies already on the firing-line in the common cause.

General Munitions Board.—The advisory commission of the Council of National Defence early recognised that new factories must be erected for the construction of guns, aircraft and other munitions of the elaborate type, and that a preliminary determination of standards must precede this in order that the types put into production should be as few in number and as useful as possible. On March 20 1917 the Munitions Standards Board came into existence to advance this work as a sub-committee of the Council of National Defence. On April 9 it was reorganised as the General Munitions Board. Within a few weeks of the declaration of war numerous special bodies were created to carry on parts of the munitions work.

Ships.—The growth of shipping under the American flag (in vessels of 500 gross tons or over) was as follows:—

	Ships	Gross tons
Strength April 6 1917	1,614	3,569,675
New construction to Nov. 11 1918	704	2,287,034
Ships otherwise acquired to Nov. 11 1918	95	274,366
Enemy ships seized in United States	97	648,894
Dutch ships requisitioned	87	354,278
Total to Nov. 11 1918	2,597	7,134,247
Ships lost April 6 1917–Nov. 11 1918		
By enemy action	103	313,569
By other causes	213	416,578
Strength Nov. 11 1918	2,281	6,404,200

Aircraft.—Prior to April 6 1917 the United States had acquired in all 224 aeroplanes. The appropriations of Congress for military aviation were as follows:—

1912–6	$ 900,000
1916–7 (Urg. Def. bill)	500,000
1917 (Army approp.)	13,281,666
1917 (Milit. aeronautics)	10,800,000
July 24 1917	640,000,000
1917–8 (Urg. Def. bill)	43,450,000

The policy adopted by the air service was to design a standard type of aeroplane engine, put it into quantity production, and have ready for the campaign of 1918 a fleet of 22,000 effective aeroplanes. By July 4 1917 the first experimental "Liberty Motor," as the standard engine was named, had been constructed. After further refinement of design it was turned over for production to the manufacturers of automobiles in the absence of large aircraft industries in the United States. The first finished Liberty engines were delivered in Dec. 1917, and 15,572 more followed within the next year. The first American squadron completely equipped by American production was reported by General Pershing to have crossed the German lines on Aug. 7 1918. The A.E.F. was provided by the French Govt. with 2,676 aeroplanes, and received from the United States 1,379 planes of the De Havilland type. The delivery of aeroplane engines of all types to the Government in the United States began with 66 in July 1917 and rose to 5,297 in Oct. 1918, with a total of 28,509 to the end of 1918.

Gas Manufacture and Shipment

1918	Toxic materials produced (in tons)	Grenades, shell, etc., filled	Toxic materials shipped overseas (in tons)	Shell, etc., shipped overseas
Jan.	10	..	..	..
Feb.	61	..	..	..
March	211	..	..	..
April	399	..	..	..
May	697	..	..	..
June	993	..	..	..
July	1,351	73,201	..	..
Aug.	1,548	354,962	..	..
Sept.	1,911	374,968	..	..
Oct.	2,726	459,895	..	..
Nov.	910	151,043	..	..
Total	10,817	1,414,069	4,278	868,664

Heavy Ordnance.—Only six government arsenals and two private plants had had experience in producing heavy ordnance before 1914; by Nov. 1918 there were nearly 8,000 plants at work upon ordnance contracts, light or heavy. Up to the Armistice 1,102 guns (from 3-in. to 9.5-in.) and 14,623 forgings (from which the finished guns are turned and bored) were made in the United States for the Allies. Fifteen additional heavy-gun factories were equipped to meet the American need, and the rate of production for Oct. 1918 was above 24,000 guns per year. In mobile field artillery the French 75-mm. gun was accepted for the standard in quantity production, and its designs, with those for its intricate recuperator, were redrawn to meet American conditions in manufacture. The tolerances, which the French were in the habit of working out in the assembling plant, were reduced to figures and gauges in order to permit the American method of manufacture of separate interchangeable parts. In Oct. 1918 464 complete artillery units (guns, carriages and recuperators) were produced and delivered to the army by American manufacturers, with an accumulated total of 2,058 units to the end of the year. But no 75-mm. guns or 155-mm. howitzers of American manufacture were on the front at the date of the Armistice. The French Govt. provided the A.E.F. with equipment of this sort sufficient for 30 American divisions.

Production of Rifles

	1903 Springfield	1917 Enfield
1917	128,475	302,887
1918 Jan.	31,570	153,499
Feb.	9,370	170,857
March	540	160,142
April	2,631	167,485
May	3,970	181,034
June	6,759	191,354
July	16,879	231,193
Aug.	28,617	191,769
Sept.	33,583	199,635
Oct.	39,176	187,477
Nov. (1–9)	11,308	56,097
Total	312,878	2,506,307

Machine-Guns.—An American gun, invented by Col. I. N. Lewis, "was a revelation when it came to the aid of the Allies early in the Great War," and capacity for its manufacture was developed in private American plants on Allied order. In May 1917 the machine-gun board tested and adopted two newly

designed guns, one heavy and one light, both the work of John M. Browning. During Oct. 1918 the War Department accepted 14,639 heavy and 13,687 light Browning guns. By the end of the year 226,557 machine-guns of all types had been accepted by the United States.

Naval Ordnance.—Much delicate experimentation was done in search for new rangefinders and submarine detectors, various listening devices being brought forward for the latter purpose. The construction of the North Sea mine barrage called for the development of a new mine and anchor. Orders were placed for 125,000 mines, of which 56,611 were laid in the barrage by American mine-layers operating from bases in the north of Scotland, near Inverness. The whole barrage included 70,263 mines, of which 13,652 were British laid, covering a zone of sea from 15 to 35 m. in width, and to a depth sufficient to prevent submarines from diving under it. The complete barrier was in place by July 29 1918, although it was much tightened thereafter. The barrage is known to have destroyed 17 submarines and to have closed the North Sea outlet, particularly after Norway announced a determination to mine her own territorial waters adjacent to the barrage.

MUNSEY, FRANK ANDREW (1854–1925), American publisher and newspaper proprietor, was born at Mercer, Me., Aug. 21 1854. He was educated in the public schools and became a telegraph operator in Augusta, Maine. In 1882 he went to New York City and established *The Golden Argosy*, a magazine for children, later changing this to *The Argosy*, a magazine for adult readers. In 1889 he founded *Munsey's Weekly*, replaced two years later by *Munsey's Magazine*, the first monthly of its class to sell for the popular price of 10 cents. He also founded *The All-Story Weekly* (1904) and *The Railroad Man's Magazine* (1906) and purchased *The Baltimore News* (1908), *The New York Press* (1912) and the New York *Sun*, both morning and evening issues (1916). He merged the *Press* in the *Sun*. In 1920 he bought from the executors of James Gordon Bennett's estate the New York *Evening Telegram* and *The New York Herald*, together with its Paris issue. He combined the *Herald* and the morning *Sun* as *The Sun and the New York Herald*, but in Oct. 1920, changed the name to *The New York Herald*, at the same time continuing the evening paper as *The Sun*, thus perpetuating intact two names famous in American journalism. He died in N.Y. City Dec. 22 1925. By his will, after providing for relatives, he left the residue of his estate, estimated at $40,000,000 to the Metropolitan Museum of Art, New York.

MUNSTERBERG, HUGO (1863–1916), German-American psychologist (*see* 19.12), died in Cambridge, Mass., Dec. 16 1916.

Among his later publications were *American Problems from the Point of View of a Psychologist* (1910); *Psychology and Industrial Efficiency* (1913); *American Patriotism and Other Social Studies* (1913); *Psychology and Social Sanity* (1914); *The War and America* (1914); *The Peace and America* (1915); *The Photoplay: A Psychological Study* (1916) and *Tomorrow: Letters to a Friend in Germany* (1916).

MURAL PAINTING (*see* 19.16).—France more than any other country has maintained a continuous and vigorous tradition of mural decoration in recent years, and this despite economic difficulties and the vagaries of modern art. The annual Salons furnish an index to mural work though the final fruit does not necessarily appear in them.

French Examples.—Nearly every year murals have been among the most admired works of the Salons. In 1910 at the spring Salon it was the "Luncheon" by Aman-Jean, a large panel for a room in the Museum of Decorative Art which attracted all visitors. The autumn Salon of the same year was particularly rich in mural paintings. M. Denis, who had already won, with his decorations of the chapel of Vésinet, the position of France's leading decorator, left vacant by the death of Puvis, exhibited a series called "Florentine Evening," in which he combined with the chaste dignity of Puvis a Florentine sensitiveness suggestive of Fra Angelico and Botticelli.

Alongside these decorations hung four ingenious panels by P. Bonnard, with dancing figures in fanciful fountained courts and gardens and with fantastic irregular borders ornamented with silhouetted monkeys and birds. At the spring Salon of 1911 Aman-Jean's exhibit of two more figured panels for the same museum room was overshadowed by a great section of ceiling decoration for the Théâtre-Français in which A. Besnard gave a monumental presentation of the garden of Eden with various subsidiary figures, genii and writers. Even more admired, because of their simple subjects, lucid composition and idyllic charm, were three decorative paintings by Denis: "Sunny Sands," "September Evening," and "First Steps." The following autumn Salon contained two outstanding murals by J. Flandrin, "Summer" and "Fountain," both calm and spacious, and modern in matter as well as manner. The spring Salon of 1912 brought new laurels to Denis and Aman-Jean. The latter eclipsed his previous works with a decoration for an amphitheatre of the new Sorbonne, "The Elements," elaborate in symbolism, clear in pictorial conception and accomplished in execution. Denis filled his five staircase panels, "The Golden Age," with bathers, lovers, dancers, vintagers and the like in a vague enchanting paradise. In these panels he gave pictorial expression to what he has expressed in words: *L'art est la sanctification de la nature.* He revealed here his spiritual kinship to St. Francis of Assisi, whose Fioretti he has feelingly illustrated. In the spring Salons of 1913 and 1914 a series of decorations called "Garden Games" drew attention to another able mural painter, J. P. Laurens.

In 1913 the Théâtre des Champs-Elysées opened. Of its extensive wall paintings the most important are by Denis, though E. A. Bourdelle, E. Vuillard, K. X. Roussel, H. Lebasque, and Jacqueline Marval also contributed. Denis painted the frieze around the dome, consisting of four panels and four medallions. Two of the panels, "Dance" and "Musical Drama," are each more than 50 ft. long, and the other two, "Symphony" and "Opera" more than forty. While these four panels illustrate both the principal forms of music and the successive stages of its history its technical means are shown by four intervening medallions, "Orchestra," "Choir," "Organ," and "Sonata." Of their relation to the large panels it has aptly been said: *ce sont comme des reflexions intimes entrecoupant les grandes affirmations publiques.* The crowning panel directly above the stage, "Dance," distinctly recalls Ingres.

After the interruption of mural painting by the War, the French began again with remarkable precision exactly where they had left off. If any effect of the War on mural painting, other than impoverishment, was observable in the Salons of 1919 and succeeding years, it was a greater emphasis on subject and a greater demand for religious paintings. As before Denis was prominent. In the spring Salon of 1919 he exhibited a glorious "Annunciation," and in the autumn Salon of that year a "Jesus at the House of Mary and Martha." Another religious mural prominent in the autumn Salon was the "Ex-voto to Ste. Geneviève" by G. Desvallières. The following spring Salon contained L. Simon's diptych for the church of Notre-Dame-du-Travail in Paris, conspicuous because it is one of the few successful decorations inspired by the War. The energetic ascent to Calvary and the touching Mass of the dead soldier are modern, but reflect the grand style of religious painting of the 17th century; this adherence to the traditions of religious painting accounts for the compact composition, which makes the diptych seem crowded to eyes accustomed to the usual loose composition of modern murals. The post-War spring Salons were enriched by the decorations for the Conseil d'Etat at the Palais Royal by H. Martin.

The Paris Exposition of Modern Decorative Art of 1925 occasioned much mural painting, which was, however, not representative of all phases of contemporary work. P. Baudoüin's *Corporation de la Fresque* did many frescoes directly on the wall (instead of paintings on canvas attached to the wall, the now all but universal practice), among which "The Poet" by J. Adler and "Music" by L. Toublanc on the Cour Bouchard were outstanding. H. Marret was also represented by two frescoes on the exterior of the Pavillon Ruhlmann, though he commonly works on canvas; his principal contributions among many were four large paintings on the Cour des Métiers ("Traffic," "Sports," "Street" and "Architecture") and an "Annunciation" in the village church, to the decoration of which Desvallières contributed a retable and Denis a great Calvary, which served to reaffirm his supremacy. Deserving of mention also were the murals of G. L. Jaulmes and J. Dupas, who with his followers decorated the Pavillon du Collectioneur.

Courtesy of the New York Cotton Exchange

VIEW OF THE PORT OF ALEXANDRIA, EGYPT

Photographed in colour from the painting by Ezra Winter

Work in other Countries.—Compared with the French, the murals by artists of other European countries represented in the Paris Exposition were of minor importance; this corresponds to the minor importance of mural painting in those countries. The fervent nationalism throughout eastern Europe has given rise to ambitious patriotic decorations, such as those of A. Mucha for Prague, but not to mural painters of the first rank. East of France the most important figure of recent years was F. Hodler (d. 1918), a Swiss active also in Germany. Among his later works was the dignified " Unanimity " for the Rathaus at Hanover, exhibited at the autumn Salon of 1913.

Thus, while Hodler may be considered an offshoot of the figure tradition of France, Walser seems to be inspired by the luscious sign paintings of the Tyrol. Another interesting eddy somewhat like that of pre-Raphaelitism, is occupied by B. Goldschmitt, who completed in 1911 a droll cycle of frescoes representing the Tyrolese legend of King Laurin's rose garden for the Hotel King Laurin at Bolzano. The vigour of modern Spanish painting is attested by its power to propagate itself across the Atlantic whither two of its most representative mural series have migrated; the decorations by D. Rivera for the Ministry of Education in Mexico City and the 14 paintings of the provinces of Spain by J. Sorolla y Bastida for the Hispanic Society in New York.

An Anglo-American Tradition.—Britain and America have co-operated to such an extent in mural painting that one may speak of an Anglo-American tradition based partly on pre-Raphaelitism, and point to the American, J. S. Sargent (*q.v.*), and the Englishman, F. Brangwyn (*q.v.*), as its exemplars. This Anglo-American mural painting is the closest rival to that of the French school. It makes less use of landscape and poetry than the French and greater use of man and his material achievements. It is local and realistic where the French is idyllic. Its abstract figures are usually allegorical rather than mythological. The last murals by Sargent were those of the stairway and rotunda of the Museum of Fine Arts, Boston.

The decoration of the Missouri State Capitol is the largest current effort in mural painting in America. The following list of painters besides Brangwyn represented there is an indication of the size of the undertaking and of the number of mural painters in America: R. E. Ball, T. P. Barnett, O. E. Berninghaus, A. Blondheim, F. G. Carpenter, C. Hofbauer, R. Kissack, R. E. Miller, F. Nudersher, R. Ott, H. Reuterdahl, E. Wuerpel and N. C. Wyeth. The paintings of the Wisconsin State Capitol were undertaken about a decade earlier and represent the work of another group of artists mainly older: the sensitive and distinguished stylist, J. W. Alexander, who died in 1915, H. Ballin, E. H. Blashfield, who has been the most prolific of American mural painters, Kenyon Cox (d. 1919), E. E. Garnsey, and F. D. Millet. Quaintly illustrative and very personal are the murals by Violet Oakley in the Pennsylvania State Capitol. (*See* also PAINTING.) (J. SH.)

MURKLAND, WILLIAM URWICK (1842–99), American divine, was born Nov. 17 1842 in Demerara, British Guiana. When a child he moved with his parents to Petersburg, Va., and later to Richmond. In 1857 he entered Hampden-Sidney College, but on the outbreak of the Civil War enlisted in the Confederate Army. He was captured at Laurel Hill but was paroled, and returned to Hampden-Sidney College, where he graduated with first honours in 1862. Having meanwhile been exchanged, he again entered the Confederate Army. After the close of the war he entered the Union Theological Seminary of Virginia. After his ordination as a Presbyterian minister in 1869, he was pastor of Centre Church, Cumberland Co., Va. In Jan. 1870, he was called as assistant to the Franklin Street church, Baltimore, Md., and the following June was chosen pastor, which position he held until his death, May 13 1899. In 1890 he was a delegate to the World's Peace Congress in London. Dr. Murkland was one of the prominent figures in the Presbyterian Church in the United States.

MURMANSK, Russia, the Russian port on the Kola peninsula, has been connected with Leningrad (St. Petersburg) by rail since 1917. The line runs across the base of the Kola peninsula and along the coast of the White Sea, joining the Leningrad-Vologda line about 75 m. east of Leningrad. Owing to swampy ground, the line is almost unworkable in some parts of the summer months. A British flotilla was stationed at Murmansk in 1917, and after the Russian collapse, in order to maintain a hold on the coast, two cruisers and a battleship and 5,000 troops were sent in 1918. In that year N. Tschaikowsky overthrew the rule of the Soviets, and set up a provisional government with the help of the British forces; but after their evacuation in 1919 Murmansk came again into Bolshevik hands.

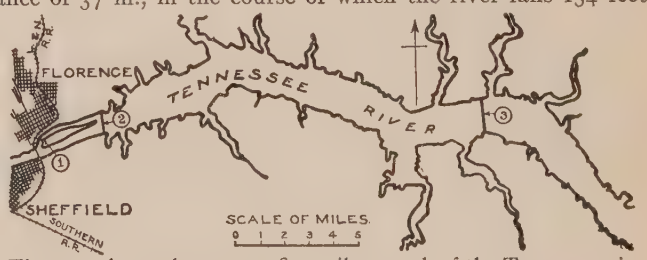
MURPHY, JOHN FRANCIS (1853–1921), American landscape painter (*see* 19.38), died at New York City Jan. 30 1921.

MURRAY, GEORGE GILBERT AIMÉ (1866–), British classical scholar, was born at Sydney, N.S.W., Jan. 2 1866, but left Australia at the age of eleven. Educated at Merchant Taylors' School, London, and St. John's College, Oxford, he at once established his reputation as the most brilliant classical scholar of his day, winning the Hertford and Ireland scholarships (1885), the Craven scholarship (1886), the prize for Latin verse (1886) and the Gaisford prizes for Greek verse and prose (1886–7). He was elected to a fellowship at New College, Oxford, in 1888, and next year to the professorship of Greek at Glasgow University, a position he held till 1899. In 1908 he was appointed regius professor of Greek at Oxford. In 1889 he had married Lady Mary Howard, daughter of the 9th Earl of Carlisle. Professor Murray's sympathies were always strongly shown on the advanced Radical side in politics. He was parliamentary candidate for Oxford University at the general election of 1918 and at a by-election in 1919, but was unsuccessful. During the World War he prominently espoused the cause of conscientious objectors, and later identified himself with efforts to ameliorate economic conditions in the enemy countries. In 1923 he was elected president of the League of Nations Union. He published a *History of Ancient Greek Literature* in 1897, but is more widely celebrated for his incomparable renderings of the plays of Euripides into English verse. Several of his versions were acted in England and America. He also published *The Rise of the Greek Epic* (1907; 2nd ed., 1911, 3rd ed., 1924) and *Four Stages of Greek Religion* (1913). Amongst his works on other subjects are *The Foreign Policy of Sir Edward Grey* (1915); *Faith, War and Policy* (1918); *Religio Grammatici* (1918); and *Problem of Foreign Policy* (1921). *See* GREEK LITERATURE: ANCIENT.

MURRAY, SIR JAMES AUGUSTUS HENRY (1837–1915), British philologist (*see* 19.40), died at Oxford July 26 1915, when *The New English Dictionary* had reached its 10th volume.

MURRAY, SIR JOHN (1841–1914), British geographer and oceanographer (*see* 19.42), was accidentally killed near Kirkliston, Scotland, March 16 1914. In conjunction with Dr. Johan Hjort he published in 1912 *The Depths of the Ocean.*

MUSCLE SHOALS.—The section of the Tennessee river, U.S.A., known as Muscle Shoals, extends from the head of Brown's Island, a short distance below Decatur to Florence, Ala., a distance of 37 m., in the course of which the river falls 134 feet.



The map shows the twenty-five mile stretch of the Tennessee river immediately above Florence, Ala., embracing the shallower section of Muscle Shoals. (1) the small dam affording a navigation approach to the Wilson dam. (2) the Wilson dam, the largest masonry dam ever built. (3) the contemplated third dam, which, when built, will render navigation for commercial purposes feasible at all times.

The depth of the channel varies considerably, but in places the minimum depth at low water is less than two feet, and commercial navigation at such levels has never been practicable. As early as 1827 preliminary surveys were made by the U.S. Govt. with a view to improvement, but nothing of permanent value was accomplished in the 19th century.

War Development.—Various proposals were made for power development between 1903 and 1912, but nothing definite was

attempted till the outbreak of the World War, when the urgent need for nitric acid for use in explosives induced the U.S. Govt. to construct two large nitrate plants at Sheffield near the lower end of the Shoals, to be operated by hydroelectric power. Plans were accordingly prepared in 1916 for a joint navigation-power scheme, involving the construction of three dams on the Tennessee river, and work was commenced early in 1918 on the major feature of the project, viz.: Dam No. 2, officially known as the Wilson dam. The work of construction was started immediately and the dam was completed in 1926.

Details of the Dam.—It is located a short distance above Florence and is a monolithic concrete structure, 4,500 ft. in length, 95 ft. high from the river bed to the crest, 140 ft. high from foundation to the level of the operating bridge and 105 ft. thick at the base. The structure contains about 1,353,000 cu. yd. of masonry, making it the largest masonry dam in the world—the Aswan dam on the Nile, its nearest competitor, having 1,179,000 cu. yards. It is equipped on the north side with two navigation locks, each having a lift of 46 ft. 6 in. at mean stage, and on the south side is the power-house, forming an integral part and continuation of the dam itself. The latter contains a spillway section 2,660 ft. long in the shape of an overfall dam with a heavy concrete apron and 58 steel floodgates to discharge excess water. Each floodgate is 18 ft. high and weighs about 33 tons. These gates are capable of passing a flood of 900,000 cu. ft. per second. On the top of the structure is a concrete arch bridge, supporting the floodgates and carrying a highway and a standard gauge railway track.

Power Installation.—The power-house is 1,250 ft. long, 160 ft. wide, and 134 ft. high, built of concrete with a steel trussed roof and designed for an ultimate installation of 18 hydroelectric units providing 612,000 H.P., the installation in 1926 consisting of eight hydraulic turbines generating 260,000 horse-power. Four units of this latter installation were placed in operation on Oct. 1 1925, the resultant power being leased to the Alabama Power Co. under a temporary contract, terminable on four weeks' notice. The water-power, when the full machinery has been installed and is utilising the natural flow of the river, will produce on an average 700,000,000 kw. hours of primary power per annum, *i.e.*, power which is available every hour of the year, and 1,490,000,000 kw. hours of secondary power per annum, *i.e.*, power that is available a portion of the year only. The total cost of the dam as it stands, including the present turbines, amounted to approximately $51,000,000, and at the peak of construction, 4,500 men were employed on the work.

Navigation Problems.—Dam No. 1, a small work also constructed by the Federal Govt., is situated three miles below the Wilson dam. It is 300 ft. long, having a lock with a lift of 17½ feet. Its only purpose is to provide a navigation approach to the lower lock of the Wilson dam.

These two units of the combined navigation power scheme do not in themselves solve the navigation problem, inasmuch as the Wilson dam only overcomes 96 ft. of the fall of the river at the Shoals, and the navigation pool provided by it only extends about 15 m. upstream. Consequently it does not eliminate the upper stretch of shoal water. To effect this object Dam No. 3 was designed, located 14 m. above the Wilson dam. When constructed it will overcome about 40 ft. of the fall of the Tennessee, provide above it a navigation pool some 84 m. in length and, combined with the Wilson dam, will eliminate the Muscle Shoals as an obstacle to transportation. In March 1926 nothing had been done in regard to this dam beyond some preliminary surveys and borings.

In Nov. 1918, when the Armistice was signed, the nitrate plants had not been completed. Units, however, were ready to start operations in Oct. 1918, temporary power being supplied by the Alabama Power Co. from its plant on the Warrior river, 90 m. south of Muscle Shoals, and the first ammonium nitrate was produced a fortnight after the Armistice. By this time the emergency had passed and the final work was not done till the summer of 1919. They have not been operated since. Their total construction cost amounted to $83,500,000. The future of the whole project was the subject of much discussion in Congress. Finally bids were asked for by the Government. On July 8 1921 Henry Ford made an offer but no action was taken in regard to it and Mr. Ford subsequently withdrew his offer. No action had been taken by March 1926.

MUSEUMS (*see* 19.60b).—The normal progress and development of museums in Europe since 1910 was rudely interrupted and gravely affected by the War. From 1914 to 1918 no government was in a position to spend much money on acquisitions, and many of the usual channels of supply were cut off. Staffs were depleted by the claims of war service; and although museums continued to play a not unimportant part as an element of refreshment in the strain of war, public interest was inevitably diverted from them. In addition, in certain cases, and notably in respect of the great museums and galleries of London and Paris, special measures of precaution had to be taken, which constitute a remarkable chapter in their history.

War Precautions.—The record of these precautions would need an article by itself. It would relate the hurried removal from Paris of a portion of the collections of the Louvre and other museums (principally pictures, but including the Venus of Milo) at the critical time when a German occupation of Paris seemed far from improbable; the measures taken to protect those which remained from the risks of bombardment; the further removals at the time of the German advance in the spring of 1918. In London it would have to record the protection by sandbags and by removal to basements of the chief treasures of the British Museum, the National Gallery, the Victoria and Albert Museum, the Wallace Collection and other galleries during the early months of the War; the closing of certain galleries in 1916 by the Govt. on grounds of economy; and particularly the great removals at the beginning of 1918, when the principal contents of all the great London collections found refuge in an underground tube railway, in the National Library of Wales at Aberystwyth and elsewhere. In Italy it would have to tell of extensive removals and protections at Venice and other northern towns. The experiences of Belgium and of the towns of northeastern France would also have to be recorded. Materials exist for such a record, and it is an episode in museum history of no little interest, one remarkable feature of which is the extremely slight injury caused by the hurried process of dismantling invaluable collections of most fragile objects.

The Functions of Museums

Leaving aside, then, the special subject of museums in war time, the purpose of this article is to trace the principal features of the development of the museum service and especially to indicate the progress that has been made in making the museums perform more efficiently the services which they are intended to render to the public. The main objects of museums are threefold: (1) to preserve the historical and artistic relics of past ages—the acquisition of objects; (2) to render them readily accessible to scholars—adequate housing and the publication of catalogues and reproductions; (3) to educate the general public—arrangement, display, labelling, guide-books, cheap reproductions, lantern slides, lectures.

Museum Extensions.—With regard to the first two of these heads there is not much to say. In spite of the grave financial difficulties in post-War Europe, new museums have continued to be built, and old museums have been enlarged. Among the more important may be mentioned the London Museum, opened at Kensington Palace in 1912, and transferred to Lancaster House in 1913; the Museum of Eastern Art at Cologne (1914); the Wellcome Historical Medical Museum in London (1913); the new wing of the British Museum (1914); the National Museum of Wales, founded at Cardiff in 1912, of which a part has been opened; a new wing of the Fitzwilliam Museum, Cambridge (1921); the Museo Petriano at the Vatican and the Museo Nuovo on the Capitol in Rome (1925). A new Science Museum was in 1926 in process of erection at South Kensington, and in the galleries vacated by it the War Museum was temporarily and inadequately housed. Paris has a Bibliothèque et Musée de la Guerre, besides a special Museum at the Invalides; in other countries more attention appears to have been paid to War Libraries than to War Museums. In Russia several museums and institutions, principally of science but also of ethnology and Russian mediaeval art, have been founded or extended since the Revolution.

In America, unhampered by war expenditure and enriched by the munificence of many private benefactors, new galleries have sprung up like mushrooms; and endowments on a large scale have been lavished, of which the most magnificent was the bequest of some £9,000,000 by Mr. Munsey to the Metropolitan Museum of New York.

Organisation of Expeditions.—Meanwhile, whether in new buildings or in old, the acquisition of fresh objects has gone on continuously. It is quite impossible to give particulars of even the most important; but mention should be made of one branch of collecting activity, namely, the organisation of expeditions by the greater museums for excavation and for natural history research. In this branch of museum work America, with its great pecuniary resources, has led the way. The American Museum of Natural History has continued to despatch expeditions to various parts of the world, the most notable being that to Siberia, which made remarkable discoveries of the eggs of dinosaurs. The Metropolitan Museum of New York has continued its very thorough and elaborate work in Egypt; the Museum of the University of Pennsylvania has had expeditions in Egypt, Palestine and Mesopotamia; the Field Museum of Natural History at Chicago has made large collections of natural history and ethnography; the Heye Museum of the American Indian investigated sites in New Mexico and elsewhere. These are but examples of the fruitful activity of American museums in this direction.

European museums have not been in a position to do so much, nor has the direct conduct of excavations been a common form of activity on the part of continental museums, though, in accordance with the national laws of antiquities, the museums of Italy, Greece and Egypt have profited largely from the researches undertaken, whether by their own countrymen or others, in the soil of these countries. In England the British Museum has undertaken archaeological excavations at Carchemish in Asia Minor and in Mesopotamia; and the Natural History Museum has taken part, in greater or less measure, in expeditions in Australia, East Africa and elsewhere. This is a form of activity which seems likely to increase, owing to the fact that several areas of great importance, especially for archaeology, have been made more accessible in consequence of the War. It has, moreover, stimulated public interest in such research, and may be reckoned as a contributing cause towards the development of public interest in museums generally, which is one of the notable characteristics of the period under review.

It is, in fact, in the relation between the museum and the general public, and in the development of the museum as an instrument in the general education of the nation, that progress has been most marked; and in any consideration of the future of museums this is a point of prime importance.

Educational Uses.—The earlier conception of a museum regarded it as in the first place a storehouse of objects of antiquity for the benefit of the student, and in the second as an old curiosity shop for the amusement and edification of the intelligent visitor. Its value as a means of education for the general public was not realised until late in the 19th century. In Great Britain the recognition of this function at first took the form of a great improvement in the labelling of the collections and the provision of illustrated guide-books suitable for the intelligent reader who was not a specialist, and serviceable even outside the museum as handbooks to the subject with which they dealt. At the British Museum this reform was mainly connected with the names of Sir Edward Bond and Sir Edward Maunde Thompson; and Sir William Flower at the Natural History Museum was a strenuous advocate and exponent of the popularisation of museums.

Museum Lectures.—In America a new departure was made in the provision of oral instruction in the galleries by official guide-lecturers or docents, the example being set by Boston in 1907. It was taken up in England in 1911, when the first official guide-lecturer was appointed at the British Museum; it quickly took root there (and at the Natural History Museum, which is governed by the same trustees); and thence, largely owing to the strenuous and persistent advocacy of Lord Sudeley, it spread to the other national museums and galleries, until now it can be said that the practice of itinerant lectures in the exhibition galleries by highly educated men and women, to chance audiences who assemble to hear them, is thoroughly established as a recognised branch of museum service. In smaller museums, where the attendance is not sufficient to provide daily audiences for a lecturer, similar work is nevertheless frequently undertaken in the form of advertised courses of lectures.

Improved Guide-books and Reproductions.—The educational value of museums has also been greatly increased by the development of methods of photographic reproduction. Guide-books can be made more attractive by plentiful illustration; and photographs, especially in the popular picture-postcard form, can be obtained very cheaply. These can be rendered far more useful for educational purposes if issued, as at the British Museum since 1914, and subsequently elsewhere, in sets dealing with special subjects. Fifteen postcards in monochrome, or six in colours, with a leaflet of information, can be sold profitably for a shilling, and furnish an interesting and attractive introduction to a subject. The danger is lest the productivity of a museum should be diverted overmuch into these popular and profitable productions, at the expense of those contributions to learning which every great museum is rightly expected to make.

This development of the educational and popular sides of museum work is not by any means confined to the great metropolitan collections. It is characteristic of museum work as a whole throughout England and America. Every active-minded curator is anxious to make his museum a living centre of intellectual interest; and the future of m seum development depends mainly on the answers to be give to the question, How can museums be made more serviceable to the nation?

Research and Scholarship.—A distinction must be drawn between the great museums of the largest towns and the most important universities and the municipal museums of provincial towns in general. The former, while never forgetting the service which they owe to the general public, must not sacrifice to it their duty to scholars and researchers. For these, quantity is often as essential as quality. It is sometimes supposed that the great museums contain masses of objects with which they could well dispense, and which could more profitably be distributed among, or at least lent to, the smaller museums. It is, in fact, seldom and to a very small extent that this is true. The scholar who is investigating a particular subject needs to have under his eye, for examination and comparison, a great mass of material. He needs many editions of an author, many examples of the work of an artist, many specimens of Greek vases or Chinese porcelain, of birds, beasts, fishes, insects, fossils, minerals or flowers. His work would be ruined if he had to search for these in many different collections; and it would be exasperating to find that the objects which he had the right to expect to find in a particular museum had been scattered on loan among a score of provincial collections.

What the curator of such a museum has to consider is, not whether he has in his collections a finer example of a certain class, but whether a particular object is needed for the scientific study of the class to which it belongs. At times, no doubt, a specimen once useful may have lost its value and can be dispensed with, but this happens comparatively rarely. Nor is there much danger lest the museum curator should be led away by the lust of acquisition. Purchase grants are not so lavish that he can afford to buy anything that he does not really want; and in most great collections the demands for accommodation are so pressing that he will gladly dispense with anything that is really superfluous.

The Ideal Museums

The need of great museums, then, is proper provision for (*a*) the student, (*b*) the general public. The difficulty here is mainly structural. There was a time—a time when most of the museums in Europe were built—when there was no great difficulty in putting all the collections of antiquities on exhibition without overcrowding. That time is long past, and what is needed now is to apply to antiquities the method which has always been applied to books and prints and often to natural history specimens, namely, to exhibit only a small selection to the public, while providing facilities for students to examine the mass of the collections in convenient circumstances.

The ideal museum—an ideal realised in some of the latest—is a succession of public exhibition rooms in which a small number of the best specimens are well spaced out and adequately labelled, and another series of rooms in which students can sit down to the examination of a large number of specimens, or the intensive study of a few, according to the need of their study. The general public will have a better chance of appreciating without fatigue the charms of Greek vases or mediaeval enamels from 50 good specimens well displayed than from 1,000 ranged in serried rows of shelves. What most of the older museums need, and what architects have seldom been asked to provide, is ample storage accommodation. They would then be able to discharge the double duty—each so important—which rests upon them.

Provincial Museums.—For the provincial museums the balance of responsibilities is different. Although they can often give important aid to research, their first duty is usually to the general public. Here the educational function is paramount. Few general laws can be laid down, because museums differ so greatly in their possessions and their opportunities. A provincial museum can seldom aim at universality, but it can do much by a wise cultivation of its own particular garden. One duty is incumbent on all, to create interest in, and to diffuse knowledge of, the localities in which they are situated. The history of the town, the records of its buildings and its eminent citizens, the geology, fauna and flora of the surrounding country, the principal arts and industries of the neighbourhood—these are subjects which all active museums now regard as their proper sphere, and which they strive to illustrate with all the materials that they can acquire. On these subjects they are entitled to aim at being exhaustive. On more general subjects they can only hope to be able to give partial representations, and each must cut its coat according to its cloth.

One general counsel can be given—to vary the exhibitions as much as possible, to seize opportunities of giving them topical interest, to add to their educational value by lectures, leaflets and photographs, and generally to cultivate an air of alertness and change rather than sameness and monotony.

Loan Collections.—In this connection the question of loans is of importance. It is clear that provincial museums would be much assisted in provoking interest and in spreading education if their permanent resources were reinforced by temporary exhibitions of loan collections. It is here that a gap exists in the museum system which could be filled with great profit. It has already been indicated that not much help in this direction is to be expected from the great national collections. Local museums might help one another, to some extent, by temporary exchanges of exhibitions on subjects in which each happened to be strong. In some cases also permanent exchanges might be arranged.

Central Depository.—But a very real service to the education of any country would be rendered by the creation of a strong central depository of loan collections. In England a service of this kind, designed in the interests of craftsmanship, was a prominent feature of the original plan of the South Kensington Museum. In the department of classical archaeology, experiments in this direction have been made in England, Ireland and America (see H. Browne, *Our Renaissance*, 1917, pp. 184–281). But a stronger, better supplied, state-supported central organisation is required, which need not be costly, since it would receive subscriptions from the local institutions which had recourse to it. Taking the country as a whole, there will be a great economy in a central circulating collection as compared with a large number of local museums, each trying to add to its permanent collections of non-local objects. The central collection would not need to indulge in expensive purchases, since it would not aim at acquiring objects of the first rank; and it would receive such objects as the national museums were able legitimately to spare.

The main needs of the museum service, then, certainly in England and in varying degrees also elsewhere, are: for the greater museums, restricted exhibition to the public and fuller accommodation for the student and for storage; for local museums, centralisation, co-operation and devotion to the education (in the broadest sense) of the local public.

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MUSIC (*see* 19.72).—The purport of the present article is not that of a *catalogue raisonné* of modern music; its intention is to put forward certain general principles that seem to have become more clearly manifested since 1910. Any works and composers that are mentioned will be selected merely as the first convenient illustrations of these principles; and the convenience will be avowedly accidental. This method has, in the past history of criticism, always proved to give results far more interesting than those of an attempt to catalogue and estimate contemporary events and works; nor does the dearth of names and titles detract greatly from its interest. The greatest art takes ample time before its impulses reach the main stream of historic tendency, so that the contemporary view of the main stream is naturally, and not unjustifiably, preoccupied with work that will not interest posterity; while, on the other hand, future historians will, as often hitherto, have great difficulty in finding any historic importance in the works which prove immortal.

But we are on solid ground if we fix our attention on prevalent tendencies shown by large bodies of work and of criticism, and on the conditions in which the work is produced and enjoyed. There are periods of artistic transition in which tendencies are too vague or too involved to be distinguished by the contemporary observer. If perhaps this was so in the beginning of the 20th century, things had become clearer by its second decade; and it was possible to draw an emphatic distinction between what is real and what is unreal in the music of the day.

I. INTRODUCTION

Defects of Contemporary Criticism.—It will be convenient first to deal with the unrealities. The most formidable of these arise from the unnatural conditions on which the modern musician acquires his reputation. At no period in history has an artist been able to make his living solely by his highest line of work; but the hardships of the classical artist's life were at all events not unnatural. They were average effects of human nature, and not of an inflated self-consciousness among art critics. It has always been hard to struggle against a depressing prevalence of dull or vulgar tastes and pedantic conventions; but such a struggle is life, and victory in it is health. Far less certain is it that life and health can be found in the struggle for musical reputation under modern conditions; especially for reputation as a composer.

The grounds on which new music is commonly criticised are no longer grounds of healthy and intelligible discussion. The critics, conscious of the proverbial persecution of genius by contemporary pedants and upholders of convention, are now unanimous in condemning all that is under suspicion of being "correct," and are desperately anxious that no *soi-disant* revolutionary tendency shall miss acclamation and that no dangerous outbreak of normality shall escape damnation. The music that is most written about and talked about is the music about which it is the easiest to say clever things. The clever things must be or seem to be intelligible to the general reader; and this means that they must not be musical facts, for musical facts are involved in musical technicalities. Yet the clever sayings must be impressive. The result is a special psychological jargon, mostly unknown to psychologists, which the general public believes to be a musical jargon. The public finds it fairly amusing, especially when the critics, having exhausted their stock of new musical discoveries and revolutions, are reduced to discussing each other. But it may be news to the public that the jargon is almost wholly unintelligible to real musicians, and nowhere more unintelligible to them than where it employs musical terms.

Meanwhile real music struggles into existence, and even occasionally into recognition, while fashion follows the journalists and awards fame without popularity 10 times a year to musicians of perfectly respectable character and intellect who are driven to pose as lunatics lest sanity should earn them the reputation of

prigs. In such conditions it is not surprising that there is more genuine musical life in provincial districts than in the metropolitan cities. The musical life of the provinces is their own; the metropolitan public is so anxiously watching the jumping of the critical cat that even the formation of coteries is conditioned more by diplomacy than by enthusiasm. Popularity and healthily good music are driven to meet on new ground. Theatre music, apart from opera, is in Great Britain still in a state of squalor, which must remain hopeless as long as British theatregoers maintain the habit of drowning the musical *entr'actes* in talk. But the cinema produces a remarkably perfect silence in spectators, and in its not always fresh atmosphere many an excellent player finds a livelihood which he can ill afford to exchange for a good position in a permanent orchestra. The London music hall, especially since the advent of the great Russian Ballet dancers, has drawn into its sphere of influence many a serious musician, among composers as well as performers; and the composers to whom it is still a strange environment may sometimes find that more than a pot-boiler impulse and technique are required of them if they are to distinguish themselves there.

At all ages there have been heartsearchings as to the border lines of "legitimate" art, and the origins of the highest classical art forms have far more often been popular tendencies than critical doctrines. The health and fruitfulness of permanently valuable art demand two conditions: first, that artists shall have the inducement of a living wage for producing it; secondly, that audiences and spectators shall be accustomed to receive it so attentively as to induce the artist to refine his style. Art does not thrive in a state of public opinion and critical jargon in which nothing is allowed a right to exist except works of devastating genius; and genius itself stands less chance of recognition in such a state than in any other. A good period of art is that in which the ordinary styles are so good that the sensibilities of a child of genius are not starved or disgusted by them before he has had time to outgrow them as a genius must. Nothing good can be expected for genius or philistine from a state of art in which every style is ostentatiously paradoxical.

Between the fruitful and the unfruitful tendencies in contemporary music, the questions at issue are not primarily matters of taste or tradition. It may be assumed that vital art has deep foundations of taste and tradition, even if it professes to revolt from them all; but the signs of its vitality are neither in revolt nor in conformity, but simply in the variety and the coherence of the art in itself. And the variety and coherence are matters of discoverable fact. Principles which make for them are likely to be sound; principles which destroy them are, if correctly stated or imputed, certain to be unsound. We must, however, bear in mind that the creation of a work of art is an altogether different process from criticism and analysis. The craziest theory may be accepted by a composer as being his method of work, and it will do him not the slightest harm so long as it keeps his attention so poised that the depths of his mind are free to express themselves. But the same theory will be disastrous to most of his disciples, though some may share his luck with it. The classical art forms were not, in their origin and maturity, crazy theories, but shrewd generalisations from familiar experience. As that experience becomes remote the art forms lose their vitalising expressive power. But there is more vitality in remote experience than in none at all; and a mere arbitrary contradiction of old artistic theories is, one would think, the most obvious sterilising procedure that could be devised for future art.

II. MODERN MASTERS AND THEIR WORK

Scriabin's Harmonic System.—The procedure is seen at its worst when it is applied to some all-pervading category of music, such as harmony. Whatever may be the merits or the fecundity of the composer, we may be absolutely certain that when he explicitly promulgates a new system of harmony he is talking nonsense. Scriabin (1871–1915) began his career as a brilliant 20th century Chopin, with an unmistakable power of composition in large and free form, besides a happy vein in the tiniest of preludes. In time, certain harmonic mannerisms developed: the composer was inspired to write for orchestra; his vigorous talent for composition not only stood the strain of this larger medium but remained traceable in works based each on some single artificial chord of which the original meaning is obviously a Wagnerian progression, but which was expounded to the gasping interviewer as the most perfect chord in music. And so the gasping interviewer went on his way rejoicing in the possession of a profound technical mystery worthy of revelation together with the composer's theosophic doctrines and other matters of popular interest. There is no reason for doubting the composer's sincerity either in his theosophy or in his harmony. Artists are seldom also men of science, and even men of science keep some region of their minds in a state of holiday wherein they may be perfectly arbitrary and self-centred. Art originates from such regions of the mind, but it will be stifled, and those regions will be starved, unless it emerges and forages in the wide world of human life. Egocentric as is the nature of art, the confines of one personal life are not enough for sane self-development; and the personal note of the artist who retires into the recesses of his arbitrary domain will not long retain its power.

The untimely death of Scriabin left his art just at the point where it was beginning to alienate his enthusiastic supporters. Contemporary enthusiasm and hostility on theories of harmonic style may be left to the theosophists. The important fact is that Scriabin did, while he lived, produce compositions with a large flow and climax: nor do we know that his power to do so was likely to fail him. But the lesson of three harmonic revolutions, distributed over five centuries of musical history, is that wherever a composer becomes preoccupied with harmonic ideas his power of composition is in greater danger of dwindling than when his interests lie in other categories of his art. Scriabin himself complained at last that all his harmonic efforts had not carried him essentially beyond the dominant seventh; and herein history repeats itself, for the complaint is substantially that with which Philipp Emanuel Bach refuted the harmonic theories of Rameau, saying to Burney that he could conceive nothing more childish than this notion of the "fundamental bass," inasmuch as it "would reduce all music to a series of full closes." The truth is that all purely harmonic ideas first become intelligible by gravitating towards a full close; just as all verbal ideas gravitate towards the form of a subject, a predicate and a copula.

Nor do harmonic ideas escape their fate by being based on conceptions which deny the aesthetics of classical polyphony and attempt to treat chords as pure sensations without relation to the melodic progression of their individual notes. Sooner or later the composer will awaken to their possible meaning in a polyphonic scheme. Thus Walford Davies has sealed the fate of the "whole-toned scale" (once believed to be the anti-polyphonic backbone of Debussy's art) by pointing out that it is not a scale at all but a chord, which, properly distributed in different octaves, can resolve in six enharmonically different ways, none of which have anything to do with the sceptical and mechanical train of thought which tries to base harmonic systems on the limitations of the equal-tempered pianoforte with its 12 semitones to the octave. It is not worth while attempting to catalogue the systems of harmony evolved at the pianoforte by composers who continue to imagine that chords can be built up in fourths or in other *a priori* ways as rhythmless and unmelodic entities. Whatever the reader's indignation at finding in this article no treatment of the dozens of harmonic and musico-metaphysical topics he hears of to-day, he may comfort himself with the certainty that nobody will have heard of most of them next year. One might as well discriminate between the fashions which dye the hair green and those which dye it blue.

In all the chaos of recent experiment with discord and disordered rhythm, two questions alone are capable of permanently significant and truthful answers: the one concerns the composer and the other the listener. To the composer we may address Brahms' rude query, "Do you find this fun?" Of the listener we may ask, "Can you find a sufficient variety of coherent definite elements, events, qualities and forms in this art, quite irrespective of any question of novelty?" This question must

be answered with regard to all the elements of the art from the oldest to the newest, and it is one of the few sound artistic questions which concerns an artist's whole output as well as individual works, *e.g.*, whatever may be thought of Scriabin's last harmonic obsessions, his smallest preludes, early, middle or late, could not have been created by a composer who could do nothing else. It is an accident that his work made a new sensation: it is an essential fact that he is a composer. Without the power of composition a new sensation cannot last, even if it can make its mark at all. With power of composition everything in art must some day find wide recognition, if it escapes physical destruction; for no composer attains such power without being driven by strong human impulses. Epigrams are not enough. Human experience vividly presented never loses point.

Stravinsky and the Ballet.—But the chances of producing permanently living work are heavily weighted against the composer if he concerns himself only with things which he alone can understand. The Russian Ballet gave abundant vital impulses to music so long as it dealt intelligibly with drama, fairy tale, fable and life; and the young Stravinsky of *L'Oiseau de Feu* found in it inspiration for music that remains brilliant and intelligible apart from the ballet. In *Petrouchka* he still makes rhythmic and instrumental sounds that faithfully follow and enhance the moods of a fascinating pantomime; but the concert-goer who, knowing nothing of the ballet, affects to be moved by the music in an orchestral concert, is little wiser than the man who would rather say he preferred the wrong end of his asparagus than admit that he did not know which was the right end. The ballet is to the composer an easier and therefore more dangerous art form than the opera; in both cases the listener will always give the music credit for all the qualities of the scenario if the composer only manages not to interfere with them.

Self-deception, loss of vitality, decadence and dry-rot set in when the designers of the ballet themselves retire into the arbitrary kingdom of abstractions which they call symbolic, and which common sense calls nonsense. There is a real kingdom of nonsense, and it will have none of your owlish aesthetic solemnity about morbid twists of mind. Lewis Carroll, trained logician, leaves it to later commentators to identify his Snark with the Absolute, or with the company promoter; his and Edward Lear's wonderland of nonsense is a school of manners in the light of which any explicit social satire and many fantastic flights of modern musical imagination appear almost equally convicted of grossness and heavy incongruity. For music, as for all arts, the fruitful path, and that which leads even to the sublime as well as the imperishable, is a path of unselfconscious childlike enjoyment of the matter in hand, with no petulant preoccupation with the stupidity of the outsider. Erik Satie is amusing enough with his *Vraies préludes flasques pour mon chien*, his *Aperçues désagréables*, and all the rest of it; his works are announced with the challenge, as to *les Aplatis*, *les Insignifiants* and other more Rabelaisian nonentities who will not enjoy them, "*qu'ils avalent leurs barbes! qu'ils se marchent sur le ventre!*" English patriotism cannot but feel flattered by this contrast with the perfect manners, perfect scholarship and perfect art with which Holst has made a fairy tale of all the operatic styles in musical history in *The Perfect Fool.*

Gustav Mahler.—Prominent among the eternal questions which agitate the contemporary critics of all arts at all periods is the proportion of means to ends. The modern orchestra grows easily with the demands of the modern composer, for, in spite of local and temporary difficulties, it is to the interest of players that orchestras should increase as well as multiply; but the most extravagant modern composer has never yet faced the problem of designing music for which the band and chorus of a Crystal Palace Handel Festival would really be to the purpose. In other words, the Handel Festival exists; but the music for an organisation of even half that size has never yet been composed.

Here, then, is material for a real aesthetic development; and herein lies the significance of the recent vogue in Holland of the enormous works of Gustav Mahler. That great Viennese orchestral conductor died almost a generation ago, and his symphonies owe much of their recognition to the personal zeal of their apostle, the eminent conductor Mengelberg. It is improbable that the music-lovers of other countries will ever readily receive these huge volumes of naïve sentimentality and boyish grotesqueness. But the works nevertheless demonstrate at least three vital things: first, that it is still possible for a composer to pile up structure of illimitable extent in the most unsophisticated harmonic and melodic style; secondly, that, whereas taste cannot even begin to express itself without some technique, an immense amount of technique may be learnt from work which cannot be said to show any taste at all; and thirdly, that whatever may be objected to Mahler's taste and form in this direction, he undoubtedly fulfilled his set purpose of working out the pioneer aesthetic and technical principles of music designed for 1,000 performers and upwards. And this is no decadent proposition.

Decadence lies rather in the performance of classical music on a scale for which it was never remotely conceived. The real problems of music for 1,000 performers are, as Mahler perceived, problems for a severely disciplined and accurate imagination; and nothing can be further removed from the world of arbitrary artistic egoism. They are not to be mastered by the methods of that kind of extravagance which now and then displays a revulsion in some absurd economy, like Meyerbeer's old trick of thin and inadequate harmony for one voice supported insecurely by one horn and a spasmodic gurgle on a solo violoncello. With much of Meyerbeer's "best-seller" qualities, Mahler nevertheless has none of Meyerbeer's worldly wisdom, and in his special field there is as yet no greater and more masterly idealist. In vocal music he often attains great beauty and purity of style.

Schönberg.—The main stream of music still flows within the Wagner-Strauss limits, and seldom requires 150 instrumental players. Arnold Schönberg's *Gurre Lieder* (a large vocal and choral cycle, the great success of which is held by his disciples to be a serious hindrance to the spread of his later gospel of *a priori* harmonic revolution) requires a huge orchestra; but the very fact that the score often employs 50 staves proves that Schönberg is by no means imagining the aesthetics of an unprecedented scale of performance; the polyphony that requires 50 staves for its notation implies detail rather than bulk.

Max Reger and Classicism.—The life work of Max Reger presents a strange study of artistic vitality working on methods the reverse of vitalising. At first sight his productivity seems enormous; and since Orlando di Lasso in the 16th century we have had no other conspicuous instance of a composer who seems always able to sit down before a pile of blank music paper with a blank mind and work himself up into genuine inspiration by sheer interest in the weaving of rich musical texture. To the present generation of German musicians Reger is the last of the classics; but there are few things in music less classical than Reger's art forms, rigidly orthodox though they seem. They are the direct result of extraordinary docility in the pupil of the most systematic musical scholar of recent times, and anyone who has groaned in spirit at the sight of one of Hugo Riemann's editions of a piece of classical music may easily recognise in Reger the traces of his teaching. Every external feature of the classical art forms is present without any trace of the classical reasons for it. Everything has been worked out from one detail to the next, without any first principles to account for the whole procedure.

A facile contrapuntist, Reger writes untold numbers of fugues, all on one mechanical plan, mostly with some combination of subjects, but never a combination between subjects sufficiently contrasted to give it point. His instrumental works are for the most part cast in sonata forms; except for the incessantly modulating and chromatic style, the whole collection of works contains neither an unorthodox procedure nor the slightest reason for its orthodox procedures. Bach wrote great works for unaccompanied violin, and Reger does likewise. But he shows no sense of the principle that Bach's unaccompanied melody is its own bass; Reger's melodies cry loudly and ambiguously for harmonic support. You might as well cut out with scissors a full-face portrait of a judge in his wig and expect it to be recognisable as a silhouette.

Whatever is to be learnt from Reger, it is not the meaning of classical art forms. And much is to be learnt from Reger. His texture is inevitably thick, for his rigidly systematic completeness vetoes that suggestiveness which is one of the secrets of the greatest art. But it is astonishingly sonorous, and, in its heavy literal-minded way, effects its purpose in the fewest possible notes, numerous though they be. Every instrument is profoundly studied and developed on the basis of its natural technique; and while the player who claims that he can read Reger at sight is probably mendacious, he will enjoy his instrument all the better for playing Reger well. Nor is this the only or the most important non-egotistic reality in Reger's work. The reality of Reger is that he is a consummate and impassioned rhetorician. His unreal art forms hinder and help him no more and no less than the alphabetical acrostic hindered and helped the poet of the *Lamentations of Jeremiah*. He extemporises on paper, and is profoundly attentive to the nature of his instruments and to whatever text he is setting in his vocal music. In the history of art there can be no more conspicuous example of the difference between analytical theory and the practical conditions of creative work.

Bantock, Holst and Boughton.—The only things that matter to the composer and to his posterity are the things that help or hinder him in creating his works. Posterity will not inquire whether Sebastian Bach, Granville Bantock, Richard Strauss, Busoni—whosoever you will—were reactionaries or revolutionaries, whether they followed classical forms, misunderstood them or abolished them. Nor will posterity pay any attention to the questions we so often ask as to whether such and such a composer's work has led to further developments or hindered them. This is a totally different question from that which is often confused with it, the question whether certain principles (such as a revolutionary but disciplinarian theory of harmony) do or do not interfere with a composer's capacity to write coherent and fluent works. On the sane musician the effect of the achievements of Wagner or Strauss is to enlarge his ideas of the range of his art.

He is not obliged to cover that whole range himself; and the musician who, not being Wagner or Strauss, dooms himself to failure by working on their huge scale with inadequate resources, does not thereby show that his artistic balance would lead him to better success on a smaller scale. All great art may be accused of "leading to a blind alley," inasmuch as its achievements are always individual and unique. Yet every achievement that lives (and many live, like the works of Domenico Scarlatti and Couperin, that cannot well be called great) is a source of inspiration to right-minded artists. It is not a matter of taste; nor need it be an incitement to handle any particular art form or to imitate the style that has inspired the artist with Correggio's conviction "*Anch'io son pittore!*" It would be difficult, for instance, to name any composer whose style shows the influence of Granville Bantock; just as it is difficult to trace in his style, otherwise than by merely technical measurements, the influence of Strauss and of the schematic purity and brilliance of Russian orchestration. Yet there is probably nowhere in Europe a more radiant source of musical health.

Another striking example of artistic vitality commands attention in the work of Gustav Holst, an English composer whose interest in oriental subjects is (like Bantock's) no whim for *chinoiseries* but a true expression of the nostalgia of the West for the East. In every direction his work is masterly, independent and indisputably real. *Savitri* is an oriental opera written with the slenderest of instrumental resources and with much singing that is not only unaccompanied but unharmonised. Holst has also produced beautiful songs for the strange combination of a solo voice accompanied only by a violin. At the other end of the scale we have his orchestral work *The Planets*, in which he shows his full musical freedom. Probably the work in which his design most accurately and tersely fills its space is his setting of the sublime ancient Byzantine *Hymn of Jesus*. Here the music seems indistinguishable from the text; and its primitive and drastic harmonic logic, which technically could not have been written before the time of Debussy and Ravel, is no more suggestive of the fashions of to-day, or of any day, than the awe-inspiring Eucharistic text which reverberates through it. No modern music is more utterly unsuggestive of outward and technical resemblance to the classics, and none rests on deeper foundations of musical scholarship.

Among the most significant signs of life in English music we must mention Rutland Boughton's remarkable musical festivals at Glastonbury, where (until interrupted by the World War) he produced English opera on a small scale, ranging from Purcell to his own and other contemporary works, several of which have since become famous.

Strauss's Later Work.—It is easy to ask what effect the World War has produced on music. The wisest answer is negative. The ascertainable effects of the War upon the arts are blankly destructive. Few, if any, of the works written avowedly to commemorate the War can possibly succeed in meaning what they say or saying what they mean. And of the losses to music, who shall discriminate between the talents that had been given time just to reveal their promise and those that were cut off yet sooner? What now of Russia, where in 1921 world-famous composers were living in starvation without even paper to write on? If any musical work is destined to impress posterity as a noble expression and reaction of the World War, the choice might fall on Richard Strauss' *Die Frau ohne Schatten*. His *Alpen-sinfonie*, which, designed before the War, appeared in 1915, was a great disappointment, amiably commonplace in "programme" and sentiment, and hardly more than automatic in its characteristic "road-hog" technique.

As regards *Die Frau ohne Schatten*, the style of Richard Strauss is no longer a new sensation, and it cannot be easily proved to be less automatic here than it is in the *Alpen-sinfonie*. The intention of the work as a whole must be ascribed to the poet Hofmannsthal; but this does not minimise the importance of what Strauss can achieve at the height of his power and inspiration. His mastery of composition and texture has never been seriously in dispute, whatever exception may have been taken to the extremes and licences of his style; and as the poet's intention is noble, the composer has made its realisation vivid as no one else could imagine. From the twilight of 19th century and recent erotic art, and from its always selfish and sometimes abnormal sexual preoccupations, *Die Frau ohne Schatten* breaks away, and its plea for love is nature's plea for life. Musically it is, more copiously than any of Strauss' former works, an occasion for beauty; as a dramatic spectacle it is a gorgeous fantastic pantomime, of which the allegorical meaning leaves it hardly less childlike than *Die Zauberflöte*, which it in some points intentionally resembles. It is altogether a noble and heroic work, unassailable by any cavil that does not condemn itself as ignoble.

III. THE FUTURE OF MUSIC

A New Pianoforte.—In the early summer of 1921 a new kind of double keyboard for pianofortes, invented by the eminent Hungarian composer Emanuel Móor, and manufactured by Messrs. Schmitt-Flohr of Berne, was demonstrated in Berne to large audiences. Two things stand in the way of its development as the most important invention in musical instruments since the pianoforte itself; first the commercial difficulty in promoting an improvement that cannot be simply added as an extra apparatus to an existing pianoforte; and secondly, the tendency to expound it as a device that makes existing feats of pianoforte technique nugatory, a policy which merely infuriates the pianoforte virtuoso. The real importance of the invention lies in its entirely new resources. The principle is simple and might just as well have been discovered when the pianoforte was first invented: in which case Mozart's pianoforte-technique would have begun considerably beyond the point where Beethoven's now leaves off. Two manuals are placed, the one so slightly raised above the other that a perfect *legato* in rapid passages is obtainable between them by one hand. The second manual is an octave higher than the first. Thus the normal stretch of one hand is two octaves instead of one; and with the cultivation of a new set of movements of the hand, backwards and forwards as well as laterally, the possibilities of pianoforte-writing already seem

limited only by pure musical aesthetics. But this is not all; the two manuals can be coupled together by a pedal, so that the instrument possesses much of the property of the organ and also of the harpsichord, in the power of doubling a whole mass of harmony or any part thereof in " four-foot tone." The restoration of harpsichord effects is completed by a lever which operates a kind of sordine, producing a somewhat crudely generalised harpsichord tone which later improvement may make very valuable.

There is a vast new technique awaiting long study and exploration; but the merest rudiments of it produce astonishing results in a short time, for the pianist who gave the first public demonstration did so within six days of setting eyes on the instrument. Doubtless it will develop its own vices as well as resources, but it begins by depriving pianists of occasion for four-fifths of their worst habits, and sets a premium upon a Bach-like and Mozart-like cultivation of polyphonic *cantabile*. Many composers use the pianoforte in the act of composition far more than they are willing to admit. They know it to be a bad habit, because it tends to cramp their invention in two directions: it confines phrasing to the obvious sequences that muscular memory best grasps, and it confines part-writing to the compass and convenience of the hands. The second limitation is now removed, and those composers who suffer from " pianistic " habits may learn from it a greater freedom in their writing for other instruments and for orchestra. Thus there is no region of music unrelated to Emanuel Móor's duplex coupler pianoforte, and this instrument should become a very important source of interest and inspiration in the music of the future.

Wireless and the Future.—The development of wireless broadcasting is effecting, in music as in other matters of entertainment and education, changes which only future generations will be able to estimate. The industrial revolution it will create in the lives of musicians will need wise guidance if it is to be beneficial to music. The function of the large orchestra in the public hall will never become obsolete, for the sounds that reach the ear from the dispersal sources of an orchestra have an acoustic perspective which no improvement in " loud-speakers " can impart to a transmitter or phonographic recorder which emits all sounds from one place. The simple experiment of putting the hands around the ears while listening to an orchestra in a concert-room will convince the listener that a " gramophone effect " is little more than the result of cutting off the waves that reach the ear from other than frontal directions. Apart from the improvements of technique that are rapidly making the transmission of timbre and balance of tone more satisfactory, the development of " wireless " music is already arousing millions to attention without arousing the inhibitions and excitements of crowd-psychology. The very defects of transmission are stimulating pianists (whose instrument suffers thereby more than most) to the study and broadcasting of intimate early keyboard music in which the plain melodic and polyphonic sense demands almost nothing from the special character of the instrument, but appeals to fireside audiences who would find it unintelligibly thin in the concert-room. Moreover, a new fact in musical aesthetics is the extraordinary beauty of microphonically magnified tones of very faint instruments, such as the clavichord.

We may be nearer than we think to a still more subversive revolution by means of the microscopic study of the wave-lines of phonographic records. There is nothing to prevent the possibility of producing music directly in terms of those lines. The limitations of music so produced would no longer be those of instruments, but would be determined solely by the precision with which it may become possible to model any sound-wave required. The composer will imagine and prescribe any producible timbre at any pitch he pleases, and will perhaps have no more to do with the craftsman who models the phonographic wave-lines than the violinist has to do with Stradivarius. The crudest beginnings of this new art will be of enormous importance, but its highest development will still leave the human handling of instruments supreme as the inexhaustible source of musical inspiration.

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MUSICAL COMEDY (*see* 8.533).—Although musical comedy is one of the most popular entertainments of the English-speaking races, it has always been passed over by writers on music as too unimportant for discussion, and books of reference have hitherto maintained a curious silence on its origin and character. Yet musical comedy and its off-shoot, revue, occupy a distinct place in the history of the modern theatre.

Character and Origins

What is musical comedy, and what is its line of descent from the recognised forms of light opera? Clearly it bears no relation to the classical *opera buffa* of Italy. That had no spoken dialogue and its place was taken by *recitativo secco*, a formal and rhetorical delivery of the words, supported by the lightest accompaniment. Mozart's *Figaro* and Rossini's *Il Barbière* are good examples of *opera buffa*. Nor has musical comedy any real connection with the German *Singspiel* except that spoken dialogue was used instead of *recitativo secco*. In France the *singspiel* developed into *opéra comique*. But the French comic opera was not necessarily comic, but was so called merely to differentiate it from grand opera. It was not considered necessary, indeed, that an *opéra comique* should include a single comic scene or character, but whatever the style of its drama might be, its dialogue had to be spoken. Since the dawn of the 19th century *opéra comique* has been a favourite form of composition with French musicians, but one may look to the popularity of the *vaudeville*, after the French Revolution, as being a more direct ancestor of modern musical comedy as far as the style of the play was concerned. But the *vaudeville* was written in verse, and musical comedy employs only lyrics for musical setting, the play itself being carried on by spoken dialogue.

A much closer analogy is to be found in the French *opéra bouffe*, which is not in any way akin to the Italian *opera buffa*. In the former, spoken dialogue alternates with light music, and in the play itself there were generally topical or satirical allusions. It was a kind of *opéra comique* in little. From the *opéra bouffe* and *vaudeville* sprang the operetta: at first, as its name implies, a short opera of one act which was employed to lengthen the evening's entertainment. Gilbert and Sullivan practically founded their operas on the operetta and *opéra bouffe*, but, except at first, they cast them into two acts of sufficient length to fill the bill.

On its formal side, the English ballad opera may be considered one of the models for musical comedy. Sentimental songs are introduced with the same irrelevance. The English ballad operas came into being as a protest against the Italian operas of the 18th century. The English works were even composed in the Italian manner, *recitativos* taking the place of dialogue. But they did not have much success until Gay wrote *The Beggar's Opera*, for which Dr. Pepusch adapted the best English and Scottish melodies that could be discovered. The opera had a great success in 1728, and when a modern version of it was produced at the Lyric, Hammersmith, in 1920, it ran for 1,463 continuous performances, being beaten only by *Charley's Aunt* (1,466) and *Chu Chin Chow* (2,238). *The Beggar's Opera* was afterwards revived and did well. The success of *The Beggar's Opera* led to the production of *Polly* at the Kingsway

Theatre (1922) and of *The Duenna* (1924). This revival of interest in ballad operas suggests that this typically English form of musical entertainment may have a future. A revival of Isaac Bickerstaff's *Lionel and Clarissa* at the Hammersmith Lyric Theatre in Oct. 1925, proved fairly popular. All these 18th-century ballad operas have been retouched and to some extent modernised, but the work has been done so well that they have not lost their antique character. But neither they nor the Gilbert and Sullivan operas have anything in common with musical comedy. Their popularity is evidence, however, that there is a large public interested in music of a light character.

The *genre* of musical comedy, then, is in direct descent from the *opêra bouffe* and the *vaudeville* of the French combined with our own ballad operas. But it must be remembered that in very few instances is one form of art purposely modelled on what has gone before. Makers of musical comedy have not been at pains to imitate and adapt to present needs former works of light music. Sir Arthur Sullivan is, perhaps, an exception, for the earlier examples of the Savoy operas do show that he had taken the French operetta as his model. Musical comedy, as it is known in London and New York, is an expression of a love of boisterous and farcical humour rather than of the high comedy of the operetta. In its present form it is peculiarly an expression of the English-speaking races. Its humour is broader, more farcical and more eccentric than anything to be found in light French or Viennese opera, and the student will find curious evidence of this in the change which French or Viennese light operas undergo when adapted to the British or American stage as musical comedies. André Messager's *Véronique*, for instance, was first performed in London by a French company (1903) as a light opera. When it was produced, shortly afterwards, in an English version, the comedy part of the florist was developed by Mr. George Graves into an eccentric low comedian. This had the effect of changing the character of the piece, although, of course, the original music remained.

Much the same change had happened to the Viennese light operas which, from 1910 almost to the present day, gradually ousted English musical comedy from the London and New York stage. The public patronises musical comedy because it is fond of music, and it soon became fascinated by the finish and skilfulness of the compositions by Oscar Straus, Leo Fall, Jean Gilbert and Franz Lehar. But to all the light operas of those composers the farce of recognised musical comedy had to be added. This is a relic of the old-fashioned Gaiety burlesque. Those burlesques were more in the nature of what afterwards came to be known as *revue* in London and New York than of the musical comedy with a plot and sentimental scenes. Gradually the Gaiety burlesque developed into the Gaiety musical comedy, the music written by Lionel Monckton, Howard Talbot, Ivan Caryll, Paul A. Rubens and others. These musical comedies always contained big parts for the low comedians, and in the second half of the entertainment the plot was held in abeyance while the low comedy was developed. The gradual popularity of Viennese light opera, adapted to the London stage as musical comedy, with big parts for the low comedians, swept all before it down to 1914. The plots of the foreign light operas gave better opportunities for sentimental scenes and their composers were able, by superior musicianship, to make the best of their ideas through clever orchestration and skilful ensembles. Occasionally light musical pieces which are neither light operas nor musical comedies are produced on the London American stage. The British *Maid of the Mountains* (1917) is but described as romantic melodrama combined with musical comedy. *Lilac Time*, first produced in America as *Blossom Time* (1921), is a light opera founded on Schubert's songs and instrumental pieces. Such pieces are, however, exceptional.

The Rise of Revue

Musical comedy for some years suffered severely from the rivalry of the revue. In Paris the revue had a special character of social satire and topical interest. Very few attempts have been made to acclimatise the French revue to the London stage, the most successful being Mr. C. B. Cochran's series of intimate revues, beginning with *Odds & Ends* in Oct., 1914, at the Ambassadors Theatre. The revue, as we have known it, has been a *mêlange* of songs, sketches, low comedy, ballets and pageants strung together without any apparent aim. Many of them have begun with a satirical idea, but the satire has never been carried out. The secret of making a successful revue is known only to those who achieve success. It appears to be based, however, on an instinctive sense of contrast between the different " turns " of the entertainment.

It is often stated that the haphazard style of disconnected " turns " was sympathetic to the war-mind. That may be a reason for the popularity of the revue during the World War and immediately afterwards, but it must be pointed out that this form of entertainment had become popular at least a couple of years before the War. Mr. George Grossmith, who had taken such a large part in the Gaiety musical comedies, was the first to adapt the revue from France. In 1910 he had made a great success in Paris in a Folies-Bergères revue with *Ip-i-addy-i-ay* from one of the Gaiety pieces. In Oct. 1912, he produced the first English revue at the Alhambra. It was entitled *Kill that Fly*, and the music was written by Melville J. Gideon. This was followed at the same theatre in May 1913 by *Eightpence a Mile*. In Nov. 1912, we find that a specimen of the new entertainment, *From Broadway to Paris*, had found its way to the New York stage. Long before the War, the revue was seriously affecting musical comedy in London. Soon after war broke out it became even more the staple musical entertainment in London, for the reason that all the most successful composers of musical comedy were enemies and their works were no longer performed on the stage. Mr. George Edwardes was interned in Germany and could not exercise direct control of the Adelphi and Gaiety theatres. By the end of 1914 only two musical comedies were to be seen in London: *A Country Girl* at Daly's theatre, and *The Earl and the Girl* at the Lyric theatre. Revues became more and more spectacular, and gradually the best of these entertainments included ballets and pageants of great beauty. In a sense, that type of revue was a throw-back to the masque. With the popularity of revue, syncopated or " jazz " music found its way to the stage from the variety halls. From revue it gradually crept into musical comedy, and the long continuance of the War, which automatically put an end to the domination of the Viennese school of musical comedy or light opera, gave this modern musical fashion full scope.

How far foreign musical comedy had gradually come to dominate our stage may be seen from the following list of the principal musical comedies produced in London and New York from 1910 to a few years after the outbreak of the War. The nationality of the composer is placed in brackets, but it must be remembered that in all cases the musical plays were very freely adapted for the countries in which they were performed. But however much low comedy may be imported into them, a foreign musical comedy always retains something of its original character. It is impossible to mistake a musical comedy by Leo Fall for one by Cuvillier, although in every respect the " book " and characters may have been Anglicised or Americanised.

The following list is not, of course, exhaustive, but it is sufficiently complete to show the different fashions of pre-War musical comedy.

1910. London: *The Balkan Princess* (British), *The Girl in the Train* (Viennese), *The Chocolate Soldier* (Viennese), *The Quaker Girl* (British).
New York: *The Arcadians* (British), *The Girl in the Taxi* (Viennese), *King of Cadonia* (British), *Madame Sherry* (American), *Our Miss Gibbs* (British).

1911. London: *Peggy* (British), *The Mousmé* (British), *Nightbirds* (adaptation of Johann Strauss's *Die Fledermaus* (Viennese).
New York: *The Slim Princess* (British), *The Balkan Princess* (British), *A Country Girl* (British, revival), *The Dollar Princess* (Viennese), *Girl of My Dreams* (American), *Gypsy Love* (Viennese), *The Kiss Waltz* (Viennese), *Little Boy Blue* (German, original title Lord Piccolo), *The Quaker Girl* (British).

1912. LONDON: *Princess Caprice* (Viennese), *Gipsy Love* (Viennese), *The Girl in the Taxi* (Viennese), *The Dancing Mistress* (British), *The Sunshine Girl* (British).
NEW YORK: *The Count of Luxembourg* (Viennese), *The Merry Countess* (Viennese, *Die Fledermaus*), *Oh, Oh, Delphine* (British-American), *Peggy* (British), *The Wedding Trip* (American), *The Charity Girl* (American), *Tantalising Tommy* (Viennese).

1913. LONDON: *The Pearl Girl* (British), *The Girl from Utah* (British), *The Girl on the Film* (German), *The Laughing Husband* (German), *The Marriage Market* (Viennese), *Oh, Oh, Delphine* (British-American).
NEW YORK: *Sweetheart* (American), *The American Maid* (American), *The Beggar Student* (German), *The Doll Girl* (Viennese), *Lieber Augustin* (German), *The Marriage Market* (Viennese), *Sunshine Girl* (British).

1914. LONDON: *A Country Girl* (British), *The Earl and the Girl* (British), *The Cinema Star* (Viennese), *Toy Ride Lady* (Viennese), *M'selle Tra-la-la* (Viennese).
NEW YORK: *The Belle of Bond Street* (British), *The Girl from Utah* (British), *The Girl on the Film* (German), *The Only Girl* (American).

1915. LONDON: *The Only Girl* (American), *Betty* (British), *To-night's the Night* (British, founded on *The Pink Domino*), Revivals of *Floradora, Véronique, The Arcadians, Chinese Honeymoon, The Dairy Maids* and *The Girl in the Taxi*, Big spectacular revues, produced by Albert de Courville and Wal. Pink.
NEW YORK: *Princess Pat* (American), *Alone at Last* (German), *The Blue Paradise* (Viennese), *To-night's the Night* (British), *Watch your Step* (American jazz musical comedy), Several big American revues.

1916. LONDON: *Chu Chin Chow* (British), *High Jinks* (British adaptation of French farce *Les Dragées d'Hercule*, Music by various British composers and Rudolph Friml), *The Happy Day* (British), *Mr. Manhattan* (British), *My Lady Frayle* (British). At end of the year no fewer than 9 theatres were devoted to *revue* and only 3 to musical comedy.
NEW YORK: *Betty* (British), *Follow Me* (American), *The Girl from Brazil* (German-American), *Katinka* (Viennese), *Miss Springtime* (German), *Step This Way* (American), *Very Good, Eddie* (American).

1917. LONDON: *The Maid of the Mountains* (British), *The Boy* (British), *The Beauty Spot* (British).
NEW YORK: *Canary Cottage* (American), *Chu Chin Chow* (British), *Leave It to Jane* (American), *May-time* (German), *Oh, Boy* (American).

1918. LONDON: *The Lilac Domino* (French), *Going Up* (American), *Yes, Uncle* (American), *Very Good, Eddie* (American).
NEW YORK: *The Grass Widow* (American), *Going Up* (American), *The Maid of the Mountains* (British), *Oh, Lady, Lady* (American), *Oh, My Dear* (American), *The Rainbow Girl* (American).

1919. LONDON: *Who's Hooper?* (British), *Baby Bunting* (British), *His Little Widows* (American), *Afgar* (French), *Monsieur Beaucaire* (French), Revival of Gilbert and Sullivan's operas.
NEW YORK: *The Royal Vagabond* (German-American), *Apple Blossoms* (Viennese), *Good Morning, Judge* (*The Boy*, British), *La, la, Lucille* (American). A number of other musical comedies of American origin were produced.

It will be seen from the foregoing list that after 1914 the stage had to rely for the most part on British and American musical comedies, until peace was declared, but towards the end of the War some works of enemy origin were produced. One of the most successful of these American musical comedies was *Irene*, produced at the Empire Theatre in 1920. There has been no great change in the type of musical comedy since the War, except that towards the end of 1925 American musical comedies, (of which *No No Nanette*, *Mercenary Mary* and *Rose Marie* are the chief examples) with their efficient production and lively syncopated music, gradually took the place of British musical comedies.

In Paris, the home of revue, the musical comedy of the English-speaking races was always an alien form of entertainment. The differences between the operetta and opéra bouffe and musical comedy are slight, but nevertheless very real. They consist partly of the kind of sentiment expressed, of the general character of the music, and, especially, of the type of humour. The light opera of the modern Viennese school, when adapted as American or British musical comedy, had, and, to some extent, still has a vogue in Paris, but even before the War Parisians had grown tired of it, and during and since the War it has never regained the popularity it once had. (E. A. B.)

MUSICAL INSTRUMENTS, MECHANICAL.—In the history of mechanical musical instruments the years 1910–26 are significant chiefly because of the remarkable advance made in reproducing the touch of the human performer. Most of these keyboard instruments are known as reproducing or re-enacting pianos, and a discussion of their mechanical details necessarily concentrates largely upon the field of the modern pianoforte (*see* 21.573).

THE PLAYER PIANO

By 1910 the foot-pumped player piano had already reached a high point of development, and there were a number of elaborate devices for lending expression to its music. Ways had been found of emphasising the melody and subduing the accompaniment, at the pleasure of the player. The control of tempo had also undergone various improvements. Some of these devices had brought about an elaborate system of controlling levers, which the human player could operate with considerable skill. But the chief source of expression still rested in the feet, with most of the shading secured through the varying rapidity and suddenness of the actual foot-pumping. The foot-pedalled player piano permits its " pedipulator " to enjoy the feeling of being actually an interpretative, perhaps even a creative, artist.

The principle of the player piano rests upon the laws of atmospheric pressure. William Braid White, in his authoritative book on *Piano Playing Mechanisms*, gives a fairly simple explanation of what happens when a mechanical piano is made to play. He first shows how " a state of reduced pressure, or, as it is called, ' partial vacuum,' is induced in a small bellows called a ' pneumatic,' one of which is attached in some operative manner to each section of the action of a piano." He continues: " When some of the air has been pumped out of such a pneumatic, the outside pressure pushes up its moving wall, and the motion of this wall constitutes the movement required to set in motion the corresponding action and hammer on the piano." He further explains that " the velocity of motion of the pneumatic in thus collapsing will depend upon the difference between the exterior, or atmospheric pressure, and the reduced pressure inside the pneumatic. The greater the difference between the two, the more effective will be the work of the atmosphere, and the higher the velocity of the pneumatic's motion. Thus it appears that the power exerted on the piano hammer (corresponding to the work of the fingers on the keys) by the pneumatic varies as the rapidity of reduction of air-pressure inside it. It is therefore plain that if we can keep this process of pressure-reduction under control we can vary our tone-strengths as required. Control of this sort is, of course, essential to the artistic rendering of music."

Refinement of Control.—The up-to-date reproducing piano has gone far beyond the ordinary player or pianola in the gradual refinement of such control. The difference is vastly greater than the mere substitution of electric power for foot-pumping. By various methods of controlling pressure-reduction, represented by different instruments, the human touch has generally been approximated, and in a few cases actually duplicated. The ideal of all experimentation with the reproducing piano has been to strike any note at any time with any degree of force used by the actual pianist. Fundamentally this becomes a problem of weight and pressure, which is all that we really mean by " touch." But it was discovered long ago that in attaining subtlety of expression and " tone-colour," the pedalling (soft, damper and sostenuto) was a very important element, and that certain effects depended not only upon such blending of tone but upon the actual overlapping of the tones themselves, and the smooth passage from one to another, in the course of a " crescendo " or " diminuendo," with a scarcely perceptible difference in volume.

The reproducing piano of the highest type permits the duplication of every detail of expression as recorded by the great pianists. (This instrument, however, still allows the amateur to experiment with his own ideas of expression by eliminating the

mechanical control and substituting the manipulation of levers or buttons under his own control.) With the discovery that the human touch could be duplicated came the invention of various recording machines, so that by 1926 every pianist of note could be heard through his records as well as in concert performance.

Recording Processes.—Processes for recording are, by most manufacturers, veiled in absolute secrecy, for obvious reasons. The results, however, depend not so much on the method of recording as on the ability of the reproducing mechanism to duplicate the effects indicated by the artist. Some records made in Europe in the early days of the reproducing piano have been successfully adapted to the later perfected instruments, and actually give a far finer performance than would have been possible when they were first made. In general the recording pianist simply sits at a regular keyboard and plays in his usual style. Electrically connected with his piano, and invisible to him, is a recording machine carrying an endless roll of paper, on which both the notes and the expression are marked as he plays the instrument.

The old player-pianos had their rolls made by mathematically following the sheet-music and with no attempt at variety of expression and interpretation. Some of the newer recording machines also perforate directly from the playing of the artist, but in these cases a careful system of editing is required before the record can be heard in public. The opportunity for editing is offered also in those machines which do not perforate immediately, but in which the start and finish of each tone are clearly indicated by pencil marks, with the exact action of the pedals and every slight variation of pressure. In fact, the possibility of revision and editing is most important in the creation of completely satisfactory recordings. There are always some mistakes to be corrected, and an artist generally finds various details which he wishes to emphasise or subdue, so that the final recording may truly represent his playing at its best.

Some Reproducing Pianos

The pioneers in the manufacture and marketing of the modern reproducing piano were M. Welte & Son, of Freiburg, Germany, and Ludwig Hupfeld, of Leipzig, both of whom were active as early as 1904. The name of Welte-Mignon, which originated at that time, was by 1926 best known in America through pneumatic actions distributed under a license issued by the owners of the Welte patent rights. The inventions of Charles Fuller Stoddard were developed independently, and the instrument which he perfected put on the market by the American Piano Co., under the trade name of the Ampico. Another type of reproducing piano was subsequently developed by the Aeolian Co. from the pianola, and given the name of Duo-Art. The latter may be attached to the Steinway, Weber, Steck and Stroud pianos, while the Ampico may be had in the Chickering, Knabe, Mason & Hamlin, Haines, Fischer and Marshall and Wendell pianos, besides the Willis in Canada, and the Broadwood and others in England. The Welte mechanism is used with the Steinway and other instruments in Europe, and (as licencee) in a great number of American pianos.

Features of Mechanism.—The mechanism of each of these types deserves separate consideration. All three are alike in the general arrangement of pneumatics and in the division of the keyboard, for convenience, into two halves, treble and bass, each controlled by special expression pneumatics. All three possess a device for automatically rerolling a record, and repeating it by the setting of a lever if desired. They also permit the elimination of recorded expression and the substitution of human control. In every case the piano can be used as such, even while a record is in progress.

The Welte.—The original Welte first appeared as a cabinet containing a separate action, operating on the keys of the piano, but by 1926 was generally found as an interior action in grand and upright pianos. The power plant consists of an electric motor and a suction pump. Including "on" and "off," 18 holes in the tracker bar are devoted to expression purposes, ten on the right side and eight on the left, the rest sounding the notes. The bass and treble sections of the action are controlled by separate expression pneumatics, each closing at two definite rates of speed, slowly for crescendo, and fast for accents. There are also pneumatics to lock the expression pneumatics in a mezzo-forte position and other details for increasing expression.

The Duo-Art.—The Duo-Art Pianola differs from other reproducing pianos of the grand type by having its note-sheet driving mechanism and tracker bar placed behind the fall-board, directly over the keys themselves, the case being extended to make the necessary room. Its expression system is divided into a melody or "theme" regulator and an accompaniment regulator, with the melody always slightly stronger. Two sets of four pneumatics each, known as the "accordion dynamics," permit as many as 16 degrees of volume.

The Ampico.—The Ampico has both a crescendo pneumatic system and an instantaneous accent pneumatic system, which it can use in combination to control the air-tension behind the hammers. These systems may be operated independently for their separate effects, or concurrently for their combined effects, thus producing an unusual smoothness in crescendo and diminuendo, as well as a delicate shading. There is also an "amplifier" for special effects of volume, and the extended perforations in the music-sheet produce the greatly desired "singing" quality of tone. Seven holes on each side of the tracker bar control expression, with an extra one on the right for the re-roll. In the Ampico grand, the note-sheet mechanism is in a drawer, while the electrically driven pump is slung under the body of the piano.

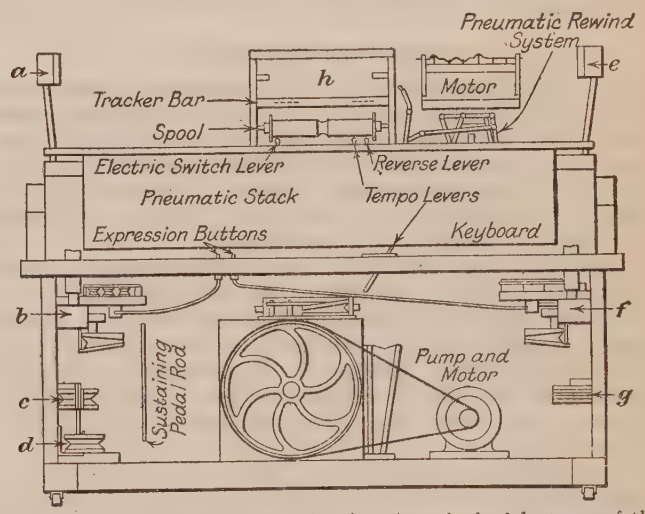

Fig. 1.—Reproducing Piano, showing the principal features of the mechanism, which are described at length in the text.

From a drawing by H. S. Smith, C.E. in Piano Playing Mechanisms, by W. B. White, Ed. L. Bill, Inc. N.Y.

Ampico Upright.—A typical reproducing piano (Ampico upright) consists of (*a*) bass equaliser; (*b*) bass regulator system, connected by tube with (*c*) crescendo pneumatic and (*d*) soft pedal pneumatic; (*e*) treble equaliser; (*f*) treble regulator system, connected by tube with (*g*) crescendo pneumatic (right side) (fig. 1).

The recording sheet is hung in place at *h*; it has a metal ring at the end of the paper caught by a pin upon the spool, so that the perforations in the note-sheet will pass over the holes in the tracker bar, which is connected by tubes with the pneumatic stack and the expression system. When the pump and motor are electrically started, air is sucked through the holes in the tracker bar, causing the individual pneumatics to set the corresponding hammers in motion exactly as by the touch of the pianist on the keys. At the same time, the crescendo, accents and various pedals are similarly set in operation through special "expression holes" in the tracker bar, corresponding to perforations on the edges of the note-sheet. The expression buttons in front of the keyboard permit the human manipulator to introduce his own ideas of shading. He can also vary the tempo at will, and do his own pedalling, if desired, the automatic expression being in that case temporarily turned off. A small motor serves to keep the note-sheet in motion and to rewind it rapidly when the playing of a record has been completed.

Research Work.—All the companies manufacturing these instruments publish instruction books for mechanicians, and the mechanically inclined reader is referred to these publications for further information. An elaborate research laboratory has been for some time in operation in New York, under the direction of Mr. C. F. Stoddard, and here the minutest details of musical expression, including dynamics, pedalling, touch, tone quality and tempo, have been scientifically analysed, so that a beauty of mechanical playing is possible that was formerly undreamt of. In this laboratory also have been developed scientific methods of recording the performance of a pianist to a degree of accuracy which permits not only the determination of the audible loudness of every note struck, but shows differences in touch that are indistinguishable by the human sense of hearing. This work has made it possible to measure scientifically the technical ability of a pianist.

Practical Uses.—The place of the reproducing piano is now fully established in the field of music on educational as well as aesthetic grounds. Distinguished artists have used these instruments in public performance, directly comparing their own playing with that of their recordings, sometimes alternating with the latter in most astonishing fashion; and recorded accompaniments have proved most valuable for singers, violinists, etc., in concerts as well as for private practice. Schools, colleges and conservatoires of music are coming to recognise the reproducing piano as an indispensable part of their equipment, particularly for teaching the appreciation of music; and teachers of the pianoforte welcome its authoritative recordings as models for their pupils.

Some Other Instruments

Concerning other mechanical keyed instruments little need be said. There are, of course, coin-operated electric pianos, which have proved themselves adequate for entertainment in restaurants and taverns, and often these are reinforced with organ pipes, drums and other orchestral effects. Essentially they are built on the principle of the player-piano, although the need of expression can practically be disregarded.

The Pipe Organ.—The pipe organ itself is thoroughly adaptable to mechanical playing, for its effects have little to do with the human touch, and can be produced at will by the electric control of stops and pipes. All the great organs can be played with the help of rolls, which are either entirely mechanical in their control of expression or permit a human agent to manipulate the stops, while the tones themselves are mechanically produced.

In conclusion, no matter how perfect a mechanical musical instrument may be, the fascination of personally producing tonal beauty will never be entirely lost, and human performance will continue to be popular, with its amazing duplication by scientific means in no sense a discouragement to personal endeavour, but rather a priceless ally to the cause of music on those occasions and in those places where individual skill and talent are not always available (*see* also Phonograph).

Bibliography.—William Braid White, *Piano Playing Mechanisms*, a most valuable and comprehensive treatment of all the mechanical essentials (1925); *Modern Piano Tuning and Allied Arts* (1917) and *The Player-Piano Up-to-date* (1914); H. C. Van Atta, *A Treatise on the Piano and Player-Piano* (1914); Alfred Dolge, *Pianos and their Makers* (1911); Gustav Kobbé, *The Pianolist* (1907) and *The Aeolian Pipe Organ* (1913); G. A. Audsley, *The Organ of the Twentieth Century* (1919); G. L. Miller, *The Recent Revolution in Organ Building* (1913); Manuals of instruction for mechanics issued by such manufacturers of reproducing and re-enacting pianos as the Aeolian Co., the American Piano Co., the Welte-Mignon Corp., the Auto-Pneumatic Action Co., etc. (S. Sp.)

MUSIC HALL: *see* VARIETY THEATRE.

MUSSOLINI, BENITO (1883–), Italian statesman and journalist, was born July 29 1883 at Dovia, in the commune of Predappio (province of Forlì). His father, Alessandro Mussolini, was a blacksmith of internationalist revolutionary and anti-religious opinions, and played an active part in the local Socialist movement, while his mother, Rosa Maltoni, was a school teacher of deep religious convictions; the views of both parents affected young Mussolini in different ways at different stages of his career. He was sent to the Salesain college of Faenza, where he showed considerable intelligence but a passionate, insubordinate spirit. Later he went to the normal school at Forlimpopoli, and eventually qualified as a school teacher at the age of 18, obtaining an appointment at Gualtieri (province of Reggio Emilia). As a youth he developed a love of literature and read widely, and soon became interested in the Italian Socialist movement. But he tired of teaching, and determined to go to Switzerland to improve his education. There he earned a precarious livelihood by manual labour of various kinds, but managed to attend the courses at the Universities of Lausanne and Geneva, and secured a diploma as teacher of French. He lived mostly among the working classes, and, born organiser as he was, he founded trade unions and even promoted strikes, with the result that he was expelled from one canton after another, and finally from the Confederation. After performing his military service in the Bersaglieri, he returned to teaching, but found time to improve his knowledge of the classics. In 1908 he was involved in the political agrarian conflicts in Romagna, was arrested, tried and condemned to 10 days' imprisonment, and afterwards was under police surveillance as a dangerous revolutionary.

At the end of 1908 he went to Trento, where he had been summoned by the local chamber of Labour as secretary, and he also joined the staff of the local Socialist paper *L'Avvenire*. But when he realised that the Trentino Socialists, in their loathing for the national idea, took their cue from the Vienna Govt., Mussolini went over to the *Popolo*, a paper edited and founded by Cesare Battisti, also a Socialist, but above all an Irredentist patriot who was afterwards to serve in the Italian Army during the War, be captured by the Austrians and hanged as a traitor. Here Mussolini took up the study of German literature, and became deeply interested in philosophy, especially in that of Nietzsche. His association with Battisti first inspired him with Irredentist ideas, and after publishing an article stating that " the Italian frontier does not end at Ala " he was arrested and expelled from Austria. On returning to Italy he published an essay of Irredentist tendencies on " The Trentino as seen by a Socialist " in *La Voce*, a periodical printed in Florence which gathered around it some of the most brilliant young *littérateurs* of the day.

The Tripoli Campaign.—The next period of Mussolini's life was wholly devoted to Socialist activity. In 1910 he founded and edited a paper at Forlì called *La lotta di classe*, but while he vigorously supported the ideals of Socialism, he deplored the materialism, as he considered it, of the bourgeois spirit into which the Italian Socialist party had degenerated. He drew further and further away from Marx and Lassalle, feeling more sympathy with the ideas of Baboeuf, Blanqui, Prudhon, and above all with the syndicalism of Sorel. An opponent of parliamentarianism, he reproved the Italian Socialists for compounding with the bourgeois parties in order to secure seats in the Chamber and lucrative contracts for bogus co-operative societies; he not only advocated direct action, but also put it into practice whenever he saw a chance of securing real advantages for the proletariat thereby, and, unlike other Socialist leaders, he was ever ready to lead his followers and run personal risks.

When Giolitti's Government decided to send a military expedition to Tripoli, although not rejecting the idea of war in general, Mussolini opposed this policy because, as he said, unlike the Nationalists, who wanted a vast Italy, he preferred an Italy that should be well cultivated, rich and free. On Sept. 25–27 1911 he therefore organised a popular movement at Forlì against the Tripoli expedition, inciting the mob to resist the authorities. He was in consequence arrested and condemned to five months' imprisonment. At the congress of Reggio Emilia in 1912, when Bissolati and Bonomi were expelled from the party for supporting the Government's African policy, Mussolini remained one of the die-hard revolutionaries, and in December of that year was made editor of the *Avanti!*, the official organ of the party. Under his able editorship the circulation rose from 40,000 to 100,000, and his vigorous leaders gave the paper an entirely new character. He insisted particularly on the necessity for improving the

economic and social conditions of the southern provinces, which other Socialist leaders neglected because their inhabitants gave few votes to the party. During the so-called "Red Week" in the Marche and Romagna (June 7–14 1914), Mussolini was one of the most active leaders of the outbreak. It was on this occasion that he lost many illusions concerning his fellow Socialist leaders, whom he found ever ready to incite the mob to violence while taking good care for the safety of their own persons. He also realised that the masses were anything but ripe for revolution.

The World War.—The great crisis of Mussolini's life came with the outbreak of the World War. From the first he strongly opposed Italy's intervention on behalf of the Central Powers. After Italy's declaration of neutrality he still hesitated, for the conflict was raging within him between the Socialist and the Italian; but it was as a Socialist that he favoured war in the belief that it would end war and re-establish the principles of right and justice, while as an Italian he doubted if his people were ready to enter the fray. In the autumn the tendency in favour of intervention had gained ground, and he wrote that Italian unity must be completed; later he gave his approval to the Government's military measures, as he realised the danger of keeping Italy alone unarmed amid the general conflagration. But he felt that his views were ever less in harmony with the official creed of his party, and he expressed the hope that if Italy did intervene her international status would be raised and an economic and social revolution promoted. He deemed it necessary to resign the editorship of the *Avanti!*, and on Oct. 25 appeared before the Socialist assembly at Milan to justify his conduct. The audience howled at him, with imprecations of "traitor, hireling, assassin!"; but instead of defending himself he violently attacked the other Socialists for their *petit-bourgeois* spirit and insincerity. He ended by confirming his belief in Socialism, and saying, "You hate me because you still love me."

He now founded a new paper of his own, *Il Popolo d'Italia*, and his enemies spread about the rumour that Mussolini had received money from the French Embassy to support the Allied cause, whereas the sole capital of his new venture was 4,000 lire advanced by advertisers. The *Popolo d'Italia* first appeared on Nov. 15 1914, and in the leading article Mussolini asked: "Do we wish to drag out a miserable existence under present conditions, content with the *status quo* of the monarchy and the bourgeoisie, or do we wish instead to break up this wretched combination of intrigue and cowardice?" He concluded with a stirring appeal in favour of war. The paper led a precarious existence in miserable premises, and was hardly able to pay the staff. But it gathered around it a number of brilliant young writers fired with enthusiasm for the national cause, although many were Republicans and Socialists.

Audacity was its keynote, and while the *Idea Nazionale* and D'Annunzio appealed to the older and more intellectual middle classes, Mussolini influenced the younger generation and the workers, and he reached the less educated masses through his friend the Syndicalist Filippo Corridoni (afterwards killed in action), editor of the weekly *Battaglie sindacali*. But he still believed in revolution, and in April 1915 he was arrested for advocating his views at a public meeting; ten days later he was slightly wounded in a duel with the orthodox Socialist Claudio Treves. When on May 24 war was declared he wrote in the *Popolo d'Italia*: "From to-day onwards the nation is called to arms. From to-day onwards we are all of us Italians and only Italians. Now that steel has to meet steel, one single cry issues from our breasts, *Viva l'Italia!*"

In the Trenches.—In Sept. 1915 Mussolini was called up, and served as a private in the Bersaglieri in the trenches along the Isonzo and on the Carso. He did his duty gallantly until he was seriously wounded by the explosion of a trench mortar on Feb. 23 1917. He spent many months in hospital, and on recovery returned to his work on the *Popolo d'Italia*. He wrote a graphic account of his war experiences in his *Diario di Guerra*. As early as the beginning of 1917 he realised the gravity of the propaganda which the Socialists and neutralists were able to conduct owing to the feebleness of the Government, especially of the Minister of the Interior, Signor Orlando, and after resuming his editorial chair he uttered warnings which were disregarded, as were those of Gen. Cadorna. After Caporetto he was one of the few who, in the depths of national depression, never lost heart and in the columns of his paper he issued daily messages of encouragement.

After the Armistice Mussolini opened a campaign in favour of a dignified foreign policy at the Peace Conference, and of adequate recognition for the services of the demobilised men. In reply to the first manifestations of Bolshevism in which the Socialists indulged in consequence of the relaxation of the censorship, Mussolini founded the first "Fascio di Combattimento" on March 23 1919 at Milan (*see* FASCISM); and although the first programme of the new group contained many demagogic demands, the patriotic note was predominant, and Mussolini continued to combat Bolshevik doctrines. With regard to Fiume, he insisted that its Italian character must be secured. When D'Annunzio occupied Fiume the *Popolo d'Italia* lent him its full support.

Mussolini was now bitterly hated by the Socialists, and when at the elections of 1919 he stood as a candidate for Milan, he secured only a few votes and was described by the *Avanti!* as a corpse to be buried in a ditch. A few days later Nitti had him arrested on a charge of "armed plotting against the security of the State" (in connection with his support of D'Annunzio), but did not dare to maintain the arrest, and he was soon liberated. Mussolini now worked harder than ever at his paper, whose circulation increased rapidly; his relaxations were writing plays and playing the violin, and he also took to motoring and aviation, in which sports he showed the same disregard of danger as in war and politics.

Fascist Discipline.—The seizure of the factories by the workmen in the autumn of 1920 did not meet with Mussolini's disapproval, as one would have expected; he regarded their action as a form of practical syndicalism breaking away from the pusillanimous policy of the official Socialist party. But when the Communists proceeded to organise political murders at Bologna, Modena and Ferrara, Mussolini and his Fascists became the nuclei of the national anti-Bolshevik reaction; it is due to him that the whole Communist-Socialist domination collapsed, first in the Po valley and then throughout Italy. But Mussolini was now coming to the conclusion that it was not enough to defeat and disperse the Reds. The Italian people, he argued, were to be made free to recover, to work and produce undisturbed, to fulfil their higher destinies; the incompetent governing caste, ready to compromise on everything, must be swept away and its place taken by the virile youth of the country who had won the War. Fascism was spreading rapidly, and in Nov. 1921 it was organised into a political party, but its discipline still left much to be desired. Mussolini now proceeded to reorganise it and establish it on a strictly hierarchical basis, until its discipline surpassed that of any other organisation in Italy. All ranks of society he regarded as necessary, for he did not wish to repudiate the past. He was, moreover, becoming ever more keenly interested in foreign politics. "I hold that, having broken the pride of Bolshevism, Fascism should become the watchful guardian of our foreign policy." But the movement was extending to every sphere of national life—internal affairs, finance, labour, industry, agriculture. At the elections of May 1921 Mussolini and 37 other Fascist candidates were returned, and together with their allies the 10 Nationalists played an active part in the debates.

During the next 12 months Fascist influence consolidated itself throughout Italy, and the obvious breakdown of the old political parties convinced Mussolini that the time for bold action was fast approaching. At first he thought only of the possibility of a coalition Government comprising Fascist elements, but by the summer of 1922 he felt that a predominantly Fascist Govt. was conceivable and indeed necessary. The strike of Aug. 1 1922, promoted by the revolutionary Alleanza del Lavoro, was broken by the Fascists, and this fact showed the increasing weakness of Signor Facta's Govt., which was no longer able to resist any really energetic action from the right

or from the left. In the meanwhile, Mussolini had been shedding the last traces of demagogic ideas, and at a Fascist gathering at Udine on Sept. 29 he openly pronounced himself an upholder of the Monarchy, thereby securing the sympathy of many non-Fascists and of the army. He now made no secret of his intention of seizing power, and said so openly at the Fascist meeting in Naples in October. The march on Rome (*see* ITALY, *History*) was organised and directed by Mussolini, and indeed it shows the Mussolini touch in every phase. When the Facta Cabinet resigned the King first sent for Sig. Salandra, who tried to form a coalition Government, but Mussolini refused to lend the scheme his support, and Salandra threw up his mandate, whereupon the task was entrusted to Mussolini himself. He formed his Ministry within seven hours, a record for Italy, where, especially during the post-war years, every cabinet crisis had lasted for many days and even weeks. He chose several non-Fascists as Ministers, but refused to contract an alliance with the parties to which they belonged.

His Reforms.—From the moment he assumed office he set to work with his accustomed energy to overhaul and reform the whole administration, to eliminate inveterate abuses, and infuse a new spirit into the State. He himself assumed the portfolios of Foreign Affairs and the Interior, although the work of the latter he left largely to the under-secretary Aldo Finzi. In June 1924, after the Matteotti affair, he appointed Sig. Federzoni Minister of the Interior, but in the following spring, on the resignations of Gen. Di Giorgio and Adml. Thaon di Revel (April 3 and May 5), he assumed the portfolios of War and Marine, and also that of the new Air Ministry; while leaving great latitude to the under-secretaries, he gradually welded the three ministries into a single department of National Defence. He also kept in close touch with all the other departments, and many questions of great national interest, such as the development of public works in southern Italy, for the purpose of bringing that area up to the level of the more progressive north, the so-called "battle for wheat" engaged to intensify wheat production, the reformed electoral law, the various reforms of a constitutional character, etc., are due to his initiative. As a Socialist Mussolini was an anti-Parliamentarian, and even later did not regard the Parliament as the sole organ of national life. His object was to make Italy powerful, prosperous and efficient, in as short a time as possible. But in order to make these reforms lasting he determined that the whole body politic shall be imbued with the Fascist spirit—*fascistizzare la nazione*, as he described it—and he therefore inserted Fascism into every activity of the country.

As a Minister, Mussolini's activity was prodigious. Even when he was seriously ill in the spring of 1925, he surprised his friends and disconcerted his adversaries by continuing very largely to conduct his business of government from his bed, and by his quick recovery. While he was immensely popular with the great majority of the people who appreciate the far-reaching benefits of his rule, he had many enemies among the members of the old governing caste, the Socialists, Communists and Republicans and the anti-national freemasons, whose influence he destroyed. At the end of Oct. 1925, a plot to murder him was discovered by the police, and the would-be murderer, the Socialist ex-deputy Tito Zaniboni, was arrested in the very act; other persons were arrested in connection with the affair, notably Gen. Capello, a leading freemason. The news of the plot aroused general indignation, and Mussolini received a plebiscite of enthusiastic congratulations. On April 7 1926, as he was leaving the Capitol, where he had inaugurated a surgical congress, an Irishwoman, the Hon. Violet Gibson, fired at him with a revolver, slightly wounding him in the nose. The would-be murderess appeared to be demented. The wound did not prevent him from sailing for Tripoli the following day according to programme.

Mussolini is not a finished orator in the classical sense; he has no rounded periods and he seldom introduces apt quotations. But every speech bristles with facts and ideas, each sentence is like a hammer-stroke on the anvil emitting vivid sparks, and each phrase, seemingly independent of the others, contributes to build up the central idea which he wishes to assert. On innumerable occasions an apparently difficult, even insoluble, situation has been solved by one of his vigorous speeches. Besides innumerable articles in *Il Popolo d'Italia*, *Avanti!*, *Gerarchia*, etc., he has published *Il mio Diario di Guerra 1915–7* (Milan, 1923), and his speeches have been collected in several volumes. A selection of them has been published in English edited by Baron Quaranta, *Mussolini as revealed in his political speeches, Nov. 1914 to Aug. 1923* (1923). His biography was published in English by Margherita Sarfatti (Butterworth, 1925). See also Antonio Beltramelli's *L'uomo nuovo* (18). (L. V.*)

MUSTAFA KEMAL (1880–), Turkish soldier and statesman, was born in comparatively modest circumstances in Salonika. His father was a customs officer who afterwards entered the timber trade and died when Mustafa was yet a small child. The boy was brought up and educated by his mother, who appears to have been a woman of character and ability. He completed his primary education in Salonika and entered a secondary school in the same place; but, having been maltreated by his Arabic teacher, he left school, against his family's wish, and secretly entered the military preparatory school.

There he proved to be an exceptional student, especially in mathematics, and attracted the attention of his fellow-students and teachers. His teacher in mathematics, who was also named "Mustafa," gave him the distinctive surname of "Kemal" (an Arabic word meaning "perfection"), as a tribute to his unusual ability. The extent to which he won the esteem and affection of his companions while at the military academy is indicated by the fact that, although he already took an active interest in politics and bitterly criticised the despotism of Abdu 'l-Hamid, he was never denounced.

In 1904 he was gazetted a lieutenant, but on the same day he was placed under arrest, taken to Yildiz Palace, and detained there for weeks under cross-examination. Finally he was banished to Damascus. In this provincial capital he had an opportunity to observe the deplorable condition into which the civil and military organisation of the Empire had fallen. He also found followers here, and founded in 1905 the secret political society "Vatan" ("Fatherland"). From Damascus he was transferred to Jaffa, and from there with the help of his friends, he made his way secretly to Salonika in order to organise a similar political movement in the European provinces. The association which he founded at Salonika was afterwards affiliated to the Union and Progress Society. By this time the Constantinople Govt. had got wind of his secret activities, and it sent orders for his arrest both to Salonika and to Jaffa. With the help of his friends at Salonika, Mustafa Kemal was smuggled on board a steamer sailing for Jaffa, and at the same time the military commandant at Jaffa reported to Constantinople that Mustafa Kemal was on duty on the Egyptian frontier. For a time he was forgotten by the Government in Constantinople. In 1907 he was promoted and sent to Salonika, where he again devoted himself to the work of revolutionary organisation.

When the revolution of 1908 re-established the constitution of 1876, Mustafa Kemal found himself in serious disagreement with the leaders of the Union and Progress Party who were now in power. His political views were more radical than theirs and he protested, though in vain, against the participation of the army in politics. In consequence he abandoned politics for the time and turned his whole energy into his military career. From this time onwards, he was appointed to a number of important military posts, in each of which he gave evidence of his ability and his powers of leadership. In 1910 he was sent to France to follow the army manoeuvres. He was loved and respected by the younger officers, but some of his superiors looked askance at him on account of his uncompromising attitude. In 1911 he went to Tripoli *incognito* in order to take part in the war against the Italians, and there he was promoted to the rank of major. He was still in Tripoli when the first Balkan War broke out in Oct. 1912 (*see* BALKAN WARS). He started at once for Turkey, but the news of his country's defeat and the fall of Salonika reached him in Egypt. In July 1913, however, during the

second Balkan War, he was appointed chief of the staff to the newly-organised army corps on the Gallipoli Peninsula, and here for the first time he made a detailed first-hand study of the problem of defending the Dardanelles. After the restoration of peace between Turkey and Bulgaria in the same summer, he was appointed military attaché at Sofia, with the rank of colonel, and held this post until after the intervention of Turkey in the World War in the autumn of 1914.

Mustafa Kemal believed that Turkey had entered the War prematurely and that Germany was doomed to eventual defeat. Possibly it was on this account that his desire to return to active service was not encouraged; but, on his insistence, he was appointed commander of the forces at Rodosto, and afterwards (in 1915) at the Dardanelles. He was the moving spirit on the Turkish side in the defence of the straits against the British attack; and it would not be an exaggeration to say that the situation was saved through his personal skill, insight and bravery when the Turkish high command had actually lost hope. During the final British assault he was struck by a splinter of shell right over the heart, but the splinter was intercepted by his watch and he thus escaped with his life.

After the evacuation of the Gallipoli Peninsula by the British, Mustafa Kemal was sent to the Caucasus front, where he was promoted to the rank of Pasha and recovered Bitlis and Mush from the Russians. In 1917 he was posted to the Hejāz, but after stopping at Damascus to study the general situation, he proposed to recall all the forces in the Hejāz in order to reinforce the Syrian front. This prudent proposal was not carried out, but later in the same year he was appointed to the command of the VII. Army Corps in the force which the German general Von Falkenhayn was organising with a view to the recovery of Baghdad. At this time Germany's intervention in the internal affairs of Turkey had reached its height, and Mustafa Kemal Pasha put himself at the head of the opposition to it. He sent in a succession of reports adverse to the Baghdad expedition, which he thought would end in another disaster, and when his advice was ignored he resigned. He was then transferred to the Second Army Corps, but abstained from taking up his command owing to his disagreement on questions of principle with General Headquarters. While on leave in Constantinople he was sent on a mission to the German G.H.Q. with the heir apparent Vahydu'd-Din Efendi. There, in the presence of Generals Hindenburg and Ludendorff, he expressed outspokenly his pessimistic views regarding the outcome of the War. In 1918 he yielded to the insistance of Vahydu'd-Din Efendi, who had meanwhile succeeded to the throne as Sultan Mehmed VI., and accepted the command of the VII. Army Corps in Palestine, but by this time all chance of taking the offensive, or even averting disaster, had disappeared. Mustafa Kemal again distinguished himself, however, in keeping together the remnants of his corps on the retreat which followed General Allenby's great victory, and before the end of Sept. he was appointed Commander-in-Chief of all the corps constituting the so-called Yildirim group.

When the Turkish Govt. negotiated the armistice of Mudros (Oct. 30 1918), Mustafa Kemal was opposed to the policy of complete surrender, and after the signature of the armistice he retired to Constantinople and began studying the new situation at his leisure. There was nothing to be done in Constantinople, but his opportunity was given to him by two events: the Greek landing at Smyrna on May 16 1919, which reawakened the Turkish nation, and his own appointment by the Ottoman Govt. in Constantinople as Inspector of the IX. Army Corps in north-eastern Anatolia. His mission, as conceived by the Sultan and the Grand Vizier, Damad Ferid Pasha, was to execute the armistice terms by superintending the disarmament and demobilisation of the Turkish army in this remote district. Mustafa Kemal's intention was to create a nucleus of national resistance against the partition of the country, and he therefore accepted with alacrity the position offered him by the unsuspecting Government. As soon as he landed at Samsun he began to organise his new movement locally at Amasia, Tokat and Sivas, and to correspond secretly with other parts of the country. The Sultan's Govt., awaking too late to what he was doing, recalled him to Constantinople, but instead of obeying he went on to Erzerum and sent in his resignation to Constantinople. He next convened two congresses, one at Erzerum in July, and the other at Sivas in Sept. 1919. Both congresses endorsed his programme of fighting for national existence to the bitter end, and they appointed a standing executive committee under his chairmanship. Thereupon he was outlawed by the Constantinople Govt., and relations between the capital and the interior of Anatolia were broken, but all the efforts of the Constantinople Govt. and the Allied Powers to frustrate Mustafa Kemal's activities were unavailing. They simply strengthened his conviction, and that of the people round him, that he had taken the right path.

The political and military history of the new Turkish Nationalist movement, commonly called the "Kemalist" movement, after its founder, is given elsewhere (*see* GRECO-TURKISH WAR; LAUSANNE, TREATY OF; TURKEY), and in this article it can only be touched upon in so far as Mustafa Kemal's personal career is directly concerned. Mustafa Kemal was in favour of the Nationalists participating in the general election at the close of 1920, but decidedly opposed to the meeting of the Assembly at Constantinople, and his judgment was borne out after the event by the high-handed action which the British military authorities and the Sultan's Govt. took in March and April 1920 respectively. On April 23 1920 Mustafa Kemal gathered together at Angora the Nationalist members of the late Parliament who had escaped from Constantinople, and was elected unanimously as president of this new National Assembly.

During the $2\frac{1}{2}$ years which followed, Mustafa Kemal was the heart and soul of the Turkish national resistance, in circumstances in which all but the most determined characters would have despaired. He knew how to make the most of the fact that this time the nation was fighting for its homeland, and not for some distant alien province like the Yemen or Albania. He succeeded in evoking the utmost powers of his followers, and his firm conviction of final victory, his exceptional military ability, his keen intellect and his persuasive oratory carried his countrymen through their ordeal. During the summer campaign of 1921, which was the supreme crisis of the Greco-Turkish War, the Angora assembly appointed Mustafa Kemal generalissimo of the Turkish forces, with unlimited power, and he took personal charge at the front during the 22 days' and nights' fighting of the battle of the Sakaria. During the battle his horse was wounded and the general broke a rib in falling, but he never left the front. After this battle the assembly gave him the rank of field-marshal and the traditional title of "Ghazi" (the victorious).

The great events which followed—the destruction of the Greek army, the peace settlement at Lausanne, the abolition of the Sultanate, the declaration of the Republic and the abolition of the Caliphate—were the direct work of Mustafa Kemal. On Oct. 29 1923, the date on which the Republic was proclaimed, the great national assembly unanimously elected Mustafa Kemal as the first President of the Republic. The wide constitutional powers which he thus received were enormously enhanced by his personal force of character and by the unique hold which he had obtained over the hearts and minds of his countrymen through the astonishing services which he had rendered to the national cause. Indeed, Mustafa Kemal became a dictator in fact, though not in constitutional theory, and this fact dominated the political situation of Turkey as she emerged from the War. In some ways Mustafa Kemal's virtual dictatorship was advantageous and perhaps even necessary to Turkey, since the period of reconstruction which now began was hardly less critical than the foregoing period of war and revolution. Undoubtedly Mustafa Kemal displayed the same energy, audacity and radicalism in setting out to "win the peace" as he had displayed in winning the War.

On the other hand, after the external menace to the existence of Turkey had been removed, the internal unity of the nation

naturally began to relax, and different parties arose with different policies for securing the national welfare. This was a healthy symptom, and an outside observer would be inclined to criticise Mustafa Kemal, during this phase of his career, for not allowing sufficiently free play to these opposition elements. His somewhat repressive policy towards his political opponents had the unfortunate effect of depriving Turkey of certain talents and abilities which she could ill afford to spare, and there was a perceptible increase of factiousness and embitterment in the internal politics of the country. Nevertheless, at the time of writing, President Mustafa Kemal's position in Turkey remained substantially unimpaired. (A. J. T.)

MUTSUHITO (1852–1912), Emperor of Japan (*see* 19.100), died at Tōkyō July 30 1912. He was posthumously styled the Emperor Meiji, according to the custom of Japan.

MYCOLOGY (Gr. *μύκης*, a mushroom; *λόγος*, discourse): the scientific study of fungi. The two decades from about 1890 to 1910 were remarkable in the history of mycology, for the many interesting discoveries made in the morphology and physiology of the fungi, especially in regard to their reproductive processes and the problems of sex and nuclear fusions. The results obtained have been since then exhaustively investigated, and have been, in large measure, confirmed, and upon the foundations thus laid our knowledge of the fungi has, during recent years, been extended in all directions.

Many new aspects of study have been opened up, life histories have been more fully elucidated, the study of pure cultures has added much to our knowledge of the physiological activities involved in parasitism, saprophytism and symbiosis; and the physiological effects of light, heat and the chemical and other changes taking place in the substratum during the growth of a fungus are more clearly understood. Knowledge of plant diseases (*see* PLANT PATHOLOGY) has, especially in the tropics, been vastly increased; and the establishment by the Govt. of an " Imperial Bureau of Mycology " has already, in conjunction with the valuable mycological work carried on at Kew and the British Museum, profoundly influenced phytopathological research in the empire.

Classification.—In the classification of the fungi, although much has been done to elucidate the life histories of a large number of different forms, there are still so many gaps in our knowledge that anything like a satisfactory natural classification is impossible. Many new schemes have been proposed, but so far the most useful classification is that which maintains the three great classes with their subdivisions: (1) Phycomycetes (Zygomycetes, Oomycetes), (2) Ascomycetes (including Laboulbeniaceae) and (3) Basidiomycetes (Ustilaginaceae, Uredinae and Basidiomycetes proper), together with the *Fungi Imperfecti*, the members of which are probably stages in the life histories of forms belonging to the Ascomycetes and Basidiomycetes, and the lichens, the majority of which are Ascolichens, a few being Basidiolichens. As regards phylogeny, evidence is gradually accumulating that the derivation of the primitive fungi such as the Chytridineae is to be traced to a protozoan ancestry (*see* PROTOZOÖLOGY).

Many of these primitive forms, and notably that curiously interesting species *Polyphagus euglenae*, have much in common with Protozoa, and we have also to consider, in this connection, the mycetozoa and bacteria, which, although they have some of the characteristics, are not regarded as true fungi. As regards the higher fungi, notwithstanding our increased knowledge of their structure and reproduction, any conclusions as to their algal ancestry, although not impossible, cannot at present be substantiated.

Recent Investigations.—Among the more generally interesting investigations of recent years are those on the symbiotic relationships of the fungi to higher plants, as exemplified by the endotropic mycorhiza of *Calluna vulgaris*. Evidence has been brought forward to show that the presence of the fungus is so necessary to the well-being of this plant that no development of the seedling can take place unless it is infected by the fungus, and this infection is brought about by hyphae in the seed coat. Further, although seedlings may be satisfactorily infected from artificial cultures, yet, if the culture is too vigorous and the seedling weak, the fungus behaves as a parasite. This raises important problems still under discussion concerning the relations of mycorhiza and symbiosis to parasitism and saprophytism.

Many new observations have been made upon the cell contents of the fungi. Among these may be mentioned metachromatin, chromidia, mitochondria, coenospheres or coenocentra and elaioplasts. The distribution and staining properties of these bodies have been carefully studied, but we are still far from a clear understanding of their significance.

Some attention has been paid to the colouring matters of the fungi. The orange coloured fatty globule in the zoöspores of Chytridineae probably plays the part of an eye spot. Most of the brilliant colouring of the fungi is due to colouring matters in the cell walls, or in the mucilaginous layers of the cell membrane. Many of these when extracted in water and alcohol exhibit a beautiful blue or blue-green fluorescence.

The stimuli of light and gravity play an important part in the orientation of the fungi. Light exerts not only a directive but also a formative influence on their growth. Positive heliotropic response occurs in many of the Agaricineae, in the asci of certain Discomycetes and in the sporangiophores of various Mucorineae, by which they are brought into the best position for the discharge of their spores. Response to the stimulus of gravity is shown during the growth of the fruit bodies of the Hymenomycetes, and is on all-fours with what takes place in higher plants. The perceptive region is located in the stipe, the upper part being the most sensitive. The gills show a very pronounced positive response to gravity.

There is very little to add to our knowledge of the sexuality and nuclear fusions in the fungi beyond what was known in 1910. In the Phycomycetes functional sexual organs and the fusion of male and female nuclei have been discovered in many species in which they had not previously been found, and the presence of functional sexual organs has been definitely established in the Saprolegniaceae. In the Ascomycetes and Basidiomycetes the significance of the nuclear fusions in the ascus, teleutospore and basidium is still not understood, and the existence of two nuclear fusions in the life histories of certain Ascomycetes is still a matter of controversy. Very conflicting accounts are given of the nuclear behaviour in such classical species as sphaerotheca and pyronema, and until some quite definite agreement as to the facts is forthcoming it seems impossible to arrive at anything like a satisfactory explanation. In that interesting group the Laboulbeniaceae, there is evidence that sexual fusion takes place by a method somewhat similar to that described for the lichens by means of a trichogyne and spermatia. The fusion has not actually been observed, and the fate of the spermatia is unknown.

In the Basidiomycetes proper a number of observations have been made to show that the phenomena of heterothallism and homothallism, as in the Mucorineae, occur here also. The criteria for this conclusion are the behaviour of cultures of monosporous mycelia as contrasted with those of bisporous or polysporous mycelia in the production of fruit bodies; and the formation of clamp-connections. Thus, *Coprinus fimentarius* is stated to be heterothallic on the following grounds: in a monosporous culture no clamp-connections were found, the nuclei remained unpaired and the mycelium was sterile. When two monosporous cultures were brought together clamp-connections were formed, the cells became binucleate and fruit bodies were produced. The presence of clamp-connections is stated to be " invariably associated with the conjugation of the nuclei." It is suggested that this criterion affords a means of determining whether a species is homothallic or heterothallic.

These conclusions are so important that the data on which they are based should be subject to the most critical confirmation, especially in view of the facts that contradictory statements concerning them have been made, and that they have been used as a basis for important conclusions upon the Mendelian segregation of sex in these forms. It is essential that we should have definite confirmation of the function suggested for the

clamp-connections, and of the transference of nuclei from one cell to another in the anastomoses that take place in the mycelia, before any satisfactory advance can be made in this new field of study. (H. W.*)

MYSLBEK, JOSEF VÁCLAV (1848–1922), Czech sculptor, was born at Prague July 21 1848. He was a pupil of Václav Levý and worked under Trenkwald at the academy of fine arts in Prague. He sprang into prominence when in 1871 he carved two symbolical figures for the exterior of the National Theatre in Prague. The statues are distinguished by a Slav lyricism and delicacy, combined with a masculine strength and a monumental feeling. After a brief residence in Paris he was in 1885 appointed professor at the school of arts and crafts in Prague, of which he became a director in 1893. All Myslbek's work presents a blend of idealism with a precise and balanced realism and exhibits his endeavour to cope with the fundamental problems of art. His statues "Devotion" (1884, Modern Gallery, Prague), and "Steadfastness" (1884, Vienna Parliament) notably unite a powerful idea with a complete mastery of the material. His "Crucifix" (1888–9), installed in the Sacré Coeur at Paris, bears comparison with the works of old masters, although it is conceived in the modern spirit, expressing human suffering and divine resignation. The statue of Cardinal Schwarzenberg (1895) is a masterpiece of portraiture, but the highest attainment of Myslbek's art is the monument to St. Václav, a work of 30 years, in St. Václav's Square in Prague, which embodies all his monumental qualities as an artist and attains a level which entitles it to a place among the great works of European statuary. Myslbek died at Prague in 1922.

MYSTICISM (*see* 19.123).—The 20th century has seen a remarkable revival of interest in mysticism. Several causes have contributed to this. First, the inevitable reaction against 19th century rationalism, with its excessive emphasis on the ethical and neglect of the transcendental in religion. Next, the disturbance of traditional theology by textual criticism and historical and scientific research, forcing many religious minds to look elsewhere for the grounds of belief. Thirdly, the application of the comparative method to records of religious experience, especially that intensive form which claims direct intuitive apprehension of God (and this is the kernel of mysticism) disclosed remarkable unity between them; and the development of psychology brought within the range of that science many "mystical phenomena" which had formerly been dismissed unexamined, as the products of superstition or of mental disease.

The fresh material brought in from the study of Oriental religions has also supported the claim of mysticism to be regarded as a genuine form of human experience. Finally, in opposition to the merely moral and humanitarian view of Christianity popularised by Liberal Protestantism and social reformers, this century has produced a number of records of contemporary mystical experience. Thus there have been both additions to the material accessible to students, and advances in the proper arrangement and understanding of facts. No well-informed person now identifies the substance of mysticism with trances, ecstasies or other psychophysical phenomena, or regards it as necessarily hostile to dogmatic theology.

Modern Study.—Modern study of the subject may be said to begin with Dean Inge's Bampton Lectures on Christian Mysticism (1899). It has since been pursued along the parallel routes of psychology, history and philosophy of religion. These aspects of mysticism cannot rigidly be separated, or indeed understood in isolation; each being of vital importance to the rest. The peculiar triumph of the greatest modern writer on mysticism, Baron Friedrich von Hügel, consists in the synthesis effected between the historical, philosophical and intuitive aspects of man's experience of God.

The Psychology of Mysticism

The serious study of mysticism, especially from the psychological point of view, and attempt to discover its relation to other forms of consciousness, originates in William James's epoch-making Gifford Lectures on *The Varieties of Religious Experience* (1902). Although based on material chosen from too restricted a field, the publication of this book revolutionised the attitude of students towards religious psychology. The conception of the subconscious was now first used to provide an explanation and sanction for the ecstatic and other abnormal phenomena found in connection with mysticism, and an attempt was made to distinguish the accompaniments of genuine religious apprehension from their pathological imitations.

These researches have continued vigorously, especially in America and France. Pratt's *Religious Consciousness* (1921) represents the matured result of the movement started by James. Considerable advance has been made towards the correlation and better understanding of such types as the prophet, visionary and religious revivalist, in all of whom a strong mystical impulse is commonly at work. The hostile study of mysticism from the psychological standpoint has its chief exponent in J. H. Leuba; whilst an approach midway between the philosophical and psychological is provided by Bucke's *Cosmic Consciousness*, a curious work which has exercised considerable influence.

Realisation of the close correspondence between the abnormal phenomena of mysticism and those connected with other forms of mental exaltation, healthy and diseased, has caused an attempt to distinguish the essence of mysticism—intuitive experience of absolute reality—from the ecstatic states often accompanying it. This may be the line along which the apologetic of the future will move. Characteristic of the revival is the important part taken by French writers. Effective criticism of mystical phenomena has come from experimental psychologists such as Pierre Janet. Delacroix's sympathetic but penetrating analyses of the evolution of the great mystics have shed much light on the psychological characteristics of religious genius. Valuable studies of the nature of mystical contemplation, and restatement in modern terms of its processes, have been produced by Roman Catholic scholars; the best being those of Père Poulain, S.J. These works have a practical as well as a scientific objective. On the whole, the general result of the application of psychological criteria to mystical experience has been to establish the claim of psychology to explain the special methods and characteristics of the mystic, and disestablish the claim of certain schools of psychology to explain away the reality of his experience.

The History of the Movement

The modern psychological study of mystical phenomena has illuminated many historical problems; especially those connected with prophecy and the origins of religious movements. It has also stimulated interest in the records of empirical religion in its intensest form—the lives and writings of mystical seers and saints. The contribution of mystical experience to the religious outlook of such apparent intellectualists as, *e.g.*, St. Augustine or Aquinas is beginning to be understood; together with the great part played in religious history by mystics and their articulation to the corporate religious life. The treatment of the subject in such works as Heiler's *Das Gebet* and *Der Katholizismus* or Brémond's monumental *Histoire du Sentiment Réligieux en France*, is symptomatic of the changed outlook. Material available for students of historical mysticism has been much enriched. Good texts and translations of many masterpieces of European mysticism have appeared, with valuable studies such as those of Abbot Butler and Rufus Jones, based on the historical method. Sūfi mysticism, once only known to Oriental scholars, can now—thanks mainly to the work of Reynold Nicholson—be compared with that of the West. Such studies are seen to have an important bearing on the history of ideas; and the substantial identity of experience which they reveal has proved that mysticism must be regarded as an enduring type of human apprehension.

The changed outlook of physical science, the new understanding of its limitations and the marked revolt from 19th-century materialism, have brought about a *rapprochement* between mysticism and philosophy. There is a tendency alike in monists, critical realists and exponents of the "philosophy of value" to consider seriously the claims and findings of the mystic, which are congenial to the pantheistic temper of modern religious

thought. On the other hand, those hostile to pantheistic doctrine find in the mystic's intuition of God a warrant for transcendentalism; and even show some willingness to reinstate in suitable disguise the ancient concept of Supernature. Inge's *Philosophy of Plotinus* (1918) and Otto's widely discussed essay *Der Heilige* (The Idea of the Holy, 1924) show different aspects of the reaction of philosophy to mysticism. But this is also felt in the pure metaphysics of Wittgenstein, and in the inimical attitude of Croce and his school. The greatest and ultimately most influential expositions of the place of mysticism in theistic philosophy, and its limitations and rightful relation with other aspects of knowledge, are Von Hügel's *Mystical Element of Religion* and *Eternal Life*. These books have affected all modern religious thinkers, and may provide the starting-point of a critical realism harmonising the mystical, moral and intellectual approaches to reality. In America, Hocking's *Meaning of God in Human Experience* is probably the most important philosophic contribution to this subject.

Modern Mystics.—The first quarter of the 20th century saw, especially in France, a revival of genuine Christian mysticism; possibly the beginning of what later historians may recognise as a "mystical epoch." Its most impressive document is the *Spiritual Journal* of the lady known as Lucie-Christine (1844–1908), a record which bears comparison with the historical classics of mysticism. Its most striking product is the career of the hermit saint of the Sahara, Charles de Foucauld (1858–1916). These stand up among a number of more obscure personalities, such as Elizabeth de la Trinité (1880–1906) and Madeleine Sémer (1874–1921), all of whom claim and describe with a conviction and sobriety compelling respect the characteristic mystical experience and certitude. From India, the autobiography of the saintly Hindu theist Maharshi Devendranath Tagore (1817–1905), and the experiences of the Christian convert Sadhu Sundar Singh (born 1889), whose career and personality have made a widespread impression, provide unspoilt examples of first-hand mysticism, and deepen the sense of unity in the spiritual intuitions.

The revived interest in mysticism has had popular results in several directions. It has seemed to endorse the shallow eclecticism in which many escape the difficulties of belief. Its superficial peculiarities have been exploited by theosophists and other apostles of eccentric religiosity. It has produced numerous bastard cults, mostly hailing from America though often wearing Oriental disguise; cults mainly compounded of pantheism, quietism and crude autosuggestion, and offering a "mystical religion" to those seeking a spiritual home full of modern conveniences and devoid of discipline. On the other hand, its spirit has affected for good the literature and activity of the organised Churches; shifting the emphasis from tradition to experience, and bringing back into focus those mysterious realities which religious symbols and institutions seek to express.

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NAIROBI, the capital of Kenya Colony, British East Africa (*see* 19.155). In 1923 the population was: Europeans 3,071, Asiatics 8,356, Africans 12,666, total 24,093. Nairobi is the seat of the Kenya Legislature and the headquarters of most of the European organisations in the colony. Nearly all the whites are British, and the town has most of the amenities of a European city. Both the standard and the cost of living are high. Laid out on a large scale, Nairobi was still in the transition stage in 1926, but had many fine private and public buildings. The main thoroughfares are Government road, in which numbers of shops and offices are owned by Indians, and Sixth avenue. Parklands is a residential suburb for Europeans. A Natural History Museum, in Kirk road, was opened in 1922. The Indian bazaar covers nine acres. The natives occupy a separate location. A branch railway runs to the foot of Mt. Kenya. Nairobi is governed by an elected municipality, with separate franchise rolls for Europeans and Indians.

NAMUR, Belgium (*see* 19.159), with a population in 1923 of 31,044, has been called the Sheffield of Belgium, because of its large cutlery industry. Tanning and glass-making are also carried on, and the town has a considerable trade, and six lines of railway. An athletic sports ground was laid out and a fine open-air theatre built before the World War in the park on the Citadel Mount. Namur was bombarded for two days in 1914, before it was taken by the Germans, and after their entry a number of houses were burnt and looted. The Place Leopold and Place d'Armes suffered severely in the bombardment and the town hall was destroyed. The forts were repaired by the Germans after the capture of the town, which formed their cavalry headquarters during the War. The railway station was bombed by the British shortly before the Armistice (*see* BELGIUM, INVASION OF).

NANKING, China (*see* 19.162), had an estimated population of 380,900 in 1923. Since it became the terminus of a railway line to Shanghai, and the line to Tientsin, terminating at Pukow, on the opposite bank of the Yangtze Kiang river, was opened, the trade has increased, but the city has little commercial importance. A short railway line has been opened to Hsiakwan, the port of Nanking a few miles to the south. A grand industrial exhibition, the first in China, was held in the city in 1910, and again in 1921. Only a portion of the ground enclosed by the 20-mile circuit of the walls is inhabited, but the area has been opened up by roads and shops, offices and government buildings in Western style have been erected. The city possesses a naval college, an arsenal, an agricultural experimental station, a Government mint and a university. The last was formed by the union of three independent mission schools in 1911, and includes a college of arts and sciences and one of agriculture and forestry; a hospital and library; senior, junior and primary schools, etc. Two-thirds of the surplus from the American China Relief Fund was presented to the university in 1922 for research, particularly in connection with famine prevention. Good work has also been done in the production of silkworm eggs immune from disease. A number of the large silk stores in Nanking were burnt and looted by Chinese soldiery in 1924, and American marines had to be landed to protect the foreign population.

Nanking was the scene of much fighting during the revolution of 1911, and the Tartar city was burnt. It became the seat of a provisional Government, which hoped to make it the capital city, but in 1913 an armed rebellion took place and the city was bombarded for a fortnight by the troops of the Government. Hsiakwan was burnt down, but was rapidly rebuilt with new and wider streets.

NANSEN, FRIDTJOF (1861–), Norwegian scientist, explorer and statesman (*see* 19.162). After Dr. Nansen's return from the North Polar expedition in 1896 a professorship of zoology was established for him at the University of Christiania. Here he was engaged in working up the results of his expedition and in general scientific research, especially in physical geography and oceanography. In the summer of 1900 he took part in an Arctic oceanographic expedition in the S.S. "Michael Sars," headed by Dr. Johan Hjort, and became director of the International Central Laboratory in Christiania for the Research of the Sea. In 1902 he published *The Oceanography of the North Polar Basin*, and in 1904 *The Bathymetrical Features of the North Polar Seas*. In 1905 Nansen actively intervened in politics for the first time. He issued a manifesto and many articles in connection with the crisis between Norway and Sweden. His attitude may be summarised by the last words of a short work published later in the year: "Any union in which the one people is restrained in exercising its freedom is and will remain a danger" (*Norway and the Union with Sweden*, London, 1905). On the establishment of the Norwegian monarchy Nansen was appointed minister to England (1906), and in the same year was created G.C.V.O. In 1908 he retired from his post and returned to his scientific work as professor of oceanography at Christiania University. He devoted all his time to oceanographic research, and in co-operation with his friend Professor Bjorn Helland-Hansen, of the Bergen Museum, wrote *The Norwegian Sea, its Physical Oceanography* (*Report* on Norwegian Fishery and Marine Investigations, vol. 2, 1909).

In 1910 Nansen made an oceanographic cruise in the "Frithjof" through the northeastern North Atlantic from Ireland to Iceland and back to Norway, and published the results in *The Waters of the Northeastern North Atlantic* (*Internationale Revue der gesammten Hydrobiologie und Hydrogeographie*, Leipzig, 1913). In 1911 he published *In Northern Mists* (2 vol.) on the exploration of the northern regions from early times up to the beginning of the 16th century. In 1912 he made a further oceanographic cruise to Spitsbergen and the waters to the north in his yacht the "Veslemoy," and described it in *En ferd til Spitzbergen;* the scientific results of the cruise are contained in *Spitzbergen Waters* (Society of Science, Christiania, 1915). The following year he made an expedition through the Arctic and the Kama Seas to the mouth of the Yenisei river and through Siberia and the Amur region, recounted in *Through Siberia, the Land of the Future* (London, 1914).

In 1914, jointly with Professor Bjorn Helland-Hansen, Nansen made an oceanographic expedition in the eastern North Atlantic to Portugal, Madeira and the Azores and back to Norway, the important scientific results of this expedition being published by the two scientists in *The Eastern North Atlantic* (Geophysic Publication, Academy of Science, Oslo). During the World War further oceanographic expeditions—Nansen's absorbing interest—were impossible. In 1917 he was appointed head of a Norwegian Govt. commission to the United States, and secured a satisfactory agreement with the American Govt. in regard to the import into Norway of essential supplies. After the Armistice (1918) Nansen threw himself with vigor into the work of repatriating prisoners of war, and under him, as Commissioner of the League of Nations, and with the executive assistance of the national Red Crosses, about 500,000 prisoners of war were repatriated from Siberia, China and other parts of the world. This work was financed largely by the governments participating in the International Committee for Relief Credits, Paris, of which Lord Bradbury was chairman.

In 1919 Nansen conferred with Hoover regarding the possibilities of assisting the Russian people, and suggested to President Wilson and the members of the Supreme Council an organisation for Russian relief on the lines of the Belgian Relief Commission. The Supreme Council supported the proposal on the condition that all hostilities in Russia cease. As this was at the time when Kolchak in the east and Deniken in the south were advancing towards Moscow the project was abandoned. In 1921 Nansen was asked by an international conference in Geneva of delegates of 48 Red Cross societies and 12 governments to put himself at

the head of the relief work for famine-stricken Russia, and on Aug. 27 in the same year he signed an agreement in Moscow with Chicherin, the Soviet Foreign Minister, regarding the method of furnishing relief on an important scale, and visited the areas of famine. In Sept. Nansen endeavoured unsuccessfully to induce the League of Nations to assist the starving millions in Russia by raising, under safeguards, an international governmental relief loan. Failing here, he visited the chief capitals of Europe, and as a result largely of his intensive propaganda the European Red Crosses fed and clothed at one time at the peak of the Russian famine over 1,600,000 inhabitants of the Volga and South Ukraine regions. His publicity campaign undoubtedly had influence in America, which under Hoover's inspiration and direction fed at one time 10,000,000 Russian sufferers. Nansen's mission in Russia continued to conduct two agricultural demonstration estates in the former famine areas. In 1923 Nansen published *Russia and the Peace* setting out the economic position of Soviet Russia. As high commissioner for refugees to the League, he accepted responsibility for the protection and settlement of Russian, Armenian and Greek refugees, and the following is the appreciation of the Assembly of the League of this work:—

> The Assembly feels it its duty to pay a whole-hearted tribute to the high commissioner, Dr. Fridtjof Nansen, both for his unceasing devotion, of which for more than four years he has given proof, in assisting refugees of every nation, and for the high qualities which he has displayed in the carrying out of his onerous duties. The Assembly would record the fact that with the very limited means at his disposal Dr. Nansen has saved from misery and often from death hundreds of thousands of human beings, and would render him the grateful thanks due to him as a benefactor of humanity.

In 1923 Nansen was awarded the Nobel Peace Prize, which he gave to the furtherance of the Nansen agricultural demonstration estates and model farms in Saratov and Ekaterinoslav Governments, Russia. In his early manhood Nansen was a great athlete, and by his writings was largely responsible for popularising ski-ing in the Alps, and evidence of his enthusiasm for sport is his work on *Sport in the Polar Regions* and *Wild Norway* (1925). Nansen, as delegate for Norway to the League of Nations, made an impassioned intervention protesting against the occupation of Corfu by Italy in 1923, and at the Fifth Assembly in 1924 he conducted the first informal negotiations that took place concerning the entry of Germany into the League of Nations. Nansen's interest in education has been evidenced by his campaign in favour of Russian professors and universities. In 1925 he was elected Lord Rector of Aberdeen. (*see* POLAR REGIONS; REFUGEES.) (J. H. Go.)

NAOROJI, DADABHAI (1825–1917), Indian politician (*see* 19.167), died at Versova, near Bombay, June 30 1917.

NAPLES, Italy (*see* 19.178), the second largest city in Italy, had a population of 772,405 in 1921. To improve the sanitary condition of the city an opening has been made through the squalid Pendino quarter, and a new approach to the castle from the Strada San Carlo. The quarter of Santa Lucia has grown largely. A fine art collection was presented to the city in 1925, and will be housed in the Villa Floridiana.

The museum, which houses the Pompeian collections, shaken by the building of a tunnel, was found to be in danger of collapse; the walls were temporarily shored up pending its repair. Excavations in 1913 led to the discovery of the old port of Pompeii, and further discoveries in Pompeii itself were opened to the public in 1915. The Neapolitan University was closed in 1925, owing to riots between Fascists and non-Fascists. A metropolitan electric railway was opened in 1925, with seven stations, the terminus being at Pozzuoli; another station will be built at Bagnoli. The work on port improvements was temporarily suspended in 1924. Fears were expressed in 1925 lest the Orient Line would cease to use Naples as a port of call, owing to the new regulations for third-class passengers. Naples is now the third port of Italy: the number and tonnage of vessels entering the harbour are greater than at Genoa, though the amount of goods is less.

NAQUET, ALFRED JOSEPH (1834–1916), French chemist and politician (*see* 19.236), died in Paris March 12 1916.

NARES, SIR GEORGE STRONG (1831–1915), British explorer (*see* 19.240), died at Surbiton, Surrey, Jan. 15 1915.

NAREW, BATTLES OF THE.—The battles on the river Narew, northeast of Warsaw, in July and Aug. 1915, were a part of the great offensive planned by Falkenhayn against Russia. (*See* EASTERN FRONT and map.) During May and June, Mackensen had driven the Russian armies in Galicia from Tarnów on the Dunajec to the east of Lemberg (*see* DUNAJEC-SAN; LEMBERG). In July the group of armies under his command was directed northeast towards Brest-Litovsk against the communications of the Russian forces which still held the Warsaw salient (*see* BREST-LITOVSK). Hindenburg, who commanded the group of armies on the northern part of the Eastern Front, was now ordered to strike a blow on the north side of the salient. Falkenhayn hoped thus by driving in the flanks of the salient to cut off large numbers of Russians in its apex about Warsaw. The realisation of this hope depended of course on the rapidity with which the flanks could be forced.

Rival German Plans.—The operation against the Narew line is of interest because of the controversy it provoked between the two men who had most influence on German strategy during the War, Falkenhayn and Ludendorff. The former was at this time chief of the German Great General Staff, and thus responsible for the supreme direction of the War; the latter was chief of staff to Hindenburg. Ludendorff had long cherished the idea of a Napoleonic manoeuvre against the Russian rear by Kovno and Wilno on Minsk, and considered the proposed Narew offensive as timid and ineffectual, Falkenhayn, with heavier responsibilities on his shoulders, mistrusted both the feasibility and the expedience of the Wilno adventure. He could not afford to become so deeply involved in the Eastern theatre as to be unable to withdraw formations to meet the coming offensive in the West. After a discussion of the alternative plans held in the presence of the Kaiser, Falkenhayn's views were approved; and Hindenburg was ordered to carry out the Narew attack.

A formidable water barrier protects Russian Poland against invasion from East Prussia. From Kovno to Grodno it is formed by the Niemen; from near Grodno it is continued by the Bobr, the Narew and the lower course of the Bug to the fortress of Nowo-Georgiewsk (Modlin); thence the Vistula flows northwest to the frontier. The Russians had fortified this river line. Besides the fortresses of Kovno and Grodno on the Niemen, Osoweic on the Bobr, Lomza on the Narew and Nowo-Georgiewsk at the confluence of the Bug and Vistula, there were fortified bridge heads on the Narew at Ostrołęka, Rozan, Pułtusk and Zegrze. Though the river was fordable in the summer at many points, marshes along its length increased its effectiveness as an obstacle.

The German Attack.—Gallwitz's army, which was to make the attack, comprised six corps (14 divisions). It extended from the river Szkwa, northeast of Ostrołęka, to the Vistula. Opposite to it, from Jednorozec, on the river Orzec, to near Płoçk on the lower Vistula, lay the Russian I. Army (Litvinov) with three corps and a cavalry corps.

The tactical details of the fighting are not of any special interest. On July 13 Gallwitz delivered his first attack on the approximate line Przasnysz-Ciechanów, aiming at Pułtusk. The Russians, over-weighted both in numbers and heavy artillery at once fell back more than half-way to the Narew line. They were attacked again on July 15, and during July 18 and 19 withdrew across the river, the Russian XII. Army on their right conforming to the movement. Reinforcements had now arrived and resistance stiffened. Though the Germans stormed the bridge-heads of Pułtusk and Rozan on July 23, and secured crossings over the river, their further progress was limited by violent Russian counter-attacks, and they were unable to reach the line Wyszków (on the lower Bug)–Ostrów, at which they were aiming. An attempt to force a passage further east at Ostrołęka on July 30 failed, and it was not until Aug. 4 that this bridge-head fell. Losses were heavy on both sides; but the Russians had secured time and space sufficient to evacuate the Warsaw salient without danger.

Hindenburg and Ludendorff naturally claimed that the result of the battle vindicated their opinion on the mistaken strategy of the Supreme Command. Falkenhayn retorted that the operations would have had the desired effect of intercepting the Russian retreat had Hindenburg used the full force available and given Gallwitz 20 divisions instead of fourteen. It seems doubtful, however, whether the communications would have allowed the effective employment of so large a force.

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(A. P. W.)

NAROCZ, BATTLE OF LAKE.—Lake Narocz, in Lithuania, 62 m. E.N.E. of Wilno (Vilna), gives its name to a great offensive by the Russian II. Army in the spring of 1916 (*see* EASTERN FRONT and MAP).

General Situation on the Eastern Front.—The river Pripet formed the dividing line between the German and Austrian commands. At the beginning of March there were 42 German and two Austrian divisions on the front north of the Pripet, the total length of which was about 250 miles. The Russians had organised their armies into three groups: the Northern (XII. and V. Armies) on the Dvina, the Western (I., II., X., IV., III. Armies) extending to south of the Pinsk marshes and the Southwestern (VIII., XI., VII., IX. Armies) up to the Rumanian border. Their main strength was concentrated on the Northern and Western fronts, where it had been decided that the principal efforts of the year should be made. The losses of 1915 in men and material had been made good; guns and munitions were available on a larger scale than previously, though still insufficient for the requirements of trench warfare.

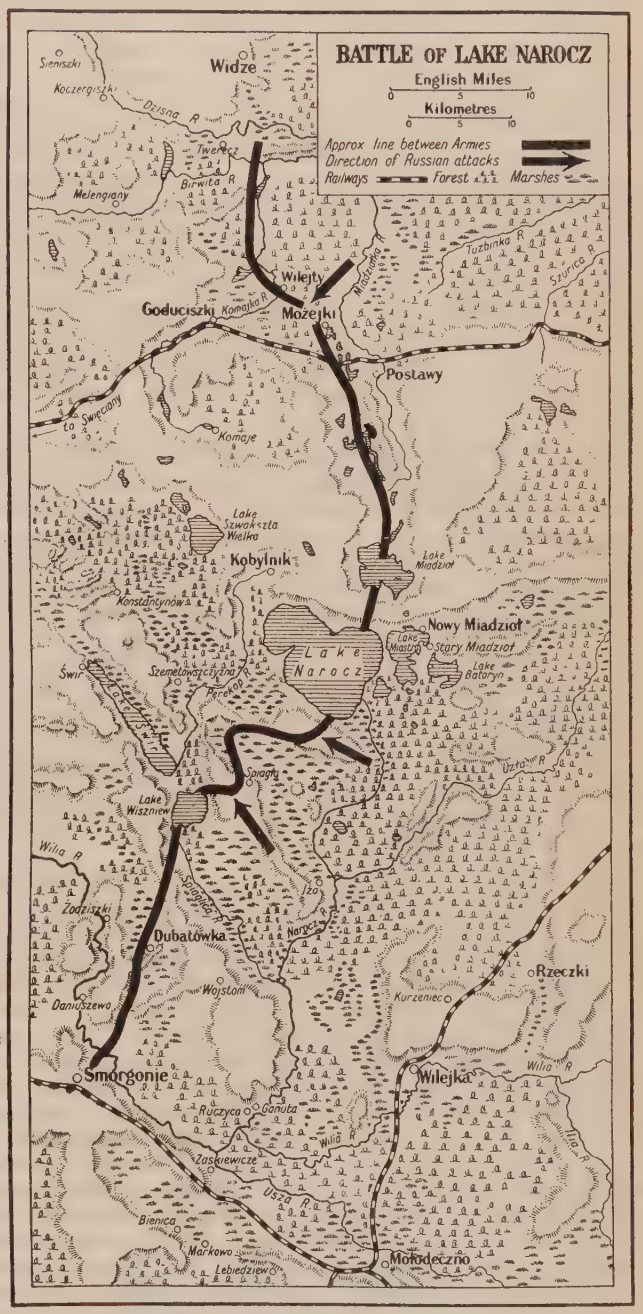
Plan of Operations.—The general idea of the battle was for the II. Army to attack on either side of Lake Narocz, where the German line formed a slight salient; the two wings were eventually to join at Swieciany and to continue their advance westwards to Panevežys (some 80 m. north of Wilno (Vilna) and 100 m. west of the original line), where the V. Army, which was to attack from the Jakobstadt bridgehead on the Dvina, was to join them. The operation seems to have been planned originally to take place later in the year, when all the Allies proposed to attack simultaneously. But on Feb. 21 the German assaults on Verdun began, and the Russians chivalrously hurried on their preparations and attacked to relieve the pressure on the French, at the worst possible time of the year, when the annual thaw, which renders all communications practically impossible for a period, might be expected at any moment.

Description of the Terrain.—Lake Narocz (eight m. by six m.) is the largest of a whole series of small lakes in which the tributaries of the Wilia and the Dzisna rise. It drains into the river Narocz, which flows south to join the Wilia east of Smorgonie. The greater part of the trench line between Dvinsk and Smorgonie (over 100 m. in a straight line) was protected by lake, stream or marsh, and stretches of dry ground wide enough for a large scale offensive were few. On either side of Lake Narocz, however, were gaps of four m. or so in the water line, where the terrain was comparatively favourable for attack, though communications were poor. The northern gap was 10 m. to the north of Lake Narocz, between the villages of Wilejty and Możejki; the southern was between the lake itself and Lake Wiszniew.

Dispositions of the Opposing Forces.—The II. Army, which was to carry out the attack, was divided into three groups: the right group, under Gen. Plyeshkov, opposite the northern gap, consisted of three corps and a cavalry corps; the centre group, under Gen. Sirelius, of two corps; and the left group, under Gen. Baluev, of three corps. Four corps were available behind these groups to exploit any success gained. The right and left groups were to attack the north and south faces of the salient respectively, while the centre group assisted by minor assaults and demonstrations. The army commander, Smirnov, went sick just before the battle and his place was taken by Gen. Ragoza.

The II. Army was opposed by Von Eichorn's X. Army, which extended from the river Dzisna to Krewo, south of Smorgonie, a front of some 85 m., and comprised 11 divisions and two cavalry divisions. The Germans were aware of the Russian concentration. Just before the attack, Gen. Von Hutier, commanding the XXI. Corps opposite the Lake Narocz front, was reinforced by one division, and other reserves were held in readiness to support him.

The Russian Attacks.—A thaw set in on March 17, but the offensive was nevertheless begun on the 18th. After a bombard-



ment of several hours, massed infantry attacks were made both by Plyeshkov's group north of Lake Narocz and by Baluev's group in the south. In the thickly wooded and enclosed terrain the insufficiently trained Russian infantry soon lost cohesion, and their assaults were ill-timed and disjointed. Though the German first-line trenches were in several cases occupied, they could not be held under the concentrated fire of the German artillery, which was extremely skilfully handled. By nightfall the Russians were back in their original positions, having suffered very heavy casualties without result. After two days of further

artillery preparation and minor attacks intended to mislead the enemy, renewed heavy assaults were made on the nights of March 19–20 and 20–21.

On Plyeshkov's front no ground was permanently gained, in spite of terrible losses, but Baluev's group in the south had some measure of success, and made an advance of over a mile on a front of about 2½ miles. The weather conditions were by now terrible; it thawed from the 17th to the 22nd, and the whole area of operations became a sea of mud. The battle was, however, continued till March 27, when the Russians at last desisted from their fruitless and costly attacks. In April a German counter-stroke retook all the ground gained by Baluev. Meanwhile, the attacks of the V. Army from Jakobstadt, March 21–6, were equally unsuccessful and almost equally wasteful of life.

Results of the Operations.—The operations resulted in a complete and disastrous failure for the Russians. Their losses were over 100,000 and they accomplished nothing. The offensive did not cause the Germans to move a single man from the Western Front, and so brought no relief to the French. The operation was mismanaged in every way. Both time and place were ill-chosen; the staff work was bad; and the artillery, in spite of a greater concentration of heavy guns on a narrow front and a more liberal expenditure of ammunition than ever before, failed to give proper support to the infantry, who as usual paid the price in terrible losses. The result was, in fact, a bitter disillusionment to the Russian high command, to the Russian soldier and to the Russian people.

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NASH, PAUL (1889–), British painter, was born in London May 11 1889, and educated at St. Paul's School and at the Slade School. His first exhibition was given in 1911, but he was comparatively little known until an exhibition of his Western Front war pictures (1918), the fruit of his work as an official artist 1917–8; several of these are in the Imperial War Museum, London. He then attracted attention as a landscape painter of individuality and charm, a somewhat mannered technique giving way gradually to a freer expression; he gave an important exhibition in London in 1924. He also produced some interesting woodcuts and book illustrations, such as the wood engravings, "Genesis" (1924). He was instructor of design at the Royal College of Art, South Kensington.

His brother, JOHN NORTHCOTE (1893–), worked on similar lines, and was also an official war artist during 1918.

NASHVILLE, Tenn., U.S.A. (*see* 19.246), had a greater business development between 1910 and 1925 than is indicated by the growth of its population within the city limits: 1910, 110,364; 1920, 118,342 (of whom 35,633 were negroes and 2,412 foreign-born, both of these groups being smaller than in 1910); 1925, 136,220, as estimated by the Census Bureau, and probably 150,000 if suburban population which is a part of the economic unit, were included. The value of products manufactured within the city limits increased from $29,650,000 (1909) to $83,041,583 (1923); postal receipts and bank clearings increased threefold, savings deposits and the value of new buildings constructed even more. During the World War the U.S. Govt. established the "Old Hickory" powder plant in the wilderness across the Cumberland river, constructing a village for 30,000 residents. Plant and village were bought after the War by a local corporation formed for the purpose of salvaging the property for an industrial centre. By 1925 a large factory for the production of rayon (artificial silk) was in operation on this site, and the location of other industries was assured. Vanderbilt University, with grants of $8,000,000 from the General Education Board and the Carnegie Corp. thoroughly reorganised its medical school (1919–25) and built for it an adequate modern plant, which was occupied in 1925. Nashville, Davidson county, and the State of Tennessee united in erecting a beautiful memorial building in honour of the men of the state who lost their lives in the War. In 1913 Nashville adopted the commission form of government.

NATAL (*see* 19.252), the smallest and most densely populated province of the Union of South Africa. Its area (including Zululand) is 35,284 sq. m. and the population (1921) 1,429,398, of whom 136,838 were whites, 141,649 Asiatics, 1,139,804 Bantu and 11,107 of mixed or other race. Since 1911 the white inhabitants had increased by nearly 39,000; the Asiatics by 8,210, the Bantu (natives) by 186,000. The density of population per sq. m. was 40.51. The chief towns are Durban and Pietermaritzburg (*qq.v.*). Next in size is Ladysmith with (1921) 6,783 inhabitants (3,221 whites).

The change from the status of a self-governing colony to a province of the Union affected Natal politically more closely than any other province, since in it alone were the great majority of the white inhabitants of British descent. The firm attachment of Natalians to the British connection continued an unchanging factor in the South African situation. Provincial administration was, however, largely carried on upon non-party lines. The first administrator, Mr. C. J. Smythe, had previously held office as Colonial Secretary and as Prime Minister of Natal. Mr. Smythe, who was reappointed for a second term in 1915, died in 1918 and Mr. (later Sir) G. T. Plowman succeeded to the post, which he still held in 1926. Revenue, derived chiefly from transfer duties and licences, increased from £118,000 in 1912–3 to £413,000 in 1922–3, the subsidies from the Union Govt. rising from £361,000 to £563,000. About 70% of the total expenditure was on education, the sums spent for that object rising from £169,000 in 1912–3 to £695,000 in 1922–3.

The Indian Problem.—Natal was deeply interested in the question of Indians in South Africa. Of the 161,339 British Indians in the Union in 1921, no fewer than 141,336 lived in Natal, where they had rendered possible the development of the sugar, tea and wattle industries, as well as provided labour for the coal-mines, railways and other public works. Besides labourers, there were many Indians engaged in professions and commerce. White South Africans in general opposed the further increase of Asiatics in the Union; while, in 1911, the Indian Govt., long dissatisfied with the attitude of Natal to Indians, prohibited the recruitment of indentured coolies. The Indians both in Natal and the Transvaal complained of many grievances, and their cause was championed by M. K. Gandhi, then resident in South Africa. Arising out of the agitation, riots and disturbances occurred in Natal in 1913. In 1914 the Union Govt. passed legislation intended to prevent Indian immigration into South Africa and to prevent Asiatics already in the Union leaving the province in which they lived. The so-called Smuts-Gandhi agreement of the same was designed to guard the vested interests of Indians already in the Union. The attitude of the white inhabitants of Natal was shown by the Borough Ordinance passed by the provincial council in Jan. 1924, debarring Indians in future from acquiring the municipal franchise. This ordinance was held up by the Union Govt. for consideration, but in Dec. 1924, assent to its operation was given. The parliamentary franchise was, with a few special exceptions, already confined to whites. In 1925 there were 38,547 parliamentary electors, of whom only 24 were Indian.

A notable element in the progress of Natal has been the development of coal-mining. The output, which in 1910 first exceeded 2,500,000 tons, had increased to 4,302,000 tons in 1923. Natal coal is of excellent quality. The quantity of coal bunkered and exported in 1924 exceeded 2,700,000 tons.

The Offical Year Book of the Union of South Africa (Pretoria) gives list of government publications dealing with the Asiatic question and provincial administration. *See* SOUTH AFRICA, UNION OF. (F.R.C.)

NATHAN, ERNESTO (1845–1921), Italian politician, was born in London, the son of an Englishman, Joseph Nathan, and of an Italian mother, Sara Rosselli, both Jews. In 1858 he settled in Pisa with his mother and attended the university there. Soon afterwards they had to repair to Switzerland on account of Sara Nathan's republican sentiments; it was then that Ernesto Nathan became acquainted with Mazzini, whose views became thenceforth his chief inspiration and cult. A violent anti-clerical,

he soon joined the Freemasons and was elected "Grand Orient" for Italy in 1899, but resigned in 1905 owing to internal disagreements. He became an Italian citizen, and although he had been a republican in his early years, he gradually accepted the monarchy as the best *régime* for Italy. He showed great activity in organising the "Unione dei partiti popolari" in 1900, a *blocco* of the various radical and anti-clerical parties in Rome, and when at the municipal elections of 1900 the clerical administration fell, Nathan was chosen as mayor. Re-elected in 1910, he fell when the *blocco* broke up in 1913. On the outbreak of the World War, in spite of his 70 years, he volunteered for the army and actually served as a lieutenant of infantry for a time. He was editor of the national edition of Mazzini's works. Nathan died in Rome April 9 1921.

NATIONAL DEBT: *see* DEBTS, INTER-ALLIED; GREAT BRITAIN: FINANCE.

NATIONAL PARKS AND GAME PRESERVES.—Under the influence of President Roosevelt's great interest in outdoor life and faith in the value to the people—moral, physical and educative—of contact with nature, the early years of the present century saw in the United States a wonderful advance in the movement for national parks and nature conservation. The momentum gathered was not lost when the administration of President Wilson came, but passed into a new constructive period under his Secretary of the Interior, Franklin K. Lane, a man of imagination and high enthusiasm for the public service and under the latter's friend, Stephen T. Mather, the inspiring head of national park accomplishment in recent years in the United States.

The National Park Service.—At the creation in 1916 of the National Park Service the separate park units created by the Federal Govt. were gathered into a logical system whose aims were clarified and placed upon the highest basis, and a foundation was established on which the future could be safely built. Its establishment, with the unified control it gave, marks the most important advance made since 1910 in national park development in America, whose influence has been widely felt.

Since 1910 a change fundamentally altering the national park problem and incalculably increasing its importance has come into the life of the American people. From being relatively stationary they have become to an extraordinary extent a nation in movement, owing to the automobile, multiplying many times the travel to the national parks and their opportunity for service, but presenting, equally, new difficulties in the organisation and care of motor-camps, the building of roads and the provision for great multitudes of visitors. The aim of the National Park Service as it has crystallised has been to have each recreationally important feature of the country's landscape typically represented in the national system, so that a traveller visiting in turn the various parks may see the country illustrated through supreme examples and learn of the characteristic life—plant and animal—inhabiting its regions.

To this educational aspect of the national parks constantly greater emphasis is being given. They form wonderful natural exhibits and outdoor museums, illustrating, in each section where they lie, the regional life and landscape. With the wide travel to them which the automobile is causing they are becoming also conservational factors of prime importance in arousing interest in the preservation of the nation's irreplaceable wild life inheritance and native beauty.

Parks Established.—During and since 1910 the following national parks, a magnificent group supplementing in extraordinary variety the earlier units, have been established by Congress in the United States: Glacier National Park (1,534 sq. m.) in Montana in 1910; Rocky Mountain National Park (397 sq. m.) in Colorado in 1915; Hawaii National Park (186 sq. m.) in the territory of Hawaii in 1916; Lassen Volcanic National Park (126 sq. m.) in California in 1916; Mount McKinley National Park (2,645 sq. m.) in Alaska in 1917, in its present stage a game preserve and mountain reservation rather than a park in the true sense; Grand Canyon National Park (958 sq. m.) in Arizona in 1919; Lafayette National Park (12 sq. m.) upon Mount Desert I. off the coast of Maine in 1919; and Zion National Park (120 sq. m.) in Utah in 1919; while a bill to create two others in the Great Smoky Mountains of Tennessee and North Carolina and in the Blue Ridge Mountains of Virginia was before Congress in 1926 and was being strongly urged.

National Monuments.—Intimately related to the national parks in the United States are the national monuments, whose first establishment in 1906 was one of the farsighted conservational acts of President Roosevelt's administration. Created by presidential proclamation for the preservation of outstanding features of historic, antiquarian or scientific interest, their number has steadily increased since 1910, until in 1926 they constituted, supplementing the national parks and administered in connection with them or with the national forests, a true museum of the out-of-doors, preserving battlefields and historical sites, prehistoric dwellings, fossil forests, rare botanical exhibits and striking geologic features.

Parks in Canada.—In Canada the older national parks—the Rocky Mountains National Park (2,751 sq. m.) in Alberta, by Banff; the Yoho National Park (476 sq. m.) in British Columbia; Glacier National Park (468 sq. m.) in the Selkirk Mountains; Jasper National Park (4,400 sq. m.) in northern Alberta; and Waterton Lakes National Park (220 sq. m.), adjoining across the national boundary the United States Glacier Park, have all been extensively added to since 1910, and the following have been created: Revelstoke National Park (100 sq. m.) in British Columbia, dedicated in 1919 and the westernmost in the chain of Canadian National Parks; and Kootenay National Park (587 sq. m.), created in 1920, on the western slope of the Rockies, adjoining the Yoho and Rocky Mountains National Parks.

In South America.—In South America plans for an international park centring about the celebrated cataract of L'Iguazu on the boundary between Argentina and Brazil were in 1926 under consideration but had not then been embodied in definite shape. Far to the south in Argentina, near the Chilean boundary in the Andean region, lies the Nahuel-Huapi National Park amid lakes and snow-clad mountains of the Cordillera range, the first of actual establishment south of the United States.

In Europe.—In Europe, Switzerland led the way in national park creation by establishing in the years before the World War a national park and botanical reservation among the Alps that lie between the Lower Engadine and the Italian border, in the Canton of the Grisons, rich in alpine flowers and in scenic beauty. Italy, since the War, has followed with the establishment of a national game preserve, Il Gran Paradiso, in the Alps of Piedmont, for the protection of the few remaining ibexes, and of a national park in the Apennines, northeast from Rome: the National Park of the Abruzzi. Originating in a royal hunting park established for Victor Emmanuel when united Italy became a kingdom, it includes the highest mountain in the Apennine range, Il Gran Sasso d'Italia, and ancient woods of beech and oak that also are the refuge of wild life in vanishing species. But it is a park still in the making, for the future to develop.

One other area in Europe claims attention as the scene of activity in national and international park creation—the Eastern Carpathian and High Tatra mountains, along whose summits lies the boundary between Czechoslovakia and Poland, where extensive parks were planned in 1926, culminating in the Tatra International Park, cresting the range in a magnificent domain of wild and rugged scenery.

In Australia.—In Australia no Federal park system has yet been established, but state reservations, notably Centennial Park, Sydney, N.S.W., have been made which the Commonwealth may make the basis for one later, as wealth and population grow. The unique flora and fauna and continental character of the country make the opportunity remarkable. New Zealand, also, has opportunity for the creation of a wonderful park system in the southern hemisphere and is moving fast toward it through the development of her sea-borne tourist trade.

Game Preserves.—The swift destruction of wild life now taking place in the United States and Canada through increasing population, the ready invasion by the motor-car of regions till now the secluded habitats of wild life, and the drainage of marshlands, has led to a widespread movement for the enactment of protective Federal legislation and the increased establishment of national game preserves.

To these the United States has largely added, both in extent and number, since 1910, and, national park areas apart, which are absolute sanctuaries, has now the following: Wichita National Game Preserve (91 sq. m.) in Oklahoma; the Grand Canyon National Game Preserve (1,384 sq. m.), co-extensive with the Kaibab National Forest, in Arizona; the National Bison Range (29 sq. m.) in Montana; the Elk Refuge National Game Preserve (4⅓ sq. m.) in Wyoming; the Niobrara National Bird and Wild Life Reservation (25 sq. m.) in Nebraska; the Pisgah National Game Preserve (120 sq. m.) in North Carolina; the Cherokee Federal Game Reserves in Georgia and Tennessee; and an extensive area bordering the Upper Mississippi, in process of acquisition in 1926 under a congressional appropriation, for a national bird and wild life reservation.

In Canada since 1910 the following national game preserves, bearing the name of parks, have been established in addition to the one, Buffalo National Park (161 sq. m.), which then existed; Elk Island National Park (51 sq. m.) in northern Alberta; Nemiskam National Park (8½ sq. m.), an antelope preserve in southeastern Alberta; and Point Pelee National Park (4 sq. m.) jutting out into Lake Erie from Ontario, a bird sanctuary at the most southerly point in Canada, which is an important resting-place for many migratory birds.

Elsewhere, apart from the big game reserves of Africa and seal protection areas, little has been done for game protection through national preserves. Much, however, has been done besides, in Anglo-Saxon lands, by Federal states and provinces, and much by associations, of which outstanding examples for bird protection exist in Louisiana, administered partly by the state and partly by the National Audubon Society, and in New Zealand, where Stewart I. (665 sq. m.) has been set aside as a sanctuary, while it is to be remembered that all game protective laws, Federal or State, have the effect, if enforced and well conceived, of creating reservations to the extent of the territory they cover and the protection they afford, and are complementary in this sense to special game preserves.

In Great Britain the constant vigilance and activity of the Royal Society for the Protection of Birds and the Selborne Society have secured legislative and administrative protection for birds. Sanctuaries have been established on properties of the National Trust and in scheduled public parks and commons. The Selborne Society provides nesting boxes for private gardens. The Farne Islands have been purchased and given to the National Trust as a sanctuary for sea birds. The Royal Society for the Protection of Birds has established a Watchers' Committee which does invaluable work against depredations by collectors, by pollution of the sea by oil, by overhead wires and rat plagues. The bird nests and perches at four selected lighthouses have been the means of saving many migratory birds. The Society keeps constant watch for evasions of the Plumage Act (1921) and develops its propaganda by lectures to schools, by competitions and by the issue of a special journal, *Bird Notes and News*. (G. B. D.)

NATURALISATION (*see* 19.275).—In the period 1910–26 there were many and important changes throughout the world in the laws respecting naturalisation, owing in part to the growth of national feeling, in part to the World War.

The consolidation and amendment of the British law of nationality and naturalisation was recommended in 1901 by a departmental committee of the Home Office, but it was not until 1914, just before the outbreak of the World War, that the principal recommendations of the committee were embodied in an Act of Parliament. This was the British Nationality and Status of Aliens Act, 1914, subsequently amended by Acts of the same name passed in 1918 and 1922, which, while not disturbing the general principles of the Act of 1914, contain important supplementary provisions. These statutes, as their title implies, are comprehensive and deal with the law as to natural-born British subjects, British subjects by naturalisation and aliens within British jurisdiction. In the second of these categories, the new statutes make three important innovations, viz.:

1. They abolish all legal distinctions between natural-born and naturalised subjects. A naturalised British subject, so long as his certificate remains in force, has the same rights and duties as if he were natural-born.

2. A certificate of naturalisation may be revoked by the Secretary of State upon proper cause appearing to his satisfaction.

3. Without prejudice to the power of the self-governing Dominions to grant local naturalisation on such terms as they may see fit, the statutes lay the foundations of a scheme of Imperial naturalisation by providing for the adoption of Part II of the principal Act (as amended) by the Dominions. Part II has (1926) been adopted by Canada, Australia and South Africa.

Grant of Naturalisation.—In respect of the conditions precedent to the grant of a certificate of naturalisation to an alien, the Act of British Nationality and Status of Aliens Acts 1914, 1918 and 1922, do not substantially depart from the provisions of the Naturalisation Act, 1870. The applicant must satisfy the Secretary of State (a) that he has either resided in His Majesty's dominions for not less than five years, or has been in the service of the crown for not less than five years within the last eight years before the application, (b) that he is of good character and has an adequate knowledge of the English language, and (c) that he intends to reside in His Majesty's dominions or to enter or continue in the service of the crown. The residence required is at least one year's residence in the United Kingdom immediately preceding the application, and previous residence for four years, either in the United Kingdom or some other part of His Majesty's Dominions within eight years of the application. These conditions as to residence, however, do not apply to a British-born woman who has become an alien by marriage and who, after the death of her husband or the dissolution of her marriage, seeks re-admission to British nationality; and the Secretary of State may also in his discretion grant a certificate of naturalisation to a minor who has not complied with the prescribed conditions.

But a certificate of naturalisation is not a matter of right. The Secretary of State may grant, withhold or postpone it in his absolute discretion and there is no appeal from his decision. A certificate does not come into effect until the oath of allegiance to His Majesty has been taken. The names of minor children of an applicant for naturalisation may be (and in practice usually are) included in the certificate. The children thereby become British subjects, but on attaining their majority they may divest themselves of their allegiance by a declaration.

Revocation of Certificate.—Under the Naturalisation Act, 1870, a certificate once granted was irrevocable, even if it afterwards appeared that the grant had been obtained by fraud. The Act of 1914 cured this defect by giving the Secretary of State a discretionary power to revoke a certificate obtained by false representations or fraud, and the Act of 1918 converted the discretion into an obligation to revoke and considerably extended the principle of revocation. Section 7, as amended, is as follows:—

(1) Where the Secretary of State is satisfied that a certificate of naturalisation granted by him has been obtained by false representation or fraud, or by concealment of material circumstances, or that the person to whom the certificate is granted has shown himself by act or speech to be disaffected or disloyal to His Majesty, the Secretary of State shall by order revoke the certificate.

(2) Without prejudice to the foregoing provisions the Secretary of State shall by order revoke a certificate of naturalisation granted by him in any case in which he is satisfied that the person to whom the certificate was granted either—

(*a*) has during any war in which His Majesty is engaged unlawfully traded or communicated with the enemy or with the subject of an enemy state, or been engaged in or associated with any business which is to his knowledge carried on in such manner as to assist the enemy in such war; or (*b*) has within five years of the date of the grant of the certificate been sentenced by any court in His Majesty's dominions to imprisonment for a term of not less than twelve months, or to a term of penal servitude, or to a fine of not less than £100; or (*c*) was not of good character at the date of the grant of the certificate; or (*d*) has since the date of the grant of the certificate been for a period of not less than seven years ordinarily resident out of His Majesty's dominions otherwise than as a representative of a British subject, firm, or company carrying on business, or an institution established, in His Majesty's dominions or in the service of the crown, and has not maintained substantial connection with His Majesty's dominions; or (*e*) remains according to the law of a state at war with His Majesty a subject of that state; and that (in any case) the continuance of the certificate is not conducive to the public good.

(3) The Secretary of State may, if he thinks fit, before making an order under this section refer the case for such inquiry as is hereinafter specified, and in any case to which subsection (1) or paragraph (*a*), (*c*) or (*e*) of subsection (2) of this section applies, the Secretary of State shall, by notice given to or sent to the last-known address of the holder of the certificate, give him an opportunity of claiming that the case be referred for such inquiry, and if

the holder so claims in accordance with the notice the Secretary of State shall refer the case for inquiry accordingly.

(4) An inquiry under this section shall be held by a committee constituted for the purpose by the Secretary of State, presided over by a person (appointed by the Secretary of State with the approval of the Lord Chancellor) who holds or has held high judicial office, and shall be conducted in such manner as the Secretary of State may direct:—

Provided that any such inquiry may, if the Secretary of State thinks fit, instead of being held as aforesaid be held by the High Court, and the practice and procedure on any inquiry so held shall be regulated by rules of court.

A committee appointed under this section shall have all such powers, rights, and privileges as are vested in the high court or in any judge thereof on the occasion of any action, in respect of the following matters:—

(*a*) the enforcing the attendance of witnesses and examining them on oath, affirmation, or otherwise, and the issue of a commission or a request to examine witnesses abroad; and

(*b*) the compelling the production of documents; and

(*c*) the punishing persons guilty of contempt;

and a summons signed by one or more members of the committee may be substituted for and shall be equivalent to any formal process capable of being issued in any action for enforcing the attendance of witnesses and compelling the production of documents

The revocation of a certificate of naturalisation, however, does not affect the status of the wife or minor children of the person concerned unless the Secretary of State so directs, and no such order can be made against a British-born woman unless the Secretary of State is satisfied that if she had held a certificate in her own right it could properly have been revoked under section 7. It is to be observed that no distinction is made between minor children who have acquired British nationality through their father's naturalisation and minor children who are natural-born subjects. The anomalous result follows that the British-born children of an alien are in a better position than the British-born children of a naturalised person.

There are other difficulties involved in the construction of the Act of 1918, the language of which is in many places very obscure, but they have never been the subject of judicial discussion. The committee constituted has, however, given certain rulings which have a quasi-judicial force. Thus, it has been held that innocent misrepresentation is "false representation" within the meaning of section 7 (1). Again, the use of the present tense in paragraphs (a) and (e) of sub-section (2) have been interpreted to mean that action under these paragraphs can only be taken during the continuance of a state of war. (D. Ca.)

II. THE UNITED STATES

In the Fourteenth Amendment to the Constitution of the United States it is provided that "All persons born or naturalised in the United States, and subject to the jurisdiction thereof, are citizens of the United States and of the State wherein they reside." This Amendment was proclaimed July 28 1868, but the method of naturalisation had been prescribed previously.

Only a natural-born citizen may become President of the United States, but naturalised citizens may hold every and any other office. The practice in naturalisation is set forth in the Naturalisation Act of June 29 1906 and its amendments; that of expatriation in the Expatriation Act of March 2 1907.

Naturalisation has two stages. The first is a declaration of intention on the part of the alien to become a citizen of the United States, the second is a petition for admission which must be filed not less than two years nor more than seven years after the declaration of intention. Every applicant must reside five years within the jurisdiction of the United States, although an occasional absence with intent to return does not break the continuity of residence. The last year of the residence must be in the state or territory in which naturalisation is to be acquired. Two witnesses are required to the fact of residence and of good character.

The general statute dealing with naturalisation applies only to white persons and persons of African race, hence the nationals of other races are not held eligible to citizenship under the naturalisation laws of the United States. (*United States v. Bhagat Singh Thind*, 261 U.S. 204; *Ozawa v. United States*, 260 U.S. 178.)

Naturalisation is perfected by the decision of a judge of a Federal or state court of record, the applicant taking an oath of allegiance to the Government and renouncing absolutely and forever all allegiance to the foreign country of which he was a citizen or subject.

The advantage of a declaration of intention was supposed to lie in testing the applicant's devotion to American institutions. The disadvantage is in the disagreeable, if not equivocal position in which he finds himself in the interval between the declaration of intention and final naturalisation. The government of origin naturally loses interest in such a person, who, if he wishes a passport, must apply to its representative in the United States. Congress, however, has been unwilling to drop the provision, although frequently requested to do so by the Executive Department of the Government. To obviate the disadvantages of the situation, the Secretary of State was authorised by the Expatriation Act of 1907 to grant temporary passports to foreigners who had declared their intention to become citizens, under such regulations as he should prescribe. This portion of the Act was repealed June 4 1920.

The Act of 1906 expressly mentions the intention on the part of the applicant to reside in the United States as an essential to legal naturalisation, and the absence of the intention may be proved as a fact in legal proceedings, or presumed from leaving the United States within five years. In the case of *Luria v. United States*, 231 Reports, 9 (1913), it was decided, however, that the intent was presumed in previous statutes.

The Govt. of the United States persistently maintained the right of expatriation, interpreting it, however, rather as the right of a foreigner to become a citizen of the United States without the consent of his government, than as a right of an American citizen without the consent of his own government to become a citizen or subject of a foreign nation. The first statute of expatriation affecting American citizens as well as foreigners was the Expatriation Act, passed March 2 1907. It provides that an American citizen, natural or naturalised, renounces his American nationality by becoming naturalised in a foreign country, or by taking an oath of allegiance to a foreign state. This became important in the World War when many American citizens enlisted in foreign armies, arrayed against the Central Powers. They had in all cases been obliged to take an oath of allegiance on entering the military service, and upon their return to the United States they were held to have ceased to be American citizens. To remedy this situation a statute was passed on May 9 1918 allowing such individuals to become American citizens upon taking an oath of allegiance to the United States.

The United States has been a party to treaties by which it was provided that a naturalised citizen might forfeit his American citizenship by residing a certain number of years in the country of his origin. The Expatriation Act generalises that provision by stipulating:—

When any naturalised citizen shall have resided for two years in the foreign state from which he came, or for five years in any other foreign state it shall be presumed that he has ceased to be an American citizen, and the place of his general abode shall be deemed his place of residence during said years.

The Act also stipulated that an American woman marrying an alien acquired his nationality, and that a foreign woman marrying an American citizen acquired American nationality. It further provided that minor children became naturalised through the naturalisation of their parents. Finally, the Act permitted American citizens who had returned to the land of their origin to overcome the presumption of renunciation of American citizenship by registering in the American Consulate; and also required that Americans born in foreign parts should register in an American Consulate.

The statutes provide easy terms of naturalisation of persons serving in the land and naval forces of the United States, provisions which were amplified during the World War. The great change, however, was made in the law of citizenship by the Cable Act of Sept. 22 1922, which provided that a foreign woman marrying an American citizen did not become an American citizen by the act of marriage; and that an American woman marrying a foreigner did not, by the act of marriage, lose her American nationality. It facilitated the reacquisition of American nationality by American women who had married foreigners before the passage of the Act, be reducing residence in the United States to one year before taking an oath of allegiance. From this privilege, however, was excluded the American woman who had married a foreigner who could not become a citizen of the United States under its naturalisation laws. The Act is in accordance with the tendency to recognise the personality of married as well as of single women, but it occasions inconvenience in the absence of treaties with foreign countries in the matter of passports from countries where the nationality of a wife depends upon and follows that of the husband.

III. GERMANY

The German Imperial and State Citizenship Law of July 22 1913 which went into effect Jan. 1 1914 has been much criticised. It contains two sections, 13 and 25, which have been considered generally objectionable to non-German countries. In view of the importance of the articles they are quoted:—

Sec. 13. A former German who has not taken up his residence in Germany may on application be naturalised by the state (of Germany) of which he was formerly a citizen, provided his case fulfils the requirements of Nos. 1 and 2 of paragraph 1 of Section 8; the same applies to one who is descended from a former German or has been adopted as a child of such. Prior to naturalisation a report must be made to the Imperial Chancellor; if he raises objections, naturalisation does not take place. (The text of section 8 of the law referred to in the section just quoted is as follows: "1. If he is legally

competent in accordance with the laws of his former home or would be legally competent in accordance with the laws of Germany; or if the application is made by his legal representative or with the latter's consent in accordance with the second sentence of paragraph 2 of section 7. 2. If he has led a blameless life . . .")

Sec. 25. Citizenship is not lost by one who before acquiring foreign citizenship has secured on application the written consent of the competent authorities of his home state to retain his citizenship. Before this consent is given the German consul is to be heard.

The Imperial Chancellor may order, with the consent of the Federal Council, that persons who desire to acquire citizenship in a specified foreign country may not be granted the consent provided for in paragraph 2.

The only comment necessary on provisions of this kind is the statement that by Article 278 of the Treaty of Versailles of June 28 1919, Germany was obliged to declare the provisions in question as null, void and of no effect.

IV. OTHER COUNTRIES

An examination of the laws of other countries dealing with naturalisation shows that there have been many and important changes since 1910, because the provisions were either in themselves deemed to be inadequate, or not in accord with the newer conditions of the century. In the next place, new states had come into existence, and as they were without legislation on the subject, it was necessary that laws should be passed regarding the acquisition and loss of nationality. Instead of attempting a summary of provisions which are in their nature local and therefore diverse, the principal constitutional and statutory provisions on the subject since 1910 are set forth:—

Argentine Republic.—Law of Nov. 27 1911, granting nationality to alien officers, etc., by virtue of law of July 14 1911; *Annuaire*,[1] 1911.

Austria.—Law of Oct. 17 1919, *Annuaire*, 1920:266; Decree of Aug. 20 1920, relative to acquisition of nationality by option, *BFS*[2] 113:879; Constitution, 1920, *BFS* 113:883, 886, Arts. 6, 11 (i).

Belgium.—Law of May 26 1914, on renunciation of Belgian nationality by persons who have acquired the same under law of 1909, *BFS* 107:587; Law of May 11 1918, granting fresh term for acquisition of nationality by descendants of inhabitants of territories ceded in 1839, *BFS* 111:652; Law of Oct. 25 1919, concerning right of option, *BFS* 112:989; Law of May 15 1922, concerning acquisition and loss of nationality, *BFS* 116:643.

Bulgaria.—Constitutional amendment, 1911, *BFS* 107:619, Art. 55; Law of Dec. 8 1911, amending law of Dec. 31 1903, *Annuaire*, 1911:765.

China.—Law of Nov. 18 1912, *Annuaire*, 1912:625; Law of Dec. 30 1914, *BFS* 114:667.

Costa Rica.—Constitution, 1917, Arts. 40–44, 60, 99 (10), 105; *La Gaceta*, June 13 1917.

Denmark.—Law of Nov. 27 1916, providing for naturalisation of persons of no nationality, *BFS* 110:838; Law of Sept. 5 1920, *BFS* 114:705; Constitution, 1920, Art. 50, *BFS* 114:715.

Dominican Republic.—Constitution, 1924, Pan American Union, *Law and Treaty Series No. 1* (1925), 6, 8, 10, 19, 21, Articles 8, 18, 21, 55, 63; Naturalisation law of Oct. 31 1924, Clunet, 1926:243.

Ecuador.—Law of Oct. 18 1921, *BFS* 114:731.

Finland.—Constitution, 1919, Art. 4, McBain and Rogers,[3] 468.

France.—Decree of Sept. 16 1910, regarding registration of citizens abroad, *Am. Jour. Sup.*[4] VI:92; Law of Oct. 3 1910, to facilitate acquisition of French nationality by Tunisians, *BFS* 106:953; Decree of May 26 1913, on acquisition of French citizenship by natives of Indo-China, *BFS*, 107:771; Decree relative to acquisition of foreign nationality by natives in some of French colonies, Nov. 25 1913, *BFS* 107:776; Law of March 25 1915, *BFS* 109:922; Law of April 7 1915, on withdrawal of naturalisation decrees with respect to former subjects of enemy states, *BFS* 109:923; Decree of April 24 1915, concerning withdrawal of naturalisation, *BFS* 109:925; Law of June 18 1917, *BFS* 112:1025; Law of July 3 1917, concerning option in case of sons of foreigners born in France, *BFS* 112:1029; Law of April 9 1920, concerning foreigners resident in French zone in Morocco, *BFS* 113:1008; Law of Nov. 8 1921, *BFS* 114:753; Law of Nov. 8 1921, relative to French nationality in regency of Tunis, *BFS* 114:755; Law of July 5 1925, concerning descendants of foreigners (not Germans) in Alsace-Lorraine, Clunet, 1925:1187.[5]

Germany.—Law of July 22 1913, on Imperial and State nationality, *BFS* 108:473. Constitution of German Republic, 1919, Arts. 1, 6(3), 110, *BFS* 112:1064, 1082.

Greece.—Constitution, 1911, Art. 3, *BFS* 108:483; Decree of Oct. 19 1922, concerning naturalisation of refugees, *Annuaire*, 1922:314.

Haiti.—Constitution, 1918, Arts. 3, 6, *BFS* 112:1113, 1114.

Italy.—Law of June 13 1912, *BFS* 106:1071; Decree of Aug. 2 1912, concerning enforcement of Law of June 13, *BFS* 106:1076; Law of June 30 1918, *Annuaire*, 1918:169; Decree relative to registration for nationality, Dec. 28 1919, *Annuaire*, 1919:76; Regulations of Dec. 30 1920, *Rev. dr. int. pr.*,[6] 1921:416; Decree of Aug. 21 1921, *BFS* 114:846; Decree of Aug. 31 1921, authorising aliens to make declaration for Italian naturalisation suspended during the War, *Annuaire*, 1921:40; Decree of Sept. 10, 1922, *Annuaire*, 1922:35.

Japan.—Amendments of Aug. 1 1916, to Law of Nationality of 1899, *BFS* 110:920.

Mexico.—Constitution, 1917, Arts. 27(1), 30, 37 73(16) *BFS* 111:787, 792, 794, 804.

Monaco.—Constitution, 1911, Art. 5 (3), *BFS* 105:737, 738; Ordinance of April 13 1911, *Annuaire*, 1911:382, 389.

The Netherlands.—Law of Feb. 10 1910, regulating status of Netherland subjects of population of Netherland East Indies, *BFS* 103:600; Law of July 15 1910, amending nationality law of Dec. 12 1892, *Annuaire*, 1910:321; Law of Dec. 31 1920, modifying law of Dec. 22 1892, *Annuaire*, 1920:116; Constitution, 1922, *BFS* 116:863, Art. 6.

Nicaragua.—Constitution, 1911, Arts. 7–11, 111 (17), *BFS* 107: 1039, 1051–52. New Constitution of 1913 contains same provisions.

Peru.—Constitution, 1919, Arts. 60, 64, *BFS* 113:1142.

Portugal.—Decree of Dec. 2 1910, *BFS* 103:619; Decree of March 28 1911, amending naturalisation law of Dec. 2 1910, *Annuaire*, 1911: 366; Constitution, 1911, Art. 74, *BFS* 105:779.

Rumania.—Naturalisation law of Aug. 31 1918, *Annuaire*, 1920: 305; Decree of Dec. 29 1918, granting certain rights to nationals, *Annuaire*, 1920:306; Decree of May 22 1919, *Annuaire*, 1920:310; Law of Feb. 23 1924, Clunet, 1925:838, and 1926:300.

Russian Socialist Federated Soviet Republic.—Constitution, 1918, Art. 20, Martin and George, *Constitutions*,[7] 231; Nationality decree of Oct. 29 1924, Clunet, 1925–548.

San Marino.—Decree of Jan. 21 1910, regarding citizenship law of Sept. 12 1907, *Annuaire*, 1910:236.

Serbia.—Constitution, 1913, for annexed provinces of Old Serbia, Arts. 6, 29, 144 (9); *BFS* 110:934, 936, 939–40.

Siam.—Law of May 18 1911, *BFS* 105:793; Decree of Aug. 7 1911, regulating execution of law of May 18 1911, *Annuaire*, 1911:918; Law of April 10 1913, *BFS* 108:585.

Spain.—Decree of Nov. 6 1916, *BFS* 110:946.

Sweden.—Law of June 11 1920, amending law of June 1 1912, *Annuaire*, 1920:220; Law on acquisition and loss of Swedish nationality, May 23 1924, Clunet, 1925:1192.

Switzerland.—Law of Jan. 29 1918 concerning cantonal naturalisation (Tessin), *Annuaire*, 1918: 239; Law of June 26 1920, modifying Law of June 25 1903, *BFS* 113:1187.

Turkey.—Law of April 3 1917, concerning Article 6 of nationality law, *Annuaire*, 1919:262.

Venezuela.—Law of May 24 1913, *Annuaire*, 1913: 586; Constitution, 1922, Arts. 10, 11, *BFS* 116:1038. (J. B. S.)

NATURAL RESOURCES, CONSERVATION OF.—The term conservation came into common use and was given special significance about 1908, when President Roosevelt inaugurated a movement in the United States to check the destructive exploitation and wasteful use of many of the most important natural resources. The underlying purpose of the movement was to make the resources render their highest service in the economic, industrial and social upbuilding of the nation. Productive use of agricultural land, continuous production of forests, economy in the use of mineral resources, skilful development of waters coupled with the protection of their sources, the building up of fisheries, the increase of useful wild life and the proper handling and safeguarding of recreation resources are examples of conservation. Use of natural resources without waste, economic development to secure from them a maximum service, continuous production of renewable resources and permanence of industries and of community life lie at the basis of the conservation principle.

The National Conservation Commission.—The idea of handling all natural resources with a view to their highest economic and public service in the long run was new in the United States. The great destruction of the American forests by fire and wasteful exploitation brought the question to the front, and it was Gifford Pinchot, then Chief U.S. Forester, who enlisted the interest of the President in this problem and the broader aspects

[1] *Annuaire de législation étrangère* of the *Société de legislation comparée*, Paris.

[2] *British and Foreign State Papers.*

[3] H. L. McBain and Lindsay Rogers, *The New Constitutions of Europe* (1922).

[4] *American Journal of International Law, Supplement.*

[5] Clunet, *Journal du droit international.*

[6] *Revue de droit international privé.*

[7] C. E. Martin and W. H. George, *Representative Modern Constitutions* (1923).

of conservation of all natural resources. The first important step taken by President Roosevelt was to call a conference of governors of the states, which assembled at the White House in May 1908. This was the first time the governors of the states had met in conference. As a result of the meeting, a National Conservation Commission was appointed by the President, and 42 states appointed state commissions to study the problems of natural resources, to assemble data regarding their quantity and condition, and to formulate a policy for their conservation. In 1909 the National Conservation Commission made its report to Congress. In the same year President Roosevelt invited the governor-general of Canada, the governor of Newfoundland and the president of Mexico to appoint commissioners to discuss, with commissioners representing the United States, the principles of conservation as applied to the continent of North America.

Legislative Action.—The movement inaugurated by President Roosevelt led to a radical change in public policy with reference to the resources owned and controlled by the Government. Not only were the National Forests and Parks placed on a permanent basis of protection and administration, but legislation was later enacted providing for the proper use under Federal control of the lands still under public ownership which contained coal, oil, phosphates or potash or which were valuable for water-power development. The movement led further to action ensuring the conservation of fisheries, game and bird life. The influence of the conservation movement has spread far beyond the handling of Federal properties. It has been the factor leading to action by many individual states. The greatest progress has been made by them in the protection of forests from fire, although many of the states are not yet doing what is needed to attain this end.

Since the World War there has been increasing appreciation of the significance of natural resources as a primary factor in the industrial strength and prosperity of nations. The older countries have by very force of economic conditions been obliged to give attention to the careful husbanding of their resources. Many of them have already been through the process of wasteful exploitation and have learned the lesson of conservation. The newer countries are still exploiting their forests without proper measures of replacement, still using wasteful methods of developing oil, natural gas and coal, still overstocking the cattle and sheep ranges, still using crude methods of agriculture, still failing to protect their natural supply of useful wild life.

Exhaustion of Resources.—In many countries, as the United States, which have been naturally endowed with an abundance of natural resources, the most accessible and most cheaply produced of the raw materials are rapidly being exhausted. Vast resources still remain, but the difficulties and cost of their exploitation are constantly mounting. This situation is of very real importance to those nations which have to look abroad for raw materials. The exhaustion of the accessible bodies of virgin softwood timber in North America will be felt by importing nations which will be obliged to pay higher and higher prices for this class of material or go without. Necessarily there will be in the near future a world shortage of softwood timber of the better grades (*see* FORESTRY). In the same way the wasting of oil, coal and minerals in one country becomes a matter of international consequence.

Government Action.—Since the War the conservation of natural resources has been given larger attention in many countries. Great Britain has embarked on an ambitious plan of reforestation and has already held two imperial conferences to discuss problems of timber supply and forestry as affecting the entire empire. The forthcoming World Forestry Congress at Rome is an event of very great significance in international conservation. Various countries are adopting a liberal policy of developing their water-power resources with a view to greater independence in power for manufacturing, transportation, heat and light, and already there has been an important water-power conference of an international character in London. The Institute of Agriculture at Rome is a vital force in the development of the resource of greatest importance in most countries, and its work is directly in the interest of conservation. Very gratifying also is the increased interest in the conservation of game and other wild life in those countries which heretofore have given little attention to the value of wild life. This is evidenced by the projects to conserve the big game in Africa and elsewhere, the progressive steps in many countries to stock the streams and lakes with fish, and the new interest in European countries to protect the native insectivorous birds which are so important to agriculture.

Agriculture.—In agriculture it is usually recognised that private ownership of farms is from every standpoint desirable. The objective is to develop a nation of small land proprietors. Government, however, gives assistance to farmers in a great variety of ways—through loans on liberal terms, through aid in co-operative buying and selling, through highway development, through research and education, through help in securing seed at reasonable cost, etc. On the other hand, it is generally recognised that the public should have control of as large an area of forest land as possible, particularly those areas in the mountains where the forests should be well handled in order to protect the watersheds and to conserve the sources of streams. Most countries early in their history adopted a policy of distributing their forest lands to private individuals, and what they now own represents the residue after this policy of distribution was stopped; and most of them are endeavouring to recover by purchase what they once owned and never should have disposed of. In France 34·5% of the forests are publicly owned; in Germany 52·7%; in Sweden 23·6%; in Great Britain 3·6%; in the United States 21 per cent.

Some countries are obliged to impose restrictions upon private owners to prevent public injury to watersheds and to insure productive use of the land. As a rule, also, the public co-operates with private owners in forestry. In some cases, as in Great Britain, a subsidy is actually given for reforestation. The United States has adopted a policy of retaining control of the publicly owned water-power sites, with a view to ensuring full development and use, and of preventing possible abuse through monopolies. The United States is retaining also in public control the coal, oil, phosphate, potash, sodium and certain other resources which are located on the public domain. How far the public will go in regulating the privately owned coal in the United States remains to be seen. The present system results in great wastage, at least in the bituminous fields; and the interruption of service to the public through strikes and other causes has resulted in serious public injury. Other countries, as Great Britain, are facing a similar problem (*see* COAL). Broadly speaking, government takes part in conservation as far as may be necessary to prevent public injury. Where such control is not necessary the aim is to secure the desired results by co-operation, education and research.

Scientific Research.—A factor of very great importance and significance in conservation is scientific research. Never in history has there been such a clear recognition of this fact; never has there been such liberal support of research by Federal and State Legislature, by the industries, by the great universities of the country and by contributions from benevolent foundations and private individuals. The foundations of conservation rest upon sound scientific research, and the work now being done holds out high promise for the future. The co-operation of nations in research in matters relating to natural resources is likely to lay the foundations for consideration of the problems of distribution of raw materials and many other problems of mutual economic interest. The countries which adopt an effective policy of conservation of their natural resources are strengthening the foundations of their industrial progress and national strength and they are rendering a service to the whole world.

See D. Drake, *America Faces the Future*, chap. 23 (1922); also COAL; FORESTRY; OIL; etc. (H. S. G.)

NAURU or PLEASANT ISLAND, an atoll in the South Pacific, midway between the Marshall and Solomon Islands, with an

area of about 5,400 acres. The population in 1923 was 110 Europeans, 603 Chinese and 1,296 Nauruans and other South Sea Islanders. The island is valuable on account of its phosphate deposits, which were worked before the War by a German company the rights of which were sequestrated during the War and vested in an English company. A German possession, placed under the German administration of New Guinea, the island surrendered to the Australian Navy in Sept. 1914, and was placed by the Supreme Council under British mandate on May 7 1919. Side by side with the mandate assigning the island to the British Empire arrangements were made for Australia and New Zealand to share with the United Kingdom in the administration and the products of the phosphate industry, which together were to supply the necessary funds for the exploitation of the island resources. The first administrator was to be appointed by the Australian Government. The Nauru Agreement Act was ratified by the three Parliaments concerned, and received the royal assent on Aug. 4 1920, subject to the provisions of Art. 22 of the Covenant of the League of Nations.

The Phosphate Deposits.—The deposits were discovered in 1900, and were worked by the Pacific Phosphate Co., which also worked the deposits on Ocean Islands. The deposits in these two islands were estimated at about 100,000,000 tons. The interests of the company in these two islands were bought out in 1919 by the British, Australian and New Zealand Govts. according to the terms of the Agreement at a cost of £3,500,000 subscribed in the proportions 42, 42 and 16. The deposits are worked by a phosphate commission of three members appointed by the governments and the output is divided in proportion to the investments of the parties. The pre-War output (1913) was 350,000 tons; the output in the first 10 years of the commission's management was over 360,000 tons a year. Though the islands do not compete in quantity with the enormous output of Northern Africa, 2,000,000 tons, or of Florida and other United States yields, 4,000,000 tons, the deposits are of exceptionally high quality

See the *Reports on the Administration of Nauru* issued by the Australian Govt.; particulars of the Mandate are given in the *Year Book of the Commonwealth of Australia* (1923).

NAVAL ACADEMY (*see* 27.736).—The expansion of the Naval Academy in the period 1910–25 began before the entry of America into the World War. In 1912 the six-year course (including two years at sea as midshipman) was discontinued, and midshipmen were commissioned ensigns immediately upon graduation from the academy. By Acts of Congress in 1916 and 1917, the number of annual appointments to the academy allowed to each senator, representative and delegate in Congress was increased from two to five; presidential appointments from 10 to 15, and appointments of qualified enlisted men from 15 to 100. Thus the total number of authorised appointments reached 3,126; and the number of midshipmen increased from 758 in 1910 to 1,230 in 1916 and in 1923 to about 2,500. The Naval Appropriation bill of 1924 provided for the pay of three midshipmen for each senator, representative and delegate in Congress in lieu of the five authorised by law. After 1920 physically qualified candidates were allowed to enter either by examination or by certificate from a recognised school. Commencing with 1925 candidates for admission by certificate were required to pass a brief examination in mathematics and English.

As a war measure, the class of 1917 was graduated in March of that year, and the class of 1918 in the following June. The course was reduced to three years; but by cutting down examination periods, holidays and reviews, and increasing the academic year to nine months, practically the same work was covered. In 1919 the four-year course was resumed. Between Sept. 1917 and Jan. 1919 five reserve officer classes, composed chiefly of former enlisted men who were graduates of technical schools, were quartered at the academy for periods of about three months' training. In this way 1,622 officers were added to the service as temporary ensigns.

The post-graduate school for officers, established in 191 in the former marine barracks near the Academy, was suspended during the World War, but reopened in 1919 with about 50 student-officers. These spend a half-year or year at the post-graduate school before continuing their studies in civilian technical institutions. In 1918 two wings accommodating 1,100 additional midshipmen were added to Bancroft Hall, an extension to the Marine Engineering building was completed in 1919 and a new Seamanship building in 1920. In 1919 the civilian corps of instructors was reorganised with increased pay and systematic promotion. The staff of the academy increased from 146 officers and civilian instructors in 1910 to nearly 300 in 1921 with a subsequent reduction to about 218 in 1925. In 1925 aviation training was included in the curriculum of the academy.

(L. McC. N.)

NAVIGATION (*see* 19.284) has progressed considerably in some departments since 1910, as the result of scientific discoveries and inventions. The advance made in the science of wireless telegraphy has been of considerable assistance to navigators; and it is probable that when directional wireless telegraphy is further developed, the methods whereby the position of a ship can be fixed by this means will come into more general use. Astronomical navigation, that is the fixing of the position of a ship by observations of the heavenly bodies, alters little, and during the period 1910–25 no new methods were introduced. The use of position lines, however, came into more general use, and calculations have been simplified by the compilation and publication of special tables for finding the zenith distance.

Old and New Methods Compared.—The accuracy of the position of a ship obtained from observations of heavenly bodies depends almost entirely on the accuracy of the time shown by the chronometers carried on board the ship. To enable the exact error of the chronometer to be obtained and the daily rate deduced, it was formerly necessary to obtain the accurate time at ports where a visual time signal was installed, or by a series of observations made with sextant and artificial horizon at places the longitude of which was accurately known. In those ships which are fitted with wireless telegraphy wireless time signals enable navigators to obtain accurate time daily in most parts of the world. At the end of 1925 there were over 50 stations working on various wave-lengths and situated in different countries for transmitting the time daily. The majority of these signals are sent by means of an automatic arrangement operated by the pendulum of a standard clock which is electrically connected with the transmitter. Greater reliance can be placed on the accuracy of signals transmitted in this manner than on those which are sent by hand. The signals are, in many cases, transmitted according to the international system; it is, however, desirable to refer to the relevant publications for details of procedure.

The term Greenwich mean time (G.M.T.) is considered to be the standard time of the meridian of Greenwich commencing at midnight and reckoned throughout the 24 hours. Both civil and astronomical time are, therefore, reckoned from midnight instead of from midnight and noon respectively. In the Nautical Almanac (abridged for the use of seamen) for 1925, and following years, the elements which prior to 1925 were given for every 2 hours of the astronomical day, which then began at noon, are given for every 2 hours of G.M.T. commencing at midnight.

To avoid confusion a system of time zones for time-keeping at sea is in force in the navies of most countries. This system has been adopted so that vessels at sea, within certain defined limits of longitude, shall keep the same time as that used on land. The world is longitudinally divided into 24 zones of 15° each, the centre of the system being the meridian of Greenwich. This centre division lies between the meridians of $7\frac{1}{2}°$ East and $7\frac{1}{2}°$ West and is known as the Zero Zone, or Zone 0; the zones lying to the eastward being numbered in sequence with a minus (−) prefix; those to the westward being similarly numbered with a plus (+) prefix. The limits of the zones on land are modified somewhat according to the geographical configuration of the country concerned. By this system the same time is kept whether on land or sea throughout each zone except during the periods of summer time.

Directional Wireless.—Determining the position of a ship at sea by means of directional wireless telegraphy (*see* WIRELESS) became of importance during the World War and is of inestimable value to ships in thick weather, when approaching the land. The bearing of the shore station from the ship can be obtained either by means of a directional receiving apparatus carried in the ship, or by the system whereby the bearing of the ship is determined by one or more directional receiving sets on shore; the result being communicated to the ship. Owing to the cost of the installation and the necessity for great skill on the part of the operator, the former method is seldom used. To enable the latter method to be of use to ships wireless direction finding (D/F) stations are established in many parts of the world. The procedure varies to some extent for different stations and in different countries. A ship requiring a bearing calls up the station or stations concerned and finally receives her bearing from one or more of these stations. The position of the ship can thus be determined.

The accuracy with which the bearing can be taken depends on several factors; bearings have sometimes been found to be unreliable at night and when the direction runs approximately parallel with the coast-line. Experiments have been made with a wireless beam which revolves in a similar manner to the beam from an ordinary lighthouse, the beam revolving through 360° at a constant rate in a definite time. Wireless waves travel along the arc of a Great circle, this being the shortest distance between any two points on the surface of the earth. It follows, therefore, that the true bearing of the ship from the station, or *vice-versa*, must be corrected for convergency to obtain the mean mercatorial bearing which is required if a chart on Mercator's projection is in use. A simple formula given in text-books enables this to be done. On a chart constructed on the gnomonic projection D/F bearings can be laid down without any correction for convergency, since Great circles appear as straight lines on this projection. If, however, a compass "rose" is used it is necessary to have one on the chart for each D/F station, to compensate for the angular alteration of the projection at that station.

Other Systems in Use.—Sound ranging (*see* SOUND RANGING) also enables the position of a ship to be determined with accuracy at a considerable distance from the land. The pressure wave generated by the detonation of a submerged explosive charge is received in hydrophones placed along a base line. This distant explosion affects the hydrophones in turn, and with the aid of time-recording instruments the position of the explosion can be deduced. To obtain accuracy at great distances it is necessary for two or more stations to co-operate. Although this method was used with success during the War no stations at the close of 1925 had been installed as aids to general navigation. It was not at that time considered probable that this method would come into common use, partly owing to the expense of installing and maintaining the stations, and partly on account of the necessity for ships to carry explosive depth charges. The combination of D/F and sound ranging would be of considerable value to navigation, especially when approaching the coast in thick weather.

The Leader system assists vessels to enter or leave harbour or to pass through narrow channels in thick weather. A submarine electric cable is laid along the channel, the shore end being connected to a station producing an alternating current. A simple and inexpensive receiving apparatus on board the ship enables the signals to be heard in telephones, or other form of amplifier, placed at or near the position from which the ship is usually conned. Two sets of coils are fitted, one on either side of the ship out of the water, and so arranged that they can each be connected up to the receiving telephones. By connecting first one set of coils and then the other, to the receiving telephones, it is an easy matter, when within range, to determine whether the cable is to port or starboard. With practice the distance of the cable can be estimated with comparative accuracy, because the signals become stronger as the cable is approached, the maximum intensity of the signals occurring when the ship is close to, but not vertically over, the cable.

The same cable enables one ship to enter and one to leave harbour at the same time, provided of course the navigable channel is of sufficient width; it is a simple matter for each ship to steer to keep the cable a reasonable distance away on her port side, so that the two ships pass safely port to port. If space permits it is possible to lay two cables, one for entering and one for leaving, the signals produced in each cable being distinctive by their note and character. This system, which proved of value during the War, had not come into general use in 1925, owing presumably to the somewhat heavy initial cost and the cost of maintenance. In channels where frequent dredging is necessary to maintain the depth the presence of a submarine cable would of course cause some inconvenience.

Echo sounding (*see* SOUNDING), by which the depth of water is obtained by the acoustic method, is of value in cases where the depth of water, or the speed of the ship, makes sounding by direct measurement unreliable. To obtain an accurate sounding by this method, complete and sensitive apparatus is required. The apparatus consists of two microphones, one of which registers the emission of a sonic signal and the other the arrival of the echo reflected by the bottom of the sea. A specially constructed time recorder capable of reading to one-thousandth part of a second is connected to the microphones and enables the depth to be deduced. Sound travels through sea water at an average velocity of 4,900 ft. per second. Consequently, by the acoustic method, very great depths can be reached in a brief space of time and the depths normally required for navigational purposes will be reached in a small fraction of a second.

The Gyro compass (*see* GYROSCOPES) is used in many ships. Owing to the masses of iron and steel used in the construction of modern ships and the presence of dynamos and other electrical machines, the position in which to place a magnetic compass in a ship requires careful consideration, to avoid undue loss of directive force and the consequent large errors which would require correction. The gyro compass does not depend for its action on the earth's magnetic field, but on gravitation and the earth's diurnal rotation round its axis. A suitable position below is selected for the master-gyro; and repeater dials, connected with the master, can be placed in any desired position in the ship. These repeaters need not be placed with the dials horizontal, they can be fixed vertically or in any other desired position. The introduction of the gyro compass has made automatic steering possible. An efficient automatic steering apparatus will keep a ship on a fixed course with greater regularity than can be accomplished by a skilled helmsman. For the navigation of the air *see* AIR NAVIGATION.

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(J. E. T. H.)

NAVY (*see* 19.299).—The most constant factor in naval affairs in modern times has been the predominance of the British Navy in relation to the forces of other maritime countries, as they have successively risen and declined. But in the evolution of national policies a counterpoise has always existed, with the result that the British Navy has seldom been, in fact, supreme. In the closing years of the 19th century the balance of power was maintained by France and Russia, while, in the Pacific, the United States and Japan, which were then emerging as naval Powers of the first rank, supplied an additional check on British predominance.

I. GREAT BRITAIN AND GERMANY

German Navy Acts.—These were the conditions which existed when the first German Navy Act was passed in 1898, to be replaced by a more ambitious measure two years later, which became known as "the Navy Act." This measure introduced a new factor in the situation. It provided for the creation of a fleet of 20 battleships, supported by eight coast defence ships,

12 large cruisers and 29 small cruisers, with a second line of older ships. Whereas British policy had always been based on the maintenance of exiguous military forces, but a strong fleet on the two-power standard, Germany already possessed an army, if not larger, at least reputed to be more formidable and efficient, than that of any other country. France and Russia, with frontiers running parallel with those of Germany, were already making the maximum effort their finances and man-power permitted to neutralise the strength of Germany as a military Power, Austria-Hungary, with not inconsiderable military resources, being Germany's "brilliant second." Neither France nor Russia, though each was vitally concerned to keep open its ocean communications and to defend its territories from invasion by sea, was in a position to make an adequate rejoinder to the menace which the German Navy Act suggested; Japan was rendered increasingly nervous as to her position in the Far East, in view of German political and economic activity, while the United States was anxious to avoid any embarrassment in the Pacific, in order that she might watch events in Europe (*see* GERMANY: *Naval Policy*).

Effects of German Expansion.—In these circumstances the whole naval situation gradually underwent a complete change. A widespread feeling of nervousness led to "understandings," or treaties, by which each country which considered itself threatened by the growing naval strength of Germany re-insured its interests. An alliance was concluded between Great Britain and Japan in Jan. 1902 which was strengthened three years later; Great Britain and France began to draw closer together towards the close of 1903 and eventually these two countries, in association with Russia, formed "a diplomatic group," which led to discussions between the several naval staffs with a view to the possibility of common action by sea and eventually also by land; and the United States and Japan signed a treaty pledging each country to respect the other's territorial interests.

It thus came about that as amendments to the Navy Act were carried in the Reichstag in subsequent years, all of them authorising further expansions of the German Navy than had hitherto been provided for, as well as of its resources for repair (of which the creation of the dockyard at Wilhelmshaven, the enlargement of the Kiel Canal and the development of Krupps's establishments at Essen, were the most notable), the tendency was for the other naval Powers to pool, in some degree, their naval interests. This movement reacted powerfully on the British Navy. A concentration of forces in the North Sea was begun at the expense of the squadrons in the Mediterranean, the Pacific and other distant seas, and British shipbuilding policy was adapted to the new situation which was rapidly developing; while France withdrew most of her ships from her Channel ports in order to increase her strength in the Mediterranean; Russia at the same time improved her position in the Baltic.

Coming of the Dreadnought.—By 1910 the rivalry between the navies of Great Britain and Germany had become the dominating factor not only to those two countries, but to every other country. Since Germany, though not neglecting the building of cruisers, was concentrating her attention on the creation of a great battle fleet, obviously, from the limited radius of action of the vessels, intended for service in the North Sea, the British Admiralty had also for some years turned its attention increasingly to the perfection of battleship design. Germany was rising to a condition of parity in modern ships of the line in 1905, when, on Lord Fisher's initiative, the all-big-gun ship—commonly known as the "Dreadnought"—was evolved, being of two types—the battleship and the battle cruiser. Germany, her policy thrown into confusion, felt herself compelled to follow the new policy, but as dreadnoughts were of greater beam than the ships of about 14,000 tons displacement which she had hitherto been building, she became involved in a complete reconstruction of the Kiel Canal, entailing an expenditure of £11,000,000, while further large sums had to be spent on deepening her shallow harbours.

The German naval authorities had assumed that the British forces would continue to be dispersed over the seas and oceans of the world. When that assumption proved unfounded, the German plans for naval expansion were repeatedly varied; the final development taking place in 1912. This amendment of the German Navy Act, providing for a large fleet always in commission, was interpreted by the British Govt. as a direct challenge to British naval power. Mr. Winston Churchill, the First Lord of the Admiralty, made a speech which revealed the anxiety with which the British Cabinet, reflecting public opinion, regarded the situation. He stated that the two-power standard no longer accorded with the conditions at sea which were rapidly developing and that in future the Admiralty intended "to develop a 60% superiority in vessels of the 'Dreadnought' type over the Germany Navy on the basis of the existing Fleet Law," with "other and higher standards for the smaller vessels." He also let it be known that for every additional keel laid down in Germany, over and above those already provided for, two would be placed in position in British yards. It was revealed later on that the British naval authorities, having already discarded the 12-in. gun, which was mounted in the original "Dreadnought," in favour of the 13·5-in., had decided to introduce a new 15-in. gun, firing a projectile twice as heavy as the 12-in. weapon. Germany, which had for many years been satisfied with the 11-in. gun, had in recent designs provided for nothing more powerful than the 12-inch.

These and other developments revealed the intensity with which the contest between the two countries was being pursued. Informal conversations in Berlin with a view to a "naval holiday" had proved fruitless. In the succeeding two years there was consequently no slackening of activities, either in the dockyards or at sea, in anticipation of a war, which Lord Fisher, studying the progress of the enlargement of the Kiel Canal, prophesied would not occur at any rate until 1914. On that calculation, as was subsequently revealed, British plans of naval development rested. The following statement shows the number of ships built and projected from the introduction of the dreadnought design.

TABLE I.

Year		Capital Ships	Protected Cruisers	Destroyers
1905–6	Great Britain	4	..	18
	Germany	..	..	..
1906–7	Great Britain	3	..	14
	Germany	2	2[1]	12
1907–8	Great Britain	3	1	17
	Germany	3	2	12
1908–9	Great Britain	2	6	16
	Germany	4	2	12
1909–10	Great Britain	8	6	20
	Germany	4	2	12
1910–1	Great Britain	5	5	20
	Germany	4	2	12
1911–2	Great Britain	5	4	20
	Germany	4	2	12
1912–3	Great Britain	4	8	20
	Germany	2	2	12
1913–4	Great Britain	5	8	16
	Germany	3	2	12
1914–5	Great Britain	4	..[2]	..[2]
	Germany	2	2	12
1915–6	Great Britain	4	..[2]	..[2]
	Germany	2	2	12
1916–7	Great Britain	4	..[2]	..[2]
	Germany	3	2	12
1917–8	Great Britain	4	..[2]	..[2]
	Germany	2	2	12

[1] Germany also laid down an armoured cruiser—the "Blücher."
[2] No provision had been made in the programme for protected cruisers or destroyers.

II. THE NAVIES OF OTHER COUNTRIES

During the years when the two naval protagonists were strengthening their fleets in feverish haste, the older navies of Europe suffered a decline of relative strength which in the circumstances was inevitable. France, Italy and Russia, even if they had had the will to do so, could not, owing to the necessities of the military situation which occupied the minds of their Governments, keep pace with the rapid and costly developments which were taking place on either side of the North Sea.

France.—From the time when, in 1908, Adml. Germinet left the Ministry of Marine, the naval policy of France lacked definite purpose and continuity. There were frequent changes of ministers, at the rate of about one a year, and each one, being a civilian, became the instrument of one or other of the rival schools of naval thought, while in the Chambers, senators and deputies increasingly lost confidence in the administration of the naval service, both ashore and afloat, with the result that supplies demanded by the expert advisers were repeatedly denied. Gradually the naval policy of the country became more and more based on defensive ideas. The *guerre de course* gained an ascendancy over the minds of those concerned with naval defence, with the result that the offensive ideal of warfare no longer dominated policy, and attention was concentrated on small craft.

The French Navy, which had ranked for many years as second only in strength to that of Great Britain, was consequently surpassed in strength, first by Germany, and then by the United States, although sums had been voted for its support (1896–1911) which were 50% larger than the amounts spent on the German fleet. In 1909, as the result of an inquiry carried out by a Parliamentary Committee, an organic law was at last adopted for the expansion of the French naval forces. But it came too late to change the situation, and on the outbreak of the World War the navy, though inspired by a new purpose, was still suffering from lack of continuity of policy, and in consequence all new construction was frequently delayed by repeated changes of design.

Russia.—Simultaneously with the decline of French naval prestige, the Russian fleet also suffered. The recently constituted Duma, established in 1905, refused to approve of measures for strengthening the navy on the ground that the Admiralty and all the naval departments urgently required reorganising. When a building scheme was at last adopted, the decision that new vessels, instead of being built in foreign yards as had hitherto been the custom, should be constructed in Russia, and as far as possible of Russian materials, proved a further handicap to progress. In these circumstances, the Russian fleet, which had sustained heavy material losses in the war with Japan, failed to recover either its prestige or its material strength. Though naval expenditure was maintained at a high level, the Russian fleet continued to decline owing largely to the failure to carry out reforms in the naval administration, which were recognised as being essential if a higher standard of efficiency was to be attained.

Italy.—In contrast with the misfortunes which sapped the strength of the allied fleets of France and Russia, the Italian naval authorities pursued a consistent and methodical policy. The increased attention which the Austro-Hungarian Govt., on the urgent representations of Germany, was devoting to naval affairs, was responsible, in no slight degree, for the energy displayed in Italy, which had ceased to evince any enthusiasm for the Triple Alliance, of which she was nominally a member.

Navies in 1914.—In these circumstances the balance of naval power in European waters underwent a dramatic change as the Anglo-German contest for naval power pursued its course, larger and larger sums being devoted each year by these two countries to ship construction, the maintenance of bigger fleets at sea, and manoeuvres for the training of officers and men. Whereas British naval expenditure had been £26,000,000 in 1900, in the spring of 1914 the House of Commons voted nearly £44,500,000. The outlay in Germany over the same period rose from £8,000,000 to over £23,000,000. A new standard of naval efficiency was set up in these two opposing fleets, and the deficiencies of the French and Russian fleets became more conspicuous in contrast, while Italy, watching with growing suspicion the course of naval events in the Austro-Hungarian Empire, occupied an ill-defined position between the two groups of naval Powers. In 1914 the strength of the fleets in Europe was as follows, the letters G.B. representing Great Britain, G. Germany, A.H. Austria-Hungary, I. Italy, F. France and R. Russia. The abbreviation Bt. indicates "built"; the abbreviation Bg. indicates "building."

TABLE II.

	G.B.		G.		A.H.		I.		F.		R.	
	Bt.	Bg.	Bt.	Bg.	Bt.	Bg.	Bt.	Bg.	Bt.	Bg.	Bt.	Bg.
Battleships:—												
Modern	21	13	13	7	2	2	3	4	8	10	2	7
Battle Cruisers	9	1	4	4	..	..	..	..	..	..	..	4
Older Battleships	38	..	20	..	9	..	8	..	13	..	6	..
Total	68	14	37	11	11	2	11	4	21	10	8	11
Cruisers:—												
1st Class	38	..	9	..	1	..	9	..	18	..	6	..
Light	72	17	39	6	6	3	7	4	12	..	8	8
Total	110	17	48	6	7	3	16	4	30	..	14	8
Destroyers	218	20	142	10	19	..	36	10	83	4	105	36
Torpedo Boats:— 1st and 2nd Class	70	..	47	..	58	27	70	5	153	..	25	..
Submarines	76	20	27	12	10	4	18	2	70	23	25	18

A leading naval authority—Count Reventlow—who was in close touch with the naval authorities in Berlin, afterwards stated that when the War broke over Europe in 1914 the German fleet was not ready. "In 1906," he stated, "came the dreadnought revolution in shipbuilding which quickly rendered worthless all ships built before that time (pre-dreadnoughts) and compelled tremendous enlargements of wharves, harbours and canals, gigantic extensions of organisations, etc. The work of completing the German fleet would have extended far beyond the year 1920 under these conditions." British policy in this respect, as well as in regard to the political "understandings" with France, Russia and Japan, which enabled the main British squadrons to be concentrated in the North Sea, completely upset all the calculations on which German naval policy had been based in the early years of the 19th century.

Eastern Waters.—During these years naval conditions in the Pacific and adjacent waters also underwent marked changes. Great Britain and the other European Powers reduced their forces to the lowest level compatible with the naval plans of Germany. While neglecting the Mediterranean and Atlantic, these plans embraced a powerful cruiser squadron in China waters, which, in view of the high standard which it achieved in gunnery, became a considerable factor in the naval situation in the Far East. Public sentiment in Japan and the United States having been somewhat reassured by the treaty of non-interference with each other's territorial interests, these two countries continued to increase their naval forces, but the movement was marked by no such political unrest as was being exhibited on the two sides of the North Sea.

The Japanese Govt., which had placed reliance upon the Anglo-Japanese alliance for the preservation of the *status quo* in the Pacific, slowly adjusted itself to the new conditions which British preoccupation in the North Sea had made inevitable, while the United States, occupying a position of complete detachment from the troubles which were coming to a head in Europe, began to occupy a position of some importance at sea. The world cruise of the American fleet, which had begun at the end of 1907 and lasted 14 months, had given the American people a new conception of their concern with naval affairs. Rear-Adml. Sperry, when his ships had made their furrow of 45,000 m.

in the seas and oceans of the world, had stated that " this cruise marks an epoch in our naval annals, for the fleet has found itself—being welded into a unity." Events in later years were to supply ample confirmation of this statement.

III. THE WORLD WAR AND AFTER

During the years of the World War, both the United States and Japan embarked upon schemes of naval expansion.

United States.—In 1916 Congress adopted an Act " for the purpose of further increasing the naval establishment of the United States," which, in its methodical character, somewhat resembled the successive German Navy Acts. It provided for the construction of the following vessels: 10 first-class battleships, six battle cruisers, 10 scout cruisers, 50 torpedo boat destroyers, nine fleet submarines, 58 coastal submarines, three fuel ships, two destroyer tenders, two ammunition ships, two gunboats, a repair ship, a transport, a hospital ship and a fleet submarine tender. Provision was also made for improving the Navy Yards at Puget Sound, Philadelphia, Norfolk, New York, Boston, Portsmouth, Charlestown and New Orleans, the work to be completed within five years. This Act provided for nothing less than the construction of a new American fleet and foreshadowed an expenditure far larger than any country had hitherto contemplated. It also contained clauses which attracted little attention at the time outside the borders of the United States, though the words pointed to ambitious hopes for the limitation of naval armaments.

It is hereby declared to be the policy of the United States to adjust and settle its international disputes through mediation or arbitration, to the end that war may be honourably avoided. It looks with apprehension and disfavour upon a general increase of armament throughout the world, but it realises that no single nation can disarm, and that without a common agreement upon the subject every considerable Power must maintain a relative standing in military strength.

In view of the premises, the President is authorised and requested to invite, at an appropriate time, not later than the close of the War in Europe, all the great Governments of the world to send representatives to a conference which shall be charged with the duty of formulating a plan for a court of arbitration or other tribunal to which disputed questions between nations shall be referred for adjudication and peaceful settlement, and to consider the question of disarmament and submit their recommendations to their respective Governments for approval.

The Act also laid down that, if a conference succeeded in attaining the purposes for which it had been called, the constructive plans might be varied in accordance with any engagement into which the United States had entered. The War in Europe was to continue for upwards of two years after the passing of this measure, and consequently keels were laid in American shipyards in accordance with the terms of the Act, and the United States was definitely committed to this great programme of naval expansion before the Treaty of Versailles had been signed.

Japan.—The course of events at sea confirmed the importance of sea-power to an island state. Japan had for several years entertained the project of building 16 capital ships, eight battleships and eight battle cruisers, none of which should at any time exceed eight years in age. On the assumption that such vessels possessed an effective life of about 24 years, Japan contemplated having at her disposal, in time, 16 capital ships of the latest design and constructions and 16 bordering upon obsolescence, with a similar number occupying a position midway between these two groups. The plan embraced the expansion of the dockyards and other establishments ashore, as well as provision of the necessary trained personnel. With the approval of the Imperial Diet, this programme of expansion was taken in hand in 1916. At that time Japan was spending £15,000,000 annually on her navy; it was estimated that the votes might rise to nearly £60,000,000 by 1920, although the Government declared that whatever other nations might do Japan would not exceed the eight-eight programme, which it was proposed to carry out gradually as the financial position of the country might render possible.

A New Rivalry.—In place of the rivalries in naval armaments which had persisted in Europe for so many years, a new race for naval power had begun between the United States and Japan while the World War was still in progress. Even after the United States had intervened in the struggle, the activities in the government and private yards continued with unabated energy, while, on the other side of the Pacific, the Japanese people settled down to the task of building up their fleet to the eight-eight standard, with all that was implied in cruisers, destroyers, submarines and other auxiliaries. Not only was the American programme really more ambitious than that of Japan, but the United States possessed within her own borders practically all the raw material necessary for the creation of a fleet, while Japan was confronted with the problem of obtaining from overseas no mean proportion of the steel and other material which she needed. On the other hand, the Japanese, in virtue of their conscriptive law, were in a position to obtain all the officers and men which the larger fleet would require, drawing freely upon a seafaring population, but the United States was faced with the problem of competing in the labour market for recruits, which experience had proved were not always forthcoming in adequate numbers.

Post-War Situation in Europe.—When the World War came to an end, the whole naval situation in Europe had undergone a complete change. The German Navy, by the surrender of all its modern units, had been reduced to the status of a third-class sea Power, and denied the possession of either submarines or aircraft of combatant types. The Russian fleet, after the revolutions, had, to all intents and purposes, ceased to be of any importance. France and Italy had been so preoccupied in supporting their armies, tasks which necessitated the concentration of all their industrial activities on the provision of military munitions, that neither country had had either the man-power or the material available for the construction of new ships. The British fleet, which had borne the main burden of the War on the Allied side, had been forced by the compelling circumstances of the naval situation to pursue a policy of expansion embracing capital ships, cruisers and every type of auxiliary craft. It emerged from the struggle, in spite of the heavy losses which had been sustained, as the only first-class naval force in European waters.

Limitation of Armaments.—When President Harding in the year following the signing of the Peace of Versailles issued an invitation to the leading naval Powers to a conference at Washington to discuss the possibility of limiting armaments, the United States was already potentially the leading naval Power of the world. All the battleships, battle cruisers and scout cruisers of the 1916 programme, as well as no mean proportion of the auxiliaries, including five destroyers, five fleet submarines, and 37 smaller submarines, were under construction. The British naval authorities had inherited from the War a great fleet, but, except for the battle cruiser " Hood," none of the battleships embodied any of the lessons enforced by the struggle at sea, while the cruisers had for the most part been designed for service in the North Sea, and, owing to their limited radius of action, were unsuited for ocean work. In these circumstances the British Admiralty, urged to economy, had entered upon a vigorous scrapping policy, one firm alone buying 113 war-ships, on the understanding that they should be broken up. At the same time provision was made in 1920 for laying down four new battleships, to displace 45,000 tons, as well as a submarine and a minelayer. Japan had in hand three of her new battleships, as well as two battle-cruisers, eight cruisers, 10 destroyers and 15 submarines.

A new phase in the competition in naval armaments had begun, involving the United States, Great Britain and Japan in vast expenditure. The Washington Conference (*q.v.*) arrested this movement, so far as the principal battle fleets of the world were concerned. The United States Govt. suggested that all the battleships then under construction should be forthwith scrapped. As the result of discussion, the American scheme was slightly varied. Japan made good her claim to retain two

post-Jutland ships of the latest design, and the same liberty was accorded to the United States, while freedom was accorded the British naval authorities to lay down two new capital ships of 35,000 tons, which on completion should replace four older vessels. It was stipulated that no other capital ships should be laid down before 1931, and that gradually the British and American battle fleets should be brought to a condition of parity with a standard of displacement of 525,000 tons, Japan being allotted 315,000 tons and France and Italy 175,000 tons, a balance of power calculated on the same proportions applying to aircraft carriers. The treaty also provided that no capital ships built in replacement of older vessels from 1931 onwards should exceed 35,000 tons or carry a gun with a calibre in excess of 16 inches. While no restrictions were placed on the number of cruisers which might be built, it was also stipulated that no vessel of this type should exceed 10,000 tons displacement or mount any weapon of larger calibre than eight inches. No limits were placed, on the other hand, on the building of destroyers or submarines.

Strength of Navies.—In these circumstances the Naval Treaty was signed at Washington and was subsequently implemented by the Governments of the United States, Great Britain and the British Dominions, Japan, France and Italy, the French Govt. making sundry reservations. In subsequent years great activity developed in the construction of cruisers, destroyers and submarines in all the shipyards of the world. At the beginning of 1926 the strengths of the fleets in completed ships were as follows (vessels building or projected are shown in parenthesis), the letters B.E. representing the British Empire, U.S. the United States, J. Japan, F. France and I. Italy:—

TABLE III. *Ships Built and Building*

	B.E.	U.S.	J.	F.	I.
Battleships	18 (2)	18	6	9	7
Battle Cruisers	4	..	4	..	..
Cruisers	47 (15)	32 (8)	31 (8)	15 (9)	14 (5)
Cruiser Mine-layers	.. (1)	..	3	.. (2)	..
Armoured Coast Defence Vessels and Monitors	3	1	..	..	..
Aircraft Carriers	8 (1)	1 (2)	2 (2)	.. (2)	1
Flotilla Leaders	17	..	..	2 (20)	11
Destroyers	172 (2)	309 (12)	103 (24)	54 (36)	52 (24)
Torpedo Boats	..	..	..	..	54
Submarines	56 (10)	120 (8)	53 (26)	45 (58)	42 (20)
Sloops	34	..	..	8	..
Coastal Motor Boats	6	..	2	2	12
Gunboats and Despatch Vessels	.. (4)	12	6	49	12
River Gunboats	18	6 (6)	8	6	2
Minesweepers	61	44	4 (2)	29	40 (6)

All the naval Powers were maintaining in 1926 a large measure of secrecy as to the designs of the cruisers, destroyers and submarines which were being built, and everything pointed to a continuation of an active policy of construction. In the summer of 1925 the British Admiralty announced details of a five-year shipbuilding programme (1925–30) embracing nine cruisers of 10,000 tons displacement, seven cruisers of smaller size, 27 destroyers, 24 submarines, five gunboats, four motor launches, two submarine depôt ships, a net-layer and a repair ship, as well as a large floating dock to be stationed at Singapore, on the development of which work had been begun the previous year.

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(A. HU.*)

NAVY DEPARTMENT (*see* 1.201).—Since 1910 the U.S. Navy Department has been reorganised to some extent in accordance with requirements found necessary to meet fully the demands of the World War, and likewise as a result of lessons learned during that war. On Aug. 29 1916, closely following the U.S. Govt.'s ultimatum of April 18 to the Imperial German Govt. with regard to unrestricted submarine warfare, an Act of Congress established a naval flying corps, a naval reserve force, reorganised the navy on a basis of immediate preparation for war, and authorised the construction of 10 battleships, 6 battle cruisers, 10 scout cruisers, 50 destroyers, 9 fleet submarines, 58 coast submarines, 2 gunboats and 12 auxiliary ships.

The naval consulting board, composed of leading scientists and inventors, was provided for on the same date. Not directly concerned with the reorganisation of the Navy Dept., but affecting the mobilisation of U.S. military power, was the authorisation by Congress, also on Aug. 29, of the Council for National Defence, with the secretaries of War, Navy, Interior, Agriculture, Commerce and Labour as members, for the purpose of correlating the factors of preparedness for war.

The Navy After the War.—Since the World War, the U.S. Navy has been reduced to a peacetime basis. Its limitation as to strength was prescribed in certain respects by the Washington Treaty for the limitation of naval armament. The Washington Treaty was ratified by the five great naval Powers concerned on Aug. 17 1923, following a conference of representatives of the United States, the British Empire, Japan, France and Italy, which was convened Nov. 12 1921 at the invitation of the American President in Washington, and which ended on Feb. 6 1922, after the representatives had signed the terms of the treaty. The efforts of the representatives of the United States were directed towards the limitation of total tonnage in each type of combatant naval craft.

The treaty as finally ratified limited the total tonnage of capital ships (battleships and battle cruisers) and large aircraft carriers; restricted the individual tonnage displacement of warships; fixed a limit to the size of naval guns; prohibited reconstruction of capital ships and aircraft carriers except as provided by treaty; fixed the *status quo* with regard to fortifications and naval bases of certain outlying possessions of the United States, the British Empire and Japan; specified the capital ships that each of the five Powers could retain; provided a schedule of replacement of capital ships; and indicated the capital ships which were to be scrapped. (*See* WASHINGTON, TREATY OF.)

Plans of Navy Department.—Certain other changes subsequent to the Armistice in 1918 affected the plans and organisation of the Navy Department. On May 28 1919 the General Board of the Navy recommended that the 1916 building programme for new ships be completed. This recommendation was carried into effect until the restrictions imposed upon new construction by the Washington Treaty were ratified. The joint army and navy board, established July 17 1903, was reorganised to some extent in July 1919. This board, composed of three naval and three army officers, confers upon and reaches conclusions regarding problems in all matters calling for the co-operation of the two services, and has direct power of approval of reports submitted by the joint planning committee, the joint aeronautical board and the joint munitions board. The bureau of aeronautics was added to the Navy Dept. by authorisation of Congress, July 12 1921. It is of interest here to note that the national advisory committee for aeronautics, which supervises and directs the scientific study of aviation in the United States, was established through the Naval Appropriation Act of March 3 1915. The latest contemplated change of any importance in the reorganisation of the Navy Dept. is the addition of an assistant secretary for naval aviation.

Organisation.—The U.S. Navy in 1926 may be considered to consist of the following: the Navy Dept. at Washington, the U.S. fleet and detached naval forces, and the naval shore establishment. The Navy Dept. at Washington is the directing

agency, operated, under the direction of the President of the United States, by the Secretary of the Navy. In deciding upon details of naval policy, the Secretary is advised by the assistant secretary of the navy, the joint army and navy board, the chief of naval operations, the general board of the navy, the major-general commandant of the marine corps and by the chiefs of the following technical bureaux: navigation (personnel), engineering, ordnance, construction and repair, aeronautics, supplies and accounts, yards and docks, medicine and surgery. The judge-advocate-general furnishes legal advice. The chief of naval operations is by virtue of his position the senior admiral of the navy (*see* STAFF, NAVAL).

The office of naval operations, which was established under Act of Congress March 3 1915, operates the fleet and detached naval forces, develops and maintains the plans for their use in war, and in general co-ordinates under the direction of the Secretary the work of the eight technical bureaux in the development of the navy. The general board makes recommendations on important questions of naval policy. The marine corps is operated by its major-general commandant. The assistant secretary supervises the preparation of the annual estimates, administers the navy yards and performs such other duties as may be assigned to him by the Secretary of the Navy. During the absence of the Secretary of the Navy from Washington, the assistant secretary becomes the acting Secretary, and in the event of the assistant secretary's absence, the chief of naval operations becomes the acting Secretary of the Navy.

Divisions of the Navy.—The fleet and detached naval forces, other than those assigned to naval districts, are organised as follows: the U.S. fleet, the naval transportation service, the Asiatic fleet, naval forces in European waters and the special service squadron. The U.S. fleet comprises the greater part of the naval forces based on home ports. This fleet is divided into four parts—the scouting fleet in the Atlantic, the battle fleet in the Pacific, the control force in the Atlantic and the fleet base force in the Pacific.

The duties of the U.S. fleet are confined to training for the development of the fleet to its maximum strength as a fighting force. The naval transportation service carries the fuel and other supplies from supply ports to the theatre of operations, where its cargoes are turned over for use or distribution to the fleet base force. The Asiatic fleet is composed of a cruiser acting as flagship, some destroyers, submarines, gunboats and a small air force; this fleet protects U.S. interests in the Far East. The naval forces in European waters protect American interests in Europe and the Near East. The special service squadron protects U.S. interests in the Central and South American republics.

The third component part of the navy, the naval shore establishment, consists of 14 naval districts, each of which has a commandant, who, as a representative of the Navy Dept., has general supervision over all naval activities in his district. These 14 naval districts include in their territory the United States proper and its outlying possessions. Each district has a navy yard, naval base or naval station, where the commandant has his headquarters and staff. These yards and stations carry out such important repairs and alterations to ships as are not performed by the forces afloat. (C. D. Wi.)

NEAL, DAVID DALHOFF (1838–1915), American painter (*see* 19.320), died in Munich, Germany, May 2 1915.

NEBRASKA (*see* 19.323) had in 1925 a population of 1,355,371 (U.S. Census Bureau estimate); in 1920, 1,296,372; in 1910, 1,192,214. The increase from 1900–10 was 11·8%; from 1910–20 8·7%. In the decade 1910–20 the foreign-born whites decreased from 176,662 to 149,652. In 1920 the urban population (in places of 2,500 or more) was 405,306 or 31·3% of the whole; in 1910 310,852, or 26·1%. The rural population in 1920 was 891,066, or 68·7%; in 1910 881,362, or 73·9%. The drift of population to the larger cities has continued strongly during the period 1920–5. The five cities having in 1920 a population over 10,000 are given in table in next column.

In the decade 1910–20, 33 out of 93 counties showed a decrease in total population, and 43 (chiefly the older counties) showed

	1920	1910	Increase %
Omaha	191,601	124,096	54·4
Lincoln	54,948	43,973	25·0
Grand Island	13,947	10,326	35·1
Hastings	11,647	9,338	24·7
North Platte	10,466	4,793	118·4

a decrease in rural population. The irrigated districts in the Platte valley and the cities of 10,000 or more have absorbed practically all the increase in population from 1910–25.

Agriculture.—The number of farms in 1925 was 127,731; 67,764 were operated by owners, 669 by managers, and 59,298 or 46·4% by tenants. The farm acreage was 42,024,129, of which there were 23,109,624 ac. of improved land. The average acreage per farm was 329. The value of farm land and buildings was $2,523,306,303 in 1925 as compared with $3,712,107,760 in 1920; the average per farm was $19,755 in 1925, $29,836 in 1920. In 1920 Nebraska ranked sixth among the States in area of cultivated lands. It was first in production of hay, second in winter wheat, third in corn (maize), third in combined production of wheat, oats and maize. About 1,000,000 ac. were in woodland, of which half or more had been planted by settlers. Production of principal crops for the years 1920 and 1925 is shown in the following table:—

	1925		1920	
	Ac.	Bu.	Ac.	Bu.
Maize	9,100,000	236,600,000	6,699,450	160,391,314
Wheat	2,676,000	34,150,000	4,429,156	57,843,598
Oats	2,699,000	73,953,000	2,029,740	59,819,545
Barley	233,000	5,662,000	211,242	4,405,323
Rye	205,000	2,552,000	359,926	3,259,390
	(tons)	(tons)	(tons)	(tons)
Hay	4,648,000	5,867,000	4,798,363	5,307,702
Sugar beets	61,000	816,000	54,486	554,646

Domestic animals on farms in 1925, 1920 and 1910 included the following:—

	1925	1920	1910	Jan. 1 1925
Horses	863,152	961,396	971,279	857,000
Mules	119,874	99,847	79,652	116,000
Cattle	3,314,342	3,154,265	2,567,392	3,301,000
Swine	4,279,824	3,435,690	3,435,724	4,545,000
Sheep				726,000

Industries.—Slaughtering and meat-packing, the chief manufacturing industry, in 1919 employed 10,122 wage-earners in 16 establishments, and the products were valued at $303,849,000. Wage-earners employed in all industries numbered 36,521, as compared with 24,336 in 1909.

Minerals.—Of the pumice produced in the United States 97% is mined in Nebraska. Production of limestone, sand and gravel for cement industries and road building increased rapidly. Potash is found in alkali lakes in the sandhill region of western Nebraska. The World War shut out importation from Germany, and commercial potash rose to 10 times its former price, with the result that a new industry sprang up, but died out after the War, when importation from Europe was resumed.

Finance.—By Act of the Legislature (1921), assessment of property was changed from one-fifth to full value. In 1925 the assessed value was $3,156,307,123. Total levies for all State purposes (1925) were 2·35 mills. Total State and local taxes for all purposes (1924) were $53,447,375, about $41 *per capita*. There is no State debt. The total debt of all sub-divisions of the State on Jan. 1 1926 was $107,000,000. The revenue in 1924 was $12,498,432 and the disbursements $12,890,046.

Roads and Transportation.—The amount expended on roads from 1920 to 1925 was approximately $8,000,000. In 1925 there were 5,960 m. State roads and 3,514 m. improved State roads. In 1925 farm-owned motor-cars were 122,910, or 40% of the whole number in the State, 301,716; farm-owned motor-trucks were 16,112, or 43·5% of the whole, 37,003. One of the great

changes since 1920 has been the entrance of motor-buses and motor-trucks into rivalry with railways. This began actively in 1923 and has rapidly expanded, and railways have since noted a large falling off in local business. In 1924 there were 6,441 m. of steam and 215 m. of electrical railway track.

Education.—Nebraska is second in literacy among the States. The 1920 U.S. census found 13,874 persons over 10 unable to write in any language. The Nebraska law requires attendance of all children between seven and 16. In 1924 there were 7,120 schools, with 327,417 enrolled pupils; teachers, 14,284; total school expenditure, $32,508,108. Foreign languages in the schools became a political issue as a result of the World War. About 200,000 Nebraskans were German-born or children of parents born in Germany. Through the efforts of the German-American Alliance, the Mockett law was enacted in 1913, providing for teaching the German language in the common schools upon petition of school patrons. After the declaration of war, the Mockett law was repealed, and the Siman law passed forbidding the use of any foreign language as a medium of instruction. On appeal to the U.S. Supreme Court, the Siman law was held unconstitutional.

History.—The chief political issues were the introduction of prohibition, woman suffrage, initiative and referendum and the reconstruction of the State government, all of which were adopted in 1920. The Legislatures of 1919–25 granted $9,000,000 for the construction of a new State Capitol. The governors since 1910 were Chester H. Aldrich (Rep.), 1911–3; John H. Morehead (Dem.), 1913–7; Keith Neville (Dem.), 1917–9; Samuel R. McKelvie (Rep.), 1919–23; Charles W. Bryan (Dem.), 1923–5; Adam McMullen (Rep.), 1925– .

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(A. E. S.*)

NEBULA: *see* ASTRONOMY.

NEGRO (*see* 19.346).—The Negro population of the United States as enumerated in 1920 was 10,463,131, an increase of 635,368, or 6·5% over 1910. The rate of increase was less than in any preceding decade and less than three-fifths of that between 1900 and 1910, the smallest up to that time. As in the white population the rate of increase between 1910 and 1920 was less than in any preceding decade, it might be thought that the fall in the increase among Negroes conformed to the trend of population change. But this would be an error. The rate of increase of Negroes in 1900–10 was about ·5 and in 1910–20 about ·4 of that of the whites. That this deviation in the rates of increase had been maintained for a long period appears from the following figures:—

Period	Increase				Ratio of Negro per cent of increase to White (100)
	Amount in thousands		Per cent		
	Negro	White	Negro	White	
1800–20	770	3,560	76·8	82·7	93
1820–40	1,102	6,329	62·2	80·5	77
1840–60	1,568	12,727	54·6	89·7	61
1860–80	2,139	16,481	48·2	61·2	79
1880–1900	2,253	23,289	34·2	53·9	64
1900–20	1,629	28,012	18·4	41·9	44

Increase.—The numerical increase of Negroes was larger in the later periods, rising to a maximum in the last 20 years of the 19th century. The rate of increase, on the contrary, diminished steadily. At each period the rate of Negro increase was less than that of the white. Apparently the immediate result of the Civil War and emancipation was to raise the relative rate of Negro increase between 1860 and 1880 from ·6 to nearly ·8 of that of the whites. But since 1880 the rate of Negro increase has fallen rapidly, and Negroes, who in 1800 were 18·9% of the country's population, in 1920 were only 9·9%. If each race should increase through the present century as it did between 1900 and 1920, the population of the country in 2000 A.D. would be over 400,000,000, of which about 20,000,000, or one-twentieth, would be Negro. The rate of increase of each race is likely to fall, but the difference in favour of the white race is not likely to diminish.

Areas.—The region in which the increase of Negroes since 1900 has been greatest is shown by the following facts. The five states with the greatest amount of Negro increase between 1900 and 1910 were all southern states. The increase in them was nearly one-half (49%) of that of the whole country. The five states which occupied a similar position between 1910 and 1920 were Pennsylvania, Ohio, Illinois, North Carolina and New York, four of them northern states, and the increase in them was nearly three-fifths (58%) of the whole. These four northern states are highly urbanised. The facts suggest a migration to industrial centres. The conjecture may be tested by computing the percentage of increase of urban population both negro and white. From 1900 to 1910 the whites in cities having 2,500 inhabitants or more increased 39·1% and the Negroes 34·2%; from 1910 to 1920 the percentage of increase decreased for each race, but among the whites it fell by 10·5% to 28·6%, and among Negroes it fell by 1·6% to 32·6%, so that between 1910 and 1920 Negroes in cities increased at a higher rate than the whites.

Migration.—The large amount of Negro migration to northern cities between 1910 and 1920 and the comparatively slight migration in 1900–10 appear from the following table:—

City	Negro population in 1900	Increase of Negroes	
		1900–10	1910–20
Chicago	30,150	13,953	65,355
New York	60,666	31,043	60,758
Philadelphia	62,616	21,846	49,770
Detroit	4,111	1,630	35,097
Cleveland	5,988	2,460	26,003
St. Louis	35,516	8,444	25,894
Total	199,047	79,376	262,877

The preceding figures are for the cities in which the Negro population increased by 25,000 or more between 1910 and 1920. All lie outside of the southern states. The Negro population of these six cities increased between 1900 and 1910 by 39%, and between 1910 and 1920 by 95%. As the increase of Negroes in all northern states between 1910 and 1920 was 444,635, nearly three-fifths (59%) of that increase was in these six cities.

Births and Deaths.—The remarkable fall in the rate of Negro increase and the rapid distribution of Negroes to other parts of the country than the South, especially to certain northern cities, are the striking changes revealed by the fourteenth census. How is the fall in the rate of increase to be explained? Has it any connection with the growth of interstate migration? These questions are elucidated by turning from the census figures of living population to the registration figures of births and deaths. The following table shows the registered births and deaths of Negroes in each of 30 states arranged in the order of increasing proportion of deaths to births:—

States with a Natural Increase of Negroes

State	Period covered by registration	Negro births	Negro deaths	Deaths to 100 births
North Carolina	1917–22	143,367	77,758	54
Mississippi	1921–2	44,940	24,574	55
South Carolina	1919–22	95,110	53,372	56
Virginia	1917–22	119,435	77,775	65
New Jersey	1921–2	6,779	4,771	70
Maryland	1916–22	45,871	40,245	87
Massachusetts	1915–22	8,846	7,870	89
Wisconsin	1917–22	657	597	91
New York	1915–22	34,502	32,126	93
Delaware	1921–2	1,248	1,200	96
Michigan	1915–22	7,603	7,453	98
Connecticut	1915–22	3,890	3,868	99
New Hampshire	1915–22	86	85	99
Total	..	512,334	331,694	65

States with a Natural Decrease of Negroes

State	Period covered by registration	Negro births	Negro deaths	Deaths to 100 births
Illinois	1922	3,704	3,786	102
Pennsylvania	1915–22	45,311	48,207	106
Ohio	1917–22	21,719	23,940	110
Rhode Island	1915–9 and 1921–2	1,522	1,684	111
California	1919–22	2,688	3,054	114
Indiana	1917–22	8,758	10,377	119
Nebraska	1920–2	564	685	122
Kansas	1917–22	5,956	7,286	122
Utah	1917–22	128	158	123
Kentucky	1917–22	24,180	30,343	125
Vermont	1915–22	29	38	131
Oregon	1919–22	100	154	150
Minnesota	1915–22	913	1,388	152
Washington	1917–22	424	738	174
Montana	1922	20	40	200
Wyoming	1922	17	39	229
Maine	1915–22	84	194	231
Total		116,117	132,111	114

If Negro deaths had exceeded births in the 17 states of the last table between 1910 and 1920, and if there had been no immigration of Negroes to this group of states, the number of resident Negroes would have been less in 1920 than in 1910. In fact, it increased from 852,120 to 1,113,940, or 30·7%. The total immigration to these states for the decade was probably not less than 300,000.

There are seven southern states for which we have births and deaths reported, and all but Kentucky had an excess of births over deaths. The Negro population of these states increased between 1910 and 1920 about 1%. On the basis of the figures for 1919 and 1920 there was a natural increase of about 35,600 annually, or 356,000 for the decade. As the decennial increase of Negroes was about 40,000, these states must have lost by emigration more than 300,000.

The bureau of the census has supplied figures of Negro births and deaths between 1915 and 1923 in the urban and rural districts. They are as follows:—

	Births	Deaths	Deaths to 100 births
Urban	266,380	269,631	102
Rural	517,945	309,243	60

These show that during these eight years in the cities of the United States for which the facts are known there were 3,251 more Negro deaths than births, but that in the country districts there were 208,702 more births than deaths. The figures of each class are given separately below for North and South.

	Births	Deaths	Deaths to 100 Births
Northern urban	155,972	151,118	97
Northern rural	33,245	40,294	121
Northern total	189,217	191,412	101
Southern urban	110,408	118,513	107
Southern rural	484,700	268,949	55
Southern total	595,108	387,462	68

Conclusion.—These figures show that the rural districts of the North are least suitable for Negro increase, that the urban districts of the South are almost as unfavourable, that the cities of the North show a slight excess of Negro births, and that the great reservoir for Negro increase is the rural districts of the South. The cause for the low rate of increase between 1910 and 1920 is found in the migration from the country districts of the South both to the North and to southern cities, and to their exposure to conditions climatic or economic which raised the death-rate and lowered the birth-rate. Urban conditions in the South as well as in the North bear far more lightly upon the whites, who thrive and multiply in American cities. In this regard urban Negroes in the United States are in a position like that of European and American whites living in cities a century or more ago, when cities were parasites upon the adjacent country districts, at whose expense alone they could maintain their population.

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(W. F. W.)

NEGRO LITERATURE: *see* AMERICAN LITERATURE; FRENCH AFRICAN LITERATURE.

NENOT, PAUL HENRI (1853–), French architect, was born in Paris, and when only 13 years old was placed in the studio of M. Lequeux as architectural pupil, coming there under the influence of J. L. Pascal. Thence, when 15, he went to the École des Beaux-Arts. After serving in the Franco-Prussian War of 1870, in which he gained the Military Medal, he continued his course at the Ecole des Beaux-Arts, and in 1877 gained the Grand Prix de Rome. While holding this prize in Rome, he competed for the Victor-Emmanuel monument in that city, receiving for his design the premium of 50,000 fr., the work itself being entrusted to an Italian. On his return to France he entered for the great competition for the rebuilding of the Sorbonne, in which he was successful, and commenced in 1885 a work that was to occupy him for the next 17 years. The building forms a parallelogram of over 900 ft. in length by 325 ft. in width, and its plan is brilliantly conceived, taking as its dictating condition the retention of Richelieu's chapel of the Sorbonne. Nenot relied steadfastly on the assistance of the sculptor and the painter, and the grand amphitheatre gave him the opportunity he absolutely insisted on of employing for its decoration Puvis de Chavannes, whose mural painting of the "Sacred Grove" is his masterpiece. The hall itself, used as a *salle des conférences*, is an admirable example of the D-plan carried by a series of alcove recesses to an ultimate development. His other buildings, mostly in Paris, include the Institut Océanographique, the offices of the Compagnie Générale and those of the Compagnie Nationale des Wagons-Lits. He received many distinctions, becoming a member of the Institut in 1895, and being later elected president of the Société des Artistes Français. He was awarded the gold medal of the Royal Institute of British Architects in 1917.

NEPAL (*see* 19.378).—The relations between the British Govt. and Nepal were for more than a century regulated by the Treaty of Segowlie of 1815, which, among other provisions authorised the appointment of a British Resident at Katmandu. On Dec. 21 1923 a fresh treaty of friendship was signed between the two countries, confirming the old treaty and making certain fresh provisions, the most important of which (at any rate from the Nepalese point of view) is the recognition by the British Govt. of the complete independence of Nepal. The old quinquennial mission to Peking has fallen into desuetude.

Slavery, which was an institution in the country from the time of the Gurkha conquest, has now been abolished by the Nepal Govt. and all slaves have been manumitted with the general consent of the slave owners and of the population of the country generally. This liberal measure was due to the initiative of the Maharajah, Sir Chandra Shamsher Jang.

Services in the World War.—During the World War, Sir Chandra Shamsher Jang gave signal proofs of his loyalty and friendship to the British Empire. Immediately after the outbreak of the War he placed the whole resources of his country at the disposal of the Allies. From March 1915 to the end of the War a force of some 10,000 men of the Nepalese Army served in India and on the Indian frontier. The normal number of Gurkha battalions (20) in the Indian Army was doubled, and it is estimated that over 200,000 Nepalese subjects left Nepal to serve with the Indian Army during the course of the War.

The Nepalese Govt. contributed sums amounting in all to 13,500,000 rupees (nearly £1,000,000) for various war funds, etc. (exclusive of the Maharajah's numerous subscriptions to

military hospitals and charitable funds in connection with the War), cardamums to the value of 130,000 rupees; tea to the value of some 32,000 rupees; over 8,000 hill blankets, and other articles of clothing; various gifts of timber, including 200,000 broad-gauge sleepers for the Indian railways, and 31 Vickers-Maxim machine-guns—a magnificent contribution from a small and poor country. Many decorations were bestowed upon the troops who served with the Indian Army, and upon the various members of His Highness' family who organised and commanded them. During the short Afghan War in 1919, the Maharajah dispatched a force of 2,000 men of the Nepalese Army, which assisted the Indian Govt. in guarding the Northwest Frontier stations.

Route into Nepal.—The only portion of Nepal (with the exception of some portions of the tarai country which lies at the foot of the hills), ever visited by Europeans is the Valley of Katmandu, and even this can only be entered by special permission of the Nepal Government. The road to Katmandu starts from Raxaul, a small junction on the Bengal North Western Railway situated close to the frontier, due south of the capital, in the district of Champaran in Northern Behar. Hence to Katmandu is a distance of 75 m., the first 50 of which lie across the alluvial plain of the tarai and through a sal forest to the foot of the hills, whence the road follows the beds of rivers and across low ridges till the small hamlet of Bhimpedi is reached. Up to this point the road is practicable (at least during the cold weather) for wheeled traffic, and it is indeed possible to drive a motor-car over it, and it is gradually being improved and rendered fit for wheeled traffic all through the year. From Bhimpedi there is only a mountain track, which crosses two bridges (elevation about 8,000 ft.), and reaches the valley of Katmandu some seven miles from the city, whence a fair carriage road is available. A ropeway has been constructed from near Bhimpedi to the Katmandu valley, and will be operated by electricity from the power station in the valley, which also supplies electric light to the city. (*See* INDIA.) (W. F. O'C.)

NERNST, WALTER (1864–), German physicist, was born on June 25 1864 at Briesen, West Prussia. He studied at the universities of Zürich, Berlin, Graz and Würzburg and became an assistant at the University of Leipzig, subsequently going in this capacity to Göttingen, where he later became a professor. In 1905 he was appointed ordinary professor of physics in the University of Berlin. He became known through a technical invention in the sphere of electric lighting, which falls within his Göttingen period. In the glow-lamps named after him, the filaments are made of the rare earths, arsenate of zirconium, thorium, magnesium and others, which, in the cold state, do not conduct electricity (second-class conductors) but do so if heated to a temperature of 600–700° Centigrade. In comparison with the carbon filament lamps that were generally used at the time these Nernst lamps offered the advantage of a considerably lower consumption of current, but the complication of the heating device soon reduced their popularity, especially as it was about this time that Auer succeeded in producing glow-lamp wires out of osmium, which after further development led to the metal filament lamps of to-day. Nernst is further known for the statement of the so-called third law of thermodynamics. In 1920 he received the Nobel Prize for physics.

He is the editor of the *Jahrbuch der Elektrochemie*, the *Zeitschrift für angewandte Chemie*, and the *Zeitschrift für Elektrochemie*. His *Experimental and Theoretical Applications of Thermodynamics to Chemistry* appeared in English (1907).

NETHERLANDS (KONINKRIJK DER NEDERLANDEN) (*see* HOLLAND, 13.587), a kingdom of Western Europe. The land area is 12,618 sq. m. and the population (Dec. 31 1924), 7,298,043.

I. POLITICAL HISTORY

Although she did not take part in it, the World War was the greatest event in Holland's history between 1910 and 1925.

Neutrality.—The fact itself of her having succeeded in maintaining her neutrality seems little short of a miracle. Holland's situation has always been a perilous one, not only because she is surrounded on all sides by the nations whose wars convulse Europe, but because important waterways, on which her neighbours' trade depends, flow out into the sea across her territory. In the years before the War, when it was already casting its shadows ahead, more than one acute controversy between the two opposing groups of European Powers had centred round the position of Holland. First, Belgium had been used in an attempt to make Holland give up her attitude of detachment. The Dutch-Belgian *rapprochement*, which was so much talked about in those years, did not proceed from the Dutch-speaking Flemings, but from Francophile circles. It never went very far, and it was forgotten in the outcry raised over the proposal to fortify the mouth of the Schelde which was submitted by the Dutch Govt. to the Chamber in 1910. The contention, however, that Holland was obliged, or even that it had the right, to allow Entente forces to use the Dutch part of that river in case of a German threat to Antwerp was quite untenable. The Entente Governments tacitly recognised the correctness of Holland's behaviour, and in 1911 and 1912 official visits of President Fallières to The Hague and of Queen Wilhelmina to Brussels and Paris made it plain to the World that there was no ill-will between Holland and the Entente.

Probably, indeed, a desire to allow Germany no possible pretext for an attempt to occupy the Dutch ports in case of an Anglo-German conflict had as much to do with the decision to fortify the mouths of the rivers as any idea that the fortifications might ever actually be used against Great Britain. While English and French newspapers were protesting against this scheme, Holland was also remodelling her system of land defence to excellent effect. The German general staff were so much impressed with these reforms that they thought it necessary to rearrange their plan of operations for the event of a war with France. From Von Moltke's memoirs it appears that at the time of his predecessor, Von Schlieffen, the German staff intended to violate Dutch as well as Belgian territory, trusting that when they rushed their armies westward through the Dutch province of Limburg (which juts out to the south, covering part of the eastern frontier of Belgium), the Dutch Army would remain inactive behind the "water line," the inundated area, which protects only the western part of the country, the most densely populated part, including the provinces of North and South Holland, in which all the largest and economically and politically most important towns are situated. Von Moltke, realising that the Dutch Army was made mobile and would be used to strike, even if only the outlying province of Limburg were violated, decided to respect Dutch neutrality, although the détour necessitated would delay the German advance from Crefeld by some precious days.

Holland's attitude, then, in those crucial years was strictly and impartially neutral. The sympathies of the public could less easily be controlled. The memories of the Boer War had already lost much of their bitterness, largely owing to the grant of self-government to the late Boer Republics and the consequent appeasement in South Africa itself. The economic prosperity of the country was to a certain extent bound up with the tremendous development of the German hinterland since 1870, but the Dutch people felt oppressed by the militarist temper and the blatant imperialism which appeared to possess their powerful eastern neighbour. On the outbreak of war in 1914, it was the violation of Belgian neutrality and the subsequent acts of repression in the occupied territory which made the deepest impression and determined the attitude of Dutch public opinion. Only when the pressure of the British blockade began to be severely felt could the small group of German sympathisers command some attention, without, even then, ever swaying public opinion.

The Government at once proclaimed, and rigidly maintained to the end, strict neutrality. Inevitably there were times when each group of belligerents felt Holland's neutrality, however impartially administered, as a burden. The British Navy was able to see to it that Holland did not provide Germany with the food and other materials she wanted from overseas, but the enforcement of the blockade gave rise to a good deal of friction. Moreover, Holland's neutrality undoubtedly had the effect of

covering Germany's right flank. On the other hand, the closure of the Schelde, once Antwerp had fallen, was all to the advantage of Great Britain, as Germany was thus prevented from using Antwerp as a submarine base.

Disputes about particular points were practically continuous, but the sincerity and reality of Dutch neutrality were recognised on both sides, and neither attempted to use violence against Holland. The efficiency of Holland's defence forces contributed to this. The army, 450,000 strong, had been mobilised without a hitch in the last days of July 1914, and was kept on a war footing, at a great cost financially and morally, till 1918. It had to cope with no serious incidents. Some thousands of Belgian and British troops were interned after the fall of Antwerp. German and British aeroplanes sometimes strayed on to Dutch territory. The naval forces occasionally had to intern a submarine or a destroyer, and to them fell the dangerous work of mine-sweeping along the Dutch coast. The Government carried out its international obligations as a neutral with consistent firmness and moderation. Mr. Loudon, the Minister for Foreign Affairs, had from the first adhered rigidly to international law, and he strove honestly to see that all the Government's actions in the carrying out of the decree of neutrality were guided by its precepts.

The Blockade.—Unfortunately, frequent cases arose in which the vague principles of international law could be variously interpreted. Great Britain, for instance, protested when Holland excluded armed merchantmen from her harbours, contending that the article in Holland's original proclamation of neutrality to which Mr. Loudon appealed had been drawn up at a time when Germany's resort to unrestricted submarine warfare could not be foreseen; and it was in reply to those utterly illegal methods that Britain had started arming her merchantmen. In this case Holland maintained her attitude. The sand and gravel dispute, which dragged on throughout 1917 and 1918, was more acrimonious, and at one time endangered Holland's neutrality. The Entente Govts. protested against Holland allowing the Germans to use her waterways for the transport of sand and gravel to Belgium for use in the construction of a new kind of ferroconcrete dugouts. Both belligerents put the severest pressure on Holland, Great Britain penalising her for concessions to Germany, Germany threatening her for concessions to Britain. Mr. Loudon at last consented to ration this traffic on the footing of pre-War statistics; but in the spring of 1918, when Germany was making her final offensive, Ludendorff wanted this arrangement to be used as a pretext to overrun Holland and make a dash for the Dutch ports. An ultimatum was actually presented, and only the determined intervention of representatives of the civil power in Germany prevented Ludendorff from having his way.

The most real difficulties, however, were economic; and these began to be of the most tragic importance to the Dutch people in 1915. For Holland international commerce is not a luxury but a necessity. It directly supports an important part of the community, Dutch industries are dependent on it for most of their raw materials and their coal, while four-fifths of the grain supply comes from abroad. Seaborne trade was gradually extinguished as the War went on. The Germans began by laying mines in front of the English ports. The British retaliated by laying a minefield in the North Sea. In order to make their blockade of Germany effective they exercised an ever more stringent control over imports into the adjacent states, regardless of the provisions of the Declaration of London.[1] They proscribed to neutral traffic a route along the south coast of England, so as to be able to examine cargoes at leisure. The Germans then proscribed the route round the North of Scotland, and declared the Channel area an area of war. In March 1915 the *Entente* Powers did away with all distinctions between legitimate and contraband trade, and prohibited the import into Holland of all goods, whatever their nature, which could be suspected of being destined for transmission to Germany. All goods imported into Holland had to be consigned to an unofficial body (the Netherlands Oversea Trust), which possessed the confidence of the *Entente* authorities and undertook that they should go no further.

[1] This declaration has never been ratified.

The Allies gradually assumed control of the entire economic life of Holland, allowing her the bare necessities of life, withholding anything that could be used to replace goods sent to Germany. Even Holland's trade with her own colonies was subject to this control. As Holland depends on Germany for certain indispensable articles, *e.g.*, coal, she was driven to export food which she really could not do without, in order to obtain them in exchange. Meanwhile in 1915 Dutch vessels had begun to fall victims to German U-boats. After the unrestricted submarine war had been proclaimed early in 1917, practically all overseas traffic ceased. Food scarcity became almost as serious in Holland as in Germany itself, certainly more serious than in England. Bread was severely rationed. Meat was very scarce, as the lack of imported fodder had necessitated the slaughtering of stock. Factories began to close down in 1917 for lack of raw materials and coal. In the last stages of the War Holland's industrial life was at a complete standstill.

Holland greeted the Armistice with relief; but the peace had many disappointments in store for her, and Mr. Van Karnebeek, who had become Minister for Foreign Affairs when a new Government was formed shortly before, was not to have a much easier task than his predecessor.

One big surprise was the discovery that Belgium proposed to advance at the Peace Conference certain claims involving Dutch sovereignty. In the first months of the War, when the Germans advanced through Belgium, a stream of Belgian refugees, which swelled to a flood when the invaders reached Antwerp, had sought safety on Dutch soil, where they were hospitably received. At one time their number exceeded 1,000,000, and their support, the provision of food and shelter, was an exceedingly heavy charge. Hundreds of thousands went back to their country when things had settled down under the occupation. Hundreds of thousands remained till the end of the War, and the way in which they were cared for by a nation which was itself soon to suffer very heavy privations is one of the redeeming features of the history of the War. But all this kindness and generosity seemed to have been forgotten, and Holland found herself decidedly unpopular in some of the Allied countries. The firm refusal of the Dutch Govt. in 1920 to surrender the ex-Emperor William, who had taken refuge there in Nov. 1918, gave rise to excited denunciations of Holland's alleged tenderness for the Hohenzollerns. Holland's attitude in the War was widely represented in the most unfriendly light.

The Question of the Schelde

On this matter Belgium declared that Holland's claim to sovereignty over the Schelde mouth, and her action in closing it against the Allied forces, had made the defence of Antwerp impossible, while her possession of the province of Limburg had hindered the defence of Belgium's eastern frontier, which ought to have been based on the River Maas. It has been argued above that Holland's action in the War had really benefited the Allied cause, but the opposite contention was made by the Belgian "*Comité de politique nationale*," which advocated annexation of the disputed regions. It claimed that Belgium should be given sovereignty over Dutch Flanders, on the left bank of the Schelde, and over Dutch Limburg, on the ground that the treaties of 1839, guaranteeing the neutrality of Belgium, having lapsed, these territories were necessary for her protection and development. With the same object in view, exaggerated complaints of an economic nature were made against the Dutch régime on Antwerp's waterway to the sea. The relations between the *Comité* and the Belgian Govt. were intimate, and Belgium initiated a discussion of these questions at the Peace Conference in Paris, claiming they arose out of the discussion of the treaties of 1839. Holland claimed that this revision should not in any case prejudice Dutch interests, and that any discussion of claims involving Dutch sovereignty was inadmissible, as Holland had not been a party in the War and had honourably fulfilled her obligations as a neutral. Mr. Van Karnebeek consented, however, to go to Paris to explain this point of view to the Supreme Council, who heard M. Hymans on May 20 and Mr. Van

Karnebeek on June 3 1919. The Powers created an international commission to deal with the question, asking them to submit "proposals which involve neither transfer of territory nor international servitudes." The question was eventually referred to direct negotiations[1] between the two countries.

These negotiations on new arrangements for the régime on the Schelde, on the Ghent Terneuzen Canal, etc., were, however, carried on in a somewhat unfavourable atmosphere. Dutch public opinion was greatly irritated. The populations of Limburg and Dutch Flanders protested their loyalty to the Dutch fatherland. Meanwhile the annexationist agitation in Belgium went on, and was still supported by the Government, as was proved when a secret circular, emanating from the Belgian Foreign Office to "Belgian agents" in Dutch Limburg, was disclosed by Flemings friendly to Holland. Yet the Dutch Govt. was prepared to go far to meet Belgian wishes. Although not admitting that the régime of 1839 had been harmful to Belgian interests, and maintaining that she had always administered it in a fair and friendly spirit, Holland declared her readiness to make important economic concessions, which she looked on as the price to be paid for good political relations.

Early in 1920 a treaty in which several Dutch concessions were laid down was ready for signature, when a new dispute arose, about the sovereignty of the Wielingen Channel, which connects the Schelde estuary with the open sea. Although that channel runs along the Belgian coast within the three-mile limit, Holland had exercised sovereign rights over it since mediaeval times, and the two delegations at the beginning of the negotiations had agreed to leave the Wielingen question on one side. When agreement had been reached on other matters it was arranged that each side was to present its case with regard to the disputed point in order to safeguard its claims for the future, but without any intention of arriving at a solution for the time being. Yet when the Dutch Note embodying the case of Holland with respect to sovereignty over the Wielingen was handed in, the Belgian Govt. regarded it as a new and unacceptable claim, and used it as a pretext to break off the negotiations; or such was the view taken in Holland, where it was believed that M. Hymans at the last moment shrank from facing annexationist criticism with a treaty containing nothing but economic concessions. When conditions everywhere grew more stable, and the annexationist programme of the *Comité de politique nationale* looked less capable of realisation, M. Hymans, who had again become Belgian Minister of Foreign Affairs after a period out of office, approached Mr. Van Karnebeek, and the treaty of 1920, was, without Holland having changed her attitude towards the Wielingen question, signed at The Hague on April 3 1925.[2]

Its ratification by Holland was, however, delayed by the prolonged political crisis; and meanwhile it was subjected to lively criticism. In 1919 and 1920 Holland had been willing to make economic concessions to avoid a threat to her sovereign rights; and Mr. Van Karnebeek's conduct of the delicate negotiations had been generally admired. When in 1925, however, the treaty was at last published in its entirety, the danger which loomed so large five years before seemed altogether negligible, and the proposed concessions were scrutinised entirely on their merits. The result was widespread dissatisfaction with the one-sided character of the treaty.

Criticism centred round two main points. Firstly, there are the provisions for a new Dutch-Belgian *régime* on the Schelde. The prosperity of Antwerp during the last years appears the best reply to the suggestion that Dutch control of the lower course of the river threatened Antwerp with ruin. Yet public opinion in Holland admits that the machinery provided by the 1839 treaty for carrying into practice the mixed commission's recommendations is cumbrous. It is greatly disturbed, however, at the provision in the new treaty by which Holland's obligations with respect to the works for keeping the river in a navigable state are defined afresh. It is feared that Holland may have to spend millions in technically unsound attempts to keep the elusive Schelde channel in the same place. A clause exempting vessels bound for Antwerp, during their transit of the Dutch part of the Schelde, from any examination or delay upon any ground whatever arouses criticism as an infringement of Holland's sovereign rights. The provision, by which pilots' fees from the open sea to Antwerp are expressly limited to the amount payable from the open sea to Rotterdam, although the first distance is three times the latter, while nothing is said to prevent the Antwerp fees from being fixed at a lower level, is thought to favour Belgium unduly.

The second point criticised is that containing Holland's consent to the construction over her territory of canals from Antwerp to Moerdyk and from Antwerp to Ruhrort. These canals are obviously intended to deflect part of the Rhine trade from its natural course down the river to Antwerp; a plan which is naturally deeply resented in Rotterdam. It is argued further that the treaty would not eliminate all matters for dispute between the two countries; but that it contains the germs of endless new quarrels. Furthermore, the Flemings, who play an increasingly important part in Belgian political life, are friendly towards Holland and will, it is hoped, understand her refusal to be bound by arrangements made during the ascendancy of the *Comité de politique nationale*, although at the same time the interests of Antwerp, the Flemish metropolis, are very particularly involved. Certain points were discussed afresh between the two governments, and at least interpretative concessions on the part of Belgium were expected.

Domestic History Since 1910.—In 1907, for the second time in the century, a Cabinet was formed out of the coalition of the parties of the Right, that is, of the two Protestant parties, the Anti-Revolutionaries and the Christian Historicals, and the Roman Catholic party. This coalition, which may at first sight appear an unnatural one, sprang from the fact that Catholics and orthodox Protestants were equally opposed to the ruling Liberalism, and in particular to the educational system developed by the Liberals. Only the State's own schools, which were strictly "neutral" as regards religion, received grants of public money. The orthodox Protestants and the Catholics both complained that as taxpayers they had to help in supporting schools to which conscience forbade them to send their children, while as parents they had also to maintain their own private denominational schools. This situation at length, and in spite of the traditional enmity between the two creeds, led to a coalition of the Calvinist parties and the Roman Catholic party.

In 1910 Dr. Abraham Kuyper formed the first Coalition Government. Himself a Calvinist, chief of the anti-revolutionary party, he succeeded in finding "one root of faith" from which both Catholics and Protestants sprang, and divided the Dutch nation into "Christians" and "Paganists." But the political situation in 1907, when the second Coalition Govt. was formed, did not permit Dr. Kuyper's strong personality to be included, and when in 1909 the general election led to further disaster for the Liberals he nevertheless remained discarded. Mr. Heemskerk was the leading member of this Government, which was somewhat too moderate in its religious policy for the more fanatical Kuyperians, whose zeal for social reform was gratified by the grandiose scheme for state disability and old age insurance on which the Minister of Labour, M. Talma, worked strenuously. The scheme, however, had not yet been carried into effect when the defeat of the Coalition at the polls in 1913 hung it up indefinitely.

The parties of the Left proved unable, in 1913, to assume the responsibilities of government. The once powerful Liberal party was now broken up into several sections, of which one was really anti-clerical conservative, while another was radical. Moreover, the Socialist party, which made a big advance in 1913, now claimed a large proportion of the forces of the Left, and there was little sympathy between it and the so-called Old Liberals. An attempt was made, nevertheless, to form a coalition of the

[1] See H. W. V. Temperley, *History of the Peace Conference in Paris*, vol. ii., pp. 192 *seq.* (London, 1920).

[2] In spite of the signature of the Convention, neither side abandoned the original contention with regard to the Wielingen Channel, the Belgians basing their claim on the three-mile limit, the Dutch on ancient rights of possession.

Left, under Dr. Bos, the Radical leader, on a programme that included universal suffrage. The Old Liberals agreed to this programme, but the Socialists, although their leader, Mr. P. J. Troelstra, was in favour of accepting, refused to co-operate.

In this difficulty an extra-parliamentary Cabinet was formed by Mr. Cort van der Linden. In conformity with the verdict of the electors it bore a decidedly "Left" character, but it attempted to find final solutions for both the questions which had long paralysed Dutch political life. Mr. Cort van der Linden and his colleagues proposed to bring about a revision of the Constitution (for which purpose a two-thirds majority of the Chamber is required) by an agreement of all parties. In it the Clerical groups would find the solution of the school problem and the Liberals, Radicals and Socialists the final extension of the suffrage.

Although faced with the problems arising out of the World War, the Government persevered with this task, and indeed the quickened sense of national solidarity helped it rather than otherwise. In 1917 its programme was carried out. Universal suffrage and proportional representation were introduced; at the same time, the principle of absolute equality with regard to the public exchequer of "public," undenominational or a religious education and "private" denominational education, was conceded in full and written in the Constitution.

The first elections held under the new suffrage law (June 1918) resulted in further disaster for the Liberal groups. The Cort van der Linden Administration resigned and another Calvinist-Catholic Cabinet was formed. The Premier, Mr. Ruys de Beerenbrouck, was a Catholic, a thing without precedent in Dutch history. This Government's mandate was confirmed by the elections of 1921, when the Coalition parties increased their number of seats to 60 out of the 100 which constitute the Second Chamber. At the elections of 1925 they lost some ground, but still retained the majority, and when Mr. Ruys retired, Mr. Colÿn, leader of the Calvinist anti-revolutionary party, formed another Coalition Cabinet. In Nov. 1925 internal disagreements compelled that Government to resign. Each of these elections since proportional representation came into force meant a further stage in the disintegration of the Liberal parties, of which only the Radical group held its own. The Socialists, on the contrary, made a big advance in 1918, and although they suffered a setback in 1921 they more than retrieved their fortunes in 1925. They then numbered 24 members and were the second largest party in the Chamber after the Catholics with 32. The 1921 election was the first at which women's suffrage was in full working order. Six out of the 100 seats were occupied by women in the Chamber of 1925.

The years of Coalition Govt. through which Holland passed after the Armistice can be divided into two very distinct periods. The years 1919 and 1920 were feverish ones, when a fallacious sense of prosperity stimulated enterprise in business and politics alike. It is not perhaps unfair to connect the zeal for social reform which characterised those days with a certain nervousness which remained after the "November days" of 1918. Mr. Troelstra, the Socialist leader, his imagination fired by the spectacle of the German revolution, toyed with the idea of imitating it among his own people. The attempt was a ludicrous failure. The Government took strong measures and the people rallied to them, and after an excited week quiet was restored on Nov. 21 1918. The Socialist party, which had been far from unanimous about this adventurous policy, re-entered the path of constitutionalism, and Mr. Troelstra, who resigned the leadership in 1925 owing to ill-health, never regained his old prestige. Yet the affair probably helped to create the spirit in which the Government tackled social problems. Mr. Talma's insurance scheme, of which the Cort van der Linden Cabinet had carried out only a small part, was taken up again, and in Dec. 1919 a comprehensive Disability Insurance Act was passed. Large sums of money were voted in aid of building societies and building schemes of municipal bodies. Not only were housing conditions greatly improved, but as architecture has again become a living art in Holland, and the best architects were called in, the new quarters of many a Dutch town afford fine examples of modern building, and have been studied and admired by the experts of other countries. A piece of legislation with which Holland was in advance of all other countries was an Act restricting the hours of labour to 45 a week.

But the fictitious prosperity was succeeded by a severe depression. Shipping and shipbuilding particularly felt the effects, and no place suffered more from the occupation of the Ruhr area and from the preference granted by France to her own and Belgian commerce than the great port of Rotterdam. When international conditions improved in 1924, economic conditions in Holland soon felt the effect. Yet unemployment remained still a drain on Dutch resources. The one really bright spot in the picture was the prosperity of the East Indian "cultures."

Meanwhile, the stress of the times occasioned a radical change in the Government's policy. Economy came to be the cry. The building subsidies were cut down. In order to enable Dutch industry to compete with the countries with debased currencies, dispensations from the Act restricting the hours of labour were freely granted. On yet another point a revulsion of feeling manifested itself against legislation passed almost without opposition a few years previously. The new Cabinet of the Right had to carry into practice the general provision of financial equality for denominational education which their predecessors had written into the Constitution. It was now felt that the multiplication of small State-subsidised schools, which resulted from Dr. De Visser's (the Minister of Education 1918–25) measures, overburdened the taxpayer.

During the years 1922–4 Dutch politics centred round the financial situation. In the early summer of 1923 the Government strengthened itself with a new Minister of Finance, Mr. Colÿn, who two years later was to succeed Mr. Ruys in the premiership. Mr. Colÿn, a strong personality, was expected to carry out a programme of ruthless economy. All salaries paid by the State were indeed cut down by one-fifth, a measure which naturally occasioned a good deal of discontent. Socialist and Radical critics complained that economies in other directions were neglected, while at the same time, by the raising of the general import tariff from 5 to 8% *ad valorem*, the introduction of a tax on bicycles (which are more numerous in proportion to population in Holland than in any other country), and the raising of the duty on tobacco, the burden of taxation borne by the mass of the community was not inconsiderably increased. The object of Mr. Colÿn's policy, at all events, was reached: in the course of 1925 the budget was balanced. An improvement in the yield of direct taxation, as a consequence of the economic revival, contributed towards this event.

In spite of this success, Mr. Colÿn's Govt. soon was unable to carry on. It was freely predicted at the time that the elimination of the education grievance would soon bring about the dissolution of the Coalition, and that thus the way would become clear for a more natural grouping of parties on economic and political lines. In Oct. 1923 it was thought that the knell of the Coalition had been sounded when 10 Catholics joined the parties of the Left and the bill for the strengthening of the naval defences of the Dutch East Indies, which the Government, in spite of their zeal for economy, and in spite of the effect which the Washington treaties might be supposed to have on the situation in the Pacific, considered indispensable, was rejected in the Second Chamber by 50 to 49 votes (Oct. 26 1923). After a crisis of several months, however, the Coalition was patched up and the elections of June–July 1925 were fought on the old lines. Mr. Colÿn formed a new Government in July. The new crisis was occasioned by a question of far less intrinsic importance, but more serious as a sign of the progressing disintegration of the Coalition.

In spite of the prolonged comradeship in office, one at least of the two Protestant parties, the Christian Historical party, never ceased to look upon the Roman Catholics without a certain watchful suspicion. Of late years, owing to their excellent organisation and also to their constant participation in the government of the country as a consequence of the Coalition,

the growth of Catholic influence and self-confidence, which started in the 19th century, had been accelerated, inducing a certain uneasiness and irritability in Protestant circles, which the Christian Historical party, for all its loyalty to the Coalition, could not ignore. In those circumstances a motion, introduced by an independent Christian Historical member of the Chamber, to abolish diplomatic representation at the Vatican, which had been introduced during the War by the Cort van der Linden Govt., assumed an importance quite out of proportion to its intrinsic merits. The whole Christian Historical party voted for it, and the motion was carried. The Liberals, Radicals and Socialists, while caring little for the question itself, had voted for the motion in order to show up the unreality of the Coalition. The Catholic Ministers in Mr. Colyn's Cabinet resigned on Nov. 11 1925, and the next day the Premier offered the resignations of himself and all his other colleagues.

Co-operation between the Christian Historicals and the Roman Catholics had now become exceedingly difficult, but the hopes of those who wanted to see the Coalition give way to a new grouping of parties were disappointed. Radicals and Socialists have long aspired to an alliance with the Catholics, among whom democratic tendencies are strongly, although by no means exclusively, represented. An attempt (Nov. 24–Dec. 1 1925) on the part of the Radical leader, Mr. Marchant, to form a democratic Ministry, however, met with a unanimous refusal from the Catholics, in spite of Mr. Marchant's offer to rescind the vote against the Vatican legation. The result was that Dutch parliamentary politics appeared to have reached an absolute deadlock. After a crisis of unprecedented duration, Jonkheer de Geer, therefore, on March 3 1926 formed a non-parliamentary Cabinet with a programme of all-round economy, including reductions in the army and navy and productive state works for the unemployed. He announced his intention of resigning as soon as a parliamentary majority had been formed.

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II. ECONOMIC AND FINANCIAL DEVELOPMENT

Although Holland remained neutral during the World War, the War itself and the subsequent years left their impress upon its economic and financial development. Some of these influences were of a temporary nature, such as the effects of the crisis of 1920–1 upon Dutch economy. The permanent changes chiefly regarded public finance. In the economic sphere the War accelerated the expansion of national industries and the process of banking concentration. The foreign capital holdings of the people were affected by the loss of Russian securities, representing an estimated value of £100,000,000, and by the realisation of a considerable number of American securities. Against these losses, there was a large increase in the extent and value of the Dutch capital invested in the Dutch Indies, and further a large increase in internal investment within the country.

Population.—The War had little effect on the growth of the population, which increases by approximately 100,000 per annum, a relatively high figure as compared with other countries, the result of a persistently favourable birth-rate (24·1 per 1,000 in 1925) and an extremely satisfactory death-rate (9·6 per 1,000 in 1925). It was only in the influenza year 1918 that the death-rate increased to 17·2 per 1,000. The population was 5,945,115 in 1910; 6,865,314 in 1920; and approximately 7,400,000 in 1925.

Agriculture.—A sound adaptation of the various branches of agriculture and cattle-breeding to the nature of the soil, the advantages of cultivation by the individual owners and an increasingly marked preponderance of small holdings, favourable market facilities and technical skill stimulated by co-operation and State encouragement—all have contributed to the development of agriculture.

The home production was only 154,000,000 kg. of wheat or about 21·8% of the total consumption (708,000,000 kg.); on the other hand 32·5% of the total output from dairy-farming was available for export. After the War the export trade recovered quickly. Exports of butter, which had ceased entirely during the last years of the War, attained their pre-War figure in 1924 (£5,800,000); cheese exports actually increased threefold (£6,200,000); whilst meat exports during the same year amounted to £6,300,000 or 30% more than in 1913.

Industry.—A number of new industries are increasing in importance, for example, the chemical and electric lamp industry. The first blast furnace was started at Velzen near the North Sea coast. The coal mining industry, whose beginnings date from the end of last century, now satisfies two-thirds of the requirements of the country. The output of coal rose from 300,000 tons in 1900 to 1,000,000 tons in 1910 and 6,800,000 tons in 1925. An approximate idea of the industrial position in 1923 can be derived from the statistics of production.

	Yield of the various branches of industry in Holland £
Foodstuffs	25,000,000
Textile industry	20,800,000
Metal industry	19,600,000
Luxury articles	8,300,000
Clothing and boots	5,400,000
Wood industry	5,200,000
Chemical industry	5,200,000
Miscellaneous	18,800,000
	£108,300,000

The value of the total agricultural output in this year was £87,900,000.

The unemployment figures showing the percentage of workers unemployed among trade unionists give an idea of the general economic situation in recent years. Whilst in 1913 the highest figure was 8·8 (Dec.), the summer average 4·1 and the winter average 8·0, the corresponding figures for 1924 were respectively 19·7 (Jan.), 5·8 and 10·5. Generally speaking the highest level was reached in 1923. Since then the figure has fallen, but was still unsatisfactorily high in Dec. 1925—13·8.

Trade and Shipping.—Trade statistics were reorganised and improved in 1917. As a result, however, no comparison of figures of values is possible while even figures of quantities before 1917 can only be used with great reserve.

	1913	1925
	kg.	kg.
Imports	21,302,000	25,500,000
Exports	5,848,000	12,336,000

The direction of Dutch trade has changed considerably:—

	Germany		England		United States		Belgium		France		Dutch East Indies	
	1913	1925	1913	1925	1913	1925	1913	1925	1913	1925	1913	1925
Imports	28·9	24·2	8·7	15·9	1·31	11·2	9·01	11·1	0·8	4·4	3·5	5·6
Exports	27·9	25·9	22·2	25·9	3·9	3·8	11·0	9·0	1·0	4·7	5·3	7·4

(The figures represent percentages of the total)

The system of virtual free trade—duties of 5% being levied on a number of "finished articles"—remained practically unchanged during the War and even during the subsequent period of currency disorder in several states of Europe; only in the case of the shoe and cigar industries special temporary prohibitive measures were introduced with a view to restricting dumped imports. The tariff was increased to 8% on July 1 1925, and the list of dutiable commodities was somewhat extended, principally on revenue grounds. In 1925 47% of the total exports of £146,200,000 consisted of foodstuffs and 35·7% of manufactured goods. The total imports in that year amounted to £204,200,000.

The importance and development of shipping can be gauged from the following figures for ocean-going shipping in the port of Rotterdam:—

Loaded ships, net tonnage registered: 1900	5,452,000
Loaded ships, net tonnage registered: 1910	8,898,000
Loaded ships, net tonnage registered: 1913	11,638,000
Loaded ships, net tonnage registered: 1925	13,903,000

The amount of Dutch high-seas shipping in 1925 was 1,319,534 net tons registered, so that Holland took the seventh place in the high-seas shipping of the world, being only surpassed by Norway in the tonnage per head of population. In 1913 the tonnage amounted to 687,635, and Holland then also stood seventh on the list.

The Monetary System and Banking.—The following figures show the extent of banking transactions:—

	1913	1920	1924
Capital and reserves	£ 12,600,000	£ 37,700,000	£ 82,400,000
Other assets . .	32,200,000	133,300,000	83,200,000
" Debtors " . .	15,600,000	75,900,000	47,900,000

Throughout this period the Dutch guilder (florin), thanks largely to the policy followed by the Netherlands Bank, maintained its position as one of the highest-valued currencies of Europe. The gold standard was officially re-introduced on April 28 1925 when the prohibition on the export of gold was cancelled. On the same day similar steps were taken by Great Britain and by the Netherlands East Indies. The amount of bank notes in circulation at the end of 1925 was £72,900,000, as against £25,900,000 at the outbreak of the War. The gold reserve increased during the same period from £13,000,000 to £37,000,000. In addition to the bank note circulation the " giro " systems of transfer through the intermediary of the Netherlands Bank and of the Post Office are becoming increasingly important. But the cheque and clearing system of the large banks has not developed much in Holland.

State Finances.—Before the War the state finances were satisfactory. The total of " ordinary " expenditure had increased from £12,400,000 in 1900 to £16,400,000 in 1910 and £18,300,000 in 1913. The increase is evidence of the tendency in Holland, as elsewhere, towards increased state activities: but it should be remembered that the general rise in prices during the period 1900–13 amounted to 16%, and the increase in population to 19%.

The position of the Dutch public debt was very satisfactory before the War. In 1840, after the end of the war with Belgium, it amounted to approximately £117,000,000. By Jan. 1 1914 it had fallen to £95,700,000, although large public works (railway construction) had been undertaken in the interval. The war and subsequent years made very high calls upon the state funds. Mobilisation cost £101,400,000; the supply of the population with material necessities during the War—the system of distribution involved subsidies from the public funds—cost £47,100,000; and the housing subsidies which were charged against the extraordinary budget cost £54,700,000. The ordinary expenditure also increased considerably as a result of increased state activities and rising prices: the highest figure reached was £52,700,000 in 1924. The deficit for the period of crisis, which terminated in 1924 as far as the state finances are concerned—after deduction of such exceptional taxation as the tax on war profits—was £183,500,000. Of this amount £175,000,000 have been funded. Although the sinking fund continued to operate in the interval, the debt rose to a record figure on Jan. 1 1925 with £244,100,000, falling to £239,300,000 on Jan. 1 1926. The ordinary expenditure for both 1925 and 1926, which can again be regarded as normal years, amounted in round figures to £50,000,000 and is wholly being met out of the revenue. 36·2% of the total expenditure was met out of the proceeds of direct taxation in 1925 as compared with 23·7% in 1913.

The above-mentioned increase of expenditure is reflected in the position of the Treasury. Whilst before the War it was very rare for more than £4,000,000 to be required for Treasury needs, the floating debt amounted on Jan. 1 1922 to not less than £71,500,000 (consisting chiefly of Treasury bills). Against this amount there stood £40,000,000 of claims, composed for the most part of advances made to the colonies. It was only owing to the exceptionally liquid state of the money market that the State was able to raise such sums. The floating debt was reduced by Jan. 1 1926 to £25,500,000, owing to various funding operations undertaken in successive years; but against this figure there are claims of the State amounting to £24,100,000, mostly against foreign countries.

The burden of taxation—viz.: of all taxes, including those of the provinces and communes—increased from £3 5s. per head in 1913 to £13 4s. in 1921 (including tax on war profits), but had been reduced by 1924 to £7 12s. per head of the population.

	Index Numbers Wholesale Prices	Imports £ million for home consumption	Exports £ million of domestic produce	Netherlands Bank Yearly average	
				Notes in circulation £ million	Domestic credits £ million
1913	100	..	..	26·1	13·3
1914	109	..	..	34·6	21·5
1915	146	..	..	44·6	15·4
1916	224	..	..	58·2	12·8
1917	276	90·2	69·8	68·0	13·2
1918	376	50·7	31·9	82·0	21·7
1919	304	235·5	117·6	85·6	32·4
1920	292	278·0	141·8	87·5	37·0
1921	182	186·7	114·1	85·1	34·5
1922	160	169·0	101·8	82·0	27·1
1923	151	167·4	108·6	81·9	28·3
1924	156	197·0	138·4	79·7	27·0
1925	155	204·6	150·6	..	..

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(G. W. T. B.)

NEUILLY, TREATY OF.—The Bulgarian Treaty was signed at Neuilly on Nov. 27 1919, and came into force on Aug. 9 1920. In the main it is the same as the Austrian Treaty. But there were important differences in the military and naval clauses, and also in regard to reparation and finance.

As regards the territorial clauses, the only serious changes were to the west and south. The Serb-Croat-Slovene kingdom obtained several strategic ratifications. The two most important are that the Strumitsa salient in the extreme south-west has been flattened out, the western half being ceded to the Serbs; also, and more important, in the Nish-Pirot area the town of Tsaribrod has been taken from Bulgaria and a line drawn whereby an advance on Nish would be rendered more difficult. The frontier, however, confers no offensive advantage on the Serbs, and is thus a sensible one. A loss more serious in another sense is that to Greece of the district of Western Thrace, lying between Xanthi and the Maritsa river. This was ceded to Greece on her obtaining Eastern Thrace and Adrianople. Bulgaria, for ethnic reasons, received a slight extension of territory west of Adrianople. The expulsion of Greeks from Adrianople and East Thrace by the Turks has, however, not caused the Allies to change their minds about Western Thrace, which remains annexed to Greece and is denied to Bulgaria. But, though these losses are humiliating to the pride of the Bulgars, it cannot be said that they seriously injure their strength or prosperity. Dedeagach, which she lost to Greece with the whole of Western Thrace, is really unsuitable as a port and also at a great distance from Sofia.

With the view of giving Bulgaria access to the Aegean, Veniselos offered, during the negotiations, to build a railway connecting the fine Greek harbour of Kavalla with the Salonika-Constantinople railway, which now runs to Sofia up the Struma valley, though with a break of gauge. This offer, though doubtless quite sincere, has never been acted upon, though in article 48 the Principal Allies undertake to ensure the economic outlets of Bulgaria to the Aegean Sea.

Bulgaria had always asserted claims to that part of Macedonia now in Serbian hands, and also to Eastern and Western Thrace. In the former area her ethnic pretensions are better founded than in the latter. But Serbian Macedonia is in the hands of a formidably armed and militarily strong nation. Greek Macedonia and Thrace are now populated by hundreds of thousands of Greek refugees from Asia, and contain over 80% of a purely Greek population. It would seem, therefore, that both districts are irrecoverably lost to Bulgaria, and that her strength must rest purely on her own resources. In population, she has only lost some 300,000 persons, of whom some are not Bulgars.

Part IV. The military, naval and air clauses have some special points. Bulgaria is allowed 20,000 regulars, 10,000 gendarmes and 3,000 frontier guards, or 33,000 in all. This number is insufficient to maintain order in a turbulent Balkan State, and the subsequent serious disturbances in Bulgaria are due directly to this fact. It is increased by the difficulty of applying the voluntary long-service system of 12 consecutive years to a nation of peasants. In an agricul-

tural country it is practically impossible to get men to leave their farms for 12 years, and the army is always likely to be dangerously below strength, and the less regular formations dangerously above it. The naval clauses do not differ from those of the German or Austrian Treaty. All Bulgaria's navy has now been destroyed, and she is left with four torpedo-boats, of which three are damaged, and six motor-boats, of which four are damaged.

Part V. (*Prisoners of War and Graves*) and *Part VI.* (*Penalties*) are the same as in the Austrian Treaty (*see* ST. GERMAIN, TREATY OF).

Part VII. (*Reparation*). This contains the most novel and interesting feature of the Treaty, and is, in fact, the only serious attempt to get reparation on to a business basis. It contained three features of great interest.

(*a*) Contrary to the practice in the German, Austrian and Hungarian Treaties, there was no attempt made to seize or distribute the Bulgarian commercial fleet on the "ton-for-ton" or "class-for-class" principle.

(*b*) It fixed the amount to be paid at the lump sum of £90,000,000.

(*c*) It created a Reparation Commission consisting of French, British and Italian representatives, with power to reduce this amount by a simple majority vote (not by unanimity as is the systematic rule), on the suggestion of the inter-allied Commission.

The general scope and powers of the Reparation Commission are drawn in such a manner as to control the finances of the country sufficiently to obtain reparation, without offensive interference. In the end, the Reparation Commission, after examining the question on the spot, has practically remitted three-quarters of the total of £90,000,000. The annual sum now required to meet the charges on the 550,000,000 gold francs of the debt is well within the capacity of the new Bulgarian State, and is being punctually paid. None of the remaining clauses of the Bulgarian Treaty have any special features of interest or importance.

Conclusion.—Viewing the Bulgarian Treaty as a whole, it is the fairest and most practical of all the Treaties imposed on the enemy Powers. There has been little diminution of territory or population, and no vindictiveness shown. Bulgaria was protected by the Principal Allies, first from occupation of her territory by Serbs or Greeks, next from the seizure and distribution of her commercial fleet, and finally from the financial anxieties and confusion consequent upon an unfixed liability, and from the difficulties of a too-powerful and too-obtrusive Reparation Commission. The reason is that the Principal Allies, while not strong enough to withstand the public demand for severity in the German, Austrian and Hungarian treaties, were strong enough to resist the Serb, Greek and Rumanian claims in the Bulgarian Treaty. The result is that Bulgaria is more relatively prosperous than any other ex-enemy state, and has been able to pay her liabilities without making the League her receiver and manager, like Austria and Hungary, or adopting a disguised form of this liquidation like Germany under the Dawes scheme. Bulgaria has shown herself more willing to accept new conditions, and it is not impossible that she may enter ultimately into some form of alliance with the Serb-Croat-Slovene kingdom. (*See* BULGARIA; PEACE CONFERENCE; REPARATION, etc.)

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NEUROMUSCULAR SYSTEM (*see* 19.44).—Briefly, recent contributions have dealt largely with the anatomical nerve-supply of the striate (so-called "voluntary") skeletal muscular system, the discrimination of the different functions of muscle substance, and the integration of neural and muscular activity. From consideration of the action of the simplest neuromuscular unit, prosecution of the subject leads us by consecutive and logical steps to matters of deep interest and significance in relation to the function of the nervous system as a whole and to age-old questions such as the meaning of "the will." The problems of the neuromuscular system may be approached from various viewpoints; it is natural to commence with that of morphology.

Anatomical Considerations.—The striate skeletal muscular system is supplied by efferent motor nerves from the anterior or ventral horns of grey matter in the spinal cord; the course and distribution of these nerves, and, conversely, the representation of individual muscles in the nerve-cell groups of the anterior spinal horns, are all well known. When a motor spinal nerve enters a skeletal muscle at its so-called "motor point" its fibres divide up and ramify to the various component muscular fibres of the muscle, ending on these latter structures by "motor-nerve end-plates." According to the views of Langelaan, each motor nerve-fibril is in communication with the sarcoplasm of the muscle fibril which it is supplying.

In addition, however, to this accepted spinal nerve supply, close study has been given in the period under review to the question of a sympathetic nerve supply to the skeletal musculature (apart, of course, from the familiar sympathetic innervation of non-striped, visceral muscles). Suspected long ago by Ranvier and others, and held in more recent times by Fano, Botazzi and Pekelharing, the notion of the duality of nerve-supply to the "voluntary" muscles has been set on a firm histological basis especially by the work of Boeke, Kulschitsky, Dusser de Barenne, Agduhr, Hunter, Latham and a number of other investigators. Even so, we are still confronted with the question whether spinal and sympathetic motor nerve fibrils end in the same, or in different, muscle fibrils. On the determination of this point much will depend. While Boeke and others claim that both kinds of nerve end in the same muscle fibre, Hunter and his collaborators contend that as there is a double neural supply, so there are two distinct sets of muscle fibres, each having its specific function, and they maintain, in consequence, that each skeletal or "voluntary" muscle is anatomically and physiologically a couple, a doubled structural and functional unit, and that by experiment or by disease one of these may be destroyed and the other left. Their theories of muscle function are based on the histological claim that the actual innervation of muscle fibres is single, not dual, the sympathetic system sending its fibrils to muscle fibres *not* linked to the spinal motor system, that is, not furnished with spinal motor-nerve end-plates. In his most recent work, on the other hand, Langelaan takes the view that the sarcoplasm of one and the same muscle fibril is reached anatomically from *both* spinal and sympathetic sources, though he distinguishes the function of the two. Since the question has an obvious physiological bearing, it may also be approached from that standpoint.

Physiological Considerations.—Among the problems of the functions of muscle substance one has emerged more definitely in recent years as being of fundamental significance, viz., the relation of the function of contraction to that of maintenance of muscle tone. We owe largely to the work of Sir Charles Sherrington our current conceptions of muscle tone, according to which it is commonly understood as being that condition of contraction of a resting muscle which exists without "voluntary" innervation and is also present though the limb is passively supported, since the muscles do not then "sag" or hang flaccid. Tone gives a shape to muscles, and is in evidence both in resting (static) and in moving (kinetic) states of the musculature. Sherrington has shown that tone is in reality postural contraction, that is, it is a mild contraction of muscle-fibres produced reflexly by sensory excitations arising in peripheral sensory end-organs substantially those of the muscles themselves, the impulses passing therefrom by sensory paths to the spinal grey matter and back to the muscles by spinal motor nerves. This is he proprioceptive reflex arc of Sherrington, and interruption of it at any point is followed by loss of tone in the muscle concerned. In virtue of this reflex contraction, further, a muscle can adapt itself to its varying length; in other words, whether its fibres are as a fact in a shorter or longer anatomical state the reflex contraction is maintained. This property was described by Sherrington as "plasticity," whence the term "plastic tone."

Plasticity.—The exact sense in which the expression "plasticity" is employed is of importance, for others have understood it somewhat differently. When an ordinary nerve-muscle preparation is taken from such an animal as the frog it must by definition be absolutely toneless, since it is separated from the tone-maintaining proprioceptive arc, and cannot therefore exhibit that quality of tone described as "plasticity." In his recent communications, however, Langelaan states that the preparation, though contraction-less, possesses "plasticity," signifying thereby a property of having its form modifiable slowly by external force. Most physiologists and neurologists follow Sherrington in regarding "plasticity" as being a muscle property derived solely from somatic proprioceptive arcs in a condition of integrity.

Movement and Posture.—It is now commonly declared that a distinction is permissible between " contractile tone " and " plastic tone "; more especially during the last decade a hypothesis has gradually taken shape, to the effect that movement can be legitimately distinguished from posture, that these are subserved by different mechanisms, and that whether initiation of movement and maintenance of posture are " active " (" voluntary "), or " reflex " (" involuntary "), each is the expression of a neural activity different from that of the other. In respect of reflex activity, the form the hypothesis takes (according to the late Irvine Hunter, one of its chief supporters) is that " postural tone "—the mild postural contraction defined above as being of reflex proprioceptive origin—is in reality compounded of two subvarieties, acting together but distinct, viz., " contractile tone " and " plastic tone." When in response to suitable stimuli a muscle or muscular group in a limb contracts reflexly, that is, when the limb or a limb-segment changes from one posture to another, this is effected by the contraction of muscle fibres which are innervated by the spinal (somatic) nervous system; such fibres are considered to be responsible for " contractile tone," the tone that is in evidence during contraction. When, next, a posture reflexly assumed comes into being at the end of a reflex movement, that posture is held or maintained by the action of a different set of muscle fibres, whose postulated function, in Hunter's view, is to remain at a given fixed length, once movement of the contractile fibres has ceased, thus immobilising the muscle for as long as may be. These are thought to be responsible, therefore, for " plastic tone." At this point we revert to the considerations in the first section, since Hunter argues that it is the sympathetically-innervated fibres which develop " plastic tone," and the spinal fibres which underlie the manifestations of " contractile tone." Further, he states that the former are essentially *non-contractile;* he assumes their length is passively altered during the contractions of the contractile set.

Dual Theory.—The dual theory of the neuro-muscular system, as it may be termed, has had in recent years various other exponents whose views by no means harmonise with those of Hunter outlined above. Reference may be made to one or two pertinent considerations. Re-examination by Langworthy of Vulpian's phenomenon (1862) would seem to show the possibility of muscular contraction via the sympathetic nervous system. Langworthy has found that stimulation of the lingual nerve (containing bulbar autonomic fibres) leads to slow, wavy contractions of the tongue muscles after complete degeneration of the hypoglossal nerve end-plates by previous section of that nerve. It is more than doubtful, therefore, as regards Hunter's theory, whether *non-contractile,* sympathetically-innervated muscle fibres actually exist. Not a little can be said in favour of the view, however, assigning some function connected with the tension of muscular tissues to a sympathetic innervation, seeing that the actuality of a sympathetic supply to striped muscles cannot be gainsaid. Langelaan, for instance, considers that the sympathetic supply to muscle sarcoplasm maintains the latter in a state of appropriate tension such as to facilitate within it the passage of an innervating current of somatic motor-nerve origin.

Movement Analysed.—Other arguments go to show that a rigorous and schematic differentiation as between movement and posture can scarcely be sustained. Movement is in reality a continuous series of changes of posture, and Sherrington has demonstrated that no clear-cut distinction can be drawn physiologically between reflexes of posture and reflexes of movement. From still another standpoint, experiments with the string-galvanometer have proved that an action-current exists in a healthy muscle when at rest and in a state of normal tone, and that no *qualitative* difference can be detected between it and the action-current when the same muscle is either actively (" voluntarily ") innervated or passively moved (Von Weizsäcker, Wachholder, Mann and Schleier). Such data favour the view that tone and contraction are identical and that no fundamental or essential distinction is to be drawn between them; and they militate against any conception of neuromuscular activity which entails the existence of completely separable neural mechanisms for posture and for movement.

Automatic Action.—A second aspect of the problem furnished by the activities of the neuromuscular system concerns reflex or automatic action. Speaking generally, " voluntary " action has always been thought, for seemingly cogent reasons, to contrast specifically with " involuntary " action. The experimentalist and the clinician have long been familiar with so-called spinal automatisms, with co-ordinated grouping in action of neuromuscular units, forming a " pattern " which has an apparent meaning or purpose. In the " spinal animal," for example, following transection of the neuraxis at the level of the junction of medulla and spinal cord, numerous reflex activities can readily be demonstrated, of which the " scratch reflex " is a classical variety. Similarly, in suitable cases in man (of which the War furnished us with many instances) it is quite simple to demonstrate that the isolated spinal cord can live by itself and that it possesses capacities for activity in a co-ordinated form, primitive neuromuscular mechanisms usually hidden in health but capable of expressing themselves in the form of release-phenomena when the cord is separated by disease from higher physiological levels.

The apparently purposive character of many of these reflex activities (automatic emptying of the bladder, attempts at spinal walking or stepping, biologically old reflexes connected with the genital apparatus, etc.) is of considerable importance and significance, for they are entirely independent of conscious control and of intelligent guidance, since in the given circumstances (gunshot wounds of the cervical cord, experimentation) the cord with its neuromuscular patterns is physiologically severed from the brain. Thus muscular action of a strictly reflex kind, produced solely by appropriate stimuli at the same low physiological level, may, and does, exhibit outward characters which render the discrimination from " voluntary " action not a little arduous—as far, that is to say, as externals are concerned.

Neuromuscular Functions at Higher Levels.—Pursuing this line of investigation, the physiologist is led to examine the neuromuscular functions of the animal in which transection is performed at higher levels than the spinal. During the last few years a whole series of apparently purposive reactions superficially indistinguishable from combined movements of the order usually called " voluntary," have been demonstrated by Prof. R. Magnus, of the University of Utrecht, and his colleague, Prof. de Kleijn, and other collaborators, to occur in the higher animals through the agency of mechanisms that are purely and rigidly automatic. Magnus and de Kleijn's method has been to study the reflexes and reactions of the " spinal " animal; then to take the " midbrain " animal (transection at the level of the corpora quadrigemina of the mesencephalon) and observe what additional functions it is capable of executing; they next take the " thalamus " animal (separation from cerebral cortex and corpus striatum at the level of the internal capsule) and investigate its functions. They then argue for the localisation of the mechanisms underlying these respective additional functions within the corresponding limits of the respective additional areas of the neuraxis above the upper spinal cord. They have thus been able to demonstrate with precision that a large group of seemingly purposive movements, by which man and the higher animals balance their bodies, maintain normal postures and adjust themselves to forces disturbing equilibrium, are as a fact nothing else than reflex actions of ascertained neuromuscular mechanisms.

Static and Stato-kinetic Reflexes.—Under the former are included: (1) Standing reflexes. The head influences the posture of the body by means of tonic neck-reflexes acting on the limbs. When the position of the head in relation to the body is passively altered, specific corresponding changes take place in the attitude of the limbs. If the head is fixed in its relation to the body, and then its position in space altered, the musculature of body and limbs is correspondingly modified by means of tonic labyrinth-reflexes. (2) Eye reflexes of compensation. For each position of the head in space there is an appropriate reflex setting of the eyes in the orbits, effected both by tonic neck-reflexes and labyrinth-reflexes, acting on the eye musculature. (3) " Correcting " or " righting " reflexes. Animals whose midbrain is intact are capable of reassuming correctly a

normal attitude, through reflex action, from which they have been passively deflected. The machinery for this reflex "righting" is complex, there being at least four different sets of reflexes.

The discoveries of Magnus and de Kleijn have made a large addition to the long series of automatisms of which the physiologist has been cognisant. Into them no element of choice enters. Activities hitherto considered intelligent must be relegated to the category of automatisms, of reflexes, almost, indeed, of tropisms.

Cerebral Motor Cortex.—Finally, in respect of the cerebral motor cortex itself, recent investigations indicate that revision here also is required. Classifying in a general way as belonging to the "old motor system" the motor reactions of infracortical physiological levels (*cf.* supra), the neurologist has been in the habit of regarding as the "new motor system" that comprised in the electrically excitable motor area of the cortex with its corticospinal prolongation to the motor cells of the anterior cornua of the spinal cord. This corticospinal system (with its analogues) is usually understood to be the "voluntary" motor system and to exercise a controlling influence on infracortical motor centres. In some respects it is unquestionably the master system, yet in other respects this is no more than a *façon de parler.* The writer has shown (Croonian Lectures before the Royal College of Physicians of London, 1925) that many of the "involuntary" movements of diseased conditions, *e.g.*, those of chorea, are as a fact identical in all essential respects with "voluntary" movements of cortical origin, except that the patients' "volition" neither initiates nor is able to inhibit them. They constitute cortical reflexes, the expression of activity of neuromuscular mechanisms whose anatomical site reaches to the cortex and which are nevertheless outside "volitional" control. Other recent work points in the same direction. Monakow, for example, has come to the view that the function of the pyramidal areas seems to be in the class of reflex activity. Lashley, who has done much experimental work on cerebral function, concludes that the conception of "volitional" activity is too vague to have any scientific value, while years ago Hughlings Jackson taught the neurological world that, in respect of movements, "voluntary" and "automatic" were not terms of differentiating quality, that gradations existed between the two, and that the progression is in reality from "least automatic" to "most automatic."

Conclusions.—The conclusion from this very brief survey of recent developments in the field of the neuromuscular system cannot, however, be expressed in any definite form. On the one hand, some will hold that these accretions to knowledge widen the gap between intelligence and automatism, even though they appear to bring that gap higher up in the scale of motility. Others will argue that if some part, at least, of cortical motor activity is shown to be "non-volitional," then "volition" is driven further back, physiologically, to a transcortical level, and that it can be little else than transcortical inhibition.

(S. A. K. W.)

NEUVE CHAPELLE, BATTLE OF.—The German failures at Ypres in Oct.–Nov. 1914 had caused them to alter their strategy. They abandoned the effort to obtain a decision in the west, adopting a defensive attitude there, and concentrated their strength on crushing the Russians, who were isolated, short of equipment and munitions, and in consequence unable to utilise fully their vast resources in men. In the west the Germans could profit by all the factors which so greatly favour the tactical defensive in modern warfare, barbed wire and machine-guns in particular; they could hold their lines lightly and yet keep occupied Allied forces much stronger than their own.

The Allies, to whom the expulsion of the Germans from France was an urgent necessity, economically as well as politically, were impelled to pit themselves against the German defences before adequate measures could be devised for neutralising the special sources of the defensive's strength. In selecting the locality of their attacks they were directed to Artois by the fact that the German lines in Artois covered the main railways by which the German armies on the Western Front were supplied at their most vulnerable point, the plain of Douai. A break through in Artois therefore offered special advantages.

The Various Plans.—While the winter months saw incessant local fighting, at the Allied Headquarters more ambitious projects were being contemplated. Neither Sir John French nor Gens. Joffre and Foch would admit that the German lines could not be broken, and both entertained hopes of a substantial strategic success. Joffre's chief project was the recovery of the Lorette and Vimy ridges as a preliminary to an advance in force into the plain of Douai. Sir John French was particularly keen on recovering the Aubers ridge and so getting his right centre out of the water-logged Lys valley; success here, moreover, would threaten the German hold on Lille and might open the way to effective co-operation with French operations nearer Arras. Actually, owing to the diversion to the Dardanelles of the 29th Div. which had been earmarked for relieving French troops at Ypres, the first serious offensive of 1915 was undertaken by the British alone, the French X. Army being unable to co-operate unless this relief could be carried out.

Opening of the Attack.—The British offensive took the shape of an attack on Neuve Chapelle, where a nasty salient had been driven into the British line when the Germans captured that village in Oct. 1914. To recapture Neuve Chapelle would greatly improve the position tactically, and might lead to gaining a foothold on the Aubers ridge, an indispensable preliminary to any major operation on the I. Army's front. The attack delivered on March 10 began well. The Germans, far from expecting it, had thinned their forces opposite the British and had only three battalions on the frontage attacked. The bombardment had been effective and, except on the extreme left, the wire was well cut. The centre of the attack reached and captured Neuve Chapelle without much difficulty, but the uncut wire on the extreme left held up the flank of the 8th Div., which only secured its final objective after several hours' delay. On the extreme right also one battalion of the Indian Corps lost direction and found itself separated from the rest by a stretch of untaken trenches in which Germans were resisting. Here also there was delay, and the diversion of supports and reserves to help overcome the obstacle.

Meanwhile the centre was held up until the flanking brigades could get up level, though had it pressed on at once, regardless of its exposed flanks, it seems doubtful if there was anything at hand to stop it. But it was considered essential that there should be no advancing with unprotected flanks and the centre had to wait. When at last the flanking brigades came up, the opportunity had gone, for sufficient German reinforcements had arrived to man the redoubts in their half-finished second line. On the right two Gurkha battalions reached the Bois de Biez about nightfall, but being too much in advance of other troops were withdrawn, and on the left the leading brigade of the 7th Div. passed through the 8th, but too late to make much progress before darkness stopped its advance. One main cause of delay had been difficulties in transmitting accurate information from the front line to the higher commanders and in forwarding orders back to the front; another was the holding back of reserves until the situation was accurately known.

Second and Third Days.—Next day (March 11) saw efforts made to push on, but with little success. Mist hindered the observation of artillery fire, the interruption of communications with the front line hampered co-operation between artillery and infantry and caused much of the precious ammunition to be ineffectively expended. German reinforcements arrived in sufficient numbers to secure the second line and even to counter-attack in force early on March 12. There was very heavy fighting, ending in the repulse of the Germans with great slaughter, and the 7th Div. profited by this chance to storm a strong redoubt north-east of Neuve Chapelle. Elsewhere, however, no progress could be made and on March 13 it was decided to suspend the attack. The advantage of surprise was lost, the Germans were

[1] It was calculated that in May 1915 the Germans had under 2,000,000 men on the Western Front, a force considerably inferior to the French alone, while the British then numbered nearly 500,000.

now in force on the front, the ammunition expenditure had exceeded expectations and used up the available supply.

Sir Douglas Haig was anxious to renew the offensive without delay and to recover the advantage of surprise by attacking at a new point. Unfortunately, the ammunition shortage forbade this and postponed any renewal till a fresh reserve had been accumulated, and the delay allowed the Germans to strengthen their defences greatly, and remedy defects in them which the battle had revealed. (*See* WORLD WAR: BIBLIOGRAPHY.)

(C. T. A.)

NEVADA (*see* 19.450), a State of the United States of America. The population in 1920 was 77,407, a decrease of 5·5% compared with 1910 as against an increase of 93·4% for the preceding decade. The native white population in 1920 numbered 55,897; foreign-born whites 14,802; Indians, 4,907. The density of population in 1920 was 0·7 per square mile. The urban population (in places of more than 2,500 inhabitants) was 19·7% and the rural 80·3 per cent. Reno, with a population of 12,016, an increase of 10·6% over 1910, was the only town having more than 5,000 inhabitants.

Agriculture.—The number of farms in 1920 was 3,163. The value of farm property increased in 1910–20 from $60,399,365 to $99,779,666. The value of crops more than doubled between 1915 and 1920, largely owing to higher prices. Since 1919 the value of agricultural products has surpassed that of mineral production. Sheep and cattle are Nevada's chief assets. The average wool clip from about 1,000,000 sheep is 7,500,000 pounds. The chief crops are hay, potatoes, wheat, barley and corn. Turkeys are raised, and cantaloupes (melons) are grown extensively on the Truckee-Carson Irrigation Project, while dairy-farming is the chief industry near Reno.

The better utilisation of the water supply for irrigation and power is one of the most pressing needs, as the old laws gave vested rights in water to those who used it for irrigation; but marked progress has been made, through court decisions, in the adjustment of water rights for the Truckee, Humboldt, Carson and Walker river systems. The next step is the development of storage projects, of which the Newland Irrigation District is the first unit. The Walker River Irrigation District is a state project which has reclaimed over 150,000 acres. An appropriation was made by Congress in 1925 for the Spanish Springs Reclamation Project, near Reno.

Minerals.—From 1907 metal production steadily increased until it reached its peak in 1917, in which year gold, silver, copper, lead and zinc were produced to the value of $54,424,580. From 1918 to 1921 production steadily decreased, the decline of 1919 being more than 50% of the figure of 1918. A further fall took place in 1919 and again in 1921, in which latter year the mineral output was only valued at $12,137,000. Increased operating costs and low prices for metals because of accumulated war stocks, together with exhaustion of ore and scarcity of labour, were the prime causes. The Pittman Silver Purchase Act of Congress kept the silver industry in better condition until the expiration of the Act in June 1923. In 1922 the output increased in value to $18,374,023; in 1923 and 1924 metal production again showed an increase, reaching about one-half the normal output.

Production for 1924 was valued at $23,800,000 and the output gradually improved, the production of base metals—copper, lead and zinc—becoming the most important. Nevada contains valuable tungsten deposits which were not at first profitably worked because of foreign competition, but which, in 1925, were advantageously operated in several places. Other minerals commercially developed are quicksilver, antimony, manganese and platinum. The production of non-metals, such as gypsum, borax, lime, fluorspar, diatomaceous and fuller's earth, alum, potash, sulphur and other rock products has increased. Large quantities of pure rock salt exist. A shale-oil plant near Elko produces oil and a large number of by-products. Opals and turquoises of value are mined.

Industries.—Manufacturing industries are of little importance. The value of all manufactured products increased by 77·5% between 1909 and 1919, but the value added by manufacture in 1919 showed a decrease from 1914 of 5·7%, due to the decrease in the smelting and refining of copper. The most important works are for grist, flour, dairy products, the making and repairing of cars and the smelting of ores.

Transport.—Since 1910 the Western Pacific Railroad has acquired a part of the Nevada-California Oregon line and has altered it to broad gauge, thus making connection with Reno. In 1925 a new line was completed from the Idaho line to Wells, where it connects with the Southern Pacific and the Western Pacific. In 1924 there were over 2,000 m. of railway in the State. The Las Vegas and Tonopah Railway discontinued operation from Beatty to Las Vegas in 1918: the Legislature of 1919 designated the line as part of the State highway system, and the Highway Dept. converted the road bed into a modern highway. Between 1916 and 1925 Nevada expended over $7,000,000 on road building.

Government, Education and Finance.—State social service has been extended through numerous commissions and a few new departures, such as the industrial school and the grant to the Florence Crittenton Home. Nevada was one of the first States to have industrial insurance. Counties are permitted to arrange for mothers' pensions and old-age pensions. An extensive building programme for state institutions was begun in 1917, and included new prison and asylum buildings, a Heroes' Memorial Building, additions to the Orphans' Home and the Nevada School of Industry and several new buildings at the University of Nevada.

State recreation grounds are being developed on the sites of the prehistoric cities in Clark and Nye counties, at the Chloride Cliffs near Beatty, at the Lehman Caves and other points of interest in White Pine county, and at the Valley of Fire in southern Nevada. Illiteracy, mainly among the Indian population, was reduced from 6·7% in 1910 to 5·9% in 1920. In 1924 there were 319 elementary public schools and 46 public high schools in the State. The bonded debt on Jan. 1 1925 was $1,660,000, and state-owned bonds had a value of $3,055,357. The total assessed value of taxable property in 1924 was $201,292,000.

History.—In 1912 the Progressive party polled a vote second to that of the Democrats. The Democratic party continued in undivided power until the election of 1920 gave many important offices to Republican candidates. Emmet D. Boyle, Democrat, was elected governor in 1915 and was re-elected in 1919. James G. Scrugham, Democrat, was elected to the same office in 1923. The most important amendments to the constitution of Nevada were those of 1911 and 1913 for the recall and for female suffrage. A state prohibition law was enacted, pursuant to a direct vote of the people cast Nov. 5 1918. The legislature ratified the 16th Amendment (income tax) to the Federal Constitution in 1911, the 17th (direct election of senators) in 1913, the 18th (prohibition) in 1919 and, in 1920, the 19th (woman suffrage).

(J. E. W.*)

NEVILL, LADY DOROTHY FANNY (1826–1913), British writer, was born in London April 1826, the daughter of Horatio Walpole, 3rd Earl of Oxford. She married in 1847 Mr. Reginald Henry Nevill (d. 1878), a grandson of the 1st Earl of Abergavenny. She travelled widely, and had a very large circle of acquaintances, including Disraeli, of whom she was a great admirer, Richard Cobden and Joseph Chamberlain. She was noted for her amusing conversation and powers as a hostess, was a member of the first committee of the ladies' branch of the Primrose League, and was the author of various volumes of entertaining reminiscences; *Reminiscences of Lady Dorothy Nevill* (1906); *Leaves from the Notebooks of Lady Dorothy Nevill* (1907); *Under Five Reigns* (1910); *My Own Times* (1912). She died in London March 24 1913. Her daughter, Meresia Dorothy Augusta Nevill (1849–1918), was born Dec. 14 1849 and was also a devoted and energetic worker for the Primrose League. She died in London Oct. 26 1918. The *Life and Letters of Lady Dorothy Nevill* (1919), were edited by her son Ralph, author of *Sporting Days and Sporting Ways.*

NEWARK, N.J., U.S.A. (*see* 19.460), began in 1914 to develop its waterfront on Newark Bay as a shipping terminal and industrial centre. About 1,100 ac. of meadow land on the west shore of the bay were bought, an approach channel was dredged from the government channel in the bay, which leads out through the Kill van Kull into New York Bay, and the adjacent land was reclaimed. On the entrance of the United States into the World War in 1917 the War Dept. leased 133 ac. of the newly filled land for one of its largest army supply bases, spending $12,000,000 on docks, warehouses and equipment for handling freight; and the U.S. Shipping Board established here a $30,000,000 shipyard, employing 17,000 workers, where 150 steel cargo vessels were constructed by the Submarine Boat Corporation. At the close of the War the army base (including nine warehouses with 2,000,000 sq. ft. of floor space) became a commercial terminal, and the city resumed its original programme. With aid from the Federal Govt. the channel was deepened to 31 ft. and widened to 400 feet. Additional land was reclaimed, making available over 200 industrial sites.

The aggregate value of the products manufactured within the city limits was $201,888,000 in 1909; $577,609,000 in 1919; $336,809,458 in 1921; and $448,172,394 in 1923, when there were 1,863 plants, with 70,056 wage-earners. The leading industries, measured by value of output in 1923, were electrical machinery, apparatus, and supplies, leather, jewellery and chemicals. Ninety new factories were established in the Newark industrial district in the year ending Oct. 1 1925. Important improvements in the city's equipment include the public service terminal at Park Place, opened for street railway operation April 30 1916; a trunk sewer, constructed in co-operation with Paterson and 13 other municipalities, to collect the sewage of towns in the Passaic valley, carry it across Newark Bay, and discharge it in upper New York Bay; doubling of the water supply by development of the Wanaque watershed, a new public market and a city stadium, seating 12,000. A magnificent group of bronze statuary, "The Wars of America," by Solon Borglum was placed in Military Park in 1925. At a special referendum election held Oct. 9 1917 the commission form of government was adopted. Population (1910), 347,469; (1920) 414,524, of whom 16,977 were negroes and 117,549 foreign-born; (1925), according to Census Bureau estimate, 452,513.

NEW BEDFORD, Mass., U.S.A. (*see* 19.462), took first place in 1919 in the manufacture of cotton goods, as measured by value ($177,058,520), ranking above Fall River. The aggregate value of all its manufactured products rose from $53,238,000 in 1909 to $210,773,000 in 1919; dropped to $110,014,358 in 1921; and rose to $149,998,694 in 1923. The number of wage-earners in factories was 26,566 in 1909; 41,630 in 1919; 37,917 in 1923. The population increased to 121,217 in 1920; but in 1925 was 120,494 according to the Massachusetts state census, indicating that the loss during the period of depression had not yet been recovered. The proportion of women and children employed was exceeded in 1920 only by Washington and Fall River respectively. Housing conditions, severely taxed during the War, were studied by a special commission in 1919. A thorough survey of the public-school system was made by its own personnel (1921–2) under the direction of an expert, resulting in a programme of "principles, policies and plans," which was adopted by the school committee. A state pier, 750 ft. long, with 25 ft. of water on all three sides, was an important addition to the harbour facilities. New Bedford is the spot cotton market of the north.

NEW BRUNSWICK (*see* 19.464), a province of the Dominion of Canada. The population in 1921 was 387,876, an increase of 35,987 since 1911. Of the total 70% was rural; 30% was of French extraction. The towns having over 5,000 population in 1921 were St. John (47,166), Moncton (17,488) and Fredericton (8,114). The Government consists of a lieutenant-governor and a legislative assembly of 48 members; an executive council consisting of the Premier and eight other ministers is formed from the legislative assembly. The province is represented in the Federal Parliament by 10 senators and 11 members of the House of Commons.

Education.—Primary education is free and undenominational, being supported by legislative grants supplemented by local taxation. In 1924 there were 2,195 schools, 2,395 teachers and 72,713 pupils. A noteworthy fact, however, is that in 1921 12·46% of the population were illiterate, the highest percentage of any province in the Dominion.

Production and Industry.—Agriculture is limited chiefly to the production of potatoes, hay and clover, oats, turnips and buckwheat, this order representing production value in 1924. The area under wheat showed a steady decline between 1920 and 1925. The total area under crops in 1925 was 900,033 ac., as compared with 1,335,118 ac. in 1919, the highest on record. The total value of field crops in 1925 was $25,681,100. Farm livestock greatly decreased during the years 1922–3, the number of horses falling from 70,152 in 1922 to 50,644 in 1923, cattle from 303,115 to 212,901, sheep and lambs from 236,031 to 157,808, and swine from 85,260 to 66,182. From 1923 to 1925 numbers remained steady. The total value of livestock in 1924 was $15,390,800. The production of butter and cheese is relatively unimportant, the total value of both in 1924 amounting to $592,605.

The forest area of the province comprises about 15,000,000 ac., one half of which are crown lands. Of the timber cut in 1924, amounting to 362,000,000 superficial ft. 27% consisted of fire-killed spruce, cedar and fir, and 20% of spruce and fir killed by the bud-worm. The average annual value of the lumber output in the years 1917–21, not including wood used by settlers, was $13,235,128: in 1924 lumber production was valued at $12,407,262. Reseeding of the burnt-over lands was commenced in 1924. There were five pulp-mills in 1923, with a production of 111,126 tons valued at $6,986,208. The first paper-mill was put in operation in 1923.

The total value of the fisheries in 1923 was $4,548,535, as compared with $6,298,990 in 1918. The province possesses some mineral resources, coal, gypsum and oil being the most important. The manufacturing industry of New Brunswick has shown sustained progress. In 1922 there were 885 establishments with a capital of $81,789,934, employing 14,199 persons and having a total production valued at $64,614,137. In 1923 the total value of manufactures had increased to $70,114,006. Of the 120,000 H.P. available some 45,000 H.P. had been developed by 1925. The development of Grand Falls, the largest undeveloped water power in eastern Canada, was postponed owing to a change of government.

Communications.—There was a marked improvement in the roads of the province during the post-War period: 1,100 m. out of a total of 1,763 m. of main road were reconstructed. The policy followed in 1924 involved an expenditure of $860,000 or $2.20 *per capita* on roads. The province had 1,947 m. of railway in operation in 1923, most of which is controlled by the Canadian National Railways. St. John is the eastern terminus of the Canadian Pacific Railway. (*See* CANADA.) (S. LE.)

NEWCASTLE-UPON-TYNE, England (*see* 19.472), with a population of 275,009 in 1921 and an area of 8,452 ac. (including the town moor of 927 ac.), maintained a large output of ships, guns and munitions during the World War, but suffered subsequently from trade depression. Since 1918 the city has returned four members to Parliament. The port is constantly being improved; the channel from Newcastle to the sea has been dredged to a depth of 30 ft., and to 25 ft. for a distance of 11 m. westward from Northumberland dock. A quay extension, providing three berths, was opened in 1924. In 1925 schemes for further quay extensions, for a new road through the centre of the city, for the purchase of the Tyneside tramways, and for lifts from the quay to a new bridge across the Tyne (then in course of construction), were submitted to a vote of the ratepayers, but only the last mentioned scheme met with approval. A large extension of the Royal Victoria Infirmary was opened in 1920, and the Princess Mary maternity hospital in 1923. A War Memorial in Eldon Square, and a monument at Barras Bridge to commemorate the raising of several battalions, were unveiled in 1923. A memorial to men of the 6th Battalion Northumberland Fusiliers was erected in 1924 (*see* DURHAM, UNIVERSITY OF).

NEWFOUNDLAND (*see* 19.478), a Dominion of the British Empire. The area of the Island is 42,734 sq. m., and its population at the census of 1921 was 259,259. The total population

of the colony, including its dependency of Labrador (*q.v.*), which has an area of about 120,000 sq. m., was 263,259.

I. POLITICAL HISTORY

The inauguration in 1912 of the Fishermen's Union, which established large trading stores in all the principal outposts and had as its political object the safeguarding of the interests of the fishermen by means of representation in the Legislature, was the outstanding political event of the immediate pre-War period. In the elections of Nov. 1913, although the Government of Sir Edward Morris was re-elected, the candidates of the Fishermen's Protective Union (F.P.U.) won all the constituencies in the north and northeast. On the outbreak of the War a Newfoundland regiment was formed and served overseas in Gallipoli, Egypt and France. Altogether some 6,500 men joined up for service during the War. In 1917 the Morris Government was enlarged into a National Government by the inclusion of the opposition, in order to expedite measures dealing with war requirements. At the end of 1917 Sir Edward Morris resigned, and was succeeded by Mr. (Sir) William Lloyd, the former leader of the Opposition.

In 1919 Sir William Lloyd attended the Peace Conference as the representative of the Colony. During his absence his Government was destroyed by internal dissensions, and Mr. (Sir) Michael Cashin became Premier. The elections of Nov. 1919 were marked by extreme bitterness, religious feeling being introduced to a great extent. A considerable turnover of votes resulted, and the Government was defeated by a party led by Mr. (Sir) Richard Squires, consisting of his own supporters and those of Mr. (Sir) William Coaker, the leader of the Fishermen's Protective Union. The year 1920 was marked by a dispute with Quebec over the Labrador boundary, and the question was finally referred to the Privy Council.

The Government was re-elected in 1923, but shortly afterwards Sir Richard Squires resigned as a result of grave charges preferred against him in the Legislature, including, amongst others, the receipt of money from private corporations and the diversion of Government funds to persons occupying high official posts. Subsequently these charges were investigated by Mr. T. Hollis Walker, K.C., Recorder of Derby, England, who was obtained to act as a commissioner for this purpose, and his finding was adverse to Sir Richard Squires on certain points. Thereupon a criminal indictment was preferred against the latter in the Supreme Court, but the grand jury found "no bill," and the Crown did not pursue the matter further. The Attorney-General, Mr. William Warren, had assumed the leadership, but on the opening day of the legislative session of 1924 his ministry was defeated. It was reconstructed, but without avail, and then Mr. Albert Hickman, with the backing of the F.P.U., formed a ministry and went to the country. The leading political issues were the reorganisation of the public services and a greater honesty in the Government, and the election resulted in a victory for the party led by Mr. Walter Monroe, which assumed office in 1924.

II. ECONOMIC AND FINANCIAL HISTORY

The colony enjoyed considerable prosperity between 1910 and the outbreak of the War. Fishing, mining, paper-making, etc., made marked progress, but after 1914 the financial difficulties of the European countries in which these products were marketed, coupled with difficulties of transport, brought about a serious depression, which was followed by a financial crisis. Later the food requirements of Southern Europe sent the price of codfish to a record figure, and the war demands for timber and fish resulted in a period of great prosperity, which continued until 1920. A reaction then set in, with disastrous consequences to the whole commercial community and to the economic stability of the island. In the effort to overcome this, the Government attempted a policy of control over the marketing of colonial fishery products in foreign markets, but it could not be enforced, and ultimately had to be abandoned after severe monetary losses. Sales of iron ore were likewise hampered by the economic poverty of customers, and the depression in the paper market compelled wage reductions, which were followed by labour troubles which seriously affected the output of the mills. After 1923, however, a slow but sure recovery was being made to pre-War conditions of industry and trade.

Fisheries.—The cod fishery continued to be the chief industry, and the years 1924 and 1925 were marked by fair catches and good prices. The seal-hunt, owing to over-fishing, yielded not much more than 100,000 pelts annually, against twice that number annually before 1914. The lobster fishery, for the same reason, suffered such decline that a "close season" for three years was put in effect in 1924. The herring fishery considerably improved during the post-War period. The salmon fishery also yielded better returns, and the whale fishery showed a slight improvement. Efforts are being made to improve the curing and marketing of these products, to develop the canning industry and encourage the fishing for other species, heretofore neglected, but which it is believed could substantially augment the annual catch. The total value of the fishery products exported during the fiscal year ending June 1924 was $10,867,496.

Forest Products.—The development of the forest resources was very marked during the period 1910–25, notably in paper-making. The mills of the Anglo-Newfoundland Development Co., at Grand Falls, first designed to produce 200 tons of newsprint paper daily, were enlarged to produce another 75 tons, the additional mechanical pulp required being pumped through underground pipes from a subsidiary mill at Bishop's Falls, 9 m. distant. In 1923 still larger mills were begun at Corner Brook on the Humber river, with a capacity of 400 tons of "newsprint" daily, by the Newfoundland Power and Paper Company. These mills were completed and officially opened in Aug. 1925. A third mill of similar capacity, to be located on the Gander river, on the east coast, was projected by the Reid Newfoundland Co. in 1925. Mills for the manufacture of mechanical pulp were also projected, and the island seems destined to develop into a great paper-producing centre. Lumbering on a small scale, entirely for local consumption, is also practised. The total value of the exports of paper, pulp, etc., in 1923–4 was $5,955,725, as compared with $428,459 in 1909–10.

Minerals.—Mineral development has been mainly connected with iron ore. The mines at Bell Island, which are estimated to contain 15% of the world's total available supply, were only partially operated during the War years, and during the post-War period, owing to chaotic financial conditions in Europe, suffered considerably in their sales. After 1922, however, the export exceeded 1,000,000 tons annually, four-fifths going to Germany and the remainder to Nova Scotia. The total value of the mineral export in 1923–4 was $1,281,929. Mining otherwise has been on a small scale and without any substantial results.

Finance and Trade.—With its population only slightly increased since 1911, while its burdens have been almost doubled by War outlays and post-War reconstruction, Newfoundland has realised the necessity of encouraging other industries in order to avoid the former dependence on the fisheries. Hence the efforts to stimulate paper-making, mining, etc., and the adoption of tourist and other policies. Substantial success is being attained, so that emigration from the Island, which was very great in the immediate post-War period, had virtually ceased by 1925, while a surplus revenue and swelling bank deposits attested the greater prosperity of the resident population. Trade has considerably improved since 1921–2, as is shown by the table below. The increase in the value of imports for the year 1924–5 was due

Year	Funded Debt	Revenue	Expenditure	Imports	Exports
	$	$	$	$	$
1919–20	43,033,035	10,597,561	9,247,005	40,533,388	34,865,438
1920–1	49,033,767	8,438,039	10,949,053	28,909,727	22,441,267
1921–2	55,030,027	8,269,680	9,127,542	18,209,853	19,478,417
1922–3	54,957,765	8,876,772	9,552,301	19,321,824	20,956,863
1923–4	60,456,965	8,401,669	10,022,137	27,677,182	21,071,571
1924–5[1]	68,964,665	9,783,188	9,436,185	36,374,674	23,590,186

[1] This amount includes an issue of $2,500,000.00 in Dec. 1925.

to the great demand for raw materials for development schemes, including the Corner Brook paper mill, the extension and repairs to the dry dock at St. John's, and the re-laying of a section of the railway.

Communications.—The railway system, over 900 m. in length, with 10 subsidiary steamers covering in-bay and coast routes, proved a great boon to trade during the War, but ceased to be profitable after hostilities ended because of the increased cost of commodities and services. Annually recurring deficits, in some cases exceeding $1,000,000, proved too great a strain for the resources of the Reid Newfoundland Co., which was operating the entire system under a 50-year contract of which about 20 years had expired, and in 1923 the Government bought out the Reid interests for a payment of £2,000,000 and took over the railroad and the steamers. Since then, these public utilities have been operated under direct Government control. The telegraph system, which is being gradually extended all over the seaboard, is similarly operated, and the wireless service has also been extended. The ocean steamship services have been gradually improving, and in 1925 the Government constructed a new steamer for the service which connects the Newfoundland railway system at Port-aux-Basques with the Canadian National Railway system at North Sydney. In the same year the Government decided on a policy of constructing modern highways, suitable for motor traffic, to link up the best scenic and sporting areas in the Island, and also secured the construction of a new modern hotel in St. John's.

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(P. T. M.)

NEW GUINEA: *see* PAPUA.

NEW HAMPSHIRE (*see* 19.490); a State of the United States of America. The population in 1920 was 443,083, a gain of 12,511 since 1910, or 2·9%, as against 4·6% in the preceding decade. The urban population was in 1920, 279,761, or 63·1% of the whole, as against 59·2% in 1910. The estimated population in 1925 was 450,175. The population of the eight cities having more than 10,000 inhabitants was:—

	1910	1920		1910	1920
Manchester	70,063	78,384	Portsmouth	11,269	13,569
Nashua	26,005	28,379	Dover	13,247	13,029
Concord	21,497	22,167	Keene	10,068	11,210
Berlin	11,780	16,014	Laconia	10,183	10,897

Agriculture.—The statistics for farm property, showing the changes from 1910 to 1920, are as follows:—

	1910	1920
Number of farms	27,053	20,523
Value of farm property	$103,704,196	$118,656,115
Average acreage, all land	120·1	126·9
Average acreage, improved land	34·3	34·2
Av. value per ac. (farm property)	$31.91	$45.57

Farms of from 100 to 499 ac. constituted 42·9% of the whole: farms of 20 ac. or less had the greatest proportion of land improved, 67·4%, and farms of over 1,000 ac. had the least—13·5%. Of all farms 90·6% were operated by owners, 2·7% by managers, and 6·7% by tenants, these percentages being without substantial change from 1910. Native farmers decreased from 24,347 in 1910 to 20,509 in 1920. The table at top of next column shows the increase in agricultural production between 1909 and 1919. In 1925 livestock included 32,000 horses, 121,000 milch cows, 32,000 other cattle, 18,000 sheep and 28,000 swine.

Forestry, Highways and Motors.—The biennial report of the forestry commission for the period ending June 30 1924 shows

	1909	1919
Dairy products sold	$5,130,057	$9,627,286
All crops	12,112,260	23,509,665
Cereals	879,631	1,456,628
Hay and forage	7,847,148	13,616,378
Vegetables	2,276,176	5,228,489
Potatoes	1,204,620	2,952,351
Miscellaneous crops	200,845	480,804
Orchard fruits and grapes	730,703	2,420,837
Maple sugar and syrup	182,341	440,250

a total of 47 state reservations containing 20,538 acres. The estimate of forest-bearing land in the State is 4,434,793 ac., of which the Federal Govt. owns 9·42% and the state 46%. The total acreage of tree-bearing land is valued at about $95,000,000. The legislature of 1925 provided for the purchase of Franconia Notch, and its dedication "as a memorial to the men and women of New Hampshire who have served the nation in times of war." The policy of establishing and maintaining state highways has been continued with increased scope. During the year ending Dec. 31 1924 the number of motor registrations was 71,929. In 1923 there were 1,239 m. of steam railway in the State: electric railways totalled 261 m. in length in 1924.

Manufactures.—According to the census of 1919 the nine leading industries, according to value of products, were: cotton goods, boots and shoes, paper and pulp, woollen goods, boot and shoe stock, lumber and timber products, worsted goods, foundry and machine shop products, and leather (tanned), ranging in value from $85,986,000, for the products of the first of these industries, to $7,309,000 for the last. The number of wage-earners increased, 1914–9, from 78,993 to 83,074; female employees from 23,115 to 83,074; workers under 16 from 485 to 859; wage-earners in the group "48 hours and under" from 5·7% to 65·6%. Manchester has the most wage-earners in the State, 25,512, Hillsborough county, containing Manchester and Nashua, has 44·6% of the total and manufactures 45·1% of the products. The tendency noticed in 1914 toward the diminution of the number of small establishments and of the number of wage-earners in them continues. The following table shows the development from 1909 to 1919:—

	1909	1914	1919
Establishments	1,961	1,736	1,499
Employees	84,191	85,013	90,332
Salaries and wages	$ 40,391,440	$ 46,523,733	$ 92,538,743
Value of products	164,581,019	182,843,863	407,204,934

Legislation.—Important Acts were those establishing a state Board of Conciliation and Arbitration; providing employers' liability and workmen's compensation; regulating child labour and hours of labour; providing for medical and surgical devices in factories; for safety and health of employees; and for reporting of occupational diseases. The legislature of 1917 enacted a law prohibiting the manufacture and sale of spirituous liquors. The law took effect May 1 1918, superseding local option.

Finances and Taxation.—The following figures show the increase in expenditures:—

	1910	1920	1924
Revenue	$1,694,636.54	$4,344,322.20	$5,176,948.75
Payments	1,662,694.07	5,198,534.62	4,296,724.69
Debt	1,293,209.33	3,040,524.17	181,966.65
Bonded Debt	1,071,070.00	2,589,500.00	1,619,500.00

The increase in expenditures was on account of increased cost of maintaining public institutions and for highways. The increase in the bonded debt was nearly all due to the World War. In 1918 the State issued $500,000 of bonds to assist the Federal Govt. in the War; and in 1919 it issued $1,489,000 in order to increase the war service recognition from $30 to $100 for those who served. The total valuation of property for purposes of taxation in 1924 was $585,422,877; amount of taxes assessed was $14,599,100. The average rate was $2.49 per $100. Poll taxes assessed were 235,765 in number. The total valuation

of all public utility companies was $51,252,200. The tax on the income of intangibles for two-thirds of the year was about $220,000.

Education.—Important work was done in 1918 by the state committee on Americanisation. In the parochial elementary schools the principle was established that instruction in designated branches and in administration should be exclusively in English. In the large industrial plants the plan was largely carried out by evening schools for adults. The system of public instruction was reorganised by the legislature of 1919. In the bill "the work of Americanisation is hereby declared to be an essential part of public-school education." The legislature of 1923 changed the name of the New Hampshire College of Agriculture and the Mechanic Arts to the University of New Hampshire, and the legislature of 1925 provided for it a stable annual revenue of one mill on every dollar of assessed valuation.

History.—The Ninth Constitutional Convention, held in 1912, submitted to the voters 12 amendments, of which four received the necessary two-thirds vote, namely, defranchisement for treason, bribery and deliberate violation of the election laws; the substitution of plurality for majority vote in the election of governor, councillors and senators; extension of the jurisdiction of police courts; the substitution of a basis of population for that of property in the election of councillors. In 1915 the office of assistant attorney-general was created, and the number of bank commissioners was reduced to three, and in 1925 to one, and their term of office was made six years. The Railroad Commission became the Public Service Commission in 1911, its powers were enlarged, and the term of office of the three members was made six years. In 1913 the Fish and Game Commission was reorganised, and the number of commissioners reduced from three to one. The Department of Public Instruction was reorganised in 1913, so that the superintendent holds office indefinitely; it was again reorganised in 1919.

In 1913 the Department of Agriculture was reorganised with a commissioner instead of a board, and in 1915 it was further reorganised. In 1911 the name Board of Equalisation was changed to Tax Commission; the members were reduced from five to three, and the tenure of office was extended from two to five years. The Bureau of Labour was reorganised in 1911, and in 1913 a Board of Arbitration and Conciliation was organised to work with it. In 1913 the License Commission was reorganised, in 1915 it was again reorganised and its name was changed to Excise Commission. The Highway Department was reorganised in 1915 with a highway commissioner at its head appointed by the governor for five years. A Department of Institutions was created in 1913 and reorganised in 1919. The State institutions were managed by seven trustees, consisting of the governor and one member of the council, *ex officio*, and five appointed trustees. The institutions governed by the department were the prison, the hospital, the sanatorium, the industrial school, and the school for feeble-minded children. The legislature of 1925 vetoed bills to abolish the direct primary, and to limit the working hours of women and children to 48 per week, and permitted absentees to vote for President of the United States, made examination of the finances of the state institutions, and revised the salaries of state officers.

The governors after 1910 were: Robert R. Bass (Rep.), 1911–2; Samuel D. Felker (Dem.), 1913–4; Rolland H. Spaulding (Rep.), 1915–6; Henry W. Keyes (Rep.), 1917–8; John H. Bartlett (Rep.), 1919–20; Albert O. Brown (Rep.), 1921–2; Fred H. Brown (Dem.), 1923–4; John G. Winant (Rep.), 1925– .

(E. J. B.)

NEW HAVEN, Conn., U.S.A. (*see* 19.499), enlarged its boundaries to include 22·4 sq. m. by 1925. Its population grew to 162,537 in 1920 (of whom 4,573 were negroes and 45,686 foreign-born), and was estimated by the Census Bureau at 178,927 in 1925. The varied output of its factories was valued at $50,870,000 in 1909; $125,455,000 in 1919; $113,924,862 in 1923, when there were 483 establishments, employing 26,108 wage-earners. The Cedar Hill classification yard of the New York, New Haven and Hartford Railroad Co., covering 1,160 ac., had a capacity of 11,000 cars in 1925. Additions to the park system, including a large acreage with a bathing beach at Lighthouse Point, brought the total area to 1,549 acres. There were 59 public grade schools, a manual training school, two high schools (one for commercial training) and two junior high schools, with a total enrolment of 34,315 pupils. New construction included hotels, industrial and commercial buildings, a railway station, and buildings for Yale University (*q.v.*).

NEW HEBRIDES: *see* OCEANIA.

NEW JERSEY (*see* 19.501), a State of the United States of America. In 1920 the population was 3,155,900, as against 2,537,167 in 1910, an increase of 618,733, or 24·4%. The population in July 1925 was estimated at 3,506,428. The density of the population, exceeded in the United States only by that of Rhode Island and Massachusetts, averaged 426 to the sq. m. in 1925. The proportion of people living in places of 2,500 or more inhabitants increased from 75·2% in 1910 to 78·7% in 1920—the urban population in 1920 being 2,482,289; the rural, 673,611. The 10 largest cities, with populations in 1925 as estimated by the census bureau, are as follows: Newark, 445,606; Jersey City, 312,157; Paterson, 140,637; Trenton, 129,705; Camden, 126,399; Elizabeth, 106,251; Bayonne, 86,582; Hoboken, 68,166; Passaic, 68,045; and East Orange, 58,284.

Agriculture.—The State is steadily developing its industries, and is tending towards specialisation in agricultural production, particularly the production of fruits and vegetables. Between 1910 and 1925 the number of farms decreased at the rate of about 1·5% per annum. Vocational training in agriculture in the public schools was made possible by Acts of 1914 and 1917. County farm demonstrators have been established since 1913 in 18 of the 21 counties in the State. The years 1920–5 witnessed a rapid extension of the highway systems, and the motor-truck has developed into the chief transportation unit for agricultural products. In 1925 there were 39 farmers' co-operative organisations in the State. The dairy industry is confined mainly to the production of milk for consumption in New York, Philadelphia, and other large cities. The variation in the number of the chief farm animals from 1920–5 was as follows:—

Livestock	1925		1920	
	No.	Value	No.	Value
Swine	113,000	$ 1,978,000	139,000	$ 3,503,000
Dairy Cows	153,000	11,475,000	148,000	18,944,000
Horses and Mules	73,000	8,035,000	79,000	12,201,000

Livestock products were worth about $20,000,000 in 1920, and approximately $15,000,000 in 1925. There are about 2,750,000 chickens on farms, and considerable numbers in urban districts, producing nearly 15,000,000 dozens of eggs each year, worth about $6,000,000. Poultry products other than eggs bring the total value up to about $10,000,000.

The State ranks among the leaders in the commercial production of many crops, viz.: peaches, sweet corn for market, sweet potatoes, asparagus, string beans, lima beans, tomatoes, early Irish potatoes, peppers and egg-plants. The most important single crop is hay, although it is not raised for sale to any extent, being largely used for feeding livestock on the farms. The total value of the tame hay crop in 1925 was $8,584,000. The corn crop of 1925 was worth over $7,820,000 and was produced on about 206,000 acres. The value of the wheat crop in 1924 exceeded $2,100,000. The oat crop is gradually declining in importance, the climate being too warm for the highest yields; in 1924 the crop occupied approximately 67,000 ac., and the product was worth about $1,372,000. Rye, grown on 65,000 ac., was valued at $1,286,000, and buckwheat at about $250,000. The total net value of New Jersey's agricultural production each year is nearly $100,000,000, as compared with manufactured and mineral products worth over one and three-quarter billion dollars.

Mining.—The output of zinc ore in 1923 was 584,891 tons. The iron-mining industry, which from about 100 mines attained a maximum output of nearly 1,000,000 tons in 1882 and then

declined, has revived, and the post-War annual production was about 400,000 tons. Eight iron mines were actively operated in 1923. Raw clay production in 1923 was 375,854 tons: the total value of clay and clay products in 1923 was $47,618,171, of which $23,836,455 was for pottery. The State possesses in the green sand (marl) deposits vast stores of potash, 10,656 tons of which, valued at $131,123, were mined in 1923 and used chiefly for softening water.

Manufacturing.—About 17% of the population is actively engaged in manufacturing. It ranks first in the list of States in the smelting and refining of copper, in the refining of oil, in shipbuilding, in dyeing and finishing textiles, and in the manufacture of paving materials, phonographs and upholstering materials; second in the manufacture of linoleum and silk goods; third in the manufacture of iron and steel, pottery and electric fixtures; and fourth in the manufacture of electrical machinery and paper goods. In 1923 the value of the products of the State's 8,766 manufacturing establishments was $3,321,301,524; wages paid to 447,948 employees amounted to $578,999,234.

Education.—The Russell Sage Foundation, after an exhaustive examination of the public-school systems of the various States, ranked New Jersey in 1920 first among the States east of the Mississippi river, and fourth in the whole country, and added that it was "the only State in the eastern division that has gained in relative rank during a period of 28 years, 1890–1918." The State Board of Education, which had consisted of eight members, was enlarged in 1921 to 10, of whom at least two must be women. In 1923–4 the total enrolment of pupils was 715,877, an increase of 136,946 over 1916. The number of teachers was 22,693; of school buildings, 2,210. Nearly 310,000 pupils received manual or industrial training of some sort, and 16,000 some form of vocational training. The current expense for operating the schools during the year 1923–4 was $63,528,320, an increase over that of 1918–9 of $38,077,241. Of this total more than $38,500,000 was for salaries of teachers, superintendents and principals, the average salary being $1,757. The Catholic parochial schools numbered 201 in 1924, with about 91,000 pupils. A legislative Act of 1917 designated the State college (Rutgers) which in 1923–4 had 2,663 students, as the "State University of New Jersey." A college for women affiliated with it was opened in Sept. 1918. Stevens Institute of Technology in 1924 had an attendance of 529; Princeton, of 2,446 (*see* PRINCETON UNIVERSITY).

Legislation.—For more than two generations New Jersey had sedulously fostered the aggregation of capital in corporate form, but this policy was reversed by the passage in 1913 of the series of Acts widely known as the "Seven Sisters," the purpose of which was the elimination of the power of trusts to create monopoly, limitation of production, price-fixing and restraint of trade. In 1920 the legislature proposed and the people ratified an issue of bonds to the amount of $28,000,000 for the construction of a bridge across the Delaware and a tunnel under the Hudson river. Bonds subsequently authorised for the highway system and water-supply conservation brought this total, in 1925, to $76,000,000.

The laws governing elections were radically changed in 1911 and subsequently, by provisions extending the application of the direct primary law and providing the blanket ballot and safeguards against frauds. In 1911 also, the commission form of municipal government was introduced. The Practice Act of 1912 is noteworthy as simplifying procedure in the courts. The legislation of this period further embraced the following subjects: the regulation and control of public utilities; jury reform; employers' liability; workmen's compensation; conditions and hours of labour; labour of women and children; juvenile courts; sanitary and safety conditions; motor vehicle control; a State system of highways; inheritance and bank stock taxation; regulation of insurance; water supply; food laws and storage of food; civil service in state and municipalities; state administration of municipal sinking funds; and the establishment of a police force.

Political History.—Woodrow Wilson was elected governor in 1910 as candidate of the Democratic party, receiving a plurality of 49,056; in 1912 Wilson secured a plurality of 24,873. He lost the State to Hughes in 1916 by 57,964 plurality. In 1924 Coolidge (Rep.) received 675,162 votes; Davis (Dem.) 309,743. In the elections for the State executive the Democratic party was successful from 1910–25 with the exception of the election in 1916. From 1914 the Republicans controlled both branches of the Legislature. In 1925, of the 21 Senators, 18 were Republicans, 3 Democrats; in the Assembly there were 13 Democrats; the other 47 were Republicans. Despite the predominantly Republican complexion of recent New Jersey politics, no Republican governor was elected later than 1916, a fact largely due to the anti-prohibition stand of the Democratic party in the state.

New Jersey's governors were: Woodrow Wilson, 1911–3; James P. Fielder (acting), 1913; Leon R. Taylor (acting), 1914; James P. Fielder, 1914–7; Walter E. Edge, 1917–9; William N. Runyon (acting), 1919–20; Edward I. Edwards, 1920–3; George S. Silzer, 1923–6; A. Harry Moore, 1926– . (W. N. R.)

NEW MEXICO (*see* 19.520), a State of the United States of America. The estimated population in 1925 was 379,074. The population in 1920 was 360,350, as against 327,301 in 1910, an increase of 33,049, or 10·1%. The urban population (in places of 2,500 inhabitants or more) in 1920 was 18% of the total. The average number of inhabitants per sq. m. in 1920 was 2·9. The following table shows the growth of the principal cities for the period 1910–20:—

City	1920	1910	Increase %
Albuquerque	15,157	11,020	37·5
Santa Fé	7,236	5,072	42·7
Roswell	7,033	6,172	13·9
Raton	5,544	4,539	22·1
Clovis	4,904	3,255	50·7

Agriculture.—During the period 1910–25 the number of farms decreased from 35,676 to 31,687. Farm-land increased from 11,270,021 ac. in 1910 to 24,409,653 ac. in 1920, or 116·6%; improved land from 1,467,191 ac. to 1,717,224 ac. or 17%. The value of farm property rose from $159,447,990 in 1910 to $325,185,999 in 1920. The average acreage per farm in 1920 was 817·9; in 1910 it was 313·9. The average value of land per acre decreased from $8.77 in 1910 to $8.04 in 1920. Of the 29,844 farmers in 1920, 25,756 were owners, 433 managers and 3,655 tenants. The figures in respect to the chief agricultural products in the years 1909 and 1924 are shown in the following table:—

Crop	Year	Area	Production	Value in $
Corn	1924	210,000 ac.	4,200,000 bu.	4,620,000
	1909	85,999	1,164,970	984,052
Wheat	1924	163,000	2,551,000	3,188,000
	1909	32,341	499,799	508,726
Beans	1924	110,000	559,000	2,090,000
	1909	20,766	85,795	232,023
Hay and forage	1924	175,000	309,000 tons	4,759,000
	1909	370,596	433,504	4,493,918

Of livestock on farms Jan. 1 1925 it was estimated that there were 167,000 horses, valued at $6,179,000; 21,000 mules, valued at $1,218,000; 1,009,000 beef cattle, valued at $21,694,000; 47,000 dairy cattle, valued at $2,115,000; 60,000 swine, valued at $660,000; and 2,360,000 sheep, valued at $18,172,000. The production of wool in 1924 was estimated at 12,408,000 lb., as against 15,076,000 lb. in 1919. In 1920 the number of farms irrigated was 11,390; the area irrigated was 538,377 ac., or 31·4% of the improved land in farms. The capital invested in irrigation enterprises was $18,210,412 in 1920, as against $9,154,897 in 1910.

Manufactures.—Between 1914 and 1919 the capital invested increased from $8,984,000 to $15,226,000, or 69·5%; and the value of products of manufacturing establishments increased

from $9,320,000 in 1914 to $20,422,126 in 1923, or 119%. The operation of steam-railway repair shops is the leading industry, as measured either by the number of wage-earners or by the value of the products.

Transportation.—In 1923 the railway mileage of New Mexico was 2,959, excluding switches and sidings. The Atchison, Topeka and Santa Fé railway owned almost half of the total.

Mineral Products.—The total value for 1922 was $18,038,022; as compared with $40,631,024 in 1918. The chief products in 1922 were: coal, 3,100,000 (in 1924, 2,550,000) short tons; copper, 31,937,207 (in 1924, 78,145,629) lb.; silver, 752,240 (in 1924, 783,338) oz.; gold, 19,964 (in 1924, 24,207) oz.; also zinc and lead. In addition, granite, marble, limestone and sandstone are quarried.

Education.—On June 30 1924 the total school enrolment was 80,368. The number of school houses was 1,551, made up as follows: 1,358 public elementary schools, 164 public high schools, 26 Indian schools and three public normal schools. The University of New Mexico, at Albuquerque, founded in 1889, had in 1923 457 students and 23 professors. The Museum of New Mexico, established at Santa Fé in 1909 in the historic palace, built about 1630, of the governors of the old Spanish province, contains a notable library of works on general linguistics and a remarkable collection illustrating American archaeology. The Archaeological Institute of America maintains there a special school of American research.

Finance.—For the first seven years of statehood—Dec. 1 1911 to Nov. 30 1918—the aggregate State expenditure was $15,573,817, and county expenditure $34,227,143, making a total of $49,800,960. State receipts amounted to $16,520,448, and county receipts $34,235,224, making a total of $50,755,672. At the end of that period the bonded State debt was $3,385,500; county, $2,972,335; city, town and village, $3,250,000; school, $1,800,000, making a total of $11,407,835. The total assessed valuation of property was $360,961,891. In 1923 this total valuation had fallen to $313,065,248, upon which taxes were levied amounting to $1,493,625, being $7.03 *per capita* of the population. At the close of 1923 the funded debt amounted to $4,035,500, the net debt being $3,947,875, or $10.61 *per capita.*

Legislation.—In 1917 a workmen's compensation law was enacted. In 1919 legislative acts included the establishment of State mounted police; a child's welfare bureau; an annual franchise tax on corporation; state inheritance and income taxes; provisions, on petition, for the teaching of Spanish in high schools; and the establishment of night schools for illiterates. In 1918 an amendment to the constitution prohibited the manufacture and sale of intoxicating liquors after Oct. 1 1918 (28,732 for, 12,147 against). In 1919 the State Legislature ratified the prohibition amendment to the Federal Constitution, and in 1920 the amendment extending the right of suffrage to women.

History.—The most important historical fact concerning New Mexico during the period 1910–25 was its admission into the Union, Jan. 6 1912, as the 47th state. Following the Enabling Act, passed by Congress June 20 1910, the territorial governor ordered an election of delegates to frame a constitution. The election was held Sept. 6 1910; the convention, consisting of 71 Republicans and 29 Democrats, assembled Oct. 3; and the adopted constitution was approved by the people Jan. 31 1911. The vote was 31,742 for and 13,300 against. The chief opposition came from the voters who favoured the inclusion of state prohibition. In 1916 the Elephant Butte Dam, under active construction since 1910, was completed by the United States Reclamation Service at a cost of about $5,000,000. It is situated 12 m. west of Engle, Sierra county, and, built across canyons of the Rio Grande, governs the entire flow of the river and is one of the largest storage irrigation reservoirs in the world. The average width of the reservoir is 1¼ m.; maximum length 45 m.; area of water surface when full, 40,080 ac.; shore line, 200 m.; average depth, 66 ft.; and maximum depth near the dam, 193 feet. When full it holds 115,498 million cu. ft., or 862,200 million gallons. It irrigates 185,000 ac. of land lying in New Mexico, Texas and Mexico.

The last territorial governor was W. J. Mills (Rep.), 1910–2. State governors were: W. C. McDonald (Dem.), 1912–7; Ezequiel de Baca (Dem.), Jan. 1–Feb. 18 1917; W. E. Lindsey (Rep.), 1917–9; A. Larrazolo (Rep.), 1919–21; M. C. Mechem (Rep.), 1921–3; James F. Hinkle (Dem.), 1923–5; A. T. Hannett (Dem.), 1925– .

NEW ORLEANS, La., U.S.A. (*see* 19.526), increased in population 14·2% in the decade after 1910, reaching 387,219 in 1920 (of whom 100,930 were negroes and 25,992 foreign-born), and 414,493 in 1925 according to the Census Bureau estimate. Foreign commerce grew from 3,754,705 net tons in 1911 to 9,239,546 in 1923; coastwise commerce from 733,021 net tons to 4,385,166; and the Mississippi-Warrior river Federal Barge Line, established in 1918, handled 849,503 tons of cargo in 1924. Harbour facilities and equipment were much improved. The state commission which administers the port had by 1925 built wharves, steel sheds, public cotton warehouses, a grain elevator, a coal and ore tipple and a bulk commodity handling plant, along six miles of the 41 m. frontage on the Mississippi river. Railway terminals, U.S. Govt. wharves and the private wharves and warehouses of over 30 industries, brought the total improved frontage to about nine miles, with berthing space for 90 vessels 500 ft. long.

The board of port commissioners constructed (1918–23), at a cost of about $20,000,000, the Inner Harbour Navigation canal, commonly called the Industrial canal, 5½ m. long, which crosses the city from the Mississippi to Lake Pontchartrain, serving as an inner harbour with still water, a navigation artery with advantageous industrial sites on its banks and on the banks of its proposed laterals, and which will eventually, after the construction of the necessary channels, provide a shorter route to the sea. The output of the manufacturing establishments within the city limits was valued at $135,184,088 in 1923, as compared with $78,794,000 in 1909. For the entire industrial area, with some 1,200 factories instead of 648, the value would be perhaps double that amount.

By 1925 about $39,000,000 had been expended on the water drainage and sewerage system begun in 1903; there were 661 m. of water mains and 547 m. of sewers. The death-rate, though still high (17·7 per 1,000 in 1923), had decreased appreciably. Enrolment in the public schools (1924) was 59,954; in Tulane University, 2,605; in Loyola University, established in 1911, 870. Public improvements and important new buildings under construction in Oct. 1925, or planned for the immediate future, represented a valuation of about $200,000,000. The cost of living is relatively low (93·2% of the average for 31 American cities, Dec. 1924). The commission form of government was adopted in 1912. The governing body is the commission council, consisting of the mayor and four other commissioners, elected for four years.

NEWPORT, Monmouthshire, England (*see* 19.533), with an area of 5,020 ac. and a population of 92,369 in 1921 has developed into one of the chief ports of Great Britain. Over 7,000,000 tons of goods were dealt with in 1913, and trade is now again expected to increase. A number of large factories have been erected in recent years on and near the Usk, and the national cartridge and box repairing factory was established here during the World War. Shipbuilding has increased in importance. A sea lock, with a length of 1,000 ft. which gives direct access to the Bristol Channel and brings the port 1½ m. nearer to the sea, was opened in 1913, and has resulted in the calling of an increased number of large ships. The town has grown rapidly under a town-planning scheme, and extensive building has been carried out at Somerleyton and St. Julian's. The electricity and water services are being extended. The diocese of Monmouthshire formed in 1921, has the church of St. Woolos, Stow Hill, as its pro-cathedral. The parishes of St. Matthew, St. Julian and St. Andrew have been formed, largely out of that of Maindee. In 1924 it was decided to remodel the town market. The ruins of a castle on the Usk were given to the corporation in 1924, on condition that they should be restored and preserved.

NEW SOUTH WALES (*see* 19.537), a state of the Australian Commonwealth. Its area of 309,432 sq. m. had in 1925 a popula-

tion of 2,271,944, 67·8% of which was urban, an increase of 625,210 since 1911.

Political History.—In 1910 the first Labour Government of the State was returned, with Mr. J. S. T. McGowen as Premier, followed by another Labour Government in 1913–14, with Mr. W. A. Holman as Premier. In the latter year the Liberals and Moderate Labour formed a coalition Government which held office until 1920. Between 1920 and 1925 power alternated between Labour and the Nationalists supported by the Progressive party. Industrial legislation passed after 1918 included provision for a basic wage and a 44-hour week. The Lang Labour Government in 1925 was the first Government in Australia to carry a measure providing pensions for widows. An attempt in 1926 to abolish the Legislative Council was defeated by the Council. A movement for the formation of new States within New South Wales gained much prominence during the post-War period. The movement aims at decentralisation from Sydney by the opening up of deep-sea ports north of Sydney served direct by railways from the producing centres.

Production.—New South Wales produces nearly one-half of the wool, one-fourth of the agricultural products, two-thirds of the minerals and some 45% of the manufacturing output of the Commonwealth. Whilst wool was still the principal product in 1925, agriculture had made great progress. A vigorous State-aided migration policy between 1910 and 1914 brought large numbers of settlers from Great Britain for work on the land. The area under wheat increased from 2,128,000 ac. in 1911 to 3,543,000 ac. in 1925 and the yield from 27,913,000 bu. to 59,785,000 bushels. Bulk handling of wheat was introduced in 1920. Dairy production also steadily increased, and in 1921 the output was more than 100,000,000 pounds. The industry is highly organised, the butter factories being run on a co-operative basis under the strict supervision of Government experts.

Irrigation.—Irrigation schemes carried out by the New South Wales Govt. are playing a big part in the development of the State. The Murrumbidgee Irrigation Scheme, the main feature of which is a storage dam across the Murrumbidgee river at Burrinjuck to retain the flood waters, will ultimately serve water to an area over 200,000 ac. in extent devoted to fruit and vegetable growing, dairying and stock-raising: the district is one of the greatest fruit-producing centres of the State and has a large output of fresh, canned and dried fruits. A fruit-canning factory has been erected and is operated by the Government, which processes fruit grown by the settlers. The Government is also co-operating with the Commonwealth, Victorian and South Australian Governments in the scheme to lock the waters of the River Murray.

Minerals and Manufactures.—Broken Hill is the great centre of silver production in Australia. In 1913 the output of ore from its mines amounted to the record figure of 1,744,000 tons. In 1923 the production of ore was 878,537 tons, from which 7,233,236 oz. of silver, 124,570 tons of lead and 41,153 tons of zinc were produced. New South Wales is the principal coal-producing State, the output in 1923 exceeding 10,000,000 tons, and is the centre of the iron and steel trade. In 1923 the Lithgow Iron Works produced from local ores 94,350 tons of pig iron. The Newcastle Iron and Steel Works, established by the Broken Hill Proprietary Co. in 1915, produced in 1924 327,809 tons of pig iron and 302,384 tons of steel ingots. The works are capable of producing from 8,000 to 10,000 tons of ingot steel weekly. The total value of the manufacturing output of New South Wales in 1924 was £146,359,260 of which metal works and machinery accounted for £38,121,000, food and drink, etc., £40,789,000 and clothing and textile fabrics £13,684,000. In 1924 there were 11 woollen and tweed mills in the State, besides a large number of hosiery and knitting mills. In 1923 the first up-to-date mill for the manufacture of cotton goods was erected in Sydney for the treatment of Australian-grown cotton. In 1924 the value of the output was £361,773.

Besides undertakings of a national character, such as the Murrumbidgee Irrigation Works and the Walsh Island Dockyards, the State has engaged in various industrial enterprises since 1911, when the brick works at Homebush and metal quarries were established. In 1913 the State took over the Monier Pipe Industry. All three enterprises were operating profitably in 1925. Other enterprises, such as the state bakery, state timber yards and state trawlers, were established but ultimately abandoned as unprofitable.

Sydney, the capital and principal port, had at Dec. 31 1924 a population of 1,012,000, 45% of the total for the State. Other towns of importance are Newcastle, the coal-mining centre; Broken Hill, silver Zinc and lead mining; and Tamworth, Bathurst, Goulburn, Wagga and Albury, pastoral and agricultural centres. (*See* AUSTRALIA.)

NEWSPAPERS (*see* 19.544).—The outstanding feature of the newspaper world during the years 1910–25 is the remarkable change that has come over the Press in Great Britain during that period by the formation of great newspaper trusts and amalgamations, the elimination of the financially weaker journals and the enormous expansion of the popular illustrated newspapers.

I. PRESS ENTERPRISE IN GREAT BRITAIN

At the beginning of 1910 there were 2,331 newspapers in the United Kingdom, distributed as follows: London, with the postal area, 414, of which 23 were morning dailies and 7 evening dailies; the English provinces, including localised issues, 1,342, of which 46 were morning and 76 evening dailies; Wales, 118, including 4 morning and 4 evening dailies; Scotland, 258, including 8 morning and 10 evening dailies; Ireland, 183, including 10 morning and 7 evening dailies; the British Isles, 16, of which 5 are dailies.

After 26 years the newspapers, in spite of the addition to the population, had decreased owing to amalgamations and cessations, to 2,149 in Great Britain and Ireland, distributed as follows: London, 406, of which 23 were morning, including specialist papers (*Jewish Express*, in Hebrew, *Jewish Times*, *Lloyd's List, and Lloyd's Daily Index*), and three evening dailies (and the *Jewish Evening News*, published in Whitechapel). The newspapers in the English provinces and Wales, including localised issues, numbered 1,330, of which 37 were morning and 79 evening dailies; Scotland, 235, including 7 morning and 9 evening dailies; Ireland, 166, including 8 morning and 6 evening dailies; the British Isles, 16, of which 5 were dailies.

While the number of newspapers has decreased, the sales in the period have more than doubled. Up to the year of the World War the halfpenny newspaper gained in popularity and prestige. Following upon the unprecedented success of *The Daily Mail*, which had become a national newspaper, with simultaneous publication in London and Manchester begun during the Boer War, other newspapers had come down to a halfpenny, including the old established *Daily News* and *Daily Chronicle*. These papers appealed to a new and wider public and were made interesting to the masses.

The new class of readers included women and young people, who had hitherto been only occasional patrons of the daily Press. Space was devoted to social news, personal gossip, magazine features and serial stories, which had a stabilising effect on sales. The late Lord Northcliffe was the first journalist to see the significance of women readers. Not only did the attraction of women readers mean a wider public, but it stimulated advertising. The remarkable success of *The Daily Mail* was due primarily to the influx of advertisements which appealed specially to women.

The introduction of the half-tone pictures to illustrate the news of the day was another new element in extending the sphere of the daily Press and in popularising it. The continued journalistic and commercial success of the halfpenny newspaper had created a revolution in the newspaper world and made it increasingly difficult for the old-fashioned provincial newspapers to prosper.

The World War brought other changes. At first, like all other industries, except those concerned with the production of munitions or in some way associated with catering for the

forces, the Press was disorganised. The Government recognised that the Press was an essential element in national effort, and facilities were granted to newspapers, both in regard to obtaining materials and in retaining man power. For the first time also, war correspondents became more than camp followers, were granted uniforms and became officially attached to armies. Many papers suffered losses in the earlier years of the World War, but adapted themselves to the emergency, and made up in profits on sales for what they lost in advertisements. In the boom period after the War their prosperity increased amazingly. The post-War period brought more amalgamations and organisation of syndicates.

Picture Papers.—Encouraged by the support which he received from women readers of *The Daily Mail* and of his many weekly variety papers, Lord Northcliffe issued a newspaper which was to be edited by women for women. He produced *The Daily Mirror*, intended to be a higher type of paper than *The Daily Mail*, and to appeal more to the interests of serious-minded women. It was stillborn. It was Lord Northcliffe's greatest failure. It was a lucky failure. The paper which was intended to be the women's *Times* was transformed into the first illustrated daily newspaper, and became, with its offshoot, *The Sunday Pictorial*, as great a financial success as *The Daily Mail*.

A new type of paper was thereby added to daily journalism. Other picture papers were started, and every newspaper was by-and-by led to introduce half-tone illustrations. *The Times*, *The Daily Telegraph* and *The Morning Post* were the last to adopt the new feature. Press photographers became as indispensable as reporters; photo-engraving was a new big industry associated with the Press.

The first phase in the popularisation of the Press was the growth of the halfpenny paper which began with *The Morning Leader* in 1892, followed by *The Daily Mail* in 1896. Next came the establishment of the illustrated paper beginning with *The Daily Mirror* in 1903. Another development has been the introduction of features specially for children, which, in the case of the illustrated dailies, has become a big factor in circulation. There has been a general adoption of a system of insurance, the object of which is to keep up sales, and, for the same reason, cross-word and other puzzles and competitions are introduced, including competitions in connection with sport.

The Evening Press.—One of the more remarkable developments of the post-War period has been the great progress of the evening Press in its earning capacity and its circulation. In these respects it has gone ahead in the provinces. The average man in provincial cities has little time to read the morning paper, but devotes his leisure to the evening sheet when his day's work is finished. Thus it comes about that the conditions of modern life favour the evening Press, which is accordingly in a state of increasing prosperity. The local evening paper is not subject to the competition from national newspapers from which the provincial morning papers suffer. Some of the latter have gone under, others are kept alive by evening papers issued under the same ownership. The trend of events indicates that before many years there will not be in England more than a dozen provincial morning newspapers run on a commercial basis. The demand for net sales forced by Lord Northcliffe, and taken up by the Association of British Advertising Agents, has had a prejudicial effect on country morning newspapers with small sales, although the value of publicity cannot always be measured by numbers. Much depends on the class of paper and the nature of the goods advertised.

London has fewer evening papers per head of the population than any city in the world. There were once nine evening papers in the metropolis. In 1919 there were six. In 1926 there were three. The old-established *Globe* was absorbed by *The Pall Mall Gazette* which in 1924 was taken over by *The Evening Standard* when the latter was acquired by Lord Beaverbrook, while *The Westminster Gazette* retired from the evening field, in which it occupied a distinctive and influential position, and joined the morning newspaper journals among which competition was intensely keen. The three existing evening papers, which have a monopoly of circulation in a population of over 10,000,000 living within 10 m. of Fleet street, are *The Evening News*, belonging to the Rothermere Press, *The Evening Standard*, controlled by Lord Beaverbrook, but in which Lord Rothermere has a 49% interest, and *The Star*, issued by *The Daily News*. Glasgow, with a population of a little over 1,000,000 publishes three evening newspapers—two belonging to *The Glasgow Herald*—which contain far more news than the London evening Press. Indeed, the provincial evening newspapers, as a rule, contain more reading matter than their London contemporaries.

The Sunday Press.—The colossal growth in the sale and prosperity of Sunday newspapers since the World War is of particular significance in the light which it throws on the changed outlook of the nation towards its duties, moral and ethical. A few of these journals show continual improvement in make-up and matter; but the big circulations are practically monopolised by those which pander to the more sordid tastes of the masses. The Sunday newspaper is a national paper. By special trains it is circulated all over the country. In order to reach the uttermost parts early editions are printed on Friday night. Sunday newspapers represent almost the best, and certainly the worst, of English journalism. If we exclude the Sunday illustrated papers, which are of a special type, the less creditable productions have the largest sales. *The Observer* and *The Sunday Times* are in a category by themselves and consist chiefly of Saturday's news home and foreign and special features. Following upon these, but of a more popular type, come *The Sunday Express*, *The Weekly Dispatch* and *The Sunday News*, while the large sellers give more space to the news of the week, or of the world, selecting the most sensational stories of crimes, and serving up the reports of unsavoury law cases, although several days old. The majority of the Sunday papers give such full accounts of Saturday's news and sport that they make inroads into the former news province of the Monday paper. On April 16 1926 a bill was introduced by Sir Evelyn Cecil and supported by the Government for restricting the publication of the reports of judicial proceedings "in such a manner as to prevent injury to public morals." The second reading was carried by a majority of 222 to 3.

The General Strike and the Press.—A development of the coal dispute in England, which came to a head at the end of April 1926 was a general strike organised by the General Council of the Trades Union Congress. It began on May 3, being precipitated by the action of members of the National Society of Operative Printers and Assistants in the office of the London *Daily Mail*, who objected to the opinions expressed in an editorial article. As the editor refused to accept their dictation, the men left work, although other sections of trade unionists, including the compositors, process engravers and telegraphists employed in the office did not then join the strike. Stoppages of other newspapers, before the general strike was formerly declared, followed, and for the same reasons, viz.: that the National Society of Operative Printers and Assistants objected either to opinions expressed or to certain items of news.

The strike developed quickly and paralysed newspaper production. It was the direct cause of the break off in negotiations by the Government for the settlement of the coal dispute. Interference with the freedom of the Press was considered by the Government to be an overt act and they called upon the Trades Union Council to withdraw the strike notices, as a condition precedent to the resumption of the negotiations. The trade union leaders did not accept this suggestion and the strike became general. The policy adopted was not consistent in regard to newspapers, nor was the suppression of the Press complete. While *The Daily Mail* of Monday, May 3, was suppressed in London it was permitted to appear in Manchester and was circulated throughout the country. In some towns the employees of newspapers were not in agreement with the general strike policy and resumed work.

Newspapers began to appear in the first instance mostly by photographic processes, but in two or four diminutive pages

which were gradually increased in size as voluntary labour was obtained. *The Times* appeared as a four-page paper two days after the strike took place. The Government issued an official paper, *The British Gazette*, containing all news relating to the strike, describing the action of the Government to meet the national emergency, and appeals to all classes to help in maintaining the supremacy of Parliament and constitutional action. The Trades Union Council, which was placed in charge of the strike, produced an official organ entitled *The British Worker* by trade union labour. The newspaper and periodical business probably suffered more by the strike than any other industry, as a considerable proportion of the staff had to be retained and heavy general expenses incurred. The general strike was called off under the Government's original conditions, on Thursday, May 13, and after negotiations the newspapers resumed normal publication on Tuesday the 18th. One condition of the settlement was that " there shall be no interference with the contents of newspapers owned by members of this association " (*i.e.*, the association of newspaper proprietors), and other conditions were agreed to by both parties which considerably reduced the powers hitherto exercised by trade unions without, however, modifying the policy of collective bargaining.

The Era of Amalgamations

The great change in the British Press was begun by Lord Northcliffe in promoting limited liability companies to take over Harmsworth Bros., and afterwards *The Evening News*. Amalgamations and groupings of papers followed. Referring to this phase of newspaper development Sir Robert Donald, in an address at York, as president of the Institute of Journalists in 1913, said: " combination has been the chief characteristic of industry all over the world, and the Press could not remain outside this tendency. One company sometimes owns or controls a series of newspapers. There have been absorptions, amalgamations and alliances, with the result that vast aggregations of capital have been built up in which thousands of shareholders are interested. These agglomerations, piling up power and wealth, are controlled by the same forces which operate in other fields of industrial activity." He also predicted that the future would see combinations increase; there would be fewer newspapers and " colossal circulations would continue to grow." The newspaper run as a luxury and for a mission, and not as a business enterprise, would be squeezed out of existence. There would, therefore, be fewer newspapers, but the total circulations would be greater.

These predictions, made a year before the World War, have been fulfilled; but no one foresaw that the Press combinations would reach such gigantic proportions, or become so immensely profitable. The War expedited and facilitated the rise of the Press syndicates. The movement for consolidation received its chief impetus since the War, and more especially since the death of Lord Northcliffe. The *Daily Mail* Trust, Ltd., was incorporated on Sept. 27 1922 to purchase the 400,000 deferred (controlling) shares in Associated Newspapers, Ltd. sanctioned by the court. The price paid was £1,600,000, which was met by an issue of 7% first mortgage debentures. Early in 1923 the Trust purchased 49% in the *London Express* Newspaper, Ltd. A little later it purchased the large newspaper business of E. Hulton and Company, Ltd., and paid for it by a second issue of £8,000,000 7% debentures, liquidating out of the proceeds the former issue of £1,600,000 debentures. At the same time the Trust acquired 49% interest in *The Evening Standard*. In the same year the Trust sold the greater portion of the Hulton Press to the Berry brothers for more than the original purchase price, while retaining possession of *The Daily Sketch*, *The Sunday Herald* and new printing works; these three assets being subsequently promoted and sold for £1,600,000 under control of Lord Rothermere. The Trust paid £4 for the deferred shares in Associated Newspapers, Ltd. They appreciated almost as much again. The Trust in two years discharged a debenture obligation of £9,000,000. Its financial success enabled it to benefit by premiums and to issue bonuses. The marketing price of one share (2/– paid in 1925) was £2 10·0. A bonus of 5/6 per share was allotted out of reserves to the ordinary shareholder in Nov. 1925. The capital was £810,450 and £1,158,779 debentures but these were being redeemed.

The Rothermere Group.—*The Daily Mail* Trust is controlled by Lord Rothermere through *The Daily Mirror* and *The Sunday Pictorial*, which in turn control Associated Newspapers, Ltd. In 1925 Lord Rothermere sold the Glasgow *Daily Record* and *The Sunday Mail* to the Berry group. The chief combinations at the end of 1925 were Associated Newspapers, Ltd. (capital of £3,000,000 increased by the gift of bonus shares and capitalisation of reserves), proprietors of *The Daily Mail*, *The Evening News* and *The Weekly Dispatch; Daily Mirror* Newspapers, Ltd. (capital £1,110,000); proprietors of *The Daily Mirror*, associated with which is *The Sunday Pictorial*, Ltd. (capital £1,370,000); and *The Daily Sketch* and *Sunday Herald*, Ltd. (capital £1,710,000). The above newspapers form the Rothermere group. Debentures are included in the capital. The combined sale of the daily papers in the group in 1925 was about 3,500,000 and of the weeklies nearly 3,000,000. In addition to these newspapers the Rothermere group, through the *Daily Mail* Trust, owns 49% of the ordinary capital in *The Daily Express*, *The Sunday Express* and *The Evening Standard*. Lord Rothermere's companies also own very large paper-making works in England and Newfoundland. He is also proprietor of *The Continental Daily Mail*.

The Berry Group.—Then there is Allied Newspapers, Ltd., capital £8,157,015, and Allied Northern Newspapers, Ltd., capital £4,000,000, including £3,000,000 debentures. These companies form the Berry group, so called because Sir William Berry and Mr. Gomer Berry are the controlling shareholders, and consist of a large number of properties including the following daily and evening newspapers: *The Financial Times*, *The Daily Graphic*, *The Daily Despatch*, Manchester, *The Evening Chronicle*, Manchester, *The North Mail*, Newcastle, *The Glasgow Daily Record*, *The Newcastle Evening Journal*, *The Glasgow Evening News*. They also own *The Sunday Times*, *The Sunday Chronicle*, *The Empire News* (*Manchester*), *The Sunday Sun* (*Newcastle*), *The Sunday Mail* (*Glasgow*). The Berry group have also acquired a large interest in *The Sheffield Daily Telegraph*, *The Sheffield Evening Telegraph*, and *Star*, *Weekly Telegraph* and associated publications. Among the other properties of the Berry group may be mentioned Kelly's Directories, a group of technical and trade papers, fashion journals, the old publishing business of Cassell, the weekly *Graphic*, *The Bystander* and large printing works.

The Beaverbrook Group.—The Beaverbrook group, in which Lord Rothermere has a minority interest, consists of *The Daily Express*, *The Sunday Express*, owned by London *Express* Newspapers, Ltd. (capital £539,439), and *The Evening Standard*. The policy of Lord Beaverbrook has not been to distribute dividends on the ordinary shares, but to extend plant and building, reduce capital and organise a future impregnable position.

United Newspapers (1918), Ltd.—This company (capital £2,000,000) owns *The Daily Chronicle*, the northern edition of which is printed in Leeds, *The Sunday News* and *The Edinburgh Evening News*. It also controls *The Yorkshire Evening News*, and *The Doncaster Gazette*.

The Cowdray Group.—A widespread association of newspapers is described as the Lord Cowdray, Sir Charles Starmer, and Rowntree group. Its nucleus was the *Northern Echo* of Darlington. It expanded rapidly and includes the following morning and evening newspapers: *The Birmingham Gazette* and *The Evening Dispatch*, *The Nottingham Journal* and *The Evening News*, *The Sheffield Independent* and *The Sheffield Mail*, *The Northern Echo* and *The Northern Evening Dispatch* (*Darlington*), *The Swindon Evening Advertiser* and *The Islington Daily Gazette*. Lord Cowdray, who had for some years been supporting the group, added *The Westminster Gazette* as a morning newspaper to the combination. At least 12 weekly papers throughout the country are under the same control, and also a Sunday paper, *The Sunday Mercury and News* (Birmingham).

The foregoing represent the national owning syndicates. There are a number of other combinations among newspapers. *The Glasgow Herald* owns two evening papers and one morning paper in Glasgow. *The Liverpool Daily Post* and *The Echo* have acquired interests in *The Liverpool Daily Courier* and *The Liverpool Evening Express*. There have been a number of local concentrations as in Aberdeen, Dundee, Plymouth and other cities, where, in each case, all the morning and evening newspapers are under one proprietory.

The increased prosperity of newspapers is due partly to improved organisation, but chiefly to the fact that the selling price has been doubled and the rates for advertisement trebled, which more than covers the extra cost of production.

The weekly literary and political reviews have lost ground, and so have the monthlies. On the other hand, the illustrated weekly press shows a remarkable vitality. The six chief illustrated newspapers, *The Illustrated London News*, *The Sphere*,

The Sketch, The Tatler, The Illustrated Sporting and Dramatic News and *Eve*, all belong to Sir John Ellerman, the shipping magnate.

Organisations.—A net-work of organisations exists for employers and workers. In the newspaper business collective bargaining is the rule. On the employers' side, there is the Newspaper Proprietors Association, which represents the London Press, the Newspaper Society for the provincial Press, the Scottish Newspaper Proprietors' Association, and the Irish Newspaper Society. There is also the British Trade and Technical Trade Journals Organisation.

Since 1913 the position of the working journalist has been vastly improved by the continued activities of the Institute of Journalists, and more especially by the influence exercised by the National Union of Journalists, which is organised on trade union principles and was the means of raising the standard in the lower ranks of newspaper workers and of establishing the principle of the minimum weekly salary to all ranks of journalists.

On the side of the manual workers there is also a complete net-work of organisations. The chief federated societies are the Typographical Association, representing compositors throughout the country; the London Society of Compositors; the National Society of Operative Printers and Assistants and Printing Machine Managers. Press telegraphists; correctors of the press; electrotypers and stereotypers; pressmen; paper-makers and others engaged in connection with newspapers, all have their unions. Beyond the federated Societies is a large number of affiliated federations covering Great Britain.

Advertisers have organisations also, including advertising managers, circulation managers, and, indeed, every one associated with the production and distribution side of the press. Newsagents combine chiefly in the Federation of Wholesale Newsagents and the National Federation of Retail Newsagents.

Another organisation which represents not only the Press of Great Britain but of the Dominions, is the Empire Press Union, which was the outcome of the first Imperial Press Conference held in 1909. It represents newspapers, either by proprietors or responsible members of the staff. It has branch sections in the overseas Dominions and keeps a permanent supervision over such questions affecting cable services and charges, and matters of common interest to the Press as a whole. The second Imperial Press Conference was held in Canada in 1920, and the third in Australia in 1925. The first president of the Empire Press Union was the first Lord Burnham, and he was succeeded by his son, the present Lord Burnham, who is also president of the Newspaper Proprietors Association. The Chairman of the Council from 1915–26 was Sir Robert Donald, who was succeeded by Mr. J. L. Garvin. The Empire Press Union has insisted continuously on better and cheaper communications with the overseas Dominions and has devoted particular attention to the promotion of Empire wireless. After many years delay the first Empire wireless station began to operate in Jan. 1926 in the super-station at Rugby. A series of stations was erected, which began to operate in the same year for communication to and from the Dominions.

Cheaper Communications.—Cheaper and quicker means of communication and distribution of news is always in process of evolution. What are known as " loaded cables " have been laid down, increasing enormously the capacity and speed by which messages can be transmitted by cable, the advantages of which newspapers will share. In the address to the Institute of Journalists in 1913, to which reference has already been made, Sir Robert Donald visualised a time when news would be collected by wireless telephone and the reporter would always have a portable telephone with him, with which to communicate with his paper without the trouble of going to the telephone office, or writing out a message. The competitor, he said, to the national newspaper would not be another national newspaper, but a method of circulating news by means of some scientific mechanism for transmitting the spoken word. He predicted that all the news of the day would be laid on to houses and offices, just like gas and water. During the years 1924 and 1925 the development of broadcasting brought this vision within the region of realisation. Newspapers look on this development with a watchful eye, lest it should, in addition to supplementing their functions, arrest their progress.

Subordination of the Editor.—Compared with 50 years ago, the most marked change in the personal side of British journalism has been the ascendancy of the proprietor and the subordination of the editor. This is reflected in the now prevailing habit of referring to the Northcliffe Press, the Rothermere Press, the Beaverbrook Press and the Berry Press. There are now only a few well-known editors whose personalities are impressed on the public mind. First, there is Mr. C. P. Scott, the veteran editor of *The Manchester Guardian*, who is also controlling proprietor of his paper. Mr. Scott represents the finest type of editor-proprietor in England, while his journal, distinguished for its honesty and consistency, stands for the highest ideals of journalism and has acquired a great international reputation and influence. It has been under the control of Mr. Scott for over half a century. On the occasion of the centenary of *The Manchester Guardian* in May 1921, King George congratulated Mr. Scott on his 50 years' association with the paper which, " under your courageous and high-minded guidance, has secured for itself a position of such eminence and esteem in the world of journalism."

The other great personality in English journalism is Mr. J. L. Garvin, editor of *The Observer*, who is pre-eminent as a writing editor, brilliant and independent. He is a recognised authority on foreign affairs, who has exercised an influence on world politics for many years. In 1926 Mr. Garvin took on new responsibilities, becoming editor of *The Encyclopædia Britannica* and chairman of the Empire Press Union. Four editors of London papers who were controlling policies before and during the World War lost their posts, partly through proprietorial changes. Mr. H. W. Massingham, who had been editor of two daily newspapers and, afterwards, of *The Nation*, died in 1924, soon after he was displaced from the editorship of that journal; Mr. A. G. Gardiner, of *The Daily News*, Mr. J. A. Spender, of *The Westminster Gazette*, and Sir Robert Donald, of *The Daily Chronicle*, who had all for many years been controlling editors, left their positions during these years.

The proprietor who pushes himself before the public occasionally prints signed articles in his papers. He uses them as vehicles for expressing his personal views. One effect of the change, accentuated by the syndication of newspapers, is that consistency is not so well maintained and editorial responsibility is very much weakened. The old conception of an anonymous entity, who regarded a newspaper as a public trust and took responsibility seriously, has been dispelled. One individual may be in financial control of several or many newspapers; but as organs of opinion they either become a " gramophone Press," or different interpretations are given to the same policy in papers under the same ownership. The mass production of public opinion does not carry weight.

The changed system of ownership has unseated most of the old newspaper dynasties. The Press families no longer in power include the Lloyds (*Daily Chronicle*, etc.); Hulton (*Daily Dispatch*, etc.); Ingram (*Illustrated London News*); and Borthwick (*Morning Post*). The Walter association with *The Times* is maintained, but the family control has gone. There remains, however, *The Daily Telegraph*, in control of the second Lord Burnham, representing the third generation of the Lawson family. *The Times* has reverted to its traditional policy, as the first newspaper in the world, occupying its place with easy dignity. Its scholarly editor, Mr. Geoffrey Dawson, maintains anonymity, while the controlling proprietor, Hon. J. J. Astor, M.P., maintains the reserved tradition of the Walters. The change has, however, assured *The Times* the position of independence as a national newspaper. When *The Times* Holding Company, Ltd., acquired Lord Northcliffe's controlling interest in the newspaper, special restrictions and conditions were introduced, which provided that none of the shares may be transferred

to any person other than Major Astor or Mr. John Walter, unless or until such person shall have been approved as a proper person to hold ordinary shares in the company by a resolution of the committee which the articles of association appointed. The same restriction applies to a corporation. The committee consists of the persons who for the time being are Lord Chief Justice of England, Warden of All Souls College, President of the Royal Society, President of the Institute of Chartered Accountants and Governor of the Bank of England. The decisions of this committee must be by a majority of votes, the chairman to have a casting vote. In exercising their decision in regard to the transfer of shares the committee must have regard to the importance of maintaining the best traditions of *The Times* newspaper, and national rather than personal interests, and eliminating as far as reasonably possible questions of personal ambition and commercial profit.

Sir William Berry and Mr. Gomer Berry carry on their vast and varied interests in a business spirit without bringing their personalities before their many millions of readers. An arresting personality in the British Press is Lord Beaverbrook—controlling proprietor of *The Daily Express*, *The Sunday Express* and *The Evening Standard*. He went into the newspaper business during the World War and it was not long before he showed striking gifts for the particular kind of journalism which he took up. He has the news and the political sense highly developed and if he frequently annoys he always interests.

Popular Weeklies.—The popular periodicals during the last 30 years attained great sales, pushed up artificially by means of prizes, competitions and the insurance system. The period, which may be described as the era of popular journalism, was begun by the late Sir George Newnes over 40 years ago with *Tit Bits*. Two men who had been contributors to his paper followed his example. Alfred Harmsworth started *Answers*, and C. Arthur Pearson, *Pearson's Weekly*. These three little weekly papers were the foundations upon which arose three great publishing and newspaper businesses. The George Newnes publishing business expanded in several directions. Sir George Newnes himself made excursions into newspaper journalism. He founded as a political organ *The Westminster Gazette* and other papers which did not survive. C. Arthur Pearson (afterwards Sir Arthur Pearson), besides building up a big periodical business, also entered the newspaper world, but was not commercially successful. The Newnes business is now amalgamated with Pearson's, and publishes a large number of popular information and entertaining weekly papers.

The one man who attained unprecedented success, both in the periodical and newspaper field, was Alfred Harmsworth (*see* NORTHCLIFFE, VISCOUNT). His creation, Amalgamated Press Ltd., is to-day the biggest business of its kind in the world. Its publications appeal to all classes, and in recent years it has been expanding and appealing to a higher class of reader, publishing a number of very useful encyclopaedias, histories and reference works of various kinds, issued in very attractive form.

II. THE BRITISH DOMINIONS

Irish Free State.—Newspapers in the Irish Free State are settling down to Dominion conditions, but it cannot be said that the new political freedom has stimulated newspaper enterprises. The Dublin morning papers are now *The Irish Times* and *The Irish Independent*, and the evening papers, *The Herald* and *The Dublin Evening Mail*. In 1910 there were four morning papers and three evening papers in the Irish capital. The historic *Freeman's Journal* passed through many vicissitudes, and finally disappeared in 1923, after 160 years of existence. There are two morning papers and one evening paper in Cork. British newspapers, daily and weekly, have a considerable sale in the Irish Free State.

Canada.—There are no more independent newspapers than those published in the British Overseas Dominions. They are comparatively free from Government influences, and are not subject to the domination of syndicates or trusts. The Press of each Dominion has its own characteristics. Canadian newspapers not unnaturally reflect the style and appearance of American newspapers, while retaining some of the more sedate qualities of English journalism. There are no Sunday newspapers in Canada, although American Sunday newspapers are sold at railway stations and at hotels throughout the Dominion. The evening Press is more important than the morning Press. Such evening papers as the *Montreal Star* and the *Toronto Globe* have very large sales and are second to none in enterprise. The Canadian Press publishes a great deal of British news and carries American magazine features.

There are no national newspapers in Canada, as the Dominion is too vast for papers to circulate beyond the area of one province, but there are several newspapers of national reputation and wide political influence, such as *The Manitoba Free Press*, *The Montreal Gazette*, *The Toronto Globe*, *The Vancouver Daily Province*, and *The Halifax Chronicle*. In merit, such newspapers stand high, and Canadian journalists are continually being tempted to cross the border to fill important posts on the American Press, and in recent years have been drawn in greater numbers to London. In some towns, such as Ottawa, the same papers have morning and evening issues. There is a healthy French Press in the Quebec province. *La Presse* of Montreal claims to have the largest sale of any newspaper in Canada, French or English. Every town in Canada, even if its population does not exceed 5,000, has a daily newspaper, as is the case in most communities in other British dominions. The trade and technical Press of Canada compares well with similar papers in other countries. Monthly publications are at a disadvantage because of competition from the excellent cheap magazines and Sunday supplements from the United States, which regard the Dominion as a dependency for periodical literature. The small town of St. John's, population 38,645, in the large island Dominion of Newfoundland, prides itself in having one morning and three evening newspapers.

Australia and New Zealand.—In Australia, two-thirds of the population are concentrated in cities. The evolution of the Press in Australia has led to the building up of very prosperous newspaper properties. There are not many newspapers per 1,000,000 population. Competing newspapers and cable agencies send a very full service of news from Great Britain, and the place occupied by an Australian newspaper is determined chiefly by the volume of British news which it contains and by the literary quality of its editorial articles. The Australian daily Press combines the dignified appearance and solid qualities of British papers like *The Times*, *The Daily Telegraph*, *The Manchester Guardian* and *The Glasgow Herald*. Without exception, they are prosperous and are efficiently equipped mechanically. In Melbourne, which with its suburbs has a population of nearly 1,000,000, there are only two morning newspapers—*The Age* and *The Argus*—a pictorial paper, founded in 1922; and one evening paper, *The Herald*. The selling price of each is 1½d. In Sydney, the parent city of Australia, with 1,000,000 inhabitants, there are four morning newspapers and two evening newspapers. Sydney has the cheapest newspapers in the world. *The Morning Herald* and the Sydney *Daily Telegraph* are larger than *The Times* or the London *Daily Telegraph*, and are sold at 1d. Brisbane has two morning and three evening papers, all 2d. each. Adelaide has two well-known morning newspapers, *The Advertiser*—"from 96 to 252 columns daily,"—and *The Register*, selling price 1½d. There is one evening newspaper.

Australia possesses a healthy weekly Press which devotes special attention to the farming industries and several national journals, notably *The Sydney Bulletin*, which is read throughout the island-continent, and *Truth*, described as "the most virile organ of democracy." There are Labour daily and weekly papers in Australia. An Act has been in operation for some time in Australia, which provides that during a Federal electoral campaign all articles on reports or news dealing with political matters must be signed by the writer. A similar law has been adopted in South Africa.

Wealth is well distributed in New Zealand among its population of 1,000,000 and the trade statistics per head is excep-

tionally high. This state of things is reflected in the prosperity of the New Zealand Press. The daily Press is even more characteristically English than are the Australian newspapers. The capital, Wellington, with a population of less than 100,000, has three daily newspapers.

South Africa.—With a white population of 1,350,000 divided racially between the British and the Dutch, the Union of South Africa makes a good showing in the matter of the Press. All branches of the newspaper business are well organised. The leading English papers are well known outside the Union, such as *The Cape Times*, *The Cape Argus*, *The Rand Daily Mail* and *The Star* of Johannesburg. There are four well-conducted daily papers in Natal. *The Friend* of Bloemfontein and *The Diamond Field Advertiser* of Kimberley are also influential organs. The leading Dutch papers are *Die Burger* and *Ons Land* of Cape Town and *Volkstem* of Pretoria. It is customary for many newspapers in South Africa to be sold by subscription. There are newspapers in the smaller towns throughout the Union and in every British settlement of a few thousand people in all African colonies.

India.—The part played by English newspapers in India cannot be measured by the copies which they sell. In Calcutta, with a population of nearly 1,500,000, is published the oldest newspaper in India, *The Englishman*, and also the most popular, *The Statesman*. *The Times of India* (Bombay), *The Madras Weekly Mail*, *The Pioneer* of Allahabad, *The Civil and Military Gazette* of Lahore, are the best-known papers and organs of opinion. There are quite a number of official journals in India. The vernacular papers are growing in number and in influence, and some of the Nationalist organs are published in English—as, for instance, the *Amrita Bazar Patrika* of Calcutta. Some papers are published in two languages, in English and vernacular.

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(R. D.)

III. THE UNITED STATES AND S. AMERICA

The newspapers in the United States tend with the passing years to become more and more economic products. They offer two things for sale: to the reader they sell news, editorials and other interesting reading matter, and to the advertiser they offer white space at so much per inch. Economic complications are numerous because these two joint products must be marketed in the same container—the white paper on which the news is printed and on which the advertising is displayed.

The Economic Side.—In other economic products the cost of the container is relatively small in comparison with the cost of the product itself; the paper which wraps a cake of soap may well serve as an illustration. In the newspaper business the cost of paper is the largest bill the publisher must pay. The increase in the cost of newsprint paper, especially during the World War, forced an increase in subscription price. During certain war years this high cost necessitated a curtailment of the privilege of returning unsold copies, compelled some newspapers to limit the number of their pages, required editors to present news in condensed form and reduced in many instances the size of headlines. Those publishers who, having during this period a liberal supply of white paper from their own mills, were able to maintain pre-War sizes, often printed issues nearly as valuable for waste paper as for news media—from the financial point of view. Since the War the increased subscription price has for the most part been maintained.

After the outbreak of the War economies in newspaper production were secured through pools and combinations. Pools in cable tolls came with the advance in rates for trans-Atlantic messages. London newspapers resold their news to American newspapers, and obviously, after the declaration of hostilities, news from London was wanted more in detail. Consequently when the New York *World*, the New York *Times*, and the New York *Tribune* pooled their interests and let one cable dispatch serve all, each saved two-thirds in tolls.

The War Period.—When the United States, after entering the War, made preparations to send troops overseas newspapers combined to save expense in war correspondence. Such combinations are seen in the accredited correspondents who were permitted to accompany the first Expeditionary Force to France and who represented the following: The Associated Press, The United Press, The International News Service, The Associated Papers, The Newspaper Enterprise Assn., the Philadelphia *Ledger* syndicate, the Munsey group of newspapers, the New York *Times* and group of newspapers, the New York *Herald* syndicate, the Chicago *Tribune* and group of newspapers, the New York *World* and group of newspapers, the New York *Tribune*, the Philadelphia *North American* and group of newspapers, the Denver *Post* and *Collier's Weekly*. The Hearst string of newspapers was represented by The International News Service. It will be noticed that most of these newspaper combinations were headed by either a New York or a Philadelphia newspaper. American troops overseas soon had their own newspaper, *The Stars and Stripes:* its publisher was Richard H. Waldo, formerly business manager of the New York *Tribune*. *The Stars and Stripes* was run as a commercial proposition, was entirely self-supporting, and, *mirabile dictu*, had, when it ceased publication, a large surplus.

Press censorship in the United States during the War may be dismissed with few words. A Committee on Public Information, appointed by President Wilson, consisted of the Secretary of State, the Secretary of War, the Secretary of the Navy and one civilian, George Creel. Its two principal purposes were first, to be a clearing-house for the news of the various departments at Washington; second, to act as censors for war intelligence received from overseas. In practice it limited its activities principally to the dissemination of information. But it did publish a pamphlet, similar to that issued by the Press Censor of Canada, to aid American newspapers in voluntary censorship. (*See* CENSORSHIP.)

The War favoured the evening papers in the presentation of the news and the reason may be found in the difference in time between Europe and America. If correspondents filed their cable dispatches promptly and if they wrote their accounts so that little, if any, work was required by the official censors there was time enough to record the hostilities of the day before the late editions of the evening newspapers went to press. Previous to the War there was a marked tendency on the part of the evening papers to present the day's news more or less in bulletin form and to devote most of the contents to special features, to regular household departments and to comic strips. There were notable exceptions to this tendency, but they were the exceptions which prove the rule. War, for the time being at least, put the news back in the evening papers.

The editorial page, which had been steadily declining in influence since the days of Greeley of the New York *Tribune*, Dana of the New York *Sun*, Godkin of the New York *Post*, Medill of the Chicago *Tribune*, Waterson of the Louisville *Courier Journal*—to mention only a few—came to be a necessity for thoughtful readers. To them the news from overseas needed not only presentation, but also interpretation. This interpretation, plus the tremendous increase in the amount of foreign news, gave an international character to the American newspaper never found before.

Facts and Figures.—Census figures collected by the U.S. Govt. about newspapers, while technically accurate, are somewhat misleading. Among daily newspapers, for example, they include the dailies published by undergraduates at various universities, such as *The Daily Californian*, the Yale *Daily News*, the New York *University Daily News*, *The Harvard Crimson*, *The Columbian Spectator*, the Wisconsin *Daily Cardinal*, etc.—to say nothing of the daily trade bulletins issued in the interests of various industries. The statistics compiled for *The Interna-*

tional Year Book by *The Editor and Publisher* are more reliable. Its figures for 1925 show that there were in the United States 427 morning newspapers with a daily circulation of 12,440,387; 1,581 evening newspapers with a daily circulation of 21,208,982; and 548 Sunday newspapers with a weekly circulation of 23,354,622. These figures mean that there was one and one-third ($1\frac{1}{3}$) newspapers for every family in the United States and one Sunday paper for nearly every home. The number of weekly newspapers has declined almost steadily every year from 1910 to 1925. At the close of the latter year the United States had 13,176 community weeklies. Of these a little over 11,000 might be considered as small town newspapers. The number of weekly newspapers serving special sections of cities has increased and doubtless will continue to do so as cities expand. Since the War country newspapers have shown a decrease of something like 3,000. But what rural newspapers have lost in quantity they have made up in quality.

The Associated Press, the great co-operative news-gathering organization, in 1910 was furnishing its service to 826 papers; at the close of 1925 it had on its list 1,211. During this period its annual cable tolls increased from $87,187.46 to $147,912.18. Facts and figures about *The New York Times* illustrate from the business side the making of a leading metropolitan newspaper. The paper consumption increased from 24,421,082 lbs. in 1910 to 160,230,367 lbs. in 1925. Advertising, measured by lines, grew from 7,550,650 to 28,200,444. The average number of pages for a daily issue in 1910 was 18·6 and in 1925 was 40·5. For the Sunday edition the average number of pages was 74·6 (1910) and 173·0 (1925). The 646 employees in 1910 were distributed as follows: business, 158; editorial, 159; mechanical 329; the 2828 in 1925 were thus divided among the various departments: business, 757; editorial, 418; mechanical, 1,653. To visualize these figures it may be said that if all the printed matter, including advertisements and illustrations, of an entire Sunday edition of *The Times* could be pasted on a ribbon a column wide this ribbon would circle the globe twelve times.

Amalgamations.—The movement in the American Fourth Estate is unquestionably toward consolidation. Space does not permit mention of the amalgamations of smaller papers, but important changes in metropolitan fields may be noted. Frank A. Munsey before his death in 1925 had in New York City merged *The Press* with *The Sun* in 1916, later in 1920 he purchased the New York *Herald* and *The Evening Telegram.* Discontinuing *The Morning Sun* he transferred that title to *The Evening Sun* with which in 1923 he merged *The Globe.* At about the same time he purchased *The Evening Mail* which he consolidated with *The Evening Telegram.* He then sold (1924) *The Herald* to the New York *Tribune,* now published under a joint title. In Boston *The Herald* (morning) took over (1912) *The Traveler* (evening) and continued it as its evening edition. Later (1917) *The Herald* absorbed *The Journal* (morning). In Kansas City W. S. Dickey bought (1921) *The Journal* (morning) and (1922) *The Post* (evening). He continued *The Journal* as a morning paper and *The Post* as an afternoon, with joint publication on Sunday, with a flat subscription price for both papers. In this he followed the example of *The Star* which since 1901 has been printing *The Times* as its morning issue, with both papers going to the same subscribers.

In Philadelphia Cyrus H. K. Curtis became on Jan. 1 1913 the publisher of *The Public Ledger* which he purchased from Adolph S. Ochs. On Sept. 14 1914 he started *The Evening Public Ledger* with which he united (1918) *The Evening Telegraph.* In 1920 he purchased *The Press* to unite with *The Public Ledger* and in 1925 he did the same with the Philadelphia *North American.* In Chicago *The Record-Herald* purchased (1913) *The Inter-Ocean* and appeared as *The Herald* which later was purchased by W. R. Hearst and united with his Chicago *Examiner.* In Cleveland *The Plain Dealer* absorbed *The Leader* and in St. Louis *The Globe-Democrat* purchased *The Republic,* one of the oldest daily papers in Missouri.

New Developments.—Newspapers showed in 1925 a most marked improvement over those of 1910 in mechanical make-up. Especially has the change for the better been noted in the arrangement of material on the first page, where attempts have been made to give that page something like an artistic balance. A few papers have conducted expensive experiments to determine the kind of type that is easiest for the reader. Headlines, even during the World War, were kept within legitimate bounds and did not, even in the case of accounts of big battles, approach the streamer monstrosities printed in the days of the Spanish-American War. Illustrations, especially for Sunday supplements and for special Saturday issues, were by the more influential newspapers grouped together and printed on a finer grade of paper by the rotogravure process. Seventy-seven papers have (1925) rotogravure photographic supplements as a part of their Sunday or other editions. Improvement in speed of production may be seen in the modern Unit-Type press of 12 units which can print 180 m. of paper in an hour.

Radio has, at least up to 1926, supplemented rather than supplanted the newspaper. In almost every daily newspaper it has created a special department to list the attractions of broadcasting stations. In some it has created a special section—occasionally printed in tabloid form as a supplement. People hearing over the radio, like the people in the audience, have wanted to see what the press printed about the address. News broadcast in condensed form has awakened an interest for details to be found in the paper of the morrow. Pictures by radio, still in their infancy, promise much by way of making newspapers more timely in illustrations. In 1925 the United States had 68 newspapers owning or operating a radio station or studio.

Tabloid Newspapers.—The introduction of tabloids may be explained, in part, by the passing remark of Lord Northcliffe, "If some American does not start one I shall have to come over to do it." The first in the field was *The Illustrated Daily News,* established in New York City June 26 1919 by the Chicago *Tribune.* At the close of 1925 it had the largest circulation of any American newspaper, over a million copies daily. Its success doubtless led W. R. Hearst, publisher of the New York *American* and the New York *Evening Journal,* to establish (1924) *The Mirror* and make over his Boston *Advertiser* (est. 1813) into a tabloid. The third tabloid in New York is *The Graphic* (1924). Philadelphia has two tabloids. The first, the Philadelphia *Daily News,* was started March 31 1925 and is as sensational as any in New York. The second, the Philadelphia *Sun,* came two months later and, under the ownership of Cyrus H. K. Curtis, has followed more after the London tabloids. Others are *The News* of Washington, D.C.; *The Post* of Baltimore, Maryland; *The Daily News* of Los Angeles, California; *The Ledger* of Newark, N.J.; *The Daily Tab* of Miami, Florida; and *The News* of St. Petersburg, Florida. Pictures, features and contests constitute the stock in trade for tabloids which, together with motion pictures, doubtless put picture pages into conservative newspapers of standard size.

Adless Newspapers.—Los Angeles, California, attracted some attention in 1912 when it made an attempt to publish a weekly municipal newspaper. *The News,* a copy of which was left without cost at every home regardless of the wishes of the tenant, was controlled by three municipal newspaper commissioners appointed by the mayor. Any political party polling 3% of the vote of the city was entitled to a column in each issue. A space of half a column was available for the mayor, or any member of the city council in all issues. After the appropriation set aside by the city had been expended the paper was discontinued. A publicly owned daily newspaper, however, may be one of the papers of to-morrow.

Two advertisement-less daily newspapers have appeared. Chicago, on Sept. 28 1911, saw the first appearance of *The Day Book* which printed no advertisements. Its circulation increased until in 1916 it was averaging over 20,000 daily. The latter year witnessed its suspension because of the increased cost of white paper. *The News-Post* (1912–4), an adless newspaper in Philadelphia, was edited by Marlen E. Pew. Adless newspapers, lacking the bargain sales of department stores, will never be

popular with women. Adolph S. Ochs, publisher of the New York *Times*, once remarked that a full page advertisement of a department store was more extensively read than an address by the President of the United States, when both appeared in the same paper.

The foreign language press has shown the largest decrease in number of papers, especially those printed in German. The stricter immigration laws have doubtless reduced most materially the audience to which such a newspaper addresses itself. Consequently numerous papers have begun to insert departments printed in English and possibly have in mind the time when still more space, if not the entire paper, must be given over to material in English. The decrease in foreign language papers has been most marked in New York and Chicago.

Legal Enactments.—Two government regulations, both of Aug. 24 1912, need passing mention. The first provided that all periodicals should " file with the Postmaster-General and the postmaster at the office at which said publication is entered, not later than the first day of April and the first day of Oct. of each year a sworn statement setting forth the names and post-office addresses of the editor and managing editor, publisher, business managers and owners, and, in addition, the stockholders, if the publication be owned by a corporation; and also the names of known bondholders, mortgagees, or other security holders; and also, in the case of daily newspapers, there shall be included in such statement the average of the number of copies of each issue of such publication sold or distributed to paid subscribers during the preceding six months."

The other Act provided that " all editorial or other reading matter published in any such newspaper, magazine or periodical for the publication of which money or other valuable consideration is paid, accepted or promised shall be plainly marked 'advertisement.' " These two regulations have made circulation statements more truthful and have made American newspapers more ethical from the advertising point of view. Incidentally, it may be said that the most remarkable change in American journalism from 1910 to 1925 may be found in the advertising columns where truth in advertising has been promoted both by state statutes and by support of the Associated Advertising Clubs of the World. The Association of National Advertisers has gone definitely on record as being opposed to black squares, circles, sweeping curves and the follow-the-arrow lines—all of which smudge the typographical appearance of newspapers.

Advertising, the economic background of the newspaper, has with slight fluctuations steadily increased in volume since 1910. A remarkable fact is that newspaper advertising in 1925 was double that of 1914 and 5% more than that of 1924. Advertising rates for newspapers in metropolitan cities have advanced with increases in circulation. But carefully collected statistics indicate that in smaller cities and towns the increase in advertising rates have been in proportion to increased operating expenses. Mention has already been made of the ethical advance in advertising copy. An unusually high standard has been set by the New York *Times* in order to prevent the printing of fraudulent and misleading advertisements. Where advertising offered has exceeded the space available, *The Times* and other newspapers have favoured advertisements that had news value.

Overseas Newspapers.—A postscript paragraph may be inserted about American journalism overseas, the Paris edition of the Chicago *Tribune* and the European edition of the New York *Herald*. The latter, the first in the field, was started in Paris in 1887 merely to gratify a whim of the late James Gordon Bennett. It was the only newspaper in English and one of the few in any language to publish in Paris when the Germans were practically battling at the gates. In the latter half of 1918 and the first half of 1919 this *Herald* reached its largest circulation (400,000). The sale of the New York *Herald* to Mr. Munsey included its Parisian namesake; he put in charge of it as managing director Laurence Hills, who remained in control when the paper in 1924 was again sold to the New York *Tribune*. The Paris edition of the Chicago *Tribune* was something of a war enterprise and was started on July 4 1917 with Joseph Pierson as editor. As the number of American troops increased the circulation grew and at Armistice time it numbered around 100,000. The managing editor (1926) is Bernhard Ragner.

Magazines.—New York City has, if anything, strengthened its claim of being the publishing centre of the periodical press, except possibly for agricultural publications and religious journals. To be more exact, the editorial offices are in New York City, but the periodicals themselves are being printed in plants often outside even of the State of New York. While technical journals have not experienced consolidations to the extent found in the newspaper field, they have tended to drift to the larger publishing corporations to save overhead charges and permit economy in composition and in the purchase of paper. In technical and trade magazines the improvement in the literary quality of material and in the mechanical make-up of pages has been especially noticeable since 1910. Industrial journalism is yielding greater profit than ever before in its history—profits that have come for the most part from increased advertising.

Popular magazines have seen a much more radical change than newspapers. Dime novels have taken on a new dress and now appear nicely printed as magazines with three-colour covers. Clean and wholesome for the most part, these magazines of adventure have done little harm compared with the sex-story magazines of which the United States has had enough and to spare. The epidemic of questionable magazine fiction must be left for explanation to the pathological expert. Fortunately, the decline in questionable fiction seemed at the close of 1925 to be in sight. Three magazines now published consist almost entirely of reprints of short story classics; they are *The Golden Book*, *The Famous Story Magazine* and *Ainslee's Magazine*. The first two are new publications and the last was formerly a short story magazine which had done much to develop new writers. It introduced O. Henry, for example, to America. Feeling the competition, some of the popular magazines changed their editorial policy and limited their contents exclusively to fiction. *Everybody's Magazine* and *Munsey's Magazine*, at the close of 1925, illustrate this change. Of the literary trio, *Harper's*, *The Century* and *Scribner's*, the last only has remained unchanged. *Harper's* and *The Century* now appear without illustrations for their special articles and have materially changed the character of the fiction which they print. It must be frankly admitted that news stands do not offer purchasers the same quality of goods in 1926 as they did in 1910.

The brighter side of the picture for 1926 may be found in that *The National Geographic Magazine* of Washington has a circulation of nearly 1,000,000 and that *The Atlantic Monthly* has the largest circulation in its history. *The North American Review* has become a quarterly and now competes with *The Yale Review* which was started in 1911. *Current History Magazine*, started by the New York *Times* in 1914, presents each month an intelligent discussion of public affairs. *The World's Work*, though a trifle more popular in its mode of treatment of articles, has not departed from its high standards. The sophisticated reader is having his needs met by *The American Mercury*. *The Nation* has changed from a conservative to a somewhat radical organ and *The Independent* after several ups and downs—chiefly the latter—has moved from New York to Boston where it seems to be regaining its old popularity. *The Weekly Review* and *The Freeman* are no longer published. They disappeared about the same time as *The Unpopular Review*.

The periodical having the largest circulation in the United States (2,436,734) is *The Saturday Evening Post* of Philadelphia which, both in its fiction and special articles, is addressed to men. Publications designed to appeal primarily to women have since 1910 witnessed a remarkable growth in circulation. *The Ladies' Home Journal* of Philadelphia, *The Pictorial Review* of New York and *McCall's Magazine* of New York have each a circulation exceeding 2,000,000, while *The Woman's Home Companion* of New York has one nearly reaching that figure and *The Delineator* of New York has a circulation of over

1,000,000. Mr. Hearst has purchased *The Cosmopolitan*, *Good Housekeeping* and *Harper's Bazar*. With the first mentioned he combined in 1925 *Hearst's International Magazine*.

Radio and motion pictures have added to the periodical press numerous technical and popular journals. The introduction of the magazine section into the Sunday newspaper explains to some extent the disappearance of articles from popular magazines. The pictorial and rotogravure sections of the Sunday newspaper account, in part, for the disappearance of *Harper's Weekly* and *Leslie's Weekly* and the changing in contents of *Collier's Weekly*. The suspension of *The Bellman* of Minneapolis was deeply regretted by its readers. Among the new periodicals the success of *Liberty*, edited in New York and published in Chicago, is somewhat startling. Established in 1924 it had at the end of 1925 a circulation of over 1,000,000. In conclusion, it must be frankly said that the average American reader is seeking entertainment and amusement rather than education and enlightenment in his periodical literature.

South America

The two leading newspapers, not only in Argentina but also in South America, are *La Prensa*, founded Oct. 18 1869 by Dr. José C. Paz, and *La Nación*, founded Jan. 4 1870 by Gen. Bartolomé Mitre, of Buenos Aires. For 56 years (1926) both papers have remained in the families of their founders. Each compares favourably with any other newspaper in any country. Both specialise in printing foreign news; possibly *La Nación* pays more for cable tolls than any other newspaper in the world. Classified advertisements are usually a safe index as to character of newspapers because they represent local opinion. Judged by such a yardstick, *La Nación* resembles the New York *Times* and *La Prensa* the New York *World*. The editorial page of *La Nación* is always dignified in subject-matter and serious in mode of treatment. Its Sunday supplement contains contributions from the best writers, not only of Argentina but also of Spain. Much material later appears in book form. *La Nación* had (1910) a circulation of 80,000: its sworn statement of daily average for Aug. 1925 was 192,007: its average Sunday circulation for the same month was 238,000. At the first Pan-American Congress of Journalists held in Washington in April 1926 Dr. Jorge A. Mitre had the honour of responding to the address of welcome by the President of the United States. He is a grandson of the founder of *La Nación* who was the first constitutional president of the Argentine Republic.

To campaign for civic righteousness seems to be the editorial policy of *La Prensa*. Its evening competitor, *La Razón*, established in 1905, once spoke of it as being a safe and serene guide in the difficult task of creating a public conscience. *La Prensa* widens its influence through syndicating to some 175 provincial papers a weekly feature supplement for Saturday or Sunday editions. *La Prensa* operates a free clinic, offers free legal advice to the poor, pays for a free industrial and agricultural bureau, opens its library to the public and awards 1,000 pesos annually to the person teaching the largest number of illiterates to read. The oldest evening paper in Buenos Aires is *El Diario* (est. 1881). The oldest of all is the English paper, *The Standard* (est. 1861) which competes with *The Herald* (est. 1876). In 1925 Argentina had about 1,000 newspapers and other periodicals.

Crossing the Andes, one finds the newspapers of Chile next in influence. First comes *El Mercurio* (est. 1827) of Valparaiso with separate publication in Santiago and Antofagasta. Its chief competitor is *La Union*, which also publishes a paper of the same name in Santiago. In the city last mentioned are the rather influential *La Nación* and *El Diario Ilustrado*. The total number of newspapers and periodicals published in Chile (1925) is about 500. In Peru the three leading papers are *La Cronica*, *La Prensa* and *El Comércio* of Lima.

In Brazil the most influential paper is probably *O Estado* of São Paulo. *Fanfulla*, the Italian daily of that city, wields considerable power through the State of São Paulo. The oldest and best known daily in Rio de Janeiro is the *Jornal do Commercio* (est. 1827), an extremely conservative paper of limited circulation. Two other influential morning papers are *O Paiz* and *Correio da Manha*. Newspapers in Brazil are often the personal organs of owners to whom they are useful for political purposes. At the fall of the Empire Brazilian journals numbered about 600. In 1910 the total exceeded 1,000, since when the increase has been about 100 to a decade. The more influential papers in Mexico are limited to the capital city and frequently contain features obtained from American syndicates. They include *El Universal*, *El Nacional* and *El Democrata*.

References.—James Melvin Lee, *Historia de la Prensa Periodística de la América del Sur;* Affonso Celso, *Historia da Imprensa do Brazil;* Ricardo Rojas, *La Literatura Argentina*.

To South America, rather than to its sister continent to the north, belongs the honour of printing the first sheets of news in the Western Hemisphere. Not only in contents but also in mechanical make-up they followed the pattern set by the sheets of Southern Europe. This relationship was further emphasised by a similarity in titles for these precursors of printed newspapers: *Gazeta Diario*, *Mercurio*, *Relación*, etc. But these stray sheets lacked regularity of publication and continuity in presenting news. The first newspapers, in the technical sense of that term, for the countries of South America may be listed as follows:—

Mexico. *Gazeta de México* (1679).
Guatemala. *Gazeta de Goatemala* (1729).
Peru. *Gazeta de Lima* (1744).
Cuba. *La Gaceta de la Habana* (1764).
Colombia. *La Gaceta de Santa Fé* (1785).
Ecuador. *La Gaceta* (1785).
Argentina. *El Telégrafa Mercantil* (1801).
Haiti. *La Gaceta del Cabo* (1804).
Uruguay. *La Estrella del Sur* (1807).
Brasil. *Gazeta do Rio de Janeiro* (1808).
Venezuela. *La Gaceta de Caracas* (1808).
Chile. *La Aurora de Chile* (1812).
Panama. *Miscelanea del Istmo* (1822).
Bolivia. *El Condor de Bolivia* (1825).
Paraguay. *El Paraguay Independiente* (1845).

Bibliography.—Before 1910 the literature relating to journalism was most scant and jejune, but since then books have rapidly increased in number. Histories of individual newspapers include: *History of the New York Times 1851–1921*, Elmer Davis (1921); *The Story of a Page* (N.Y. World), John L. Heaton (1913); *The Story of the New York Sun 1833–1918*, Frank M. O'Brien (1918); *The Evening Post* (New York), Allan Nevins (1922); *The New York Globe*, James Melvin Lee; and *The Story of an Independent Newspaper* (Springfield Republican), Richard Hooker (1924). Among the books on newspaper editing and making are: George C. Bastian, *Editing the Day's News;* Willard G. Bleyer, *Newspaper Writing and Editing* (1923); Jason Rogers, *Newspaper Building* (1918); Norman J. Radder, *Newspaper Make-up and Headlines* (1924); M. Lyle Spencer, *News Writing* (1917); Oswald Garrison Villard, *Some Newspapers and Newspaper Men*, offers a critical survey of some of the leading American newspapers; L. N. Flint, *The Conscience of the Newspaper* (1925), and N. A. Crawford, *Ethics of Journalism*, make notable contributions to the field of ethics. *The New York Times* publishes in book form a quarterly index for that newspaper in particular and others in general. Carl L. Canon, *Journalism—A List of References in English*, lists both books and magazine articles relating to journalism. James Melvin Lee, *Instruction in Journalism in Institutions of Higher Education* (U.S. Dept. of Education, 1918), traces the development of such instruction since the first school of journalism was established at the University of Missouri in 1909. (J. M. L.*)

IV. NEWSPAPERS IN OTHER COUNTRIES

Freedom of the Press did not accompany the introduction of democratic institutions and universal suffrage. The Press laws in the new countries of continental Europe usually begin with the declaration that the Press is free and then follow with provisions which can be used to muzzle or suppress the newspapers. Nevertheless there has been a significant growth of newspapers representing Social Democrats, Socialists and Communists, and so long as they do not openly advocate revolution and direct action for upsetting the social order they are tolerated. In Germany, the Social Democratic Press has gained in strength as the parties are well organised and associated with the trade union movement. It is the same in Czechoslovakia and Austria. In France, where the trade unionists are loosely organised and

undisciplined, there has been no notable increase in journals representing the extreme Left in politics. In all the new countries there are papers representing agrarian interests as well as democratic. All parties have their newspapers and governments have organs which are more or less official.

Germany.—Under the old German Empire, especially when Bismarck was the power behind the throne, the Press was not respected, but it was exploited by the Government for its own purposes. There was liberty of the Press within reason and a few independent voices were raised; but, as a rule, most papers were obliged, for one reason or another, to accept inspiration from the Foreign Office. In domestic affairs they reflected the opinion of political parties. Journalists did not enjoy a high standing, but before 1914 they had begun to conquer positions in the political world. To-day the Press has complete freedom and is independent of the Government. The German Press is the most serious in Europe. There are few sensational newspapers. Newspapers do not sell because of sport and "stunts." Journals which cater to the working classes discuss economic problems. Literature, the drama, art, music and economics occupy a greater proportion of space in German newspapers than in the Press of any other country.

The journalistic characteristics of the German Press—apart from the greater freedom which it now enjoys—have not changed since the War. The former national organs occupy relatively the same positions, but there has been a shifting of ownership, not due to the political revolution but to the effects of inflation. During this period of inflation many of the old family newspaper owners, particularly in the provinces, were unable to survive and sold to industrialists. Hugo Stinnes, the industrial magnate, was able to create a great newspaper trust, which was, however, broken up after his death, when his mushroom millions were dispersed. There are few afternoon papers in Germany. A new syndicate, financed by industrialists, is the Hugenberg Press, which owns a string of country newspapers. It has its own news agency. It is a new political force representing Nationalist feelings. While the Nationalist newspapers are controlled largely by industrialists, the organs of the Centre or Roman Catholic party are under strict party control and owned by party men. The Centre represents about a third of the population of Germany, but its Press, although vigorous, consists of papers which have not big circulations. The most influential are the *Germania* of Berlin, and the *Volkszeitung* of Cologne. Another group of papers which has increased in prestige since the War is the Democratic and Social Democratic Press, powerful factors in political life.

The German Government has no longer an interest in newspapers as in the days of the Kaiser, when the Foreign Office directed or swayed the policy of several political journals. Its connection with the Press is now confined to its participation in Wolff's Agency, which is parallel to the Havas Agency in France.

Among the most independent and influential papers in Germany are the provincial organs, *Frankfurter Zeitung* and the *Kölnische Zeitung*, known throughout the political world as the *Frankfurter* and the *Kölnische*. The chief papers in Berlin are the *Börsen Zeitung* (non-party), the *Lokal Anzeiger* (Popular), *Der Tag* (Nationalist), the *Berliner Tageblatt* and *Vossische Zeitung* (Democratic), *Allgemeine Zeitung* (Nationalist), the *Tägliche Rundschau* (Patriotic), *Deutsche Tageszeitung* (National and Agrarian), the *Morgenpost* (Democratic) and the *Vorwärts* (Social Democratic) and a Communist paper, *Die Rote Fahne* or *Red Flag* (sale, 65,000). The more popular papers in Berlin have sales exceeding 250,000. Among the most widely circulated papers outside Berlin are the *Erzgebirgischer Volksfreund* (Democratic), which has a daily circulation of over 100,000. The *Düsseldorfer Nachrichten* (Independent-National), which reaches the same figure, the *Frankfurter General-Anzeiger*, 115,000, the *Hamburger Anzeiger*, 110,000, the *Leipziger Neueste Nachrichten* (Patriotic), 175,000, the *Münchner Neueste Nachrichten* (National), 145,000, the Dortmund *General Anzeiger* (non-party), 122,000, and the *Dresdener Neueste Nachrichten* (Liberal Democratic), over 100,000. There are a number of Communist journals, including, besides the Berlin *Rote Fahne*, papers in the following cities: Breslau, the *Arbeiterzeitung*, sale 15,000; Chemnitz, *Der Kampfer*, 75,000; Bochum, the *Westfälischer Arbeiter Zeitung*, 22,000; Essen, the *Ruhr Echo*, 47,000; Hamburg, the *Volkszeitung*, 25,000; Leipzig, the *Sächsische Arbeiterzeitung*, 30,000.

There are several newspapers which occupy a status and exercise an influence in German journalism and public life which cannot be measured by sales. The *Frankfurter Zeitung*, already mentioned, is perhaps the most powerful. It has 19 issues a week—morning and afternoon. Of a similar type is the *Kölnische Zeitung* and the *Hamburger Nachrichten*, founded in 1792. The *Jenaische Zeitung* has been in the same family since it was founded in 1674. A still older paper, the *Königsberger Hartungsche Zeitung*, dating from 1640, keeps its flag flying in the Eastern outpost on the Baltic. Papers published in districts which are inhabited by Germans, although not now under the German flag, are intensely Nationalist, such as the *Saarbrücker Zeitung*, papers in Polish Upper Silesia, Danzig and other territories formerly included in the Empire.

In Germany, no general newspapers are published on Monday, except two or three in Berlin. Sunday is a day of rest to newspaper workers. The provincial morning papers in Germany issue three editions during the day, the contents varying more or less. In Berlin, two editions are issued.

According to the *Politischer Almanach* there are over 100 important newspapers in Germany, and 38 serious political journals, representing all shades of political opinion. There are 24 large news agencies in Berlin, with branches in the chief cities. All the political parties have their Press agencies. Among the best-known German Reviews are the *Preussische Jahrbücher*, *Deutsche Rundschau*, *Neue Rundschau*, *Süddeutsche Monatshefte* and the *Neue Zeit*.

France.—In no other country is the political influence of the Press so great, or its literary merits so high, as in France. In France, journalism is literature and literature is journalism. Journalism and politics are also inextricably mixed. Presidents of the Republic, Prime Ministers, Colonial Governors, Academicians and others who attain high positions in national life, graduate through the Press. When they retire, they return to their muttons. The most famous journalistic statesman was Georges Clemenceau, the great War Premier. He retired a year after the Treaty of Peace was signed, and at the age of eighty was an unsuccessful candidate for the Presidency. He did not profess disappointment at his failure but consoled himself with the observation: "What matters; with good pen and paper one could be king of the world." While the literary reputation of the French Press stands high, its commercial and political morality is not on the whole quite so commendable. Many newspapers are run for, or by, ambitious politicians, or in some interest, and nearly all of them accept inspiration from the Foreign Office. Ministers change frequently but the system remains. It is like part of the constitution. The smaller papers—and there are many of them—farm out their financial and advertising columns to agencies.

The French Press has been little changed by the World War. During the War many newspapers temporarily disappeared, owing to the lack of staff, or of means, or shortage of paper. All papers were under a severe censorship and, more than ever, were the servants of the Government.

In 1926 there were 227 political journals published in Paris, of which 48 were political dailies. This total does not include papers dealing with technical subjects or sport. There were 127 sporting newspapers, of which five were dailies. The number of newspapers published in the provinces was 3,076, including publications of all descriptions. Morning and evening dailies numbered 256.

France was the first country to have national newspapers with sales of over 1,000,000. The sale was stimulated more by two serial stories run by each paper than by news, but since the War news has become conspicuous in such widely circulated papers as *Le Petit Parisien* (1,200,000), *Le Petit Journal* (1,000,000),

Le Matin (900,000) and the *Petit Journal* (800,000), which may be described as the "Big Four of the Paris Press." Following upon these in point of sales comes the *Echo de Paris* (800,000). The better-known political papers are *Le Temps*, the venerable *Journal des Débats*, *La Liberté*, *L'Oeuvre*, *L'Humanité* and the *Ere Nouvelle*. The *Figaro* maintains its unique position. Characteristics of all the popular Press are signed articles and serial stories. There is a popular daily illustrated paper, *Excelsior*, established 1910, and numerous dailies devoted to sport, finance, the drama, motoring, etc. Four daily papers are published in Paris in English; *The Daily Mail*, *The New York Herald*, *The Chicago Tribune* and *The Evening Times*. Every phase of politics is represented in the Paris Press, from Legitimist to Communist, and every trade and interest has its organ. The provincial Press is more independent politically than the Paris papers and several journals, such as the *Dépêche* of Toulouse, the *Progrès*, of Lyons, the *Petit Marseillais*, *La Petite Gironde* of Bordeaux, have national reputations. The small local Press exercises an independent influence during elections.

Improvements have taken place in the mechanical equipment of the French Press in recent years, and there has been a marked increase in illustrated weeklies and monthlies. The best known weeklies are the dignified *Illustration* and the gay *Vie Parisienne*, which flourished during the War, the literary *Annales Politiques et Littéraires*, and a light variety paper *Nos Loisirs*. The *Revue des Deux Mondes*, the *Mercure de France* and the *Revue Hebdomadaire* are the best known monthlies. The sale of the French Press is pushed all over Europe. The chief news agency, Havas, has official support. There is also a universal wireless service which broadcasts news and propaganda. It is a subsidiary of the wireless company, which holds a concession from the State.

Italy.—Until the fascist régime of Mussolini, the Italian Press laws were based on a Royal decree of 1848. In July 1924 a decree was issued which made newspapers liable to suppression and editors to punishment if they published "tendencious news" which might embarrass the Government in foreign or domestic affairs; and an elastic interpretation of these powers has enabled the Government to suppress all newspapers which ventured to offer any independent criticism to such an extent that in the early part of 1926 the freedom of the Press no longer existed. The most famous newspapers in Italy suffered punishment, and were only tolerated on condition that they refrained from hostile criticism. Where the Press was not muzzled there was a forced change of proprietorship in harmony with Fascist policy. This was the case with the well-known *Corriere della Sera* of Milan, for some years the most powerful organ in Italy. The *Stampa* of Turin, although never strongly anti-Fascist, was tamed; the same fate overtook the influential journal in the south, the *Mattino* of Naples. The complexion of the best-known papers in Rome has been changed. The only journals which enjoy a certain restrained independence are the semi-official organs of the Vatican. A number of newspapers have ceased to exist, and the journalists' associations have been placed under the control of Government Commissioners. There were only 68 daily newspapers in Italy in 1926.

The Press in New Countries.—The rebirth of nations after the World War was followed by a revival in journalism. Every new State had its crop of new journals. Although freedom was not complete, the influence of political parties led to the maintenance of rival organs. Under the three Empires out of which it was carved, Poland's Press existed on sufferance. Now, there are nine daily papers in Warsaw—two of them official, one in Polish and one in French. There are four dailies in Cracow and several in other cities. Besides exponents of the various national political policies there are Zionist, Ukrainian and German papers in Poland, but the authorities sometimes suppress non-Polish journals.

In Czechoslovakia there is a greater measure of freedom and there are far more newspapers. The Press of Yugoslavia has not yet developed a full sense of responsibility. It represents all races, policies and languages. New Turkey now possesses a democratic Press which can speak its mind within limits. The new Baltic States have a Press which is creditable for the small populations for which it caters. In these states and in other territories, where under old conditions there were German interests, newspapers in German are still published. The Press of new Rumania is largely concentrated in the capital, Bucharest, with 24 dailies, of which one is in French and three are in German. In Hungary the popular papers are in the Magyar language—*Az Est* and *Az Ujsag*—and the most influential in German—the *Pester Lloyd* and the *Neues Pester Journal*. The Austrian Press—still headed by the *Neue Freie Presse* of Vienna—is free, but not flourishing under the narrowed limits of the country. Under the new Austrian Press laws power is given to the educational authorities to prohibit the sales of newspapers which "by exploiting youthful impulses may endanger the normal health of young persons."

Russia.—Freedom of the Press has been completely suppressed in Soviet Russia. In Tsarist Russia censorship was severe, but a measure of toleration existed. In Soviet Russia censorship is applied before the matter is printed, which has to be submitted to an official editorial Board known as the Gosizdat. There is a further check on the publication of news and expression of opinion, as newspapers are only published under the auspices of the governing authorities and are thus practically all official organs.

In 1914 there were 17 dailies in the capital, some of them of international reputation, such as the *Novoe Vrèmja*, and the *Retch*, and five in Moscow. In 1910 there were 52 daily newspapers in Russia, of which 13 were in St. Petersburg (Leningrad), and four in Moscow, exclusive of papers in Finland and Polish Russia. In 1926 almost all the Press was concentrated in Moscow. There were 11 morning and evening papers in Moscow, but only two of any importance, the *Izvestia* and the *Pravda*. In Leningrad there were only two morning papers, the *Pravda* and the *Krasnaya Gazeta*. The number of daily newspapers in Russia was, in 1926, eighteen.

Belgium.—Belgium possesses a vigorous Press, published in French and in Flemish. Although the chief Paris papers circulate all over Belgium, the Belgian Press nevertheless enjoys a large sale, and the popular journals are highly prosperous. There are 17 daily papers published in Brussels and nine in Antwerp. There are a number of Socialist journals, the chief organ of the party being *Le Peuple*. The success of the Socialist Press is due largely to its association with the co-operative movement. *La Libre Belgique*, which appeared regularly during the War in occupied Belgium in spite of the vigilance of the Germans, now exists as a daily newspaper. In Belgium, the Press laws have not been changed for many years and the Press enjoys almost unlimited freedom.

The Netherlands.—The Netherlands, with a population of over 7,000,000, possesses a healthy Press, including journals which enjoy a high reputation for their literary merits and as organs of opinion. The chief among these are the *Nieuwe Rotterdamsche Courant*, *De Telgraaf* and the *Algemeen Handelsblad*, of Amsterdam. There are eight daily papers in Amsterdam, seven in The Hague and five in Rotterdam, and these circulate throughout the country.

Scandinavia.—The newspapers in the Scandinavian countries appeal to a highly intelligent reading public and are among the best written and the best produced on the Continent. The three kindred races can understand each others' newspapers.

Spain and Portugal.—There is little progress to record in the Spanish Press, and circulations are small. The illustrated *A.B.C.* is the most popular paper. The *Imparcial* is an important political organ. The *Heraldo* and the *Liberal* are other leading Madrid journals. *El Sol* was founded in 1917 by the Spanish Paper Trust. There are 20 daily papers in Madrid and 17 in Barcelona, and about 200 dailies of sorts in Spain. The principal Portuguese papers are the *Diaris Noticia* (founded 1820) and the *Jornaldo Commercio*, both published in Lisbon.

Switzerland.—Switzerland, owing perhaps to its small population, has few papers known outside the country. In 1926 there were 38 daily newspapers published in German, 19 in French

and two in Italian. The best known are the *Journal de Genève*, read in France, the *Neue Zuercher Zeitung* and the *Zuericher Post*, which have a considerable circulation in Germany.

China.—By no means the least result of the Chinese revolution of 1911 was the amazing expansion of the vernacular press. Actually the movement had begun some years earlier, but after the revolution it developed into a portent. Native newspapers sprang up in all parts of the Empire in a night, as it were, and it is not surprising that the Chinese Press exhibits most of the undesirable attributes of a mushroom growth. The general quality is poor. Most of the papers are run for political or personal ends, the news supplied by them is untrustworthy and their standard of journalistic ethics low. This is the more to be regretted as their multitude testifies to the interest which awakened China takes in affairs and their influence on public opinion is beyond doubt enormous; but little improvement is to be expected until political conditions become more settled. As things are it is only fair to say that, with all its irresponsibility and corruption, the Chinese Press is on the whole liberal and patriotic in intention if not always in fact. It may be noted that Chinese periodical publications are on a much higher level than the newspaper press.

Between twenty and thirty European and American newspapers are published in China, more than half of them at Shanghai. The majority are British, including the *North China Daily News* of Shanghai which, founded in 1864, is the oldest foreign daily in China. Other British morning newspapers are *The Shanghai Times*, *The Central China Post* (Hankow), *The Peking and Tientsin Times*, *The Hongkong Daily Press* and *The South China Morning Post* (Hongkong), The principal British evening papers are *The Shanghai Mercury*, *The North China Daily Mail* (Tientsin), *The Hongkong Telegraph* and *The China Mail* (Hongkong). There are three American morning dailies, *The China Press* (Shanghai); *The Peking Leader* and *The North China Star* (Tientsin)—and three French, *L'Echo de Chine* (Shanghai), *Le Journal de Pékin* and *L'Echo de Tientsin*. In addition there are a number of Chinese and Japanese-owned journals published in English.

Japan.—The restraint of the Press which was common to all belligerent countries during the World War was maintained much longer in Japan than elsewhere, and it was not until 1922 that the War-time regulations were repealed. Nevertheless the period 1911–25 was marked by steady progress and a great expansion of the circulation of the more important newspapers, and while there is no Japanese journal that can be said to belong to the first class in the world's Press, there are several that rank high in the second class. The most widely read newspapers are the *Osaka Asahi Shimbun* and the *Osaka Mainichi Shimbun*, each of which has a circulation of 700,000 daily. The leading Tokyo papers, such as the *Jiji Shimpo* and the *Tokyo Nichi Nichi Shimbun*, are influential but have a far smaller circulation. The most notable feature of Japanese newspaper enterprise during the period under review was the growth of the evening Press. Formerly there was but one evening paper, the *Maiyu Shimbun* of Tokyo, and even now there are, strictly speaking, only two, the *Tokyo Mainichi Shimbun* having been converted into an evening paper in 1918, but practically all the principal morning dailies publish evening editions.

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NEW TESTAMENT: *see* BIBLICAL CRITICISM.

NEW YORK CITY (*see* 19.610).—The population of New York City in 1925, according to the State census, was 5,873,356, as against 4,766,883 in 1910, an increase of 1,106,473 or 23·2%. The population of the separate boroughs was: Manhattan, 1,945,029 (in 1910, 2,331,542); Bronx, 872,168 (in 1910, 430,980); Brooklyn, 2,203,235 (in 1910, 1,634,351); Richmond, 138,277 (in 1910, 85,969); Queens, 714,647 (in 1910, 284,041). The average number of inhabitants per acre was: Manhattan, 139·0; Brooklyn, 48·5; Bronx, 32·9; Queens, 10·3; Richmond, 3·8; whole city, 30·6. In 1924 the average death-rate for the city was 11·8 per 1,000, as compared with 15·98 per 1,000 in 1910. The reduction of the general death-rate has been due mainly to special activities in the prevention and control of communicable diseases, especially those of childhood.

I. PUBLIC SERVICES

Finance.—The city's budget grew from $163,130,270 in 1910 to $399,618,885 in 1925. Important items were $95,099,162 for education and recreation; $59,068,521 for protection of life and property; $60,255,956 for health, sanitation and care of dependents; $106,487,232 for debt service and tax deficiencies. The assessed values on which taxes for 1925 were levied were $11,901,348,553 real estate and $239,507,540 personal property, or a total of $12,140,856,093. In 1910 the total assessed value of taxable property, real and personal, was $7,416,837,499. The net funded debt of the city as of March 1925 was $1,262,736,066, the gross funded debt being $1,969,515,440.

Water Supply.—The most notable extensions to public services made since 1909 include the development of additional water supply from the Esopus and Schoharie watersheds in the Catskill Mts., and extending rapid transit facilities throughout the city. The two watersheds have an area of 571 sq. m. and a safe minimum yield estimated at 515,000,000 gal. daily. The flow of the Schoharie creek is intercepted by a temporary diversion dam through the Shandaken tunnel, 18 m. long, to join the water of Esopus creek, which discharges into the Ashokan reservoir. The Gilboa dam, under construction in 1925, was designed to form the Schoharie reservoir with a storage of 20 thousand million gallons. The main reservoir of the system, the Ashokan, is located about 92 m. from the northern boundary of New York City. Its estimated available storage capacity amounts to 130,400 million gallons. Other features of the Catskill system are the Kensico dam, the Catskill aqueduct and city tunnel and the Hudson river crossing. The Kensico dam is one of the great masonry structures of the world, containing nearly 1,000,000 cubic yards of masonry and at its highest point rising 307 ft. above the rock foundations on which it rests. The Catskill aqueduct includes 69 m. of plain concrete grade aqueduct and tunnel, 17 m. of reinforced concrete pressure tunnel and 6 m. riveted steel inverted siphons. The Hudson river crossing comprises a 14-ft. tunnel driven in granite rock 1,114 ft. below the sea-level. The total cost of the completed Catskill supply will be about $180,000,000. Other supplies, together with the Catskill, provide a safe yield estimated at approximately 1,000 million gal. per day. Water consumption during 1925 reached 865 million gal. per day, thus indicating the need for developing additional supply in the near future.

Rapid Transit Development.—As a means of meeting the demand for additional rapid transit facilities, the city, in March 1913, entered into separate contracts with the Interborough Rapid Transit Co. and the New York Municipal Railway Corporation, for the construction, equipment and operation of a system of rapid transit lines known as the dual system. At that time the Interborough Rapid Transit Co. operated the subway lines in Manhattan, the Bronx and Brooklyn and under lease the elevated lines owned by the Manhattan Railway Company. The New York Municipal Railway Corporation was formed in the interests of the Brooklyn Rapid Transit Co. for the operation of various lines constructed or to be constructed as outlined in the dual plan. The New York Railway Co. and Third Avenue Railway Co., which operated most of the surface lines in Manhattan and the Bronx and the surface lines of the Brooklyn Rapid Transit Co. were the only large traction systems in the city not included in the dual system. The operating contracts made with each company run for a period of 49 years (dating from Jan. 1 1919 in the case of the Interborough; and from Aug. 1 1920 for the Brooklyn Co.), at the end of which time all leases and agreements will terminate and the city will have complete ownership and control over the construction included in the dual plan. Provision is made for the sharing of profits with the city after the

operating company has paid all necessary expenses and taken out an amount designated as a preferential. The contracts also specify that the fare for a continuous ride shall be five cents.

The dual plan provided for the construction of about 325 m. of new tracks, making the total mileage of the completed system 618·4. While the plan as outlined approximately doubled the existing mileage, it tripled the facilities then available, as the third tracking and extension of existing elevated railways materially increased the carrying capacity. For the Interborough these extensions comprised subway construction north and south of 42nd street, Manhattan. North of 42nd street, the new subway extended up Lexington avenue and connected with the existing Fourth avenue subway. New subway construction south of Times Square extended the west side subway down Seventh avenue to lower Manhattan and by tunnel under the East river and to South Brooklyn. This construction provided independent through north and south rapid transit lines for the east and west sides of Manhattan Island. The addition of third tracks and extension of existing elevated lines have brought the route mileage to 115·4, and the total track mileage for the Interborough system to 333·3.

The main feature of the extension of the lines of the New York Municipal Railway Corporation was the subway beginning at the Queensboro Bridge and extending west by 59th and 60th streets to Seventh avenue, thence south by Seventh avenue, Broadway, Vesey street, Church street and Trinity place to a connection with a tunnel under the East river at Whitehall street. This construction and other extensions make a total of 99·4 route m. and a total track mileage for the New York municipal railway system of 274·3 m. now in operation. A continuous ride of 26·63 m. for five cents is available on the Interborough system and one of 18·5 for the same fare on the Brooklyn lines. Up to June 30 1925, expenditure by the city and the operating companies for rapid transit construction and equipment, exclusive of the cost of the privately owned lines of the old Manhattan elevated structures, amounted to approximately $537,000,000. Of this amount the city's part was about $327,000,000 and the operating companies' $210,000,000.

Communications.—Two important enterprises in providing additional direct lines of communication with New York City are the New York connecting railway across the East river and the vehicular tunnel under the North river. The New York connecting railroad provides direct rail connection with the New York, New Haven and Hartford line for the boroughs of Queens and Brooklyn. The main features include a reinforced concrete arch viaduct extending from the connection with the New York, New Haven and Hartford railroad in the Bronx to a point on Ward's Island, in the East river, a steel arch spanning that section of the East river known as Hell Gate, and connecting with a similar reinforced concrete viaduct in the Astoria section of Queensborough. Surface construction provides direct passenger rail connection with the Sunnyside Yard of the Long Island railroad and thence access to the Pennsylvania railroad terminal in Manhattan, while another branch for freight only extends to the Bay Ridge section on the water-front of South Brooklyn. The entire length of the connecting railway is 12 miles. The total amount expended was approximately $30,000,000. The bridge itself (Hell Gate), having the largest steel arch in the world, cost $18,500,000. Its massive granite piers rise to a height of 240 ft. and are 1,017 ft. apart. The steel arches which support the deck of the bridge rise 300 ft. above the water, and the clearance for vessels at mean highwater is 135 feet. The bridge carries four tracks, two of them for both passenger and freight service.

The Holland vehicular tunnel beneath the North river connecting Manhattan Island and Jersey City was to be open for traffic during 1926. Its construction is under the joint jurisdiction of the New York Interstate Bridge and Tunnel Commission and the New Jersey Interstate Bridge Commission, and the cost was to be shared equally by the two States. The estimated traffic capacity of the tunnel is 15,000,000 vehicles per annum. The tunnel section, the construction of which was completed Oct. 1 1925, comprises two tubes each 29 ft. 6 in. outside diameter and approximately 9,500 ft. in length. The tubes are constructed of cast-iron segments and reinforced concrete and were built by the Shield method of construction. Each tube includes a 20-ft. roadway to accommodate two lines of traffic moving in the same direction and a 3-ft. sidewalk for pedestrians. The greatest single engineering difficulty involved was that of providing an adequate system of ventilation. That adopted was the so-called transverse system, under which fresh air is forced into the tunnel structure through air ducts under the roadway and ejected into the tunnel section through apertures along the roadway curb at each side The foul air is discharged through air ports in the tunnel roof section, and thence forced through air ducts to the ventilation shafts and the outer air.

Other Public Improvements.—Growth of the city and the great development in the use of motor vehicles have produced serious traffic congestion which has necessitated extensive street widening and the construction of new thoroughfares. Notable examples of new construction are the Varick street extension of Seventh avenue, Manhattan, the extension of Flatbush avenue, Brooklyn, and the construction of the Jamaica Bay boulevard in Queens. The removal of elevated railway structures from 42nd street and Upper Sixth avenue and the construction of a viaduct carrying Park avenue over 42nd street at Grand Central Station have aided in relieving traffic congestion at those points. Progress has been made in relieving the waters of New York Harbour from sewage pollution by the construction of sewage screening plants along the North and East rivers and at other points.

There have been marked changes in the use of property, particularly in Manhattan, since 1909. The principal shopping district has shifted northwards, until in 1926 its boundaries, broadly speaking, were 34th street, Broadway, 59th street and Madison avenue. In the vicinity of 42nd street there has been an extensive development of office buildings. The buildings formerly housing the Knickerbocker, Holland House and Manhattan hotels and two famous restaurants—Sherry's and Delmonico's—have been replaced by office buildings. Notable building construction from 1909–25 includes the Woolworth building (792 ft.), the highest structure in the world excepting the Eiffel Tower, Bankers' Trust (539 ft.), City Investing (487 ft.), Equitable (485 ft.), Adams Express (424 ft.), Whitehall (424 ft.), Bush Terminal (419 ft.), American Express (415 ft.), American Telephone and Telegraph (403 ft.), and the new Telephone building (400 ft.). Height restrictions and set-back provisions in the city zoning ordinance have offered the opportunity for considerable variation in the architectural treatment of high buildings constructed during recent years, which have resulted in securing more artistic effects than were formerly possible. Among the newer hotels are the Pennsylvania, with 2,200 rooms, the largest hotel in the world; the Commodore; the Ambassador; and the Roosevelt. Madison Square Garden, an historic structure used for amusement purposes and as a place of public assembly, was demolished in 1925, a 28-storey office building being erected on its site.

II. COMMERCE AND INDUSTRY

Port of New York.—During 1924 the tonnage of vessels entering the Port of New York direct amounted to 18,280,975, while ships clearing from the port carried 18,858,693 tons. The value of the imports received during 1924 aggregated $2,047,759,136, representing an increase of 130% over 1909. Exports for 1924 amounted to $1,685,562,079, an increase of 169% over 1909, but a decrease of 52% from those made during 1920. Improvements in port facilities made since 1909 include the completion of the Ambrose Channel work and deepening of the East river channel by the Federal Govt. and the reconstruction and extension of the Erie canal by the State. Eight canal terminals have been built at various points along the North and East rivers together with a modern grain elevator with a capacity of 2,000,000 bu. located at the Gowanus Bay terminal. Expenditures on the canals up to 1925 aggregated $167,123,774. The most noteworthy port development works carried out by the city since 1909 include the North river, Staten Island and Jamaica Bay

projects. Along the North river two 1,000-ft. piers were built between 44th and 50th streets, and by 1925 two others had been planned. The completed construction, which cost approximately $5,500,000, including real estate, provides 285,000 sq. ft. additional dock space. The construction of a steamship pier 1,000 ft. long and 174 ft. wide above the Holland vehicular tunnel, involving an estimated expenditure of $2,500,000, was planned. A railroad pier costing about $900,000 and providing 92,000 sq. ft. additional dock space, was completed during 1925 at Pier 2, North river. Three piers providing 568,500 sq. ft. dock space were built along the East river during 1916 at the foot of 29th, 30th and 35th streets respectively, South Brooklyn, and subsequently there was extensive bulkhead improvement of both the Manhattan and Brooklyn waterfronts along the East river. Remodelling High Bridge over the Harlem river and straightening of the alignment of that waterway was also accomplished. In 1919 the city initiated the Staten Island improvement project involving the construction of 12 modern steamship piers with terminal warehouse facilities. This improvement, built at a cost of about $30,000,000, includes over six miles of wharfage and 1,800,000 sq. ft. dock space. Through its connection with the Baltimore and Ohio railroad, opportunity was provided for track railhead connections between these piers and all but two of the railways entering the Port of New York. The facilities afforded by this improvement exceeded, in 1926, those available for similar purposes on the island of Manhattan.

The Jamaica Bay project constitutes the most important development undertaken by the city in recent years. Jamaica Bay has an area of about 26 sq. miles. In 1909 the State of New York ceded to the city all of the State's ownership in the Bay, amounting to about 16,000 acres. The Federal Govt. adopted a project to dredge a channel through Rockaway Inlet and from Barren Island to Cornell Basin, to an ultimate depth of 30 ft. and to a width of 1,000 feet.

In 1923 the Department of Docks laid out in the middle of Jamaica Bay a scheme for the construction of two islands, to be made by dredging a channel 2,500 ft. wide and 30 ft. deep around the bay. The islands will contain 6,500 ac., and will have a quay wharfage of about 28 miles. At an expenditure of about $1,250,000 the department has completed an embankment 550 ft. wide and more than two miles long. This embankment provides a roadway of 150 ft., which is the Cross Bay boulevard, over the island and in addition gives the city about 2,000 building lots. The two islands, will provide homes for about 400,000 people.

Port Authority.—In 1921, on recommendation by a joint commission appointed in 1917 by the governors of New York and New Jersey to investigate conditions at the Port of New York, a treaty was entered into between these two States providing for the creation of the Port of New York District and the establishment of the Port of New York Authority. This treaty was subsequently ratified by Congress; and the Port Authority was appointed, consisting of six commissioners, three from each State, serving for overlapping terms. In Dec. 1921 the Port Authority presented to the legislatures of New York and New Jersey a comprehensive plan for the development of the port, which was adopted by the legislatures and ratified by Congress. The principal features of the plan are a series of belt lines and marginal railways, a freight tunnel from Greenville, N.J., to Bay Ridge, Brooklyn and an automatic electric system of freight transportation for serving Manhattan and union inland terminal stations on Manhattan Island.

In 1924 the states of New York and New Jersey made appropriations for and granted authority to the Port Authority to make surveys and borings for two bridges across the Arthur Hill from Staten Island to New Jersey. In 1925 the legislatures provided for the building of these bridges by the Port Authority, the States contributing a total of $4,000,000 toward the cost, to be eventually repaid from the collection of tolls, and the balance of the cost is to be financed by the issuance of bonds, to be amortised from the tolls collected. In 1925 the legislatures also provided for studies for a bridge across the Hudson river from Manhattan, in the neighbourhood of 178th street, to Fort Lee, New Jersey.

Manufactures.—The New York City Metropolitan District (a district of 616,928 ac., including in addition to New York City the neighbouring cities and towns both in New York State and New Jersey) is by far the largest industrial district in the United States. In 1919 there were 32,590 manufacturing establishments in New York City with a total number of 825,056 persons engaged in the industries. Of these 638,775 were wage-earners; 35,101 were proprietors and firm members; 36,894 were salaried officers, superintendents and managers; and 114,286 were clerks. The sum of $326,171,741 was expended for salaries and $805,822,451 for wages. The total value of the products manufactured was $5,260,707,577, and the amount of capital invested in industries in the whole city was $3,038,557,492. The clothing industry ranked first in importance, the total value of men's and women's clothing manufactured being $1,346,839,946 or 57% of the value of clothing produced throughout the entire country. Printing and publishing ranked second, with products valued at $206,585,376.

Art.—The additions to the Metropolitan Museum of Art during the years 1910–25 have made it rank with the large museums of the world. Among the notable bequests have been those of Francis L. Leland, $1,000,000; Joseph Pulitzer, $900,000; Benjamin Altman, collection of paintings, sculpture, Chinese porcelains, etc., with a fund for their care; William Henry Riggs, collection of arms and armour; Harris B. Dick, collections and funds over $1,000,000; Isaac D. Fletcher, collection of paintings and objects of art and fund over $3,400,000; John Hoge, over $1,000,000; and Frank A. Munsey, the bulk of an estate estimated at $40,000,000.

III. LOCAL POLITICS

Mayor Mitchel's Administration.—During the administration of Mayor Gaynor, which began in 1910, there arose an increased interest in city affairs. The mayor who in consequence of an attempt to assassinate him had gained a hold on popular sympathy, died on Sept 10 1913 while on a voyage to Europe. Adolph L. Kline (b. 1858), president of the Board of Aldermen, succeeded to the office for the remaining few months of the term. A fusion ticket, led by John Purroy Mitchel (1879–1918), who had made an enviable record in public office as Commissioner of Accounts, Collector of the Port and president of the Board of Aldermen, easily defeated the Tammany ticket. Mitchel, but 35 years of age, undertook a complete reorganisation of administration and obtained remarkable results, making his mayoralty a period of unprecedented efficiency in the city's government. Of special note were the improvements in police, street cleaning, charities and corrections and the establishment of high standards and expert service in taxation, purchasing and the selection of personnel.

The Tammany Reaction.—Though admittedly efficient, economical and honest, this administration saw itself at the end of four years buried under the greatest majority for Tammany on record. John F. Hylan (b. 1868), a candidate from Brooklyn, led a complete Tammany ticket into office, with a platform of outspoken opposition to almost everything the Mitchel administration had done. Subsequently, however, upon the election of the president of the Board of Aldermen, Alfred E. Smith, to the governorship of the State and the death in office of the president of the borough of Manhattan, Republicans were elected to the vacancies.

In 1921, largely as a result of the enactment of legislation sponsored by Gov. Miller which seriously curtailed New York City's powers over local rapid transit matters, Mayor Hylan was renominated and again elected by a substantial majority, together with a complete Tammany ticket. During both terms of Mayor Hylan's administration there was practically continual wrangling among the members of the Board of Estimate and complete lack of co-operation with other public agencies. These conditions, together with the general character of appointments made by the mayor, resulted in a distinct lowering of the morale of city employees and a disturbance of administrative machinery that interfered seriously with the public service. Particularly in

providing for much-needed rapid transit facilities the demagogic attitude of Mayor Hylan and to a less degree that of the other members of the Board of Estimate in refusing to work with the transit commissioners, brought about a virtual *impasse* that for seven years prevented action necessary to afford public relief. Finally, in 1924, the Board of Estimate filed charges against the transit commissioners with Gov. Alfred E. Smith, and the latter appointed the Hon. John V. McAvoy, Supreme Court Justice, Appellate Division of the State of New York, a commissioner to investigate the charges. Commissioner McAvoy's report, presented early in 1925, placed responsibility for the transit situation directly on Mayor Hylan. The administrative incompetence of Mayor Hylan and his subservience to Mr. William Randolph Hearst, publisher, were factors in causing many influential Tammany leaders to withdraw their support and in Sept. 1925 he was soundly defeated in the primaries as a candidate for mayor by James J. Walker. The Republican nominee was Frank D. Waterman, a prominent manufacturer. Walker was easily elected in the Nov. elections.

Home Rule.—Important legislation affecting New York City since 1910 included the Home Rule Act of 1924 and the Home Rule Transit law. Under the provisions of the Home Rule Act the power to enact local laws in New York City is conferred on a bicameral body known as the " municipal assembly " consisting of the Board of Estimate and Apportionment and the Board of Aldermen. The Home Rule Transit law provided for the establishment of a Board of Transportation to have jurisdiction over the regulation of existing rapid transit lines and gave the board broad powers for providing additional transit facilities together with the right to undertake municipal operation of such lines.

(R. B. F.)

NEW YORK STATE (*see* 19.594), a State of the United States. The population in 1920 was 10,385,227 as compared with 9,113,614 in 1910, a gain of 14%. The average population per sq. m. in 1920 was 217·9 as compared with 191·2 in 1910. The urban population (in cities with 2,500 or more inhabitants) was 8,589,844, or 82·7%. The native white population was 7,385,915, of whom 3,668,266 were of native parentage; 2,844,083 of foreign parentage; and 873,566 of mixed parentage. The foreign-born white population was 2,786,112.

In 1920 there were 28 cities with populations of over 20,000, of which the chief were:—

Albany	113,344	Rochester	295,750
Binghamton	66,800	Schenectady	88,723
Buffalo	506,775	Syracuse	171,717
New York	5,620,048	Utica	94,156
Niagara Falls	50,760	Yonkers	100,176

Government and Political History.—The constitution of 1894 was frequently amended during the period 1910–25, but the amendments did not alter fundamentally the system of government. Among the most important constitutional changes were the adoption of woman suffrage in 1917, the establishment of a literacy test for new voters in 1921 and the granting of home rule to cities in 1923. An important constitutional amendment providing for the consolidation of numerous state administrative establishments (187 in 1919) into 20 departments was approved in Nov. 1925.

On Oct. 6 1910 Gov. Hughes resigned to accept a position on the U.S. Supreme Court, and was succeeded by Horace White, the lieutenant-governor. In the election of Nov. 1910 the Democrats carried not only the State but also the Legislature, and John A. Dix was elected governor. The 1911 Legislature adopted a compromise direct primary law, which retained the party convention for the selection of candidates for state-wide offices. The Wagner-Levy election law limited independent nominations to registered and enrolled voters, made registration days uniform and provided for personal registration in rural districts for voters who had not voted in the previous election. It also prevented a candidate's name from appearing more than once on the ballot, and thus made fusion tickets and independent voting difficult. In the fall elections the Republicans regained control of the Assembly. The Legislature of 1912 allowed party organisations to substitute the assembly district for the election district as the unit of repr sentation. This caused absurdly long ballots and tended to discredit the direct primary system. The hours of labour for minors in factories were restricted.

The Democrats again carried the State and the Legislature in Nov. 1912, and Sulzer became governor. The Legislature of 1913 passed laws insuring greater safety in factories, providing for an eight-hour day for employees on public works, and a 54-hour week for women and children under 16 in certain industries. In April 1913 Gov. Sulzer sent a special message to the Legislature urging a direct primary law that would abolish party conventions. The Legislature refused to enact the primary bill, and the governor vetoed the legislative substitute. When the Legislature recessed on July 23 the governor declared the special session adjourned, but the Legislature reassembled on Aug. 11. Two days later the assembly voted to impeach the governor; on Oct. 17 he was removed from office and Martin H. Glynn, lieutenant-governor, succeeded. In the elections of Nov. 1913 Sulzer was elected to the Assembly. A constitutional amendment authorising a workmen's compensation law was adopted by a large majority. The special session of the Legislature which had impeached Gov. Sulzer reassembled on Dec. 18 and adopted a direct primary law abolishing conventions; a modified office group ballot law; measures to carry out the 17th amendment providing for the popular election of U.S. senators; a resolution submitting to the voters the question of calling a constitutional convention; and the adoption of a workmen's compensation law for certain hazardous employments.

The Republicans were successful in the elections of Nov. 1914, and Whitman became governor. The new Legislature passed a widowed mothers' pension law; reorganised the inferior criminal courts of New York City by creating a board of city magistrates, the judges of which were given the right to sit in special sessions and to dispose summarily of minor misdemeanours; and authorised parole commissions in cities of the first class. In Nov. 1916 Gov. Whitman was re-elected, the Assembly continuing Republican; in the presidential contest, also, the Republicans carried the State. State legislation of 1917 was strongly influenced by the entrance of the United States into the World War. The woman-suffrage amendment was ratified by a large majority.

In the Nov. election, 1918, Alfred E. Smith (Dem.) was elected governor. Most of the other state officers and the Legislature, however, remained Republican. One of the most important laws of the year was the one providing for an income tax of from 1% to 3%. The Federal prohibition amendment was ratified. Shortly after his inauguration Gov. Smith appointed a non-partisan reconstruction commission to investigate the problem of reorganising the state government. This commission in its report of Oct. 10 1919 recommended an executive budget and the consolidation of the numerous administrative agencies. The most constructive work of the session was the passage of several laws for the relief of the housing situation.

In the elections of 1920 the Republicans carried the state by large majorities, and their candidate for governor, Judge Nathan Miller, was elected. The Legislature passed a law placing all public utilities, except transit in New York City, under the jurisdiction of one state commission. A state prohibition enforcement law was adopted. The direct primary was abandoned and the convention system restored for the nomination of state and judicial officers. The state industrial commission and the state tax commission were reorganised, and a board of estimate and control created.

The 1922 Legislature authorised life-insurance companies to invest 10% of their assets in new buildings for dwelling purposes; extended the emergency rent laws to 1924 and fixed assessments as the basis for determining the reasonableness of rents. Women were given representation on county party committees. A home rule amendment was adopted. Under the law passed the previous year the candidates for state office were nominated by party conventions in 1922. The election resulted in the election of Alfred Smith as governor. The 1923 Legislature provided for a commission to study the problem of bringing the state laws into

conformity with the home rule amendment, which the Legislature again approved. Some progress was also made in carrying out the governor's consolidation programme for a constitutional amendment providing for consolidation of the numerous administrative agencies into 20 departments. The Mullan-Gage prohibition enforcement Act was repealed, and Congress was memorialised in favour of liberalising the Volstead law.

In the fall elections the voters approved by large majorities two constitutional amendments. One authorised a bond issue of $45,000,000 to pay a bonus to World War veterans. The second amendment extended to cities a large measure of home rule. The referendum on a bond issue for $50,000,000 for new hospitals was likewise approved. The Republicans increased their majority in the assembly. The Legislature of 1924 passed a bonus law awarding $10 for each month of service to all active participants in the World War who were residents of the state; the maximum payment was fixed at $150. The emergency rent laws of 1920 and the following years were extended to 1926. An important measure of the session was the Home Rule Enabling Act, designed to carry out the amendment adopted the previous year. This law, drafted by the state home rule commission, was adopted unanimously by both Houses of the Legislature. The New York amendment differs from constitutional provisions in some other states in that it grants powers in general terms. In the presidential election of 1924, the Republicans were successful. Gov. Smith was re-elected, but the Republican candidates for the other six elective state offices were successful, and the Legislature became more strongly Republican.

Agriculture and Stock-Raising.—In 1924 New York, with crops valued at $303,812,600, ranked eighth among the states in the value of all crops and first in the production of hay and potatoes. In 1923 the number of farms in the state was 190,000 and the total acreage 20,300,000. The U.S. Census of 1920 placed the value of all farm property at $1,908,483,201. In 1924 7,327,000 tons of hay; 24,519,000 bu. of corn; 6,840,000 bu. of wheat; 34,056,000 bu. of oats; 6,900,000 bu. of barley; 935,000 bu. of rye; 5,363,000 bu. of buckwheat; 46,620,000 bu. of potatoes; 1,820,000 bu. of beans; 23,800,000 bu. of apples; 2,178,000 bu. of peaches; 2,100,000 bu. of pears; 80,000 tons of grapes; and 2,350,000 lb. of tobacco were produced. In 1923 there were 532,000 sheep in the state, and the wool production was 2,968,000 pounds. The dairy business was one of the most important.

Minerals.—In 1923 mineral products valued at $89,975,134 were produced. The average value for the years 1919–23 was $62,243,270. In 1923 clay products were valued at $25,226,187; cement, $12,834,471; gypsum, $10,344,745; stone $9,610,324; salt, $7,431,155; sand and gravel, $7,291,076; petroleum, $4,140,000; natural gas, $3,739,000; and iron ore, $3,320,004.

Manufactures.—According to the United States report on manufactures for the year 1923, the value of the products of manufacturing establishments in the state was $8,960,693,000, as compared with $6,973,506,000 for 1921, a gain of 28.5%. The number of establishments in 1923 was 38,187; in 1921, 38,107; in 1919, 49,330; and in 1914, 48,203. The decrease in number is partly accounted for by the fact that the last two reports did not include establishments which reported products under $5,000 in value. The wage-earners in 1923 numbered 1,150,901 as compared with 1,000,414 in 1921, an increase of 15%. The wage payments in 1923 amounted to $1,582,006,000. The industries whose products were valued at more than $100,000,000 in 1923 were:—

Clothing	$1,636,529,625	Paper and wood pulp	$140,468,586
Printing and publishing	503,411,143	Furniture	137,328,234
Foundry and machine shop	273,933,262	Cigars and cigarettes	129,659,423
Bread and bakery products	236,546,477	Chemicals	128,376,073
Knit goods	230,525,505	Steel works and rolling mills	122,964,813
Millinery, lace	197,627,982	Silk	105,018,097
Boots and shoes	195,082,384	Confectionery and ice cream	103,215,335
Electrical machinery	192,224,937		

The chief manufacturing centres and the values of their products in 1921 were: New York City, $4,328,187,499; Buffalo, $431,383,131; Rochester, $291,117,230; Syracuse, $109,061,617; Yonkers, $107,182,668; and Albany, $41,171,786.

Transportation and Commerce.—In 1925 the operated railway mileage in New York was 8,401. In 1925 there were 4,792 m. of electric railways. There were 81,878 m. of highways in the state, 18,566 m. of which were surfaced. Of the $75,000,000 appropriated by Congress to the states for highway building in the year 1924–5 under the Federal aid system, New York received $3,663,105. The Erie Barge Canal was opened from Troy to Buffalo in 1918. The Champlain and the Oswego Barge canals have also been completed. In addition to the canalised rivers and lakes (382 m.) the state has a canal mileage of 525.

Education.—The University of the State of New York, a supervising and examining institution, is the State Department of Education, and controls the educational system of the state. It is governed by 12 regents, one elected each year for a 12-year term at a joint session of the two Houses of the Legislature. The board of regents elects the president of the university, who is the commissioner of education. The regents apportion the state educational funds. In 1924 there were 62,401 teachers, and 1,610,076 enrolled pupils. The cost of school maintenance in that year was $250,553,776.

Finance.—On June 30 1925 the total debt of the State was $318,456,000. The sinking funds, however, amounted to $87,123,821. Approximately one-half of the total debt was incurred for canals. Highway bonds amounted to $98,800,000, and World War bonus bonds to $45,000,000. The general revenue receipts for the year ending June 30 1924 amounted to $146,587,656, and the disbursements to $146,456,708. (E. D. G.)

NEW ZEALAND (*see* 19.624), a Dominion of the British Empire and a member of the League of Nations. The area of the Dominion proper is 103,285 sq. m., but if outlying islands are included the total area is 103,862 square miles. In addition New Zealand is responsible under the mandate of the League of Nations for the administration of the Western Samoan group, and shares with Great Britain and Australia the administration of the former German island of Nauru. Also, since 1923, the Governor-General of New Zealand is responsible for the administration of the Ross Sea area in the Antarctic. In Feb. 1926, at the invitation of the British Govt., New Zealand took over the administration of the Tokelau or Union group of islands in the Pacific. The population of the Dominion proper, according to the census of 1921, was 1,271,664. By letters patent dated May 11 1917 the designation of the representative of the British Crown in New Zealand was altered from Governor and commander-in-chief to governor-general and commander-in-chief.

I. POLITICAL HISTORY

The year 1910 saw the Dominion recovering from the financial crisis of 1908. Political control was in the hands of the Ward Ministry, which, with incidental cabinet changes, had carried on the Liberal-Labour Govt. and régime of the late Mr. Seddon, who himself had been Prime Minister without intermission for 13 years. Political interest had centred largely around the system of Crown Land tenure; amendments to industrial legislation; the passing in 1910 of the National Provident Fund Act; and questions of military and naval defence. The government was being assailed by Mr. Massey's already growing party with the proposal to relinquish the remaining remnants of leasehold principles, and to permit the sale outright, under certain safeguards against monopolistic holdings, of Crown lands. A Defence Act, embodying the principle of universal service within certain ages, had been passed in 1909, though it had not been put into operation; and in 1910 Lord Kitchener, at the invitation of the New Zealand Govt., visited the country, and, after slight alterations had been carried out at his suggestion, the system was introduced in Jan. 1911. In the naval sphere an arrangement had been made in 1909 with the Home Govt. under which it was understood that the Domin-

ion's " gift " battle-cruiser, the " New Zealand," should be the flagship of a new China unit, and that seven vessels of the unit should be stationed in peace time in New Zealand waters, the ships to be manned as far as possible with New Zealand officers and men.

The general election of 1911 was disastrous to the Ward government. The Liberal-Labour combination, which had held together for 21 years, had for some time been showing signs of disruption, while the Conservative opposition, now known as the Reform party, had improved its organisation. The polls gave the latter an apparently slight advantage, though the issue was still in doubt. In the recess the Ward Ministry resigned because of internal discord, and a new Liberal Cabinet was formed under Sir Thomas Mackenzie. The latter was defeated on a no-confidence motion two weeks after the new Parliament met; and on July 10 1912 Mr. W. F. Massey became Prime Minister.

The Reform Régime.—The new government in its first session passed the necessary legislation to enable holders of Crown leases in perpetuity to acquire the freehold. Another important measure passed placed the control of the public services largely under commissioners. No important changes in general policy were made. Nevertheless, there was ample work for the government. For some time, aided by agitators from abroad, sections of labour had shown considerable restlessness and dissatisfaction with the Arbitration Act, and this culminated in 1913 in a strike of all transport workers, seamen, and miners, who, cancelling their registration under the Arbitration Act and thus being able to strike without incurring penalties, ranged themselves under a federation of Labour. The strike, one of the most extensive in the history of New Zealand, was a grave menace to the country, for at the time it took place produce from every part of the Dominion was in store at the ports awaiting shipment to Great Britain. The government took firm measures to deal with the situation. A new Waterside Workers' Union was established under the Arbitration Act, and all temporary workers, chiefly farmers' sons and employees, joining it were given security by the police and special constables from interference; ultimately the ships, manned by volunteer crews, were dispatched with their cargoes. The strike ended after a protracted struggle. As one result of it the Labour Disputes Investigation Act was passed in the same year; it applied to workers or societies and to employers not bound by the Conciliation and Arbitration Act.

The remainder of the parliamentary session was devoted chiefly to amending legislation, and in this connection useful, if not outstanding, work was done. To the amended land laws of the previous session was added a further provision giving the same privilege of purchase to those possessing similar leases of Settlement Lands, *i.e.*, lands which had been purchased by the State and leased. Acts were also passed to provide funds to assist irrigation and also the fruit industry. A board of agriculture was established to act in a consultative and advisory capacity to the Lands Department. In this session also the second Ballot Act was repealed.

In 1913 the Minister for Defence, Finance and Education, Mr. (Sir) J. Allen, visited England, at the wish of the government, to confer with the British Admiralty and War Office in regard to New Zealand's military and naval defence, and also to attend to certain matters of general finance. Arrangements were completed with the War Office in regard to the strength and composition of the voluntary expeditionary force authorised under the Defence Act of 1909; but the negotiations with the Admiralty were not very satisfactory. It had been found necessary by the Admiralty to depart from the previous arrangement, and station the ships designed for the China Seas in English waters; and the only offer to New Zealand was of two obsolete vessels of the old Australian and New Zealand squadron. New Zealand then asked that the vessels to be sent should be of the " Bristol " type, but this could not be done. In the same year, 1913, the Naval Defence Act was passed: it provided for the establishment of a New Zealand naval force by voluntary enlistment. A New Zealand division was inaugurated in 1914, but the outbreak of war stopped the scheme of training.

During his return trip to New Zealand via Canada, the Minister, who had been instructed to purchase in Britain a stock of small arms for the Dominion's newly constituted territorial army, but had only been able, owing to a shortage, to obtain a small quantity, bought a large number of ·303 Lee-Enfield rifles—discarded by Canada for the Ross rifle—which were destined not only to serve for the training of New Zealand's expeditionary forces for the first two years of the War, but to become, many of them, the weapon of the New Zealanders in Gallipoli.

The War Period.—A considerable programme of important legislation had been arranged for 1914, but Parliament had not been in session very long before war broke out. It was, however, possible to pass, amongst other measures, an Education Amendment Act, under which there was a complete reorganisation of the educational department and the system of education control. At the declaration of hostilities neither government nor people displayed any hesitation as to the course New Zealand would pursue. Secret preparations had been made for the mobilisation of an Expeditionary Force of approximately 8,000 officers and men, and these preparations were immediately put into operation. But first, at the request of the British Govt., a force of 55 officers and 1,358 men was mobilised, and on Aug. 15 dispatched to capture German Samoa, a feat accomplished without fighting. The first expeditionary force for the actual scene of war, consisting of 360 officers and 8,139 other ranks, sailed on Dec. 14 1914. The preparation of reinforcements was meanwhile proceeded with, and also the necessary organisation for a sustained war effort.

New Zealand maintained her war effort on a scale considerably greater than that involved in her first arrangement with the War Office; her infantry division in France and mounted force in Palestine were kept at full strength with necessary reserves to the day of the Armistice, and by the close of hostilities she had sent overseas (out of a population of 1,089,825) 100,444 trained troops. In addition, 12,000 were mobilised and preparing for service when hostilities terminated. The financial cost of an undertaking on such a scale was extremely heavy. The budget of 1914 was already in print when the declaration of war was received, and authority was therefore given by Parliament to raise £2,000,000 by Treasury bills to meet immediate expenses. Afterwards loans were arranged according to requirements. Meanwhile, in Dec. 1914, the Parliamentary elections were held and Mr. Massey was returned with a small majority. Subsequently, in Aug. 1915, a National Govt, composed of the two chief parties, Reform and Liberal (the small Labour section declining representation), was formed; Mr. Massey remained Prime Minister, with Mr. (Sir) J. Allen as Minister of Defence and Sir Joseph Ward as Minister of Finance. A complete party truce was declared.

New Zealand shipped to Britain during the War produce and other supplies to a value of £160,000,000, which were sold to the Imperial Govt. at prices fixed by mutual arrangements. On three occasions during the War the Prime Minister and the Finance Minister attended Imperial Conferences in London, and on such occasions the Defence Minister, as Acting Prime Minister, combined their duties with his own. Though the country was wholeheartedly behind the war effort, problems naturally followed in the wake of the compulsory enlistment enactment, for which in 1916 the majority of the people had themselves agitated. One serious coal-miners' dispute at the West Coast mines also required settling. But whatever sectional and temporary difficulties arose, the nation as a whole supported the policy of the government.

The ability of the Dominion to ship its produce at satisfactory prices overcame the difficulties of financial provision. The output increased considerably, and extra taxation was met without inconvenience. Up to 1917, comparatively small portions only of loans authorised were raised in London, and the rest in New Zealand, an innovation so far as the Dominion was

concerned. After 1917, New Zealand provided her own financial requirements. The actual fighting costs of the troops in the field were advanced to New Zealand by the Imperial Govt. on a *per capita* basis (which fluctuated according to the engagements in which the New Zealand units participated). The total cost of the War to the Dominion was assessed in 1921 at £81,538,570, and of this amount £55,198,325 had been raised in New Zealand.

Post-War Years.—The National Govt. came to an end in 1919 by the withdrawal of the Liberal Party from the Ministry. At the general elections which ensued late in the same year the Reform party was returned with a heavy majority. Labour also showed a considerable accession of strength, and, for the first time for many years, became a distinct party in the House. The government turned its attention with concentrated effort to the repatriation of the returned soldiers, seeking particularly, under special legislation that had been passed, to place satisfactorily on the land all those who so desired. Financial assistance was also given, chiefly by loans on easy terms, to men who desired houses of their own, or wished to start in business, etc. Each case was carefully investigated by special repatriation organisations, and in every possible respect the government sought to provide for the future of each individual soldier who presented himself. In the case of those seeking land occupations, suitable areas were purchased by the government, sub-divided, and resold or leased to the men under special legislative provision at easy terms of interest; or the money was advanced as a first mortgage, with essential safeguards, if a man desired any particular farm.

An abnormal demand for land was created, and naturally, assisted by the enhanced values of produce, land values became inflated. House properties also went up greatly in value, and the shortage, since but few had been built during the War, became very acute. Altogether 9,388 men were assisted to obtain rural homes and properties, and 10,890 in securing homes in towns; 61,254 were placed in employment, trained in some future livelihood or financially assisted to re-establish themselves—a total altogether of 81,532 men. The cost to the country by July 1922 was £28,718,578. The problems of repatriation and others following in the wake of the War were in the forefront of the new government's duties. Fortunately during the later War years there had been heavy surpluses of revenue over expenditure, and these were available for partial application to repatriation needs.

The immediate post-War years were years of high prices and prosperity, but in 1921 the prices of produce, especially of wool and meat, on the British market rapidly fell. Land values in New Zealand were too high and there had been extremely heavy over-importation, largely due to merchants and manufacturers abroad being able to fulfil long-standing orders. The country was faced with an immediate crisis. Taxes were already at a high level, and there were cries for easement to meet the strain of financial calls. The country's ordinary current expenditure had grown tremendously, and it was impossible to afford much relief. The Prime Minister decided at once on a policy of the most rigid economy. Departmental expenditure was closely examined by a specially appointed commission; war bonuses were attacked, and, since a fall was shown in the cost of living, deductions were made accordingly.

As a result of its measures for economy, the popularity of the government was seriously affected. There was much unemployment, but it was possible, by pushing forward the public works programme, to offer manual labour to those able to undertake it. Meanwhile, the overseas marketing problems were tackled, reductions were obtained in freights, insurance, storage, etc., and by the middle of 1922 a recovery in market returns abroad was in evidence. The meat producers of the Dominion had tackled their own marketing problems, and had set up an organisation under which the whole industry was able to seek reasonable terms in all matters of costs from the farm to the overseas markets; the dairy producers had taken the preliminary steps for a like movement. The government was in close touch with these developments and, in the case of the meat producers, passed the necessary legislation.

The vexed question of heavy taxation was seriously disturbing the community, the commercial interests especially desiring a change in the incidence of taxation. The government then set up a commission to investigate the whole matter. By the middle of 1922, however, the general situation had considerably improved. Towards the end of the year, while the government was still unpopular owing to its drastic economies, a general election became due. The result was not unexpected. Mr. Massey could not muster a sufficient number to provide an absolute majority over the Liberal and Labour parties, the latter of whom had increased their strength to 17, the largest representation they had ever had. But when the new Parliament met in 1923, three Liberal Independent members, who had given pledges to vote against Labour, ranged themselves on the side of the government, and saved a defeat.

The year 1923 was remarkable for the recovery of the New Zealand produce markets in Britain, for the State revenue revival, and for various taxation burden remissions the government was able to institute. Income tax was greatly reduced, penny postage was reinstituted, reductions were made in telegraph rates, the income tax on revenue from farm products was removed, and a sum of approximately £2,000,000 was provided for the aid of soldier settlers who were unable to carry on under the burden of the high value at which their land had been purchased, and for further pension assistance. The incidence of taxation was also altered in some particulars, and a policy of progressive reduction of income tax was instituted, the maximum rate falling from 7s. 4d. to 4s. 6d. in the £, and the minimum from 1s. to 7d. Substantial reductions were also made in the rates of land tax. Exemptions in respect of children were increased.

An energetic policy of development was also undertaken. Legislative provision was made for the State Advances Department to extend its security for advances to 75% in the case of farming land, and to 95% for workers' houses, and legislation was passed to authorise the necessary borrowing to provide the money. For a number of years the payments from borrowers under the scheme had provided sufficient revenue to meet all applications for advances. The customs tariff was also revised, the chief features being the increase of British preference, and a separate reciprocal tariff with Australia. In 1924 the Old Age Pensions Act was improved, further beneficial amendments were made in the education legislation, the Companies Act was altered to enable the issue of "labour shares," and Acts were passed to permit the dairy, honey, fruit and poultry farmers to exercise control over their industries similar to that enjoyed by the meat producers, though differing in some essential details. Legislation was also passed making registration of electors for general election purposes compulsory.

On May 10 1925 the Prime Minister, the Right Hon. W. F. Massey, died at Wellington. Sir F. H. D. Bell, the first New Zealander born in the Dominion to occupy the office, was appointed Prime Minister on May 14, and was succeeded on May 30, following a reorganisation of the Executive Council, by Mr. J. G. Coates, previously Minister for Public Works and Railways and Postmaster-General. The session closed without any legislation of outstanding importance. In Nov. a general election was held, and resulted in an overwhelming victory for the Reform party under Mr. Coates, which secured 57 seats as against 11 held by the National (Liberal) party, and 12 by Labour.

Defence.—New Zealand's attention since the War has been directed chiefly to additional naval security. In 1919 Admiral Jellicoe of the British Navy visited New Zealand, and presented a report making recommendations and suggestions for the naval defence of the Dominion. In 1926 the Dominion maintained a training ship and two modern light cruisers. The cruisers were loaned free of charge by the Imperial Govt., the Dominion being responsible for all payments for the ships and their personnel, a considerable number of which consisted

of New Zealanders. A naval oil-tank vessel is also maintained, and at the naval base at Devonport, Auckland, one oil-tank had been erected while another was under construction in 1925. The amount provided in the Estimates for 1925–6 as the Dominion's contribution to naval defence was £538,325. All matters relating to the naval forces of the Dominion are administered by a Naval Board, constituted in 1921.

The military forces consist of the Permanent Forces, the Territorial Force and the Senior Cadets. The Permanent Forces, excluding the Air Force, contain 101 professional officers who are charged with the training of the forces and the administration of all matters connected therewith. The strength of the Territorial Force in 1925 was 699 officers and 15,481 other ranks. The strength of the Senior Cadets was 427 officers and 26,515 other ranks. Rifle clubs exist throughout the Dominion. All male inhabitants of New Zealand who have resided therein for six months and are British subjects are liable to be trained in the Senior Cadets from 14 years of age, or the date of leaving school, to 18 years of age, or, in the case of those who at the age of 18 are attending a secondary school, to the date of their leaving school; or in the Territorial Force to the age of 25. The New Zealand Permanent Air Force, with an establishment of five officers and 19 other ranks, is a unit of the military forces.

Public Finance.—The gross national debt, which at March 31 1910 stood at £74,890,645 (£72 6s. 10d. per head of population), had increased to £201,179,755 (£162 12s. 9d. per head) at March 31 1920; at March 31 1925 it amounted to £227,814,647 (£165 2s. 11d. per head). This is the gross amount, and against it are accumulated sinking funds amounting to £13,462,839, leaving the net indebtedness of £214,287,128. With the exception of that portion incurred for war purposes, the greater portion of the borrowings has been for productive and developmental purposes, resulting in revenue-producing assets such as railways, hydroelectrical installations, telegraphs and telephones. The war debt to the Imperial Govt. had been funded and repayment was already well advanced by 1925.

The following table shows the revenue and expenditure for each financial year from 1910 to 1925:—

Year ending Mar. 31	Revenue	Expenditure	Excess of Revenue over Expenditure
	£	£	£
1910	9,238,917	8,990,922	247,995
1911	10,297,273	9,343,106	954,167
1912	11,061,161	10,340,368	720,793
1913	11,734,271	11,082,038	652,233
1914	12,229,661	11,825,864	403,797
1915	12,451,945	12,379,803	72,142
1916	14,507,530	12,493,107	2,014,423
1917	18,355,194	14,058,770	4,296,424
1918	20,206,222	15,120,288	5,085,934
1919	22,352,372	18,673,599	3,678,773
1920	26,081,340	23,781,524	2,299,816
1921	34,260,961	28,068,730	6,192,231
1922	28,127,007	28,466,838	− 339,831
1923	27,579,443	26,263,760	1,315,683
1924	27,960,370	26,148,005	1,812,365
1925	28,643,000	27,399,200	1,243,800

These tables show that revenue from taxation increased very considerably from 1914 to 1921, but fell heavily from 1921 to 1925. The public services (chiefly railways and post and telegraphs) increased their revenue after 1921, while the costs of their administration were reduced, showing the excellent results of the severe and continued economies instituted in the services' administration during the post-War period.

The movement of direct and indirect taxation from 1914 to 1925 is shown in the following table:—

Year ending Mar. 31	Customs and Excise	Land tax	Income tax	Death duties
	£	£	£	£
1914	3,553,785	767,451	554,271	613,751
1917	4,037,628	713,118	4,262,126	570,040
1921	8,769,251	1,688,979	8,248,945	1,106,925
1922	5,554,334	1,637,816	6,002,987	1,512,754
1925	8,339,576	1,335,251	3,386,052	1,520,749

Education.—In 1914 the whole of the law relating not only to public, but to secondary, technical, and special schools was recast. The principal changes involved the reorganisation of the Department of Education and the inspector-general of Schools became the director of education. Provision was also made for the constitution of fewer education districts, and by an Act of 1915 nine were created from the existing 13. A council of education was also constituted, with statutory duty to report to the Minister and advise upon any matters in connection with education referred to it, or which it may consider advisable to introduce into New Zealand. By the Education Amendment Act 1921–2 the registration of all private schools was made compulsory, and teachers in all schools were required to take the oath of allegiance. The Education Amendment Act 1924 included provisions for the establishment of junior high schools, for the amalgamation of the governing bodies of secondary and technical schools and for the creation of a teachers' register.

The number of scholars receiving instruction in all educational institutions in 1911 was 194,325, and in 1924 289,033. The following table shows the advance in the state primary schools (including district high schools):—

Year	No. of schools	Pupils at end of year	Average attendances
			%
1913	2,255	172,168	89·2
1918	2,365	194,934	88·7
1924	2,574	216,190	90·7

The number of teachers in the public schools in 1913 was 4,262; in 1924, 5,822. In 1915 there were 11,958 children receiving secondary and technical instruction at all classes of schools; in 1924 there were 23,276. Free places at secondary schools are granted to suitably qualified pupils. There are also liberal national scholarships. Control of higher education is vested in the New Zealand University, which by Royal charter is entitled to grant degrees. In 1921 the degrees of bachelor of science in forestry and doctor of philosophy were instituted. There is a liberal scholarship system in connection with the universities.

The following table shows the increased expenditure on education:—

	Expenditure from public funds	Expenditure per head of mean population
	£	s. d.
1909	980,000	19 7
1915	1,378,000	24 1
1921	3,224,000	51 6
1924	3,247,000	48 8
1925	3,643,000	53 7

Chief Sources of Revenue and Expenditure

Year ending Mar. 31	Taxation	Railways	Post and Telegraphs	Crown Lands	Other Sources	Total
1914	£5,918,034	£4,028,739	£1,269,922	£262,846	£750,120	£12,229,661
1921	22,184,414	6,918,492	2,478,532	319,641	2,359,882	34,260,961
1925	16,172,306	7,105,106	2,706,882	211,749	2,446,957	28,643,000

The details of expenditure for the same years were:—

Year ending Mar. 31	Working Railways	Post and Telegraphs	Education	Interest, etc., on Public Debt	Other Expenses	Total
1914	£3,004,181	£1,170,883	£1,206,678	£2,887,981	£3,556,141	£11,825,864
1921	6,211,011	2,588,360	2,633,977	7,831,593	8,803,789	28,068,730
1925	5,636,583	2,413,436	2,777,271	8,862,644	7,709,266	27,399,200

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(J. AL.)

II. POPULATION AND SETTLEMENT

Population.—The census figures for 1911, 1916 and 1921, and the estimated population on Dec. 31 1925 were as follows:—

	1911	1916	1921	1925
Europeans	1,008,468	1,099,449	1,218,913	1,335,719
Maoris	49,844	49,776	52,751	54,768
	1,058,312	1,149,225	1,271,664	1,390,487

The actual gain in population in the decade 1911–21 (excluding Maoris) was 210,445, or 20·87%. Taking the two census periods, the gain from 1911–6 was 90,981, or 9·02%, and from 1916–21, 119,464, or 10·87%. Three factors influenced the comparatively small increase:—

1. Immigration during the War years was severely restricted;
2. Emigration figures were swelled by the inclusion of over 100,000 members of the Expeditionary Force, thousands of whom did not return;
3. The rate of natural increase was reduced owing to the absence of so many thousands of men.

In 1911 the birth-rate per 1,000 was 25·97, and in 1924, 21·57. In the same periods the death-rates per 1,000 were 9·39, and 8·29 respectively. The proportion of females to males, excluding the War years, is steadily increasing. The number of females to 1,000 males in 1911 were 896; in 1916, 993; in 1921, 956; and in 1925, 959. The population is chiefly centred in the North Island, and the " drift " that way, largely due to the development of the dairy industry, is growing. In 1911, 55·90% of the people resided there; in 1916, 59·22%, and in 1921, 60·81%. The Maoris, who are not included in these percentages, chiefly reside in the North Island. The census statistics of 1921 classed 56% of the population as urban.

In 1921, 98·43% of the inhabitants, exclusive of Maoris, had been born in the British Empire, an increase of ·51% as compared with 1911. Of the total in 1921, 74·39% were born in New Zealand, 19·54% in the United Kingdom and 3·94% in Australia. A certain number of those born in foreign countries were of British parentage or nationality, and including these the proportion of the population owning British nationality in 1921 was 99·35%. The number of aliens steadily diminished—from 12,050 in 1911 to 7,901 in 1921. Of the 7,901, 2,712 were Chinese, 1,013 Americans and 857 Yugoslavs. Certain restrictions are placed upon the entry into the Dominion of race aliens, a classification implying persons of other than European race. Of the total population in 1925 43·66% were members of the Church of England, 25·42% Presbyterian, 13·93% Catholics and 9·53% Methodists.

The Maori race increased in numbers from 49,844 in 1911 to 54,768 in 1925, and continued to preserve their individuality and strength. The above 1925 figure includes 7,352 half-castes, the majority of whom live as Europeans. There are 125 native schools, with an average daily attendance of 5,610 scholars.

Immigration.—The immigration policy of the New Zealand Government is to provide assistance, by free or reduced passage rates, to desirable immigrants from Great Britain. Assistance is restricted to persons who are nominated by permanent residents of the Dominion, or by bona fide New Zealanders visiting Great Britain, provided such persons are healthy and under 50 years of age. In the case of a married person, nomination must include the wife and family, except where a judicial separation exists, or desertion is proved. The nominator must undertake to make provision for the maintenance and employment of the nominee, and guarantee that residence will extend to at least five years. The quota of such assisted new arrivals is fixed from period to period. From shortly after the War until 1925 the quota was 10,000 per annum, but early in 1926 it was extended to 13,500. Exceptions to the nomination rule are single domestic servants and farm workers, for both of which classes there exists an unsatisfied demand.

Very complete arrangements, under the direction of the Immigration Department, which in turn is responsible to the Minister for Immigration, exist for the care and comfort of immigrants both at their departure and arrival. Assisted immigrants are required to pass severe medical tests, and to present certificates of good character. These, and all allied matters, are administered by the High Commissioner for New Zealand in London. The reduced rates of passage from Great Britain to New Zealand in 1926 were as follows:—

	£
Married or widowed adults	11
Single adults (males)	13 15s. 0d.
Single adults (females)	11
Farm labourers	11
Domestic servants	Free, with a £2 bonus
Boys, over 17 and under 19 years of age, not travelling with their parents	5 10s. 0d.
Children under 19 years travelling with parents	Free

In addition to the general immigration scheme, there exist special arrangements for British public schoolboys between the ages of 17 and 19 years. If satisfactory they are provided with passages at a cost of £7 10s. 0d.; they travel in groups under a prefect, and on arrival are placed with specially selected farmers at fixed rates of wages and taught farming. In 1924, 208 boys went to New Zealand under the scheme, and about an equal number in 1925. A large section of the sheepowners of the Dominion also have a fund of over £200,000, allocated out of wool profits of the War period, for training sons and daughters of sailors of the navy and mercantile marine who were killed or incapacitated during the War, the lads in farming at a special institution in New Zealand, and the girls in domestic and light farming work at another. Free passages are provided by the Government of New Zealand, and the children are provided with suitable employment after training. Both schemes are under the scrutiny of the Minister for Immigration and both have operated with entire success and satisfaction. The British Govt. co-operates with the Dominion in its assisted migration and provides a share of the passage money.

The following table shows the number of assisted immigrants entering New Zealand for each year from 1911 to 1924:—

Year	Number	Year	Number
1911	3,070	1918	421
1912	3,535	1919	3,569
1913	5,151	1920	7,615
1914	3,716	1921	8,085
1915	1,300	1922	7,773
1916	695	1923	6,181
1917	231	1924	8,091
		1925	8,236

Land Settlement.—The total area of the Dominion is 66,390,262 ac., and the following is the condition of the land in 1925:—

	Acres
Held on freehold	21,068,660
Reserved for public purposes	14,425,181
Crown lands leased	18,226,492
Crown lands yet available for disposal	2,925,410
Lands held by the native race	5,881,571
Unfit for settlement (including rivers, lakes, roads, etc.)	3,862,948
	66,390,262

It is impossible, in the absence of available statistics, to give a comparative table for the year 1910, but other statistics show that individual holdings increased from 73,876 in 1911 to 85,977 in 1925, and areas held from 40,238,126 ac. to 43,632,372 acres. These figures disclose the extent of new lands taken into occupa-

tion, and also the sub-division that has taken place. Of the 43,632,372 ac. of occupied land in 1925, 18,510,558 ac. were in cultivation as follows:—

Grain and pulse	699,844
Grasses and clover (for hay and seed), and green and root crops	1,068,459
Fallow	124,459
Grasses and clover (permanent pasture)	16,450,625
Vineyards and orchards	27,749
Market goods, etc.	4,998
Private gardens and grounds	63,206
Plantations	71,218
	18,510,558
Unimproved land	25,121,814
	43,632,372

The unimproved land was divided up into 54,814 ac. under flax; 14,470,990 ac. of tussock and native grasses; 4,054,760 ac. of fern, scrub, etc.; 4,331,333 ac. of standing virgin bush; and 2,209,917 ac. of barren land. The Wellington and Auckland provinces possess the greatest flax areas, and Canterbury and Otago the tussock land (used for sheep grazing); the fern and scrub areas are well distributed; Westland and the Auckland provinces contain the chief forest lands; the barren lands mainly consist of the mountain areas of South Island. The remaining Crown lands are being thrown open as rapidly as possible. In the 1924–5 financial year 168,748 ac. were offered for selection under the various tenures provided by the Land Act 1924, Land for Settlements Act 1908, and Education Reserves Amendment Act 1910. There is provision in the legislation for compulsory prevention of aggregation in large areas and for sub-division if such is desirable.

The Advances to Settlers Act 1894, was embodied in the State Advances Act 1913 under which money is lent to settlers on first mortgage of lands and improvements held under certain specified classes of tenure. The Government has authority under the Act to borrow money for these advances. The scheme has proved very successful and from 1917–21 repayments exceeded advances. In 1923 its application was widened to enable larger amounts to be borrowed and increased advances to be made; as a result the loans authorised in the two succeeding years were greatly increased. In 1924–5, 3,321 loans amounting to a total of £4,289,875 were authorised, £3,516,130 advanced, and £846,771 repaid.

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(W. S. N.)

III. ECONOMIC HISTORY

Agriculture.—New Zealand is primarily a grazing country, largely because better financial returns are obtained from the pastoral industries. Of the total area of 18,510,558 ac. under cultivation in 1924–5, 699,844 ac. were in grain and pulse crops; the area under crops intended for threshing was only 371,944 acres. Grain crops, principally oats and wheat, are chiefly grown in the eastern and southern districts of the South Island; barley is also grown, but to a very much smaller extent. Before the 1915–6 season agricultural statistics were rarely correct, owing to the unsatisfactory methods of collecting returns.

The table below clearly shows the decline in the area under grain crops, particularly wheat. The decrease in production necessitates grain imports in some years and in 1924–5, 4, 181,422 bu. of wheat were imported from Australia. About 14,000 persons were engaged in agriculture in 1925. Linseed is grown mainly in Canterbury, South Island. Its cultivation increased rapidly after 1916–7, when only 1,431 ac. were sown until 1923–4, when 12,119 ac. were sown; the acreage fell, however, to 6,679 in 1924–5. The area under potatoes in 1924–5 was 23,092 ac., yielding a return of 122,184 tons. Other root crops are grown on a large scale for winter feed and for stock fattening purposes. Turnips are a most important crop in a sheep breeding country such as New Zealand; in 1924–5 the area under the crop was 452,894 acres. The cultivation of mangolds is increasing, with 15,111 ac. under the crop in 1924–5, and the value of lucerne cultivation is being realised.

The Department of Agriculture, under a director-general with divisional heads controlling chemistry, livestock, dairy fields and horticulture sections, is concerned mainly in advancing the interests of primary production. The sum allocated to this department in 1925–6 was £368,297. While the service is mainly educational, it also is responsible for the inspection and grading of all produce exported from the country. Experimental farms and horticultural stations are maintained in various localities, and farmers are assisted by visits and letters of advice. A Board of Agriculture was established in 1913 to advise the Minister for Agriculture upon matters relating to the development of agricultural and other rural industries.

Pastoral Industry.—The number of dairy cows in the Dominion in 1910 was 804,078, while in 1925 it had risen to 1,323,432. The dairy industry is largely conducted upon a co-operation basis, and the most up-to-date mechanical aids are used. In 1925, 15,561 milking plants were in operation, milking 705,000 cows each day, and 44,656 cream separators were in use on the farms. There were 156 butter, 267 cheese, and 69 dual (butter and cheese) factories. Over 76,000 persons were employed in the industry. Pastoral products comprised over 90% of total exports in 1925. The great advance made in the dairy industry is shown by the following table of comparative percentage increases in export quantities and values for the decade 1914–24.

	Value	Quantity
	%	%
Butter	398	192
Cheese	174	85
Frozen meat	62	−1
Wool	64	−6

During the post-War period two very important branches of the dairy industry were developed: the manufacture of casein, and of dried (or powdered) milk. In 1925, 43,908 cwt. of casein were exported, valued at £110,171, and 12,598,321 lb. of dried milk, valued at £390,045. Preserved milk was also exported to a value of £35,693. The decrease in the dairy output in 1925 (as shown in the export trade table) is attributable chiefly to an extremely unfavourable season and a shipping strike.

The number of sheep and lambs in the Dominion in 1925 was only some 500,000 more than in 1910. There was a normal increase in the flocks until 1918, when a total of 26,538,302 was

Acreage and Yield of Principal Crops, 1915–25

Season	Wheat		Oats		Barley		Maize		Peas and Beans	
	Area Thous. Ac.	Quantity Thous. Bu.	Area Thous. Ac.	Quantity Thous. Bu.	Area Thous. Ac.	Quantity Thous. Bu.	Area Thous. Ac.	Quantity Thous. Bu.	Area Thous. Ac.	Quantity Thous. Bu.
1915–6	329	7,108	213	7,653	30	820	8	340	9	163
1916–7	218	5,051	178	5,371	30	738	6	274	12	243
1917–8	281	6,808	156	4,943	19	569	8	368	12	313
1918–9	208	6,568	173	6,885	19	711	10	414	18	506
1919–20	140	4,560	180	6,968	23	816	9	406	14	369
1920–1	220	6,872	148	5,225	47	1,587	15	501	14	355
1921–2	353	10,565	171	6,753	33	1,152	11	488	13	339
1922–3	276	8,395	143	5,688	17	598	20	506	24	698
1923–4	174	4,175	64	1,964	21	597	8	406	19	363
1924–5	167	5,448	147	5,707	25	798	9	427	14	411

reached, but heavy exports followed in the next three years, and in 1922 the number had fallen to 22,222,259. In 1925 a recovery had been made to 24,547,955. Only a comparatively small proportion of the frozen meat exported from New Zealand is beef, for the price of frozen beef on the British market is very low owing to competition with the chilled article from South America. As a result of this competition markets other than Britain are being sought. Shipments of frozen pork are rapidly increasing. In 1924 there were 46 meat freezing and preserving works in the Dominion, employing 7,361 hands.

Co-operation.—One of the greatest aids to the development of the primary industries has been the application of the principle of co-operation, particularly in the case of the dairy industry. The farmers have their co-operative companies, arrange their own finance, and receive monthly cheques—based on a percentage of the prices current on the British market, any surplus over the amounts paid out being subsequently distributed proportionately as a bonus. This system largely obviates the necessity for extensive capital.

After 1922 co-operative marketing was put into operation by the meat producers. Under the Meat Export Control Act 1921–2 the meat industry obtained powers to set up a board, elected by all the sheep and cattle farmers in the Dominion, to supervise the industry, shipment and marketing of the produce. The board consists of eight members, five representing the producers and one the stock and station agents, while two are appointed by the government. Since its inception much useful work has been done, chiefly in regard to the marking of parcels, grading of meat, loading and discharging, regulation of shipments and in arranging satisfactory rail and sea freights and freezing charges. The dairy producers obtained power under the Dairy Produce Export Control Act 1923, to set up a similar board, but the Act was not in full operation by the end of 1925. Both bodies have representation in London, the former by a manager, and the latter by a board consisting of three members and a manager. The fruit and honey producers also have similar organisations governing their export affairs.

Afforestation.—A very active and progressive policy is pursued in reafforestation. The first organised attempt with imported trees, chiefly European larch, Austrian pine, Corsican and western yellow pine and a variety of eucalypti, was made in 1896, when an afforestation section of the lands department was formed. This work continued with more or less progress until 1919, when a separate forestry department was set up, and was reorganised in 1920 as the State Forest Service. Then in 1921–2 the Forests Act was passed defining the forest authority as the Minister of Forestry, the Director of Forestry, with a secretary, five conservators, a milling expert, an engineer in forest products, a grazing specialist and various sub-officials. The total personnel in 1925 was 95. At March 31 1925 the area dedicated to forestry and conservation was 7,485,590 acres. Over 100,000 ac. were acquired by purchase between 1920–5. In 1923 a national forest inventory and stock-taking took place and a great deal of valuable research work in regard to the New Zealand timbers was accomplished. The total expenditure on State afforestation up to March 31 1925 was £701,675, the area of state plantations being 62,945 acres. In the year 1924–5 local bodies, owners of private lands, tree and planting companies, etc., developed great afforestation activities, and to these the state has supplied some 13,670,000 trees. The area of private and company plantations and shelter beds was about 9,000 ac. in 1925.

Fisheries.—Although New Zealand possesses a most valuable asset in the great quantities of edible fish in the seas around her coasts, very little had been done up to 1925 in the systematic exploitation of the industry. In the year ending March 31 1925 some 330,000 cwt. of fish, valued at over £400,000, were brought in from the fishing grounds. In addition, the produce of the oyster fisheries was valued at £23,268, and of the whale fisheries at £15,000. Exports in 1924 totalled £67,896 in value, including fish, £58,417; whale oil, £6,515; and ambergris, £2,000. The whale fisheries declined considerably from 1920–4. In 1924, 2,921 persons were employed in the fishing industry.

Minerals and Mining.—The gold-mining industry has declined in importance: up to 1924 the total value of gold exported was £91,414,828, the value for 1924 being £551,788. Work on a scheme for obtaining gold from the bed of the Kawarau river, running from Lake Wakatipu (in Otago), by damming the exit of the waters from the lake, was well advanced in 1925. Silver is obtained in small quantities: up to 1924 total exports were valued at £2,904,651. The exploitation of iron ore and iron sand, of which there are plentiful deposits of the best quality, has not greatly progressed, though in 1924–5 enterprise revived. During the World War, tungsten ore mining became very active, but the fall in prices during the post-War period caused a collapse in the industry: the output of sheelite (tungsten ore) fell from 266 tons in 1916 to 15 tons in 1924. Copper, manganese ores platinum cinnabar, tin and sulphur are also found. Coal is mined for local consumption. The deposits are very extensive, the proved resources amounting to 610,000,000 tons: in 1910 2,197,362 tons were produced, and in 1924, 2,083,207 tons. Kauri gum, the fossilised resin of the Kauri tree, is classed as a mineral, and during 1924 5,261 tons of gum valued at £443,576 were exported. The total quantity of gum exported to the end of 1924 was 389,052 tons, valued at £21,108,085.

Secondary Industries.—Manufacturing industry had been but little developed up to 1925. The principal branches of industry, however, advanced considerably after 1910, with a tendency to greater diversity in production as the population increased. Owing to changes in system of collecting industrial data, and in the classification of industries made in various periods, together with the fact that the statistical data available include the dairy produce and meat handling establishments, it is not possible to give accurate tables to indicate the progress made. Including small-scale establishments, the Dominion had about 100 distinct manufacturing industries in 1925. Woollen factories supplied a large proportion of the internal requirements: much ready-made clothing is manufactured locally, and also furniture and footwear as well as other commodities.

Engineering and the manufacture of metal products are increasing in importance. Motor and cycle engineering, motor body building and the manufacture of chemicals, brushware and glassware are comparatively new industries which are making rapid headway. The government, through an Industries and Commerce Department, encourages and assists secondary manufacture, and the Customs tariff is scientifically arranged to foster such industries as are capable of development. The total number of employees engaged in factories in 1923–4 was 77,661. The value of the products of manufacturing industries in 1924 was £77,000,000. This sum includes semi-primary industries engaged in the preparation of agricultural and pastoral produce for export with products valued at £32,000,000.

Water Power.—The Public Works Act 1908 vested in the Crown the sole right to use the water power of the Dominion, subject to any existing rights, and gave the government the right to develop such power. The Aid to Water Power Works Act 1910 empowered the state to establish hydroelectric supply installations. The Lake Coleridge scheme to supply Christchurch was the first undertaken and was completed in 1915; in 1925 it was being extended to supply 27,000 kilowatts. At the close of the War a policy of concentration on works to supply the whole Dominion was adopted. The Mangahao system to supply Wellington and the Wellington province came into operation in 1925. Under legislation passed in 1918, and later amendments, 39 Boards were set up to administer and finance the supply of power in created districts. The full development of the schemes in progress in 1926 will give the following results, though each scheme is capable of greater development:—

North Island	H.P.
Mangahao (Wellington province)	24,000
Waikaremoana (East Coast)	40,000
Arapuni (Auckland)	96,000

South Island	H.P.
Coleridge (Canterbury)	36,000
Waipori (Otago)	25,000
Monowai (Southland)	16,000

The progress of development (in H.P.) was as follows:—

1910	1915	1921	1925
18,353	43,016	51,114	70,143

The total cost to March 31 1925, including capital outlay, stocks, and debit balances on trading accounts, was £4,010,666; statutory authorisations existed for £10,830,000. In 1925 there were 56 power distributing stations and a net profit was shown of 1·31%. The total water power resources are estimated at 4,109,950 horsepower.

Trade.—The external trade of New Zealand rapidly developed after 1910, particularly in the post-War period, as is shown in the following table:—

Year	Exports	Imports	Total trade
1910	£22,180,209	£17,051,583	£39,231,792
1914	26,261,447	21,856,096	48,117,543
1918	28,516,188	24,234,007	52,750,195
1922	42,726,249	35,012,561	77,738,810
1923	45,967,165	43,378,493	89,345,658
1924	52,612,711	48,527,603	101,140,314
1925	55,262,272	52,456,407	107,718,679

The *per capita* value of exports in 1910 was over £21, and in 1925 £39. The imports *per capita* in the same years were £16 and £38 respectively. (Imports are valued at the current domestic value in the country of export plus 10% to cover "charges, freight and insurance"; exports are valued f.o.b.)

The following tables show the values in thousands of pounds and quantities in thousands of hundredweight or pounds, of the principal exports for certain years:—

Exports: Values and Quantities (000's omitted)

Year	Wool		Frozen Meat		Butter		Cheese		Skins, Hides and Pelts
	Value £	Quantity lb.	Value £	Quantity cwt.	Value £	Quantity cwt.	Value £	Quantity cwt.	Value £
1910	8,308	204,369	3,851	2,654	1,812	357	1,195	452	1,129
1914	9,318	220,473	5,863	3,230	2,339	434	2,564	864	1,318
1922	11,882	321,533	8,387	3,518	9,042	1,120	4,687	1,161	2,054
1923	10,905	217,566	9,013	3,044	10,689	1,250	6,870	1,441	2,380
1924	15,268	206,190	9,490	3,159	11,642	1,269	7,023	1,594	3,144
1925	17,739	..[1]	11,215	3,349	10,240	1,245	5,801	1,377	..[1]

[1] Not available.

The successful application of refrigeration to the sea-carriage of apples and eggs opened up great possibilities, and the volume of exports is rapidly increasing. In the 1926 season some 600,000 cases of apples were shipped to Britain; in 1925 the quantity was only 200,000 cases, the value of which was £116,101. Honey exported in 1925 totalled 1,822,043 lb. valued at £53,156. Increasing markets for these small lines are of very great importance to New Zealand, because as industries, either allied or run separately, they provide local people and immigrants with limited capital and opportunity to start in land occupations. It is impossible for the Dominion to consume the whole output, and success is dependent upon markets overseas, the chief of which is Great Britain. There are many localities in New Zealand eminently suitable for apple growing, and the industry is capable of very great development.

Other exports of minor importance and their values in 1925 were: hemp, £516,466; sawn timber (chiefly to Australia), £573,879; kauri gum, £414,901; gold, £472,364; grass seed, £113,046; and silver, £60,773. The following table shows the value of goods exported to each of the chief markets in 1925:—

	Value	Per cent of total
To Great Britain	£44,073,717	80
To United States of America	4,531,153	8
To Australia	2,502,113	5
To Germany	1,614,090	3

The principal import groups are: clothing and textiles, metals and machinery, sugar, tea, alcoholic liquors, tobacco, paper and stationery, oils, motor vehicles and accessories, chemicals, drugs and timber. Imports of motor-vehicles and oils (including motor spirits) have increased very rapidly: before 1911 their value was less than £300,000 annually, but in 1924 the amount was £4,567,496. The following table shows the imports for 1910 and 1925 from Great Britain, other British countries and foreign states:—

Year	Great Britain	Other British countries	Foreign countries
	£	£	£
1910	10,498,771 (61·57%)	3,967,053 (23·27%)	2,585,759 (15·16%)
1925	25,535,332 (48·68%)	12,726,269 (24·26%)	14,194,806 (27·06%)

In 1910 the figures represent the countries of shipment, whereas those for the second period are of the countries of origin. In 1910 imports from Australia were valued at £1,520,000, and in 1925 £5,238,773; imports from the United States were £1,399,737 and £8,977,840 respectively.

Customs Duties.—In 1915 changes were made in the rates of duty levied on certain articles to meet the extraordinary expenses of the year, and in 1917 additional War impositions were made, these rates remaining in force until the coming into operation of the 1921 revised tariff. The revenue from customs duties in 1910 was £2,954,989, and in 1924, £7,480,947. The Dominion's system of Imperial preference extends to all British countries. The principle was greatly extended in 1921, when 425 items in the 644 subject to duty were made subject to the preference. At the same time, the average preference was raised from 10 to 15%. Australia has a special reciprocal tariff agreement with New Zealand, arranged in 1922, and does not come under the general British preferential provision. In 1924 about one-half the total imports from the British Empire were admitted free of duty.

Communications and Transport.—Considerable progress was made in state railway communication after 1910, as is shown by the following table:—

	Length open (miles)	Revenue (gross)	Expenditure
		£	£
1910	2,717	3,249,790	2,169,474
1920	2,996	5,752,487	4,105,067
1925	3,085	7,112,524	5,545,416

The net receipts in 1925 represented £3 11s. 0d. on capital costs. The capital value of the railways (including unopened lines and assets) was £50,833,500. The state builds its own rolling stock and locomotives, and in 1925 was providing extensive new railway workshops. In 1924 the whole control of managerial organisation was changed, the affairs being placed under the control of a board responsible to the Minister.

Important railway works were carried out during the post-War period. The North Main Trunk was extended from Auckland to beyond Whangarei; sections were constructed on the east coast of North Island, and a tunnel (5¼ m.) through the Southern Alps at Arthur's Pass, to link up the railheads in the

Westland and Canterbury provinces, was completed and electrified in 1923. Railway extension work has been slow and costly, as the sections of country requiring linking-up are of a mountainous character. Duplications have been made in city suburban areas, and works are in progress to obviate the heavy grades running out of Wellington City.

In 1925 there were 64,625 m. of roads in the Dominion, 28,553 m. of which were metalled. By the Main Highways Act (1922) main highways are under the administration of a Highways Board which is responsible for their upkeep. This step has been rendered necessary by the heavy increase that has taken place in motor traffic.

Banking.—There are six banks of issue operating in the Dominion, two of them, the Bank of New Zealand and the National Bank of New Zealand, being incorporated by special Acts of the general assembly of the Dominion. In 1925 the Bank of New Zealand had branches and agencies within the Dominion numbering 219, and the other five between them 259, making a total of 478.

Development of Banking 1910–24

	Deposits	Advances	Assets	Liabilities
	£	£	£	£
1910 .	24,968,761	18,439,999	26,398,927	26,742,081
1920 .	59,405,341	38,241,932	56,111,433	67,818,469
1921 .	49,397,411	50,607,541	68,701,282	58,808,439
1922 .	45,913,394	44,768,178	61,779,570	53,868,834
1923 .	49,039,482	43,322,242	59,641,235	56,204,292
1924 .	49,502,499	44,559,661	61,325,865	57,131,235

The number of open accounts in the Post Office Savings Bank at the end of 1910 was 380,585; at the end of 1915, 509,085; and at March 31 1925, 735,148. In 1910 (calendar year) the proportion of open accounts to the total population was 1 in every 2·76; in 1925 (March 31) the proportion was 1 in every 1·88. The deposits and withdrawals in the calendar year 1910 were £10,708,939 and £9,695,515 respectively; and in 1925 (March 31) £29,582,897 and £30,413,609 respectively. The amount standing to credit of all accounts in 1910 (Dec. 31) was £14,104,990, and in 1925 (March 31) £46,948,628.

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NICARAGUA (*see* 19.642) has an area of 49,200 square miles. Nicaragua declared war on Germany, May 7 1918, and acquired membership in the League of Nations 1920. The western half of Nicaragua contains three-quarters of the population, mostly of mixed Spanish and Indian blood. There are many Nicaraguans of pure Spanish descent. In the east the inhabitants are mostly Zambos and Caribbean Indians and negroes. There are also a few Americans. Estimated population in 1923 was 700,000: Managua, the capital, 60,342; Leon, 47,234; Matagalpa, 32,271; Granada, 21,925.

I. POLITICAL HISTORY

On the flight from Nicaragua of President Zelaya on Dec. 24 1909 Dr. José Madriz, one of his supporters, succeeded him as provisional President. The United States refused to acknowledge the succession, and Madriz was superseded in 1910 by Juan M. Estrada, a member of the artisan class, who was supported by the Conservatives and a few Liberals. He was recognised by the United States and relations were resumed; but a fresh outbreak of factional quarrels amongst the political parties obliged Estrada to resign. The United States intervened, and Adolfo Diaz was elected provisional President in 1910, being elected to a second term of office in 1913. During the first term of office of President Diaz a private loan was negotiated in 1912, the currency reformed, and the customs collections placed under American control. A claims commission, sitting from 1911 to 1914, scaled down and adjusted claims. A revolt of the old Zelaya party, led by Gen. Mana, was unsuccessful in its effort to seize power in opposition to American reform of finances. After Dec. 1914 the Government was supported by American marines stationed at the legation. In Feb. 1913 a treaty was signed whereby Nicaragua gave to the United States for $3,000,000 exclusive inter-ocean canal rights through her territory together with accessory control over the entrances on the Corn Is. and in the Gulf of Fonseca. Protests by Costa Rica and Salvador on the ground that this treaty infringed their sovereignty were sustained by the Central American Court of Justice, but the decision was ignored by both parties to the treaty.

The maintenance of the Chamorro family in the presidency (Emiliano 1917–20, Diego M. 1921–3), while securing peace, caused continuous dissatisfaction. Nicaragua rejected the Central American Union of 1921, fearing that its operation would affect her status with reference to the Canal Treaty, though American official opinion denied this possibility. Crimes by U.S. marines in 1921 and 1922, arising from feuds with Nicaraguans, resulted in several courts-martial and the policy of frequent changes of personnel in the legation guard.

There were border revolts in 1921. The movement of rebel troops upon Managua in 1922 led to a conference on Aug. 22 on board the U.S.S. "Tacoma," in the Gulf of Fonseca, attended by the presidents of Nicaragua, Honduras and Salvador, for the purpose of securing united action in stopping revolutions fomented by political immigrants. This conference renewed the acknowledgment of the Treaty of Amity of 1907, and invited Costa Rica and Guatemala to reiterate their adhesion also; they declined on the ground that the pact was still in force. The Washington Conference of 1922-3 was called at the solicitation of the republics which were parties to the "Tacoma" conference. Nicaragua had before mid-Aug. 1925 approved the first 13 of the Washington agreements.

Diego M. Chamorro died in 1923, and was succeeded provisionally by Dr. Bartolo Martinez. In Jan. 1925 Carlos Solorzano took office as President The United States, Nov. 14 1924, expressed a desire to withdraw its marines in Jan. 1925, but Nicaragua asked that they be retained until the new Government should be installed after an election to be held under a new electoral law framed by Dr. H. W. Dodds. They were ultimately withdrawn on Aug. 3 1925 and replaced by native constabulary under an American officer. In 1924 claims of Mosquito Indians for land title adjustments under the British cession of 1906 were adjudicated by the British and American consuls sitting with the Minister of Foreign Relations.

Defence.—Military service is obligatory between the ages of 17 and 55 years. Active service is for one year. Under the convention for the limitation of armaments signed at Washington on Feb. 7 1923 Nicaragua agreed to limit its standing army to 2,500 of all ranks. In war time the army may be increased to 7,000. Beyond a single small boat, stationed on the Pacific coast, Nicaragua possesses no navy, and by the 1923 convention is pledged to acquire no more than 10 serviceable aeroplanes.

Education.—Primary education is compulsory and free. Secondary education, which is conducted under private auspices, is neither free nor compulsory. Fifty per cent of the population is estimated to be illiterate. In 1923 there were 344 state elementary schools with 730 teachers and 21,651 pupils. There were three secondary schools, five provincial schools, two normal schools and 160 private and municipal schools. The total school population was 29,864. There are universities at Managua, Leon and Granada and a national industrial, commercial and scientific museum at Managua.

II. FINANCIAL AND ECONOMIC HISTORY

Finance.—The revenues and expenditures of the Government were, in cordobas:—

	1925	1924	1920
Revenues . . .	2,772,640	2,211,706	3,147,752
Expenditures . .	2,772,640	1,580,000	1,528,077

The surplus was used each year until July 1924 for public works and on treasury bills; the treasury bills being then paid, the surplus was thereafter used for Government purposes. Customs collections for the five years 1920–4 were, in cordobas: 1920, 2,055,989; 1921,

990,168; 1922, 972,024; 1923, 1,591,131; 1924, 1,988,865. The report of the Collector-General of Customs for 1924 showed a sound financial condition for the republic; the public debt of 32,236,223 cordobas in 1911 was reduced to 7,390,590, March 31 1925.

Production and Commerce.—Agriculture continued to expand throughout 1924, though retarded by labour shortage. Bananas on the east coast constitute an important crop, and coconuts, oranges, pineapples and yucca are raised. Rice, wheat and tobacco also are grown on the east coast. Coffee, the most important crop of Nicaragua, showed export values in cordobas (1 cordoba = 1 U.S. gold dollar), as follows: 1920, 2,874,141; 1921, 2,352,487; 1922, 2,300,572; 1923, 3,937,833; 1924, 7,321,784. The total commerce for 1924 was over 20,000,000 cordobas, twice the average of 10 years previous. The increase was due to the excellent coffee crop, which was the largest in the history of the republic, and its high price. The other principal products exported—gold, mahogany, bananas and sugar—showed a slight decrease. In the west, beans, corn, cheese, lard and sugar are exported. Important lumber exports go from both coasts, as well as dye woods, gums and medicinal plants. The gold export in 1921 was 989,973 cordobas; in 1922, 1,065,733; in 1923, 823,554; in 1924, 771,375 cordobas. Operations were curtailed in 1924 and several mines closed.

Leading exports for recent years were (in cordobas):—

	1924	1923	1920
Cotton goods	2,504,670	2,276,781	5,242,189
Iron and steel mfr.	676,727	471,638	754,075
Leather and mfr.	244,973	242,321	370,804
Flour	439,294	383,852	665,660

Since 1916 the United States has supplied from 73 to 84% of Nicaraguan imports. For the same period the United States has taken from 62 to 85% of the exports, save in 1924 when it took 57%. Proposals to reduce import duties on manufactures used in development were pending in March 1925. A convention between Nicaragua and Guatemala, Sept. 10 1924, provided for free trade for five years in natural products or those manufactured with native raw materials.

The trade movement for the four years 1921–4 was:—

	1924	1923	1922	1921
All Countries				
Imports	$8,806,896	$7,268,432	$5,123,505	$5,309,903
Exports	12,990,025	11,028,309	7,903,446	8,070,949
United Kingdom				
Imports	£ 349,223	£ 235,773	£ 114,425	£ 150,549
Exports	112,324	82,728	75,119	97,707
United States				
Imports	$5,453,167	$5,509,254	$4,127,205	$3,857,202
Exports	6,250,499	7,896,177	5,617,507	6,264,531

Communications.—Most of the roads in the country are nearly impassable in the winter season, but construction has been carried on as follows: from Managua through Matagalpa to Jinotega, 104 m.; Managua to Diriamba 35 m.; Leon to Matagalpa, 80 m.; Puerto Diaz through Juigalpa to La Libertad, 50 miles. Construction on these roads is intermittent. The Pacific railway of Nicaragua has a total length of 146 miles. It runs from Corinto *via* Leon, Managua and Granada to Diriamba. The total railway mileage is 172. The government has contracted for the installation of wireless stations at Managua, Cabo, Gracias a Dios and Bluefields. The station at Managua was under construction in 1925.

Banking.—A new monetary unit was introduced in 1912, the *cordoba*, equivalent to the United States dollar and containing 1·672 gr. of gold $\frac{9}{10}$ fine. Provision was made by law for a gold coinage of 10·5 and 2½ cordobas, but no gold coins have been minted. Cordobas in circulation amounted to 2,379,254 in Nov. 1923. In 1912 the National Bank of Nicaragua was established in Managua, the nominal capital being $300,000.

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NICHOLAS (1841–1921), King of Montenegro (*see* 19.651), was the last member of his house to reign over a separate Montenegrin realm. The story of the last 20 years of his life is very largely the contemporary history of Montenegro. His grant of a constitution in 1905 was followed by a period of violent internal conflict between him and his opponents, whose position had been strengthened by the elections to the Skupshtina, whom he sought to discredit by the Cetinje bomb plot mystification. His assumption of the kingly title in 1910 marked a further stage in the evolution of his plans, of which it constituted a public notification, and aroused hostile comment among his own people as well as in Serbia. The Balkan wars resulted in a marked *diminutio capitis* for Nicholas, who failed to play a conspicuous part in them and was forced to call in Serbian aid before Scutari. At this time already the survival of a Montenegrin throne appeared a doubtful problem. In the World War the breach between him and his people was complete, and even before the final act the old monarch was apostrophised derisively as Nicholas the first and Petrovich the last. He died at Antibes March 1 1921, and was buried at San Remo.

NICHOLAS (1856–), Russian Grand Duke and soldier. Nikolai Nikolaievich was born Nov. 6 1856, the grandson of the Emperor Nicholas I. and first cousin of the Emperor Alexander III. Educated at the school of military engineers, he received his commission in 1872, and in the following year, at the early age of 16, entered the military academy. In the war of 1877–8, as a general staff officer for special service, he joined the staff of his father, the very popular Grand Duke Nikolai Nikolaievich (Senr.), who had been appointed commander-in-chief of the Russian forces. At the crossing of the Danube at Zimnicea on April 15 1877 he was awarded, for his courage, the Cross of St. George, 4th Class. In the attack on the Shipka he acted as chief of staff to one of the columns, and received the distinction of the Golden Sword.

After the war the Grand Duke joined the Guard Hussar Regiment, in which the Emperor Nicholas afterwards served, and passed through every stage as officer till appointed commander in 1884—a position he occupied for 6½ years. He then commanded in succession a brigade and a division, and in 1895 was appointed inspector-general of cavalry. He held this post for 10 years, a period which is regarded as a bright epoch in the history of the Russian cavalry, for he carried through fundamental reforms in training and in the organisation of the cavalry schools, of the cavalry reserves and of the remount service.

In 1905 Nicholas was appointed commander-in-chief of the St. Petersburg military district, a post he held till the outbreak of the World War in Aug. 1914. Here, as elsewhere, he gave proof of his zeal for efficiency. Setting himself the task of instilling the lessons of the Japanese war, he encouraged musketry and work in extended order, but at the same time allowed no slackness in ceremonial. To help him in his work he called from the Far East men like Generals Ivanov, Lesh and Lechitski, who were of comparatively humble origin but had made their reputation in the field. The appointment of such men to high command in the Imperial Guard was characterised in his diary at the time by another Grand Duke as "revolutionary," but the men selected justified their choice in the World War.

In the same year (1905) as he was appointed commander-in-chief of the St. Petersburg military district, Nikolai Nikolaievich became the first president of the newly created council of national defence, and he held this position till 1908, when the council was abolished. During this time the Emperor seems to have hesitated between the final adoption of a military system analogous to that of Germany, under which the chief of the general staff, as well as the minister of war, should have the right of access and of direct report to the Sovereign, and of the system in vogue in countries with a constitutional government, under which that right was confined to the minister of war. On the council the Grand Duke worked in close co-operation with General Palitsin, who, in 1908, on the Emperor's decision in favour of the latter system, gave way to General Sukhomlinov as chief of the general staff, the latter, in the following year, replacing General Rediger as minister of war.

From 1908 to 1914 Nicholas took no part in the strategical

preparation for the War, the work being delegated by the Emperor to General Sukhomlinov and his nominees on the general staff. At the outbreak of war the Emperor first intended to take command himself, and actually appointed the Grand Duke Commander-in-chief of the 6th (Reserve) Army at St. Petersburg (Leningrad). It was only on the evening of Aug. 1, the day of Germany's declaration of war, that he yielded to the entreaties of his ministers and decided to hand over the supreme command to the Grand Duke.

Services During the War.—The position the commander-in-chief was called upon to fill was a peculiarly difficult one. He was responsible for carrying out a plan which he had no hand in drawing up, a plan which was dependent on promises previously made, without his cognisance, to the French general staff. He had to work in accordance with the "Regulations for the Direction of the Army in the Field," a new edition of which had been issued on the very eve of the War, handing over much power to the two group commanders. Finally, he was compelled, by the Emperor's directly expressed personal wish, to take as his chief of staff and general quartermaster, Generals Yanushchkkevich and Danilov in preference to Generals Palitsin and Alexeyev, whom he would have preferred.

The plan of the Russian general staff consisted of the invasion of East Prussia by a right group (I. and II. Armies), while a left group (IV., V., III. and VIII. Armies) operated against the Austrians in Galicia, and a centre group (IX. and X. Armies) assembled at Warsaw to advance on Posen. It was owing to the decision of the Grand Duke that this centre group was broken up, the X. Army being sent north to fill the gap left by the failure in East Prussia, and the IX. Army sent south to overwhelm the Austrians in southern Poland.

When the Germans came to the rescue of their discomfited ally by advancing in Oct. 1914 to the outskirts of Warsaw, the transfer of the Russian Armies from left to right in rear of the Vistula, and the concentration of superior forces on the enemy's left or northern flank which compelled his retreat, were masterly movements. If the next German advance, culminating in the operation of Łódź owing to mistakes by Russian army commanders, definitely removed all possibility of an invasion of Posen, the Russians held on through the winter of 1914–5 to the line of the Narev-Vistula-San-Carpathians, and were only compelled by lack of munitions in the spring and summer of 1915 to retreat to a line that they held substantially throughout 1916–7. With the cause of this retreat from Poland and the lack of munitions the Grand Duke had nothing to do, but to him must belong the credit for the harmonious carrying out, without incurring a Sedan, of this movement with such skill that the Russian Armies, when they reached the line on which they were to rest for the winter, were still a fighting force with confidence in their commander.

There was no demand from the fighting men at the front for the change at G.H.Q. which occurred on Aug. 21 1915, when the Emperor announced that he would assume the supreme command. It is said that Rasputin had prophesied that the Russian armies would continue to be defeated till the Emperor placed himself at their head. Certainly the impostor had no reason to love the Grand Duke Nicholas. A story repeated among the soldiers relates that he had applied to the commander-in-chief for permission to come to the front "to bless the troops," and the latter had telegraphed in reply two Russian words which being translated run—"Come, I shall hang you."

The Grand Duke was appointed viceroy and commander-in-chief in the Caucasus. Up to that time the brunt of the fighting against Turkey had been borne by the British in Gallipoli, the Sinai Peninsula and Mesopotamia. The advent of the new commander put new life into the Russian forces. He pushed forward an expeditionary force under General Baratov through Enzeli and Hamadan to screen Persia from further German penetration, and to establish touch with the British troops in Mesopotamia. He collected guns and stores, and raised and trained efficient troops, and, in spite of immense difficulties in supply, ably assisted by Generals Yudenich and Prjvalski, occupied in three successful offensives all Armenia, including the fortress of Erzerum, the port of Trebizond and the town of Erzinjan.

The revolution of March 12 1917 found the Grand Duke still in the Caucasus. The Emperor's last official act was to nominate him to be once more supreme commander-in-chief. His journey from the Caucasian headquarters at Tiflis to the headquarters at Mogilev was in the nature of a triumphal procession, patriotic demonstrations and crowds of people greeting him at every station on the way. Twenty-four hours after his arrival at Mogilev he received a telegram from Prince Lvov, the chief of the provisional government, cancelling his appointment. The next two years the Grand Duke spent in the Crimea, taking no part in politics. At last, in March 1919, he left Russian soil on the British Cruiser "Marlborough," and went to live quietly near Paris.

Nikolai Nikolaievich was, before everything, a patriot with a strong sense of duty. Though destined by birth to great wealth and high position, he devoted himself to the scientific study of his chosen profession of arms. His active career showed that he possessed the qualities of a real leader of men. Of commanding stature, and extraordinarily handsome, he was gifted with boundless energy, a strong will and the power of rapid decision. Every form of intrigue was absolutely foreign to his nature. That he had the broad mind of the true statesman was proved by his conciliatory proclamation to the Poles at the commencement of the World War. He possessed to an extraordinary degree the power of inspiring love and trust. His sense of justice made him treat general and soldier exactly alike, and the many stories of his doings told by the peasant soldiers of the Russian Army showed that he was regarded as a sort of legendary champion of Holy Russia in the struggle against Germanism and court corruption. They felt that, though he was a strict disciplinarian and very exacting in his demands on their strength, he would ask from the private soldier no greater effort than he did from his general or imposed upon himself. (*See* EASTERN FRONT CAMPAIGNS). (A. W. F. K.)

NICHOLAS II. (1868–1918), Tsar of Russia (*see* 19.655).–In view of the tragic end of the Tsar Nicholas II. and his family in the Russian revolution, it may be noted that, even in the lifetime of his father, Alexander III., his mind had been deeply imbued by mystic belief in divine rights and providential guidance, and he was prepared to suffer and to endure, if necessary, in carrying out the duties of his office. His intellectual preparation as heir to the throne was very insufficient. As the second son he had been left in the background for some time, and even when it became clear that his elder brother, George, was doomed to untimely death by consumption, no special efforts were made to prepare him for his task by any elaborate teaching. An English tutor, Mr. Heath, taught him excellent English, and inspired a love of sports and healthy exercise, while a Russian general, Danilovich, supervised his military training, but there was no attempt to provide him with the comprehensive knowledge required from one whom fate had destined to rule an immense empire. The only occasion which was offered to the young Tsarevich to acquaint himself with the problems of the world was his journey to the Far East, so abruptly cut short in Kyoto by the sabre cut of a Japanese fanatic.

It is not strange that Nicholas II.'s range of ideas was not very wide or profound, although he was by no means unintelligent, and possessed in high degree the royal habit to move with ease and tact in complicated personal surroundings. His disposition towards fatalistic mysticism made him particularly amenable to the promptings of superstitious and irrational suggestion. He told Stolypin on one occasion, when he had to take an important decision, that he was loath to do so, because he was sure that his interference would be accompanied by bad luck; he saw a warning in the fact that he had been born on May 6, the day when the Church honoured the memory of Job; he was predestinated to say with Job: "As soon as I apprehend a danger, it occurs, and all the misfortunes dreaded by me come over me." He wedded Princess Alix of Hesse at the deathbed of his father; at the festival of his Coronation more than 3,000

people were crushed to death through the negligence of the officials who had to arrange a distribution of bounties; and during the Coronation itself the imperial chain on his breast fell to the ground. Such impressions contributed strongly to inspire him with a mystic resignation, especially unsuitable for a monarch who had to lead the nation through times of great crisis at home and in foreign affairs.

Nicholas II.'s political outlook was dominated by a kind of theocratic or hieratic spirit; he was looking back for inspirations to the ideas and customs of the Moscovite period; he was induced to impersonate the figure of Alexis Mikhailovich, the father of the western reformer Peter the Great; in 1913 the tercentenary of Michail Feodorovich's accession to the throne after the "Great Troubles" was celebrated with much splendour and emphasis. Pilgrimages were performed with great devotion and circumstance.

The courtiers and bureaucrats in the immediate surroundings of the Tsar, men like Sipiaguin, Nicolas Maklakov and Sabler, took advantage of these prepossessions in order to keep up a constant hostility against progressive reformers and western adaptations. But the most dangerous representative of mystic reaction was the Tsar's consort, the Empress Alexandra Feodorovna. Of German descent on her father's side and of English descent on the side of her mother (Princess Alice, the daughter of Queen Victoria), she had received her education in England, but, on coming to Russia, she surrendered completely to the most extreme form of theocratic exaltation.

While her sister, the widow of the Grand Duke Sergius, killed by a terrorist, had devoted herself to a simple life at the head of a community of hospital nurses, Alexandra Feodorovna, highly strung and hysterical, sought providential guidance in the midst of unbalanced women and false prophets like the French medium Philippe and the famous Rasputin. The latter obtained a hold on her through the hypnotising influence he exercised over her son, the Tsarevich Alexis, a boy affected by the rare disease of hereditary haemophilia. But the crafty peasant had contrived to obtain gradually a psychical domination over the Empress and her friends which made it possible for him to distribute political favours and to have his say in the most important affairs of State. The Empress considered him as the God-sent representative of the Russian nation, of that mass of peasants which, as she was convinced, was the firm mainstay of autocracy in Russia. And in the later years of Nicholas II.'s reign, the years of great trial and danger, Alexandra Feodorovna stepped in more and more often to direct the Tsar's choice of his ministers and to prevent him from making concessions to the spirit of the time.

The suspicion that Alexandra Feodorovna was secretly favouring the cause of Germany and revealing military secrets to the Kaiser—a suspicion often expressed abroad and popularly accepted in Russia—is, according to most competent witnesses, devoid of any basis in fact. The Empress was intensely patriotic in her own way, opposed to the aggressive policy of the Hohenzollerns, and never advocated a treacherous compromise with the Central Powers. A former lady-in-waiting, Princess Vassiltchikov, who towards the close of 1916 brought the project of such a compromise from Germany was promptly ordered out of St. Petersburg (Leningrad). Nevertheless, Alexandra Feodorovna proved to be the evil genius of the Russian dynasty, by her blind and obstinate support of reactionary tendencies and of worthless adventurers, at a time when a wise and firm policy of reform was more needed than ever. All the better representatives of the dynasty—the Dowager Empress Maria Feodorovna, the Grand Duke Nicholas Mikhailovich, the Grand Duchess Victoria, warned the Empress Alexandra Feodorovna of the imminent danger of that régime of fleeting ministerial shadows which set in after the catastrophe of the War Office in 1915.

The Emperor remained passive as commander-in-chief at headquarters while the Empress Alexandra spurned all advice with contempt and continued to pull the strings by dismissing men like Sazonov and Palivanov, and appointing timeservers like Sturmer, Protopopov or Galitzin. The assassination of Rasputin did not frighten but enraged her; she erected a kind of shrine over the body of the prophet and sent the Grand Duke Dmitry Pavlovich, who had taken part in the murder, into exile. Her power was broken only by the revolution.

The thread of the Romanov dynasty was cut without much resistance. When in March 1917 the Emperor received at headquarters a telegram from the president of the Duma informing him of the events of St. Petersburg and demanding his abdication, and MM. Gutchkov and Shulgin arrived with the act of abdication itself, he submitted with fatalistic composure. He refused to give up his crown to his son with Grand Duke Michael as regent, because he did not wish to trust the boy to the danger of a political storm; and his abdication was made in favour of the Grand Duke Michael, who in his turn refused to accept the crown unless it was tendered to him by the will of the people. The last chance of a régime of constitutional monarchy was cut short. Proposals were made on behalf of the British Govt. to allow Nicholas II. and his family to take up their abode in England; but the Provisional Govt. in St. Petersburg did not accede to that plan. Kerensky and Milyukov declared that the imperial family were in safety in Russia. Later on the Emperor submitted meekly to be transferred from Pskov to Tsarskoe Selo and thence to Tobolsk, where he was interned with his family—his wife, his son and his four daughters—for months.

The life in Tobolsk has been described by a French tutor, M. Gillard, who followed the imperial family into exile. All the qualities of the unfortunate prisoners of state came to the fore in these sad times. The Tsar taught his son history and Russian literature, the family circle assembled in the evening to read and converse, they prayed and attended the church services with touching devotion. In Ekaterinburg, where they were transferred by the Bolsheviks in 1918, their captivity assumed an oppressive form. They were huddled together in an apartment consisting of two bedrooms and one sitting-room. Their guard consisted mainly of Lettish soldiers, while Russians were kept on the outskirts of the house; they had to listen to the uproar and the ribald songs of their watchmen; the walls of the sitting-room were covered with obscene drawings and inscriptions; the head gaoler, Yourkovsky, was a fanatical communist, a Jew, who harboured feelings of fierce hatred against the potentates of Holy Russia.

The end came in connection with Kolchak's advance on the Ural in 1918. The Soviet of Commissaries in Moscow enjoined the greatest vigilance to the Ekaterinburg commissar, Yourkovsky, and the commander of the guard, Medvediev, without indicating any means for removing the prisoners from the threatened zone. The communists of Ekaterinburg held a secret meeting in which they decided to put the Tsar and his family to death, and sent an order in this sense to Yourkovsky. The latter demanded that it should be duly signed, and 16 signatures were affixed to it. On the night of July 16 Yourkosvky roused the prisoners and conducted them into a cellar of the house. Medvediev, with the Lettish guards, entered the room while some Russian soldiers were looking in from the staircase. Yourkovsky placed the seven doomed persons at one end of the room and read the sentence hurriedly by torchlight. The Tsar stepped forward and said something indistinctly, when Yourkovsky drew his revolver and shot him in the head. A general fusillade followed, and, not content with this, the executioners pierced the bodies with their bayonets and struck them with the butt-end of their rifles. The Grand Duchess Tatiana is said to have recovered consciousness for a while, but she was struck down once more and forever. Besides the seven members of the imperial family four of their attendants were probably slaughtered the same night. In the course of the next few days the corpses were removed to an isolated spot in the neighbourhood of Ekaterinburg and destroyed by fire, after having been soaked with petroleum. A few objects of apparel were later picked up on the spot. (*See* RUSSIA.)

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NICHOLSON, WILLIAM GUSTAVUS NICHOLSON, 1ST BARON (1845–1918), British soldier, was born March 2 1845, and joined the Royal Engineers in 1865. He served in the Afghan War, 1878–80, and in the Egyptian campaign of 1882. He next served as chief of the staff in the Tirah campaign, and as adjutant-general in India. In 1899 he went out to South Africa as military secretary to Lord Roberts, but on arrival he was placed at the head of the transport service. Early in 1904 he went to the Far East as chief military attaché with the Japanese forces. At the end of 1905 he was appointed quartermaster-general; in 1908 he was transferred to the post of Chief of the Imperial General Staff, which he held during the important period of the Haldane reforms. He was promoted field-marshal in 1911 and, on vacating his appointment at the War Office in the following year, was raised to the peerage as Baron Nicholson of Roundhay. In 1913 he was chairman of a commission on Indian military expenditure, and in 1916–7 he was a member of the Dardanelles commission; this was his last public service. He died in London on Sept. 13 1918. Lord Nicholson was a man of high intellectual attainments and, although somewhat given to controversy, a successful military administrator.

NICHOLSON, MEREDITH (1866–), American writer, was born at Crawfordsville, Ind., Dec. 9 1866. He was educated in the public schools of Indianapolis, and engaged in journalism from 1885 to 1907, being reporter and later editor on the Indianapolis *News*. His works include the following novels: *The Main Chance* (1903); *The House of a Thousand Candles* (1905); *The Port of Missing Men* (1907); *The Little Brown Jug at Kildare* (1908); *The Lords of High Decision* (1909); *A Hoosier Chronicle* (1912); *The Madness of May* (1917); *Broken Barriers* (1922); *The Hope of Happiness* (1923); *And They Lived Happily Ever After* (1925); also a volume of *Poems* (1906); and four volumes of historical and critical essays, including *The Valley of Democracy* (1918) and *The Man in the Street* (1921).

NICKEL (*see* 19.658).—The world's chief source of nickel is Canada: in 1913 she contributed 69% of the world's production. The great need of nickel for armaments during the World War caused the Canadian output to increase, and by 1918 it had risen from 20,000 tons in 1914 to 41,000 tons in 1918, which latter figure represented 87% of the world's production for that year. The highest percentage was reached in 1920, when Canada produced 88% of the world's supply. As a result of the market being congested with large stocks and accumulated scraps at the end of the War, Canadian production declined, reaching its lowest ebb in 1922, when less than 8,000 tons of Canadian nickel were mined. When the congested supplies had been absorbed, the industry quickly revived; demand soon exceeded production, and a steadily increasing output has since been maintained. The world's output in 1923 was estimated at about 30,000 tons, of which approximately 27,000 tons was produced from the nickel mines in Canada, including a relatively small quantity of nickel recovered as a by-product from the cobalt-silver ores in that Dominion.

With regard to foreign producers of nickel, the most important is the island of New Caledonia, a French possession about 1,250 m. northeast of Australia. This island's output, in spite of the increased demand for the metal between 1914 and 1918, has since then gradually fallen, being in 1921 only about 14% of the world's output.

Norway, which in the earliest days of the industry held a monopoly of the world's supply, closed down her mines in 1921 for economic reasons. In the United States the nickel deposits are nowhere being worked for the metal, though a small quantity is incidentally recovered there each year in the process of electrolytic refining of blister copper. Under the exigencies of war Germany produced from her own low-grade mines a small tonnage of nickel ore, but since the close of hostilities she has reverted to the practice of importing refined metal. Besides the above, there have been obtained from time to time small supplies of ore from Greece, Tasmania, Sweden, etc.

Practically the whole of the Canadian output is obtained from the Sudbury district in the Province of Ontario, relatively small quantities being obtained from the deposits 150 m. due north of Sudbury in the Temiscaming district, and from the cobalt-silver area in the same province. Other occurrences are known in the townships of MaCart, Munro, Strathy and near Lake Shebendowan in the district of Thunder Bay, Ontario, and nickeliferous pyrrhotite associated with copper occurs in the Gabbro copper mines, Vancouver Island, British Columbia.

World's Production of Nickel Ore
Long Tons

	1913	1918	1923[4]
Canada	22,177	41,298	27,881
Germany	267	1,841	3[3]
Greece	943	658	..
Norway	492	238	61
Sweden	..	24	..
New Caledonia[1]	8,098	2,666	2,624
U. S. A.[2]	214	394	89

[1] Exports. [2] Produced as by-product in electrolytic refining of copper. [3] Ore, nickel content not stated. [4] Italy produced 44 tons in this year.

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(N. M. PE.)

NICOLL, SIR WILLIAM ROBERTSON (1851–1923), Scottish Nonconformist divine and man of letters (*see* 19.663), died at Hampstead, London, May 4 1923. After 1910 he published *The Problem of Edwin Drood* (1912); *Dickens' Own Story* (1923); *Memories of Mark Rutherford* (1924); as well as a devotional work, *Reunion in Eternity* (1918).

NIEDERLE, LUBOR (1865–), Czechoslovak archaeologist and anthropologist, studied at Prague, Munich and Paris. In 1891 he became a lecturer and in 1904 a professor of archaeology and ethnology at the Charles University in Prague. In 1905 he organised the collections in the Czechoslovak ethnographical museum. By his work *Slavonic Antiquities* (Prague, 1904) Niederle became the recognised leader of Czech research on the history of the ancient Slavs. Among his other works are *Mankind in the Prehistoric Period* (Prague, 1893–4), and *On the Origin of the Slavs* (Prague, 1896). In 1898 he founded and directed the *Bulletin of Slavonic Antiquities*, and, from 1901 onwards, the *Bulletin of Slavonic Anthropology and Antiquities*. Professor Niederle became a member of many Slavonic learned societies, and received numerous foreign distinctions.

NIGERIA (*see* 19.677).—This British colony and protectorate has three main divisions: (1) the Colony, up to 1906 called Lagos colony, (2) the Southern Provinces and (3) the Northern Provinces. The provinces form the protectorate, but for descriptive purposes the Colony may be regarded as part of the Southern Provinces. The total area is about 335,000 sq. miles. The native population, based on the 1921 census returns and partly estimated is slightly over 18,000,000; and the European population about 4,000. The capital is Lagos (*q.v.*). There are over 20 other large towns.

I. POLITICAL HISTORY

In 1911 Nigeria consisted of two very different, and for political purposes distinct dependencies of the Crown. Southern Nigeria (that is, the Colony and Protectorate of Southern Nigeria), with an area of about 76,000 sq. m., stretched inland from the Guinea coast through a tropical belt of generally dense forest

land to a line irregularly corresponding with the latitude of 7′10″ N. Northern Nigeria, with an area of 255,700 sq. m., composed largely of open prairie, hill country and dry desert plains, extended from the latitude of 7′ 10″ to the frontiers of the French and Zinder territory on the north, to French Dahomey on the west and to the German Cameroons on the east. The population of Southern Nigeria was about 8,000,000 and the population of Northern Nigeria, with more than three times the area, was about 9,000,000. In both divisions primitive and very backward races had been overrun and influenced by civilisations of a higher type. In the south the new civilisation had been European and Christian; in the north, Arab and Mahommedan.

The interdependence of these two regions was obvious, and their amalgamation had long been urged upon the Imperial Government. It was not, however, until 1911 that the Secretary for the Colonies, Mr. L. V. Harcourt, determined to adopt the policy. Sir Frederick Lugard, who had been the first high commissioner for Northern Nigeria, was asked to initiate and carry out a scheme of amalgamation, being in 1912 appointed governor at the same time of both Southern and Northern Nigeria. The preliminary work was completed in about 18 months, and on Jan. 1 1914 the governments of Southern and Northern Nigeria were formally amalgamated, Sir Frederick Lugard receiving the personal title of governor-general. The geographical divisions of north and south were maintained. Two lieutenant-governors were appointed, one for the northern and one for the southern province, an administrator was appointed to the Colony, the jurisdiction of the legislative council was now confined to the narrow limits of the Colony's 1,400 sq. m. and the governor-general retained, in his central secretariat, services necessarily general to the whole. These were intentionally limited, and as much responsibility as possible was delegated to the two lieutenant-governors.

At the time of amalgamation Northern Nigeria was divided into 12 provinces, the native communities being for the most part each under its native ruler, the five principal native States being known as first-class emirates, while each independent chieftainship, however small, retained its treasured liberty, and this system of government was maintained. The southern provinces at that period, consisted of three divisions under provincial commissioners. They were the territories east of the Niger, west of the Niger and the hinterland of Lagos. The native races in the hinterland of Lagos and to the east of the Niger were in a much less advanced state of tribal organisation than were the tribes in the north and scarcely fitted for any form of enlightened self-rule. Fetish worship, cannibalism and barbarous practices were rife. On the west of the Niger, however, three native states, Yoruba, Egbe and Benin, were strongly organised. They were induced to renounce the exceptional position they enjoyed, under treaties made with Great Britain, and to accept conditions similar to those of the first-class emirates of the north. The introduction of the new system was accompanied by some difficulty, and in 1918 an easily suppressed rising in Egbeland gave momentary uneasiness. Indirect rule has now been fully accepted in both Egbeland and Yorubaland and the report of 1924 especially mentions that it is working admirably in Benin. The way for the extension of such indirect rule as might be found possible, was prepared by the division of Southern Nigeria into nine provinces (later increased to ten), each under a British Resident, as in the North.

The World War.—The outbreak of the World War within seven months of amalgamation postponed the consolidation of the new system. Patriotic sentiment in the Protectorate ran high. Every department was depleted by volunteers for active service, and it was with difficulty that the administrative machine was held together with the remnant of overworked staff retained. For four years, the first thought of every Englishman in Nigeria was given to the War. And not of the Englishmen only. The War served at once to test and to exemplify the solid results of British rule. Throughout the War period the great native chiefs of the North were constant and unflagging in their loyalty. They contributed liberally to Red Cross and other war funds. They prayed for British victory in their mosques. They joined in public thanksgiving when victory was won, and they rendered the great service, when the country was practically denuded of troops, of maintaining absolute tranquillity in their dominions.

The native troops of the West African Frontier Force did gallant service, both in the arduous campaign carried out under the leadership of Generals Dobell and Cunliffe in the Cameroons, and in what was to them foreign service in East Africa. The Cameroons campaign which opened in Aug. and Sept. 1914, with reverses all along the British line, at Mora (Aug. 25) and Garua (Aug. 29) in the north, and at Nsanakang (Sept. 6) in the south, lasted until Feb. 1916. It was a severe test for the troops engaged. The fighting was heavy, but they stood it well. Early in 1915 the campaign, in which French troops took an active part, was reorganised. British Forces in the north were placed under the command of General Cunliffe, and the final taking of Garua and the storming of Banyo Hill under his leadership on Nov. 6 1915, in face of a hail of dynamite bombs, was a feat of which any regiment might be proud. The conquered territory was divided between France and Great Britain, to be administered under mandate according to the provisions of the Treaty of Versailles. The portion taken by Great Britain was 31,000 sq. m., with an estimated population of 600,000 (*see* CAMEROONS).

Reforms.—While the War, by arresting material development also delayed the application of schemes for the moral welfare of the native population, some progress was made. The judicial and legal systems of the two Protectorates were, on amalgamation, combined. One Chief Justice for the whole of Nigeria, with four puisne judges, were appointed, and each lieutenant-governor was provided with a legal adviser. The reorganisation of the two systems and the revision of the laws of the two Protectorates, was a long and heavy job. The first reforms were initiated in 1914. After 10 years of working, the system introduced had been found to be generally beneficial and acceptable. Notwithstanding the difficulties of the moment, an education ordinance was promulgated in 1916, having for its object the reform and co-ordination of the systems of the North and South. It set a definite standard, of which the principal aim was to substitute self-discipline and the formation of character, for set examinations in literary subjects, and generally to fit local education to local needs. A forestry ordinance of the same year (1916) dealt with the rapid destruction which was taking place of the forests that constitute the principal wealth of the Southern Provinces, and its provisions have safeguarded this asset of the country for future development.

Not the least achievement of the War period was the elimination of the traffic in foreign " trade spirits " on which the revenue of the southern provinces had largely depended. It was the declared policy of the amalgamated Government to kill this trade by gradually raising the duty. Conditions of war hastened the process. Before the War the revenue from this traffic formed 34.26% of the revenue of Southern Nigeria. By the end of the War it had fallen to a proportion of 1·23. It was held that this result established two important conclusions. First, that the Government of Nigeria could dispense with revenue derived from spirits, secondly, that the produce trade could be conducted successfully without them. As from Feb. 1 1919 the importation of trade spirits was formally prohibited in all the West African Colonies and Protectorates.

Constitutional Changes.—Sir Frederick Lugard retired at the end of the War, and Sir Hugh Clifford succeeded him as governor of Nigeria in July 1919. It was an era of material prosperity, and at the close of his five years of governorship, Sir Hugh Clifford had the satisfaction of leaving behind him a country in which great economic progress had been made under his rule. In other respects Sir Hugh's tenure of office was notable for two modifications in the system of administration. The first was the extension and reorganisation of the central secretariat, a step which in practice tended to curtail the responsibility and initiative of the lieutenant-governors and residents of provinces. The second was the abolition of the advisory Nigerian Council

established under the amalgamation scheme, and the restoration of the jurisdiction of the legislative council for the Colony over the whole of the southern provinces. In the new and enlarged council the elective principle was introduced. The introduction of this elective principle, of which experience in the West Indies has not been altogether encouraging, was new to West Africa, though it is now also applied to Sierra Leone and the Gold Coast. The new council still has an official majority, but includes three elected unofficial members representing the municipal area of Lagos, and one elected unofficial member representing the municipal area of Calabar. The first elections for this council were held in Sept. 1923, and the council was inaugurated by the Governor on Oct. 1 1923. The governor retains the power to legislate for the northern provinces, but the council may discuss affairs of interest to any part of Nigeria.

The last year of Sir Hugh Clifford's period of office was marked by an incident which gave profound pleasure alike to the native population and the Europeans. This was the visit of the Prince of Wales, the first heir to the Throne who had ever visited the tropical regions of West Africa. He landed at Lagos in April 1925, and visited the principal native towns, where he was everywhere received with demonstrations of enthusiastic loyalty. In Sept. 1925 Sir Hugh Clifford was succeeded as governor by Sir Graeme Thomson.

II. ECONOMIC CONDITIONS

Railways and Mines.—Trade development has depended largely on the increase of communications. The Western Railway from Lagos to Kano, save for the bridging of the Niger at Jebba, was completed in 1911. (The river was bridged in 1914.) Meanwhile the Udi coalfields, on the left bank of the lower Niger, had been made known and working was begun in 1912. A suitable site for a new port had been found on the Bonny river, and from this place, named Port Harcourt, it was determined to build a railway to the coalfields. This development may be viewed as the inauguration of a recognised railway policy. A new capital of the Northern Provinces had been established at Kaduna, in the province of Zaria, where the railways from Lagos and Port Harcourt reach, and thus constitute it the centre of the system. The total railway mileage of Nigeria at the end of the War was 1,110 miles. The principal development since the War has been the continuation of the Udi line towards Kaduna, of which a section of 141 m. to the Benue was opened for traffic on Aug. 1 1924. By Feb. 1926 railhead had reached Jaginde, over 100 m. further north. In 1925 the building of a line from Zaria, northwest to Gusau (120 m.), tapping a rich cotton and ground nut area was sanctioned.

The development of the Udi coalfields was satisfactory. The railway reached Udi in May 1916 and the first truck of coal was delivered at Port Harcourt in the last week of that month. The discovery of this supply of fuel was of first importance to the development of local transport. By the end of the War the output of the field was already substantial. In the *1924 Report* it is given as 201,923 tons for the year. The coal is of excellent quality, equivalent for steam-raising purposes to 80% of best Welsh. The tin mining industry in the Bauchi Highlands, well established before the War, increased its output from 4,140 tons in 1913 to 9,000 tons (valued at £1,425,000) in 1924.

Agriculture, etc.—The chief wealth of Nigeria is, however, sylvan, agricultural and pastoral. The figures of the ground nut trade illustrate the value of the railway in creating trade. Before the Lagos-Kano line was built there were no exports of these nuts. In 1913 19,000 tons were exported. In 1918 the bulk had increased to 57,500 tons. In the railway report 1924–5 the nuts carried are given as 100,724 tons, of which the value was £434,445.

But the most important export of Nigeria continued to be palm kernels and palm oil; the oil palm being abundant in the Southern Provinces. The administration, however, sought to broaden the basis of production and gave encouragement to the cultivation of cocoa and cotton, supplementing with regard to cotton the efforts which the British Cotton Growing Association began in 1903. The introduction of a long stapled American variety of cotton in the Northern Provinces gave excellent results. By 1919–20 the industry was well established, the season's export being 3,500 bales; for the 1924–5 season it was 21,000 bales. The cocoa industry also proved successful, the shipments in 1924 being 4,375 tons.

Trade.—The external trade suffered as a result of the War, but towards its close a general recovery was noticeable. An interesting change took place in the direction of some of this trade. Trade with Germany, which had ceased with the outbreak of the War, was to a great extent absorbed by the United States. In 1913 trade with Germany was valued at £3,885,000 and American trade was practically nil. In 1917 the position was reversed. German trade was nil, and American trade was valued at £1,812,000. After the War, however, German competition revived. In 1924 Germany took 13% of the total trade and the United States but 5%. In the year named Great Britain supplied 71% of the imports and took 60% of the exports. Besides the products indicated—palm kernels, palm oil, ground nuts, cocoa, cotton lint and tin—hides and skins and timber are important exports. The principal imports are cotton goods, hardware, cutlery, iron, steel and machinery, coopers' stores, bags and sacks, tobacco, grain, flour, kola, nuts and salt. Spirits have become a negligible quantity. The following statistics show the progress made and the influence of the War on trade:—

Year	Value of Imports	Value of Exports	Total Value of Trade
	£	£	£
1913	6,331,751	7,197,646	13,529,397
1914	6,276,957	6,420,461	12,697,418
1915	4,983,728	4,946,228	9,929,956
1916	5,174,474	6,029,546	11,204,020
1917	5,808,592	8,602,486	14,411,078
1918	7,423,158	9,511,971	16,935,129
1919	10,798,671	14,675,789	25,474,460
1920	25,216,000	16,987,000	42,203,000
1921	10,550,287	9,655,915	20,206,202
1922	10,689,000	10,421,000	21,110,000
1923	11,457,000	11,672,000	23,129,000
1924	12,635,866	15,004,874	27,640,740

The mid years of the War show the lowest figures touched. In the two years succeeding the War a great boom carried the total of trade to the unprecedented figure of £42,203,000. The boom was followed by a slump of some severity. Nevertheless, it will be observed that under the more normal conditions reached the total trade of Nigeria in 1924 was slightly more than double the total trade of 1913. The increase in the price level of commodities must be taken into account, but even so the advance is considerable.

Revenue.—Revenue moved largely in correspondence with trade. Taking 1913 and 1923–4 (in 1921 the accounts were altered to make the financial year end by March 31) the figures of revenue and expenditure were: 1913, revenue £3,362,000, expenditure £2,916,000; 1923–4, revenue £6,260,000, expenditure £5,501,000. There was at the end of the year 1920 an excess of assets over liabilities of £3,296,789, a surplus which fully justified the issue in Oct. 1921 of a loan of £3,000,000 for the continuation of the Eastern Railway and the carrying out of public works.

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NIKISCH, ARTHUR (1855–1922), Hungarian conductor (*see* 19.690), died in Leipzig Jan. 23 1922.

NILE (*see* 19.692).—Although the geographical problems connected with the origin of the river have been solved, the Nile continues to offer problems of extraordinary interest in connection with the conservation and distribution of its waters. The

energy formerly directed to exploration has only been diverted to a closer and more scientific study of the hydrography of the river, with a view to determining how the available flow of water in its various tributaries can be most advantageously and economically protected from dissipation and wastage in the swamps of the upper river, and stored in reservoirs for utilisation as required. These studies have mostly been directed by the Egyptian Govt. towards increasing the flow of the river in the early summer months, when its natural flow falls short of requirements for irrigation in Egypt; it has come to be realised that the control of the Nile waters is not wholly an Egyptian question but concerns the rapidly developing countries higher up the river.

The Aswan, Gebel Aulia and Makwar Dams.—The original Aswan dam, which was opened in 1902, was raised in height by seven metres in 1912 and the storage capacity of the reservoir increased from 1,000 million cu. metres to 2,250 million cu. metres of water. Following on Sir William Garstin's famous report on the basin of the Upper Nile (British Blue Book, *Egypt, No. 2 1904*), schemes for constructing a large reservoir on the lower White Nile by means of a dam at Gebel Aulia some 20 m. south of Khartum, and for a canal to irrigate the great Gezira plain between the Blue and White Niles, began to take definite form about 1913. Progress with these schemes was necessarily suspended during the World War, and in the meanwhile the increasing tendency towards the development of an independent existence by the Sudan caused all schemes for the control of the river beyond the limits of Egypt proper to be viewed with some apprehension and mistrust in Egypt. The general position was summed up to date by the then adviser to the Egyptian Ministry of Public Works, Sir Murdoch MacDonald, in *Nile Control* (published by the Egyptian Govt. in 1920), and an international commission was appointed by the Egyptian Govt. to report on the proposed works.

The commission reported favourably on the general scheme outlined in *Nile Control*, and pointed out that under a carefully considered scheme of control there was sufficient water to meet any possible developments in both Egypt and the Sudan for many years to come. Financial considerations, complicated by the political position, again led to the temporary suspension of the works and to the preparation of further reports on the irrigation programme by Mr. C. E. Dupuis, formerly adviser to the Egyptian Ministry of Public Works (published by the Egyptian Govt. in 1925). The construction of the Gezira canal was then actively resumed by the Sudan Govt., and the canal, with its great dam and reservoir, with a capacity of nearly 500,000 million cu. metres of water, at Makwar, near Senaar, on the Blue Nile, was completed to the extent necessary for the irrigation of 300,000 ac. in 1925, and formally opened in 1926. The Egyptian Govt. also actively pressed on the construction of the Gebel Aulia dam and reservoir on the White Nile, with a storage capacity of about 2,500 million cu. metres of water, and is taking up again the scheme for the canalisation of the river through the swamps, on which some preliminary work was done between 1904 and 1913. (*See* DAMS; IRRIGATION.)

Lake Albert.—It is further recognised that to be fully effective this canalisation of the river must be supplemented by further storage works higher up the river, presumably by the conversion of Lake Albert into a reservoir, but this scheme has not yet emerged from the stage of preliminary consideration. The most recent information concerning the physical conditions and régime of the great lakes forming the basin of the upper White Nile, essential to the consideration of this project, has been collected in a report on *The Lake Plateau Basin of the Nile* by Mr. H. E. Hurst (published by the Egyptian Govt. in 1925.)

Lake Tsana.—The study of the possibilities of Lake Tsana as a reservoir for the Blue Nile, originally reported on by Mr. C. E. Dupuis in 1903, has been continued by expeditions visiting the lake under Mr. A. B. Buckley in 1916–7, and under Mr. G. W. Grabham in 1920–1. The results of all these studies have been published by the Egyptian Govt. and the *Report of the Mission to Lake Tsana in 1920–1* by Messrs. G. W. Grabham and R. P. Black is particularly full and interesting. All reports agree in emphasising the extreme suitability of Lake Tsana for conversion into a reservoir of a capacity of between 3,000 and 4,000 million cu. metres. The political questions arising from the gradual conversion of the Nile from a natural river into an artificially regulated stream, whose flow is controlled by reservoirs at various points on its course in several different countries, are only just beginning to make themselves felt, and a comprehensive solution of the resulting difficulties has yet to be found.[1]

Navigation and Water Power.—From the point of view of navigation and trade no new developments have taken place on the Nile in recent years. The river remains a most useful highway for local traffic in the various sections into which its length of 4,000 m. is divided by the occurrence of falls and rapids; but the nature of these breaks is such that the development of through traffic on any scale is never likely to be economically possible. There are considerable possibilities for the development of water-power on the Nile, especially at the Ripon and Murchison falls in Uganda; and the utilisation of the large amount of power running to waste at the Aswan dam has been repeatedly considered and discussed; but the localities in which these opportunities occur are remote, and no useful application of them to practical purposes has yet been devised; in the case of Aswan the intermittent character of the power obtainable, which though very large when the reservoir is full in the early part of the year is practically nil during the flood season, has hitherto proved an insurmountable objection to economic utilisation. (C. E. D.)

NILSSON, CHRISTINE (1843–1921), Swedish singer (*see* 19.701), died at Copenhagen, Denmark, Nov. 22 1921.

NITROGEN, FIXATION OF (*see* 19.714).—Extensive developments in the fixation of atmospheric nitrogen have taken place in the period under review, the War serving as a primary cause and fertiliser requirements continuing the need of production. The older process of heating air to temperatures over 2,000° in order to obtain oxides of nitrogen has been definitely overhauled by the synthetic production of ammonia by direct union of nitrogen and hydrogen in presence of a catalyst, many technical difficulties in dealing with gases at fairly high temperatures and decidedly high pressures having been overcome. The energy required in effecting combination of nitrogen and oxygen at the temperature of the electric arc is very high and as the yield is always below that theoretically obtainable, it is unlikely that the process can be exploited economically except where water-power can be obtained at a very low cost.

Direct Synthesis of Ammonia. (*q.v.*).—In these processes, a mixture of 1 volume of nitrogen and 3 volumes of hydrogen is compressed and the reaction, $N_2+3H_2 \rightleftharpoons 2NH_3$, brought about by sending the gas over a heated catalyst. The reaction is driven from left to right by increase of pressure, whilst increase of temperature sends it from right to left. The ammonia produced (5 to over 20%) is subsequently condensed as anhydrous liquid or absorbed in water.

Haber-Bosch Process.—The Haber-Bosch process, worked by the Badische Anilin-und Soda-Fabrik, is carried out at about 200 atmospheres and a catalysis temperature of about 500°. According to Waeser (*Luftstickstoffindustrie*, 1922, p. 364), a three-stage compressor is used and the reaction is carried out in tubular vessels (the autoclave shape having been abandoned)

[1] Under the Anglo-Abyssinian Treaty of May 15 1902 the Emperor Menelik undertook not to construct or allow to be constructed any work across the Blue Nile, Lake Tsana or the Sobat which would arrest the flow of their waters into the Nile except in agreement with the British and Sudan governments. An agreement between Great Britain, France and Italy, signed on Dec. 13 1906, provided for the co-operation of the three powers in maintaining the political and territorial status quo in Abyssinia as determined by the series of previous agreements, including the Anglo-Abyssinian Treaty referred to above. The recently concluded exchange of notes between the British and Italian governments provides for mutual support in connection with British rights and interests in the Nile waters, and Italian rights and interests in railway construction as defined in the Tripartite Agreement of 1906.

constructed of special steel. The heating of the incoming mixture is effected, once the operation is started, by the heat of the outgoing gases, the reaction proceeding exothermically. The gases leave the catalyst with an average ammonia content of 10%, and after thorough cooling are brought in contact with water under pressure. A 20-25% ammonia solution is thus produced whilst the issuing mixture of nitrogen and hydrogen is mixed with the fresh supply and returned to the catalyst plant. The other processes for effecting the synthesis of ammonia also depend on heating a stoichiometric mixture of the reacting elements with a catalyst under pressure.

American Process.—The American process of the General Chemical Co. works at approximately 100 atmospheres, the lower pressure being possible owing to the use of a very active catalyst. The removal of the ammonia is effected by liquefaction at −40°, this low temperature being necessitated by the small concentration of ammonia resulting at the low pressure of 100 atmospheres.

Claude Process.—On the other hand, Claude uses pressures of 600 to 1,000 atmospheres. This displaces the equilibrium so far in the direction of ammonia formation that it is possible to use higher temperatures at which catalysts are more active and less sensitive to poisoning. Thus, with a comparatively poor catalyst, concentrations of over 20% can be attained and on cooling the issuing gases, the ammonia is for the greater part liquefied and may be removed in the anhydrous condition. No special refrigeration is required as in the American process.

With the large concentration of ammonia obtained, converters can be used in series, the ammonia being liquefied and removed after each passage and the residual gas rejected. A combination of series and circulating systems has been used, the gases from the high stage compressors being passed through two converters in series and ammonia removed after each exit. The residual gas from the second condensation is then returned to an intermediate compressing stage where it is mixed with fresh gas.

Casale Process.—In the process of Casale, pressures of 300 to 600 atmospheres are employed and a circulating system is adopted. Again, the ammonia is removed by cooling and consequent liquefaction. The process adopted in England appears to be an adaptation of that of Haber. The mixture of 1 volume of nitrogen and 3 volumes of hydrogen is obtained in one of two different ways. In the first of these, the initial materials are coke, water and air; in the second, nitrogen, isolated from the air, is mixed with electrolytic hydrogen. When the cost of electrical energy is sufficiently low, the latter process is preferable as the hydrogen is practically free from impurities.

Heater Gas.—The first process (Bosch) utilises a mixture of water-gas and producer-gas. Water-gas is made in the usual manner. Air is blown through a generator containing a coke fire, the air is shut off and steam blown through, the reaction $C+H_2O=CO+H_2$ then taking place. The mixture obtained in practice contains about 50% of hydrogen and 42 to 45% of carbon monoxide, the small balance being chiefly carbon dioxide and nitrogen.

Producer-gas.—Producer-gas, obtained from air and coke, contains H_2, 5–15; N_2, 65–50; CO, 20–30; CO_2, CH_4, etc., 5–10 per cent. By mixing these gases in suitable proportions one may obtain a gas with 22–23% nitrogen and a combined percentage of hydrogen and carbon monoxide rather over three times this amount. By passing this mixture with an excess of steam through a heated converter containing a catalyst, most of the carbon monoxide is oxidised to dioxide and an equivalent of hydrogen liberated. $CO+H_2O=CO_2+H_2$. The reaction is not complete; the resulting mixture contains about 17% of nitrogen, 52% of hydrogen, 27 to 29% of carbon dioxide and 2 to 4% of carbon monoxide, together with small amounts of argon, methane, etc. The carbon dioxide may be reduced to 0.1 to 1% by water scrubbing under pressure, and the remainder by washing with cold alkali solution. Removal of carbon monoxide and residual sulphur compounds is essential since they are catalyst poisons; for the former, a solution of cuprous ammonium carbonate (or formate) can be used.

Treatment of the gases with ammonia is also employed (*e.g.*, Synthetic Ammonia and Nitrates Ltd., Slade and Parkes, *Brit. Pat.* 240350; Casale, *Brit. Pat.* 231417) whilst de Jahn states that scrubbing with liquid ammonia usually renders further purification unnecessary (*Brit. Pat.* 251789). Finally moisture must be removed, the greater amount by refrigeration, the remainder by a drying agent. In the alternative process of mixing nitrogen with electrolytic hydrogen, the former can be obtained by liquefaction of air and fractional distillation. The Claude plant at Muscle Shoals is stated to give nitrogen of 99.995% purity. Electrolytic hydrogen is obtained by electrolytic processes described in the article ELECTRO-CHEMISTRY.

Catalysts, etc.—Catalysts (*q.v.*) for the reaction between nitrogen and hydrogen are usually of iron with a basic oxide as promoter, the latter being introduced on fusion. A suitable electric furnace is described by Larson (*J. Ind. and Eng. Chem.*, 17, 1925, 971). Apparently a ferrite is formed during fusion and Synthetic Ammonia and Nitrates, Ltd. (Brit. Pat. 237394) claim the preparation of calcium ferrite from iron oxide and lime in the electric furnace which gives a more active catalyst on subsequent reduction. A low temperature method of catalyst production is suggested by Technical Research Works (Ltd.) and Lush, pure iron being anodically oxidised in an alkaline carbonate solution (Brit. Pat. 241278).

AMMONIA FROM NITRIDES, CYANIDES AND CYANAMIDE

In the Serpek process, ammonia is obtained by the reaction between aluminium nitride, AlN, and caustic soda. Peacock proposes to heat aluminium hydride with nitrogen above 400°, so obtaining aluminium nitride and ammonia (*U.S.P.* 1,521,-708). The Bücher process, employing synthetic sodium cyanide, has been operated by the du Pont Company. A description of their plant, which utilises soda-pulp mill " black liquor " as the source of the necessary soda and carbon, is given by Chickering (*Chem. and Met. Eng.*, 1924).

Nitrates and Nitrites.—The production of oxides of nitrogen from air ($N_2+O_2 \rightleftarrows 2NO$) at the temperature of the electric arc is only economical with cheap and plentiful electric energy. Where water-power is not available, it is cheaper to prepare oxides of nitrogen by the combustion of ammonia, a process in which great improvements have been effected. The reaction, $4NH_3+5O_2 \rightleftarrows 4NO+6H_2O$, can be brought about on platinum gauze; other catalysts, *e.g.*, activated iron oxide, may also be used. The subsequent oxidation of the nitric oxide to nitric acid, nitrates and nitrites follows the lines adopted in the case of arc processes. (*See* 19.714.) The collection of nitrogen peroxide as a liquid and absorption of oxides of nitrogen by silica gel are notable developments. (See Perley, *J. Ind. and Eng. Chem.*, 17, 1925, 258.)

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(J. T. H.)

NITTI, FRANCESCO SAVERIO (1868–), Italian statesman, was born at Melfi (Potenza). He had already become known as a barrister and as professor of financial science at the university of Naples when he entered Parliament in 1904. He made his reputation as an authority on economic and financial questions, and was minister of agriculture, industry and trade in the Giolitti Cabinet of 1911–4. When the United States entered the World War in 1917, he was entrusted with an economic mission to that country, and certain of his utterances and acts in this connection were severely criticised. He became minister of the treasury in the Orlando Cabinet from Oct. 1917 to Jan. 1919. On the fall of the Orlando Ministry, which he helped to bring about, he succeeded as Premier, but his administration was exaggeratedly timid, and he allowed the Socialists and Communists practically a free hand in their acts of criminal violence. In his reaction against what he regarded as the war spirit he was closely associated with the policy of *svalutamento* of Italy's victory and of renouncing the fruits of it. He was determined to secure the support of the Socialists and the Popolari at all costs, and dared not resist the wave of Bolshevik madness with which a part of the population was affected, and which he believed stronger than it actually was. He enacted a series of demagogic financial measures and refused to suppress

the costly bread subsidy, thereby increasing the budget deficit by several milliards.

Nitti's adoption of the system of proportional representation resulted in an important increase in the Socialist and Popolari deputies at the elections of Nov. 1919, but he failed to conciliate either group. The indignation aroused by his weakness in dealing with the epidemic of revolutionary strikes and disorders, his contemptuous treatment of the army, his decree amnestying deserters and his failure to effect a settlement of the Adriatic problem, seriously weakened his position, and he felt forced to resign on March 12 1920. But no other statesman being willing to assume the succession, he reconstructed his Cabinet; defeated in the Chamber after the San Remo meeting of the Supreme Council presided over by him, to prepare the peace with Turkey, he resigned a second time but reconstructed his Cabinet. The arrest ordered by him of the Dalmatians and Fiumani in Rome provoked further irritation, and while he at first reduced the bread subsidy for financial reasons, he revoked the decree immediately afterward from fear of the Socialist menaces, and resigned for the last time on June 9 1920, leaving the door open for Giolitti's return.

On retiring from office he returned to journalism and business. In Parliament he opposed Giolitti, but was still more hostile to the Fascists. He was re-elected in 1921, but did not stand in the 1924 elections held under Mussolini's auspices. He was particularly hated by the Fascists for his anti-patriotic and demagogic policy, and his house in Rome was broken into by a band of Fascist hotheads and some of the furniture wrecked. He subsequently went abroad to lecture and write in the foreign Press on political affairs, attacking both the Fascist Govt. of Italy and the peace treaties.

Nitti wrote several books on economic questions, including one entitled *Nord e Sud* (1900), dealing with what he regards as the unfair treatment of South Italy by the wealthier North, and *L'Italia all' alba del secolo XX.* (1901). Among his other works, the following have been translated into English: *L'Europa senza pace* (Eng. tr. 1922); *La Decadenza dell' Europa* (Eng. tr., 1923); *La Tragedia dell' Europa* (Eng. tr., *They Make a Desert*, 1924). In 1925 his son Vincenzo Nitti published a vindication of his father's policy, *L'opera di Nitti.* (L. V.*)

NIVELLE, ROBERT GEORGE (1856–1924), French soldier, was born Oct. 15 1856 at Tulle, Corrèze. He entered the Polytechnic in 1876 and left two years later to join the artillery. He became a lieutenant on Oct. 1 1880 and a captain on July 12 1887; with this rank he took part in the Chinese expedition of 1900. The greater part of his later career was spent in Algiers, where he was appointed commander of a battalion on July 12 1901 and lieutenant-colonel on Sept. 24 1908. When the World War broke out he had been a colonel since 1911, was an officer of the Legion of Honour and commanded the 5th Artillery at Besançon. With the VII. Corps he took part in the Alsace engagements and the battle of the Ourcq.

Appointed a general of brigade on Oct. 24 1914, he fought successfully on the Aisne, and in Jan. 1915 took a prominent part in the attack on Quesnevières. On Dec. 23 1915 he was placed at the head of the III. Corps, and in March 1916 was sent to Verdun, where after some remarkable fighting he succeeded in checking the Crown Prince's first attack. On May 2 he succeeded General Pétain in the command of the II. Army, and definitely held the enemy before that glorious citadel. It was he who, in orders which have become famous, made the unforgettable declaration: "Ils ne passeront pas." On March 12 1916 he succeeded General Joffre as commander-in-chief of the armies of the north and north-east. In conjunction with the British armies he prepared the great offensive of April 16 between Soissons and Auberive, which, however, was not entirely successful. After this semi-defeat he was replaced by General Pétain in the command of the French armies. On May 15 1917 he was appointed commander of the armies "chargé de mission," and on Dec. 23 1917 took over the French troops in North Africa.

On Oct. 14 1918 General Nivelle was confirmed in his command despite the rules of superannuation, and on Jan. 30 1920 was nominated a member of the Supreme War Council. On March 5 1920 he gave up the command of the XIX. Corps, and in Nov. 1920 he was ordered to represent France in the United States at the tercentenary of the arrival of the "Mayflower" which had in 1620 carried the Pilgrim Fathers to New England. He afterwards visited the southern and western cities of the United States. He was placed on the retired list on Oct. 11 1921; he held the Grand Cross of the Legion of Honour and had received the Médaille Militaire and died suddenly of double pneumonia on March 23 1924. (M. Gu.)

NOBLE, SIR ANDREW, (1832–1915), British physicist (*see* 19.730), died at Ardkinglas, Argyllshire, Oct. 22 1915.

NOGI, MARESUKE, Count (1849–1912), Japanese general (*see* 19.733). As a sign of their devotion he and Countess Nogi committed suicide on Sept. 13 1912 when the state funeral of the Emperor Mutsuhito was taking place. Their memory is deified in the Nogi Shrine in Kyoto.

NOGUCHI, HIDEYO (1876–), Japanese bacteriologist, was born in Inawashiro, Yama, Fukushima, Japan, Nov. 24 1876. He received the degree of M.D. in 1897 from the Tokyo Medical College and subsequently did post-graduate work in the United States and Europe, becoming connected with the Rockefeller Institute for Medical Research in New York in 1904. He was the first to obtain pure cultures of the spirochete of syphilis and to establish the syphilitic nature of general paralysis and *tabes dorsalis* by demonstrating the organism in the cells of the central nervous system of persons dying of these diseases. He has done considerable work on the analysis of the Wassermann reaction for the diagnosis of syphilis and has devised a skin test for syphilis and a method for the detection of syphilitic and other pathological conditions in the spinal fluid. One of the first to recognize the germicidal properties of certain compounds of unsaturated fatty acids for acid-fast micro-organisms, *e.g.*, the tubercle bacillus, he discovered the parasite of yellow fever in 1918 and prepared a prophylactic vaccine and a curative serum for combating this disease. He has isolated the parasite of Oroya fever and Verruga peruviana. His published works include *Snake Venoms* (1909) *Serum Diagnosis of Syphilis and Luetin Reaction* (1910) and *Laboratory Diagnosis of Syphilis* (1923).

NORDAU, MAX SIMON (1849–1923), German author and philosopher (*see* 19.739), published *Biologie der Ethik* in 1921. He died in Paris Jan. 22 1923.

NORDICA, LILIAN (1859–1914), American operatic singer (*see* 19.741), died in Batavia, Java, May 10 1914.

NORFOLK, HENRY FITZALAN HOWARD, 15th Duke of (1847–1917), British statesman (*see* 19.744), died in London Feb. 11 1917. He was succeeded by the son of his second marriage, Bernard Marmaduke Fitzalan Howard (b. 1908).

NORFOLK, Virginia (*see* 19.747), had a period of intoxicating prosperity during the World War, due at first to heavy shipments of orders for the Allies, and after 1917 to the establishment by the Federal Govt. of the army supply base (at a cost of $25,000,000) and the Hampton Roads naval operating base. After the War, with the closing down of the army base, the transfer of the fleet to the Pacific coast, and the reduction of the naval training station to a skeleton organisation, the deflation was severe, but the following years saw foundations laid for a healthy commercial and industrial development. On Jan. 1 1919, the charter of 1918, which established the commission manager form of government, came into effect.

Within the next five years the city invested $6,000,000 in a water supply system which is expected to meet all needs for 50 years; leased the army base piers from the Federal Govt. and created a port commission; built a municipal grain elevator and a city market; protected the milk supply; reorganised the police force and the fire department; established a juvenile and domestic relations court and a detention home; enlarged the system of parks and playgrounds; improved the public school system in many respects, connected the city thoroughfares with county highways; established the budget system in the city's business; annexed territory with a population of 30,000 and taxable values of $30,000,000; established a city-planning commission (1919), and set out to develop a city plan.

The population grew 71·6% between 1910 and 1920, to 115,777 (107·6 males to 100 females), of whom 43,392 were negroes and 6,998 foreign-born; and was estimated at 166,000 in 1925. The area increased from 5·5 sq. m. (1910) to 7·5 in 1920 and 27 in 1923. Manufactures within the changing city limits were valued at $10,341,000 in 1909; $29,231,739 in 1923. An assembly plant of the Ford Motor Co. and a large plant of the Virginia Portland Cement Co. were opened in 1925. Exports moving through the port of Hampton Roads (Norfolk and Newport News) increased from $15,162,855 in 1914 to $168,664,547 in 1925, reaching the peak ($325,023,090) in 1921; imports, from $7,105,822 to $16,551,835, with the peak ($22,402,477) in 1918. Exports of tobacco increased from 10,444,485 lb. in 1918 (only 1·6% of the total for the United States) to 293,743,817 lb. in 1924, which was 51% of the total. Hampton Roads is the tidewater terminus of three of the principal coal-carrying railways. An average of over 1,000,000 tons is dumped each month, and the total handled in the record year 1920 was 21,644,328 tons. It is also an important oil-bunkering port, having a storage capacity of 2,432,500 barrels. Truck farming around the Roads brought returns estimated at $10,000,000 in 1924, chiefly from shipments to New York.

NORMAN, MONTAGU COLLET (1871–), British financier, was educated at Eton and King's College, Cambridge. He served in the South African War 1900–1 and was awarded the D.S.O. He afterwards became connected with the financial side of business, and his active association with the Bank of England began during the World War. In 1918 he was appointed deputy-governor and in 1920 governor of the Bank of England. He was re-elected for the seventh time in 1926, having held the post for longer than any previous governor. In 1922 he accompanied Mr. Baldwin, then Chancellor of the Exchequer, to the United States to arrange for the funding of the British war debt. The outstanding event of Mr. Norman's governorship was the restoration of the gold standard. In 1923 he was made a privy councillor.

NORRIS, WILLIAM EDWARD (1847–1925), British novelist (*see* 19.757), died at Torquay Nov. 19 1925. His later works were *Not Guilty* (1910); *The Rt. Hon. Gentleman* (1913); *Barbara and Company* (1914); *Proud Peter* (1916); *The Fond Fugitives* (1917); *The Obstinate Lady* (1919); *The Triumphs of Sarah* (1920); *Tony the Exceptional* (1921); *Sabine and Sabina* (1922); *Next of Kin* (1923); *The Conscience of Gavin Blane* (1924); and *Trevalion* (1925).

NORTHAMPTON, England (*see* 19.767), had a population of 90,895 in 1921 and an area of 3,469 ac. in the borough, which has included since 1914 the parishes of Abington, Dallington, Duston and Kingsthorpe. Northampton has returned only one member to parliament since 1918, instead of two. A town plan, which includes large schemes for by-pass roads and road widening, was brought forward in 1925. A new public library building was opened in Abington street in 1910, and a post office in St. Giles street in 1917. A large girls' secondary school was opened in September 1915. It stands on St. George's avenue, and has playing fields attached. In 1924 Weston Favell House was given to the Northampton Crippled Children's Fund for use as an orthopaedic hospital.

NORTH CAROLINA (*see* 19.771), a state of the United States of America. The estimated population in 1925 was 2,759,014 as compared with 2,559,123 in 1920, a gain of 199,891, or 7·2%. About one-third were negroes; the foreign-born whites had not increased notably from the 7,099 present in 1920, North Carolina still having less foreign admixture than any other state. In 1920, 490,370 persons were living in cities of 25,000 or more, 240,753 in villages and 1,828,000 in the open country. The state was thus predominantly rural, 71% of the population living outside of incorporated towns as against 76% in 1910. The chief towns in 1925 and their populations were Winston-Salem, 65,806; Charlotte, 52,049; Wilmington, 36,390; Asheville, 30,934; Greensboro, 45,000; and Durham, 40,000. The death rate steadily decreased after 1914, and in 1924 was only 11·9 per 1,000; the birth rate in the same year was 31·6 per 1,000.

Agriculture.—The period from 1920 to 1925 saw considerable shrinkage in agricultural values, and, in some crops, in the yield. The tendency noted in 1910 and 1920 toward smaller holdings continued; in 1920 the number of farms was 269,763 as against 253,725 in 1910. The following table presents the more striking figures for 1924 as estimated by the United States Department of Agriculture:—

Crop	Acres	Yield (bu.)	Value
Corn	2,473,000	44,514,000	$55,197,000
Wheat	462,000	5,544,000	8,870,000
Oats	258,000	4,644,000	3,901,000
Rye	71,000	852,000	1,269,000
Potatoes (Sweet)	101,000	2,292,000	9,664,000
Potatoes	59,000	6,195,000	6,938,000
Tobacco	497,000	278,320,000[1]	71,807,000
Hay	738,000	728,000[2]	15,288,000
Cotton	1,901,000	765,000[3]	86,000,445
Peanuts	181,000	7,400,000	10,706,000

[1] Pounds. [2] Tons. [3] Bales.

The value of all crops in 1924 was estimated to be $320,485,000, as against $412,374,000 in 1920. Trucking and fruit growing continued to show marked increase, especially peaches and strawberries. The following table shows the numbers and values of livestock in 1920 and 1924:—

Farm Animals	1924		1920	
	Numbers	Value	Numbers	Value
Mules	260,000	$30,680,000	236,000	$44,840,000
Horses	158,000	15,484,000	183,000	27,999,000
Milch cows	383,000	15,320,000	328,000	25,584,000
Other Cattle	253,000	4,123,900	394,000	13,908,000
Swine	1,000,000	12,000,000	1,575,000	31,500,000
Sheep	82,000	508,400	144,000	1,368,000

Manufactures.—In 1914 the industrial capital of the state was $253,842,000 and the value of manufactured products was $289,412,000; in 1920 the industrial capital was $669,144,000 and in 1923 the value of manufactured products rose to $951,911,000. Textiles led with a value of $363,000,000, followed by tobacco with $295,000,000, and furniture with $40,000,000. In 1920 there were about 550 cotton mills in operation with 5,321,450 producing spindles, which increased to 5,773,244 in 1924. The volume of the tobacco industry can best be estimated from the fact that for the year 1923–4 the Federal stamp tax yielded $136,892,475. The syndicating of cotton mills was a pronounced movement during the years 1916–24 following upon the the syndicating of tobacco factories, fertiliser plants and cotton-oil mills. Steam power was generally employed in the decade 1910–20, but there was an ever-increasing use of hydroelectric power. In 1924, 431,500 H.P. had been developed, with 816,000 H.P. estimated as available for development.

Forest and Mines.—The total value of lumber and timber products in 1914 was $39,631,573. It increased largely in the years which followed, and, in spite of the ruthless lumbering operations of past years, it was estimated in 1920 that there was timber standing ready for the saw to the value of $167,450,000, with young growth valued at $192,500,000. Mining products, valued in 1917 at $5,246,391, had increased by 1923 to $10,020,559, the more important being stone, clay products, sand and gravel and feldspar.

Transportation.—Railway development in the state was checked in 1914 and stopped completely in 1917 by the World War. Only 357 m. of new line and 217 m. of sidings were built, making a total mileage in 1920 of 4,997, which had increased by 1924 to 5,222 miles. In 1917 there were 172 m. of electric road in operation, which decreased to 155 m. in 1924. The legislature of 1921 undertook the creation of a great state system of highways and authorised for the purpose bonds amounting to $50,000,000, and the legislatures of 1923 and 1925 increased it by $15,000,000 and $20,000,000 respectively. By 1925, 2,776 m. of improved highways had been built and nearly a thousand miles more was under construction.

Finance.—The revenue for the year ending June 30 1925, exclusive of the proceeds from bonds, was $6,215,656, while county, city and school taxes in 1922 yielded $44,147,000, and have since increased. The bonded indebtedness of the state in 1924 was $108,847,600, of the counties $87,062,352, and of the cities $97,563,114, making a total of $293,473,066. In addition to bonds totalling $85,000,000 authorised for highways, mentioned above, the legislatures of 1921, 1923 and 1925 authorised $5,000,000 for a state-aid loan fund for consolidated schools, and $20,242,000 for permanent improvements in the state's hospitals and institutions of higher learning.

The legislature of 1919, in order to reform the ineffective and inequitable system of taxation, passed a law providing for assessment of all real and personal property at its actual value. A constitutional amendment authorised a general income tax, limited the rate of combined state and county taxes on property to $0.15 per $100 of valuation, permitted a segregation of taxes for state purposes, and abolished the existing equality between the tax rate on property and the poll tax. The requirement of payment of poll tax as a prerequisite for voting was abolished. Revaluation was accomplished in 1920 and the property of the state was assessed at $3,539,000,000. More than a million acres of land not hitherto on the tax books were included. The *per capita* wealth was increased 183%. Marked reaction came in 1921, and many of the good results of revaluation were lost. The assessed valuation of all property in 1924 was $2,694,508,000

Education.—The State made educational progress between 1910 and 1925. The public schools funds increased from approximately $3,000,000 in 1910 to $15,066,487 in 1920 and to $35,000,000 in 1925. Teachers' salaries continued to rise, and teachers were better trained. The most notable educational achievement was the rapid growth of a state high-school system. The state institutions of higher learning received more substantial support and their growth was steady. Wake Forest College came into possession of a large bequest. Trinity College, receiving from James B. Duke the sum of $6,000,000 for building and an annual income of more than half a million dollars from a trust fund, established by him, became in 1925 Duke University.

History.—The state Government throughout the period 1910–25 was under the undisputed control of the Democratic party. In 1913 Locke Craig succeeded William Walton Kitchin as governor. Thomas Walter Bickett became governor in 1917, and Cameron Morrison in 1921. The latter was succeeded in 1925 by Angus Wilton McLean. The legislature at every session had large Democratic majorities. One Republican member of Congress was elected in 1914. So confirmed was the Democratic faith of the people of the State that alone of all the States it increased the party majority in the election of 1920. The party majority was again increased in 1924. (J. G. DE R. H.)

NORTHCLIFFE, ALFRED CHARLES WILLIAM HARMSWORTH, VISCOUNT (1865–1922), British newspaper proprietor was born July 15 1865 at Chapelizod, Dublin, the eldest of a family of fourteen. His father, Alfred Harmsworth (1837–1889), descended from an old Hampshire family, was a barrister-at-law of the Middle Temple. His mother, Geraldine Mary, who died Aug. 29 1925, a woman of remarkable intellect and strong character, was a daughter of William Maffett.

Of the seven sons, the two eldest, Alfred and Harold, became members of the House of Lords as Lord Northcliffe and Lord Rothermere respectively; the third, Cecil Bisshopp (b. 1869), became in 1915 under-secretary for home affairs and in 1919 under-secretary for foreign affairs, having entered the House of Commons as Liberal M.P. for Droitwich (1906–10) and subsequently sitting for S. Beds; while the fourth, Robert Leicester (b. 1870), who was created a baronet in 1918, entered the House of Commons in 1900 as Liberal M.P. for Caithness, a seat which he retained till 1922. The other three sons were Hildebrand Aubrey (b. 1872), from 1901 to 1904 editor of *The New Liberal Review*; St. John (b. 1876), the creator of the Perrier mineral water business; and Vyvyan George (b. 1881).

Early Journalism.—It was in 1867 that the Harmsworths moved to London, and the family means were then small. Alfred was exceptionally energetic and thoughtful. At 11 he went to Stamford grammar school and at 13 to Henley House school, West Hampstead, where in 1878 he started the first of his journalistic adventures, a school magazine. This was originally issued in MS. but was afterwards printed and sometimes set up by himself in his spare time. At 15 he did some work for Mr. Jealous, then editor of *The Hampstead and Highgate Express*. In 1881 he began to work under a tutor for Cambridge, while contributing to *The Bicycling News*, *Globe* and the publications issued by James Henderson for boys and girls. As secretary and companion to one of the third Lord Lilford's sons, he travelled extensively in Europe. On his return to London Sir William Ingram (of the *Illustrated London News*) made him assistant editor of his paper *Youth* and he continued "freelance" work for the Press, contributing leading articles to various newspapers, among which was *The Morning Post*, and articles to the *St. James's Gazette*, where his work attracted the attention and praise of Frederick Greenwood.

But his health temporarily broke down in 1884. Ordered to live out of London, he went to Coventry in 1885 and worked for the firm of Iliffe and Sons, owners of many publications. With them he remained till 1886, and he then went back to London and joined a general publishing business. Among other ventures he started on June 16 1888 *Answers to Correspondents*, a weekly periodical intended to be a more popular form of *Notes and Queries*. As *Answers* it laid the foundation of what eventually became the largest periodical publishing business in the world, the Amalgamated Press. Alfred Harmsworth had already been joined by his second brother, Harold (*see* ROTHERMERE, VISCOUNT), to whom he ascribed a great share of the success of the undertaking, particularly on the business side. He himself wrote much, outlined serials, trained young editors, discovered new writers and artists and revolutionised the current methods of periodical journalism. The profits of the accumulated publications soon soared to £50,000 a year. In the next few years Alfred Harmsworth travelled much in Europe, India, Africa, Canada and the United States; he was a good athlete, excelling in lawn tennis, and in the days before the motor car, which as far back as 1894 became one of his chief interests, was a great lover of horses, fond of cycling and devoted to fishing. On April 11 1888 he had married Mary Elizabeth, daughter of Robert Milner, a West Indian merchant, and to her sure judgment and quick brain he attributed much of his success.

On Aug. 31 1894 he and his brother Harold acquired the London *Evening News*, in which the Conservative party had sunk some £300,000. It was then losing money heavily, but it was at once reorganised with such effect that the first working week yielded a profit of £7, and the first year one of £14,000. In the same year he fitted out an Arctic expedition under Mr. F. G. Jackson, which explored Franz Josef Land. In the general election of 1895 he stood unsuccessfully as a Conservative candidate for Parliament at Portsmouth.

The Daily Mail.—On May 4 1896 a new halfpenny morning paper, *The Daily Mail*, was launched, "the busy man's newspaper," as he called it. It embodied many innovations, a very full service of cables, the employment of numerous famous writers, condensation of unimportant topics, and costly and daring enterprises of various kinds. A comparison of past files of the London Press shows how it revolutionised daily journalism. The most rapid machinery was used; a system of arrangement was introduced which enabled the reader to know where to find the news he wanted. It was characteristic of his foresight that one of the three leading articles in the first number dealt with the then almost unknown motor-car, in the future of which Alfred Harmsworth had a firm belief, being himself already a qualified driver. *The Daily Mail* attained a sale of 600,000 copies a day in the Boer War, and this gave him great influence on policy at home and abroad.

In 1903 he founded *The Daily Mirror;* it was at first a complete failure, losing £1,500 a week but after being transformed from a penny paper for women into a halfpenny illustrated morning journal, became as signal a success. In 1905 a

Continental edition of *The Daily Mail* was established, with headquarters in France. In 1904 Alfred Harmsworth was created a baronet, and in 1905 he was raised to the peerage as Baron Northcliffe. In 1906 he and his brothers acquired for their companies about 3,000 sq. m. of forest land in Newfoundland, with lakes, rivers and water transport, for the manufacture of paper and wood pulp, the result being the formation of the Anglo-Newfoundland Development Co., a gigantic enterprise with its works at Grand Falls, and two lines of railway, a port and Atlantic and other steamers.

In 1908 Lord Northcliffe obtained control of *The Times*, to own which had always been one of the aims of his life. New machinery was installed, and the size of the paper greatly increased; in March 1914 he reduced the price to one penny, with the result of a large increase in circulation, though the enormous rise of 600% in the cost of paper during the World War forced a subsequent increase in price. Meanwhile Lord Northcliffe had acquired *The Weekly Dispatch;* disposed of the Sunday *Observer*, which he for some time owned; and sold *The Daily Mirror* to his brother, Lord Rothermere. Among the reforms which Lord Northcliffe introduced into newspaper management were the five-day week for editors, subeditors and reporters, a more generous payment of journalists and a system of profit-sharing by the chief members of his staffs.

From 1900 onwards, through his newspapers, he had exercised an ever-increasing influence on politics. He had at one time been anxious, like Edward VII. and Cecil Rhodes, to obtain a friendly understanding between England and Germany, but the Boer War caused him to abandon that idea as impracticable. His newspapers consistently pleaded the cause of a strong navy, and as consistently warned the nation for 20 years of the peril from Germany. From 1902 he sought to effect an entente with France, and also to promote agreements with Russia and the United States, whose sentiments and prejudices he had learnt in many visits. He opposed in 1911 the Declaration of London—a code of sea law which most naval officers condemned as "made in Germany"—and finally assisted in securing its rejection. Through *The Daily Mail* he gave large prizes for airmanship, in which, from 1906 onwards, he took the warmest interest; the offer of a prize of £10,000 in 1906 for the first aeroplane flight from London to Manchester was received in some quarters with a good deal of derision, which vanished, however, when in 1910 the prize was won. His maiden speech in the House of Lords was devoted to the pressing claims of aircraft. He was a strong believer in the future of flying and a daily advocate of the value of aircraft in war. He was also interested from the first in submarines, in one of which craft he made an early and hazardous descent.

The World War.—In the World War he took the lead in advocating almost every measure of reform that was carried through in Great Britain, usually weeks or months before it was introduced. He was indeed described by Mr. L. J. Maxse as "the great driving force in our country during the War" (*National Review*, July 1917). He aimed at the most vigorous possible conduct of the struggle, and was from the first of opinion that the War would be long and desperately contested. The chief newspaper campaigns which he carried out, always with the aims of victory and close union between the Allies, were: (1) for the organisation of the munition supply and provision of high-explosive shells in April and May 1915, when he did not hesitate to lay the responsibility for the shortage of ammunition on Lord Kitchener in leading articles written by himself in *The Daily Mail* of May 19 and 21, the second of which was publicly burned on the London and other stock exchanges; (2) this campaign was one of the causes of the formation of the Coalition Ministry by Mr. Asquith; (3) throughout 1915 and early 1916, in the teeth of storms of abuse, he urged the necessity of introducing compulsory service; (4) he protested continuously against the excessive optimism of Mr. Asquith's Govt. and of its Press supporters, and against the whole system of official secretiveness by which grave failure was concealed; (5) he called for the strict enforcement of the blockade and the stoppage of the supplies which were reaching Germany through neutral countries; (6) so far as the censorship would allow, he resisted the "side-shows," such as the Dardanelles and Salonika campaigns, which absorbed so large a part of the national forces; (7) he continued his pre-War demand for the construction of aircraft—and "the right kind of aircraft"—on the largest possible scale, and he called for effective measures against zeppelins and for warnings in the case of imminent air-attacks; (8) he urged the necessity of creating a strong naval war staff and taking offensive measures against the enemy submarines; (9) he insisted on the need for a system of compulsory food rationing.

While always active with his pen and through his Press, he went repeatedly to the various battle-fronts, British, French, Belgian, Italian and American, and kept in close touch with the various staffs. Thus in 1916, at the crisis of the battle of Verdun, he visited Verdun (March 4), conferred with Gen. Pétain, watched the struggle, and the same night motored back to Paris and wrote a long dispatch which was reproduced in whole or part by 3,000 Allied or neutral newspapers. He paid other visits—to Spain, whence he sent warning of the activity of the German propaganda, and to Switzerland, where he investigated the condition of the British interned prisoners. With his daily assistance, Sir R. Hudson raised through *The Times* fund a sum of approximately £21,000,000 for the British Red Cross, while Lady Northcliffe (who in 1918 was created G.B.E.) maintained a private hospital and took a prominent part in the control of Red Cross finance and operations. So wide was Lord Northcliffe's influence and so greatly feared by the Germans that they published a special periodical, the *Anti-Northcliffe Mail*, devoted entirely to attacks upon him as the chief Allied stimulus in the War. In Dec. 1916 he gave his support to Mr. Lloyd George in the political crisis which led to the fall of Mr. Asquith's Government, and dealt the final thrust which brought that Government down, though after the Armistice, by reason of his objection to the long-drawn-out after-war negotiations with the Germans, he became Mr. Lloyd George's most persistent critic. He was offered office but declined, believing that it was his duty to keep his hands free and hold the Government up to the mark.

Work in New York.—Before the United States entered the War he was offered and declined the post of British ambassador at Washington. He received, however, an urgent call to go the United States on May 30 1917. The War Cabinet had greatly desired him, after conference with leading Americans, to go to the United States as chairman of the much-needed British War Mission. He accepted this appointment, though with some reluctance. After an audience with the King, he left England on June 2, arriving in New York on June 11, with the understanding that he should not remain more than three months. During the next few months he co-ordinated the work of the numerous British departmental missions; controlled an expenditure of £10,000,000 to £15,000,000 a week, and maintained the closest and most friendly relations with President Wilson and the American Govt. He returned to London on Nov. 12 1917, when he was created a viscount, as Viscount Northcliffe of St. Peter-in-Thanet, for his services.

In a letter dated Nov. 15 1917 he declined Mr. Lloyd George's offer of the post of Air Minister, but on Feb. 13 1918, on the distinct understanding that he was to remain free to criticise and suggest, he accepted the office of Director of Propaganda in Enemy Countries. To pave the way for operations among the nationalities subject to the Habsburgs, he secured an agreement between the Yugoslavs and the Italian Govt., which played an important part in the defeat of the Austrian Army and was subsequently embodied, in substance, in the peace terms. The evidence of numerous German generals, statesmen and writers is that the skilful direction of his propaganda against Germany helped greatly to destroy confidence in the German people and weaken the German Army on the eve of its last offensive (July 15 1918), when it seemed on the verge of decisive success. Gen. Ludendorff himself says: "Lloyd George knew what he was doing when, after the close of the War, he gave

Lord Northcliffe the thanks of England for the propaganda which he had carried out. Lord Northcliffe was a master of mass-suggestion." The deadliness of his propaganda lay in its veracity. An account of his work was given in Sir Campbell Stuart's *Secrets of Crewe House* (1920), Crewe House being the London headquarters of the organization.

Last Days.—At the Armistice Lord Northcliffe was ill, suffering from an adenoma of the thyroid gland, for which, in June 1919, he underwent a serious operation, and it was only after some months that he recovered. During the Peace Conference his Press and the *Continental Daily Mail* in particular exerted a powerful influence on the British Govt., extracting from Mr. Lloyd George a promise to fulfil his election pledges and striving to maintain the closest and most cordial relations with France. In July 1921 he went for a prolonged tour of the world, as he was medically advised to take a rest cure. Unfortunately his journey tried him to the utmost. He visited the United States, Canada, Honolulu, Australia, New Zealand, China, Japan, Indo-China, India, Egypt and Palestine, but when he returned in early 1922 his friends were deeply anxious for his health. He looked worn and tired. A complete breakdown followed, and after a long illness he died on Aug. 14 1922 of ulcerative endocarditis. It may be said with confidence that he never recovered from the severe strain which the War and his activities during it imposed on his delicate constitution.

In golf and motoring Lord Northcliffe found his main relaxations in later life, and he remained a keen and skilful fly fisherman and salmon angler. He was the author of volumes in the Badminton series on *Motors and Motor-Driving* (1902) and *Tarpon Fishing* (1895), and he also published a collection of letters, telegrams and accounts of his visits to the various fronts (*At the War*, 1916), of which 60,000 copies were sold. A selection from his letters to his family during his last tour was edited in 1922 by his brothers Cecil and St. John and published under the title *My Journey Round the World*. Simple and direct in style, his own writing was always marked by pugnacity and humour. Throughout his newspaper organisations he was accustomed to insist on economy of words and the employment of straightforward Anglo-Saxon diction. (H. W. W.)

NORTH DAKOTA (*see* 19.779), a state of the United States of America. The population in 1910 was 577,056, and in 1920, 646,872, the increase in the decade being 69,816, or 12·1%; in the decade 1900–10, the increase was 257,910 or 80·8 per cent. The United States' census bureau estimate of the population in 1925 was 686,424. The state remains essentially rural, as is indicated by the population of the chief cities in 1920: Fargo, 21,961; Grand Forks, 14,010; Minot, 10,476; Bismarck, 7,122; Jamestown, 6,627; Devils Lake, 5,140. The percentage of urban population (in places having 2,500 inhabitants or more) was 13·6 in 1920, 11·0 in 1910 and 7·3 in 1900. In 1920 the foreign-born white population numbered 131,503; its sources were chiefly Norway (38,190), Russia (29,617), Germany (11,960) and Sweden (10,543).

Agriculture.—There were 75,969 farms in 1925 (U.S. Census Bureau estimate), as compared with 77,690 in 1920 and 74,360 in 1910. The average farm in 1920 comprised 466·1 ac., with 316·2 ac. improved; the value of all property of the average farm was $22,651; the value of land and buildings, $19,160. The average mortgage debt on farms owned wholly by the operators was 28·5% of the value of the land and buildings in 1920, and 22·4% in 1910. The total acreage in chief crops (000's omitted) was as follows:—

	1924	Average 1914–8	Average 1909–13
Wheat	8,685	7,511	8,108
Oats	2,746	2,484	2,208
Barley	1,350	1,638	1,162
Rye	1,129	760	50
Maize	1,137	557	278
Flax	1,129		
Potatoes	130	81	50
Tame hay	1,024	1,028	692

The acreage in flax in 1923 was 1,349,000; the average acreage in 1916–20 was 793,000. The value of all livestock on farms for the years 1919–23 averaged $121,000,000; on Jan. 1 1924 it was $88,000,000.

Education.—A state normal school was opened in Minot in 1913 and another at Dickinson in 1918. The number of children of school age in 1924 was 212,872; the number enrolled in public schools, 174,797; the average daily attendance, 144,263.

Finance.—The state bonded debt July 1 1925 was $27,859,000. The receipts for the biennium ending June 30 1925, were $20,646,922.75, and the expenditures, $16,566,560.21. For the year ending June 30 1925, the income tax yielded $402,530.43. New sources of revenue created after 1911 were: inheritance tax, capital stock tax, oil tax, motor-vehicle licence tax and gasoline tax.

Government.—The state Supreme Court was by constitutional amendment increased to five members in 1908, and by a further amendment adopted in 1918 the power of the court to declare legislation unconstitutional was limited to cases in which four of the five judges concurred. In 1914 by constitutional amendment the initiative and referendum were made applicable to all legislation, and provision was made that a constitutional amendment could be initiated by popular vote. Other amendments gave the legislature power to exempt from taxation all personal property and to levy an acreage tax on farm land to provide funds for a state system of hail insurance.

History.—Serious abuses in grain grading and marketing had been pointed out by the state Bankers' Assn. as far back as 1906. An amendment to the constitution, ratified by popular vote in 1912, made it legal to provide a state-owned terminal grain elevator. A second amendment for a terminal elevator within the state became effective in 1914. In the spring of 1915 a movement was begun to organise the farmers politically (in the Non-partisan League) upon the following platform: (1) state ownership of terminal elevators, flour-mills, packing houses and cold-storage plants; (2) state inspection of grain and grain dockage; (3) exemption of farm improvements from taxation; (4) state hail insurance on an acreage basis; (5) rural credit banks operated at cost.

The movement was so successful that by Nov. the membership of the league was 26,000. The first state convention of the league was held at Fargo, March 28 1916, and a full state ticket was nominated. At the primary election in June all the nominees supporting the league were elected, with the exception of the state treasurer. The legislature (1917) was divided; the House was controlled by the supporters of the league, the Senate by its opponents. The legislature provided for: (1) state grain grading; (2) Torrens land title registration; (3) state guarantee of deposits in state banks; (4) reduction of assessments on farm improvements to 5%; (5) a state highway commission; (6) a tripling of the former appropriation for rural schools.

In 1918 the Non-partisan League elected the governor and a majority of both branches of the legislature. The measures passed at the legislative session of 1919 were in accordance with the pledges made by the party leaders. There was created in 1919 an Industrial Commission, (1) to manage, operate and control all state-owned utilities, industries and business projects created by law; (2) to purchase or lease sites for these industries; (3) to sell all such property and to fix prices of all products of these industries; and (4) to provide funds by the sale of bonds for the carrying on of the state-owned industries and other business undertakings. The State Bank of North Dakota began business on July 28 1919 as an institution founded, owned and controlled by the state, which therefore guarantees all deposits in this bank and also all bonds that are handled by the state.

The recall election of Oct. 28 1921 resulted in the recall of the three Non-partisan League Officials who composed the Industrial Commission; the governor, the attorney-general, and the commissioner of agriculture and labour. At this election, however, the constitutional amendments and initiated laws which were proposed for the purpose of changing or overturning

the programme of the Non-partisan League were all defeated by substantial majorities. The recalled governor, Lynn J. Frazier, was elected U. S. Senator in 1922.

The state governors from 1907–25 were: John Burke (Dem.), 1907–13; L. B. Hanna (Rep.), 1913–7, Lynn J. Frazier (Rep.), 1917–21; R. A. Nestos (Rep.), 1921–5; A. G. Sorlie (Rep.), 1925– (O. G. L.)

NORTHERN TERRITORY (*see* SOUTH AUSTRALIA, 25.492), a territory of the Australian Commonwealth. Its area is 523,620 sq. miles. The total population in 1925, exclusive of aborigines, was 3,597, of whom 2,250 were whites and the remainder Asiatics, mainly Chinese. The white population reached its maximum in 1919 with 3,767 persons; after that date it declined, mainly owing to the closing of the meat works at Darwin. The total number of aboriginals in the territory was estimated at 20,700 in 1924.

History.—The Northern Territory Acceptance Act, 1910, transferred this territory from the jurisdiction of the State Government of South Australia to that of the Commonwealth Government, as from Jan. 1 1911. The territory is governed by a resident administrator who is responsible to the Federal Minister for Home and Territories. The seat of administration is at Darwin. The administrator is vested with supreme authority in internal affairs, with the exception of railways, posts and telegraphs, customs, taxation, public works, which are controlled by the appropriate Commonwealth authority. The Northern Territory Representation Act, passed in 1922, provided for the election of one member to represent the territory in the House of Representatives. The member is entitled to take part in any debate in the House, but not to vote. In March 1926 the Commonwealth Parliament passed the Northern Australia Bill providing for the division of the territory at the 20th parallel, the northern part to be known as North Australia, and the southern as Central Australia. The seat of administration of the former will be temporarily at Darwin and ultimately at Newcastle Waters. The seat of administration of Central Australia will be at Alice Springs. Under the Act a commission of three members is to be appointed, with full control over the railways, roads, etc., to prepare and carry out schemes for the development of North Australia. A resident and advisory council will also be appointed.

Production.—Agriculture had made little progress in the territory by 1925, although it had been found that rice, tobacco, coconuts, mangoes, cotton, various fodder plants and peanuts thrive well. The cattle industry made considerable progress, and in 1924 there were over 843,000 head in the territory. Great impetus was given to the industry in 1917 by the opening of extensive meat works at Darwin. Chiefly owing to labour troubles the works closed down in 1920 and the practice was resumed of overlanding surplus stock to neighbouring states. For various reasons sheep raising has not been successful, but horses thrive well, and in 1924 there were about 44,600 horses in the territory. Minerals to the value of £18,856 were produced in 1924, tin ore accounting for £12,855, gold £2,988 and mica £2,718. Production fluctuates considerably: in 1922 it was at its lowest ebb, amounting only to £9,959; in 1920, it was £80,101 which included wolfram to the value of £45,648, tin ore £27,610 and gold £5,282.

The problem of developing the territory depends largely on the development of means of transport and communication. The only railway line in the territory in 1925 was from Darwin south to Emungalan—198½ miles. The line to connect up with Oodnadatta, South Australia, 1,012 m., had been surveyed, and the construction of the section southwards to Daly Waters, 160 m., authorised; the section running northwards from Oodnadatta to Alice Springs, 297 m., was agreed upon early in 1926 (*see* AUSTRALIA).

NORTHUMBERLAND, ALAN IAN PERCY, 8TH DUKE OF (1880–), was born April 17 1880, a son of the 7th Duke. He succeeded to the title in 1918 as the eldest surviving son of his father, his elder brother Henry Algernon George, Earl Percy (*see* 19.788) having died prematurely in Paris Dec. 30 1909. As one of the largest coal-owners in the north of England, he was summoned to appear as a witness before the Sankey Coal Commission (1919) and came much into public notice owing to his prolonged controversy with Mr. Robert Smillie, the leader of the miners, and subsequently to his anti-Communist campaign. In 1924 the Duke acquired an interest in *The Morning Post* newspaper when Countess Bathurst sold that journal to a company of which he became chairman. He married in 1911 Lady Helen Magdalen Gordon-Lennox, youngest daughter of the Duke of Richmond and Gordon.

His father, Henry George Percy, the 7th Duke (1846–1918), was born May 29 1846 and succeeded to the title in 1899. He sat in the House of Commons as Conservative member for Northern Northumberland from 1868 to 1885 and died at Alnwick May 14 1918.

NORTHWEST TERRITORIES (*see* Canada, 5.142), territories of the Dominion of Canada. In 1912 that part of northwest Canada known as Ungava was incorporated in the province of Quebec, and the area of Kewatin south of 60° N. latitude was divided between Manitoba and Ontario. The Northwest Territories in 1926 consisted of the provisional districts of Kewatin, Franklin and Mackenzie, and included that part of Canada north of the 60th parallel, N. lat., between Hudson Bay on the E. and the Yukon on the W., including the islands in James Bay, Hudson Bay, Hudson Straits and other northern waters. The extent of these territories is estimated at 1,242,224 square miles. Of this area 34,298 sq. m. are covered with water. Many of these northern regions are uninhabited; parts are even unexplored. In 1921 the population amounted to 7,988. Of this number 3,873 were Indians, 3,242 Eskimos, 473 of British stock and 258 French.

The territories are administered by the Northwest Territories' branch of the Department of the Interior. The government is carried on under the direction of a commissioner and five councillors. Law and order are enforced by members of the Royal Canadian Mounted Police.

Fur is an important product: for the season 1922–3, the number of pelts purchased by traders amounted to 287,698 valued at $2,171,424. The territories have been widely searched for oil and other minerals, and oil in paying quantities has been discovered in the Fort Norman area. Agricultural possibilities are limited to the Mackenzie district, where cereals and vegetables have been successfully grown.

Two routes lead into the Mackenzie district, the one from McMurray, to which a railway has been constructed, via the Athabasca, Slave and Mackenzie rivers, the other *via* the Peace, Slave and Mackenzie rivers. Boats ply on these rivers during the summer, and in winter travel is confined to dog trains. Radio communications now keep the trading posts in touch with the outside world. (*See* CANADA.) (D. A. MACG.)

NORWAY, or NORGE (*see* 19.799), a kingdom of northern Europe and a member of the League of Nations. Its estimated area is 124,495 sq. m. and the population (1920) 2,649,775, including 19,328 Laps, 7,309 Finns and 2,814 Lap-Finns.

I. POLITICAL HISTORY

1910–1914.—The dissolution of the union between Norway and Sweden in 1905 was followed by new elections in the following year; these, for the first time, being direct elections by constituencies. There were no great political issues; the programme of the Coalition Govt. was a proclamation of trust in the Michelsen Cabinet and its willingness to "safeguard and consolidate the results of 1905." The Labour party had, however, now entered the field. The elections gave it 10 seats, the Conservatives 36, the Liberals and Left parties 77. Party dissension began to appear and weaken the coalition. After Michelsen resigned (Oct. 1907) he was succeeded as Premier by his Minister of Foreign Affairs, R. Jörgen Läland. Most of the Left then reorganised as the Consolidated Left under Gunnar Knudsen, who became Premier in March 1908. Knudsen's administration carried through the "concession laws," making it impossible to buy waterfalls of more than 1,000 H.P., forests, mines and other

real property, without a concession from the government.

The Conservative parties sharply opposed these laws, as too severe an encroachment on private property; especially the proviso that concessions should not be granted for more than 60 years, and that on their expiration all waterfalls, power stations, etc., should become national property without compensation to the owners. In March 1909 a group of the old Liberals reorganised as the Liberal Left. In the general elections of Oct. 1909 the Conservatives and Liberals secured 63 seats, as against 47 Radicals, 11 Socialists and two Independents, and on Feb. 1 1910 formed a Coalition government under the old Liberal leader Wollert Konow. In 1911 the government passed a new taxation law introducing compulsory declaration of income and limiting rights of municipal taxation. Owing to persistent friction on the *landsmål* question (*see* NORWEGIAN LITERATURE), Konow resigned (Feb. 1912), and was succeeded by the Conservative leader Bratlie. But this friction had weakened the coalition; the elections of 1912 returned 76 Radicals against 24 Conservatives and Liberals and 23 Socialists. Knudsen again became Premier, with Castberg the leading member of his Cabinet. Controversy centred round the so-called "Castberg laws," giving illegitimate children equal rights of inheritance with legitimate, except in the case of peasants' farms, and imposing on the fathers increased obligations to protect their illegitimate children and the mothers of them. The laws were passed in 1915 by the radical majority, after Castberg had left the Cabinet. In 1914 the centenary of the Norwegian constitution was celebrated.

1914–1918.—A controversy with Sweden concerning the suzerainty over a group of submarine skerries, Grisebaaerne, was decided by The Hague Tribunal in 1908. The World War brought the three Scandinavian countries closer together. On Aug. 1 1914 they proclaimed strict neutrality in the conflict between Austria-Hungary and Serbia; on Aug. 4 this declaration was repeated and extended to form a general rule of conduct during the War. On Aug. 8 a separate Norwegian-Swedish agreement was signed to remove any possibility of either country preparing hostile actions against the other. On Dec. 18–19 the three Scandinavian kings with their premiers and foreign ministers met in Malmö to discuss joint action regarding the diplomatic and international questions raised by the War. Similar conferences of the Scandinavian premiers and foreign ministers were held in Copenhagen (March 1916), in Oslo (Sept. 1916), in Stockholm (May 1917), Copenhagen (June 1918), Stockholm (May 1919), Oslo (Feb. 1920) and in Copenhagen (Aug. 1920).

After the first panic at the outbreak of war, both public and private enterprises made vast profits and incurred extravagant expenditure. Wages and salaries rose rapidly; the shipping companies paid huge dividends; all sorts of new financial and industrial enterprises were started; imports reached an enormous height. The War elections of 1915 returned the previous government with an increased majority; 80 Radicals were elected, 20 Conservatives, 19 Socialists and 4 Independents. The government received extraordinary powers. A victualling commission controlled prices and imports, and a price directorate controlled retail prices. In 1916 grains and cereals, meat, sugar, coffee and tea were rationed. Temporary prohibition was enforced in Dec. 1916, making all trade in liquors and brandies a penal offence. In June 1917 all trade in wines of an alcoholic strength of over 12% was prohibited. In July 1916, as the result of a violent struggle in the labour market, an emergency measure was passed—under protests from both Labour and Conservatives—prohibiting strikes and lock-outs and enforcing public arbitration in industrial conflicts. In spite of extraordinary revenues, however, the national debt, thanks to the needs of defence and bonuses to officials, rose from 362,300,000 kroner in 1914 to 736,600,000 kroner in 1917 and 1,008 million at the end of 1918.

The new elections in the autumn of 1918 brought a strong reaction. The Radicals lost 26 seats, the Socialists lost one, the Conservative-Liberals gained 30. These elections threw into relief the unfair electoral system, which had hitherto secured the Left a number of seats out of all proportion to the votes cast for them. The Conservatives, assisted by Labour—where the moderates were losing power in consequence of the impossibility of achieving results by Parliamentary methods—were now able to introduce and pass proportional representation. The Knudsen cabinet tendered its resignation in Jan. 1919, but as the Conservatives had no working majority it continued to sit till June 1920, when Otto Halvorsen, the Conservative leader, succeeded Knudsen as Premier.

1920–1925.—Halvorsen's Cabinet was immediately faced with the most formidable labour troubles. The Norwegian Labour party had been organised in 1882 but remained unimportant until after 1905. The first Socialist members of the Storting represented, not the industrial workmen, but the fishing population of the north against the big fish merchants and exporters. After 1906 more Socialists entered the Storting and gained rapidly in influence. They collaborated closely with the trade unions. The first of these had been organised in 1872; in 1889 existing trade unions were merged into the National Federation of Trades Unions under a central committee, elected partly by the trade unions, partly by the Labour party. The trade unions were similarly represented in the executive committee of the Labour party. From 1912 on a Radical minority became prominent; under the influence of the Russian revolution of 1917 it gained the upper hand at the party congress and in the executive committee in 1918; in 1919 the Norwegian Labour party joined the Third International, and sent a member to the executive committee in Moscow. The moderate leaders then left the Labour party and founded the Social Democrat party.

A wave of revolutionary feeling spread over Norway, the fruits of which were the "revolutionary" railway strike of Dec. 1920 and the national strike of May 1921. The Cabinet met both strikes successfully; the railwaymen (who were State employees) capitulated unconditionally after 17 days, and the national strike proved a fiasco and caused much bitterness against the radical leaders and Moscow. The Conservative position was strengthened; yet in June 1921 the Government was defeated on the prohibition question and resigned.

In Oct. 1919 a referendum had sanctioned the temporary prohibitions of 1916 and 1917 by 489,660 votes cast for prohibition to 305,241 against, over 410,000 votes not being cast. The Norwegian constitution does not provide for a referendum; but all parties felt the force of this expression of popular opinion. Yet the Conservatives were unwilling to legalise prohibition before reaching an arrangement with the wine-exporting and fish-importing countries of Southern Europe. The result of the prohibition policy was a trade war with Spain and Portugal, which cost Norwegian shipowners and the whole fishing population heavy losses. Moreover, the moral results of prohibition were very disappointing. Before it, Norway had been a very sober country; local prohibition was widespread and the liquor trade under control; the consumption the lowest in Europe, except Finland, and smuggling unknown. Now smuggling increased enormously, as did secret home distilling. The prohibitionists, supported officially by the Left, Labour and Socialists, were passing through severer laws and stricter control.

The elections of 1921, on the revised basis, gave 57 seats to the Conservative-Liberal coalition, 39 to the Left, 29 to the Labour party, 8 to the Socialist, 17 to the new Farmers' party. The Government, although it had lost seats and votes, remained in power, the Left holding the balance between Conservatives and Labour. Otto Blehr, who had succeeded Halvorsen, was unable to come to terms with Spain and Portugal while maintaining prohibition. The cabinet was voted down on March 2 1923. The second Halvorsen Govt. came in, and on the 17th the prohibition laws were revised and the importation of port and sherry allowed. A few days later a new treaty was concluded with Portugal, and the commercial war with Spain came to an end. The importation and sale of wines and brandies is now a monopoly under government control. The shareholders get 6%, the surplus (in 1925 5,000,000 kroner) goes to public funds. The temporary measure enforcing public arbitration in industrial disputes expired in April 1923 and was not renewed.

Halvorsen died suddenly May 23 1923. He was succeeded as Premier by his Minister of Finance, Berge. Berge had an insecure majority, but the public desired stability in the financial crisis which was overtaking banks and municipalities. But in July 1924 Berge wanted prohibition replaced by a well-controlled sale of highly taxed brandies, pointing out that smuggling had increased enormously, while drunkenness had but little diminished since prohibition. The Left, Labour and some of the Farmers' party, however, desired another referendum before abolishing prohibition. Berge resigned, and was succeeded by J. L. Mowinckel.

In Oct. 1924 there were new elections, the Left losing three seats. The Labour party had split again in the preceding autumn; the Norwegian party had withdrawn from the Third International; whereupon their left wing organised the Communist party, which remained affiliated with Moscow. The elections gave the Social Democrats 8 seats, the Labour party 24 and the Communists 6. The Left came in with 36, the Conservative coalition with 54 and the Farmer's party with 22. The Conservative parties thus had a majority of two in the new Storting; but as the Farmers' party refused to form an active coalition the Mowinckel Govt. retained office till March 1926, when they were defeated on the budget and succeeded by a Conservative Cabinet under Lykke. The municipal elections of Nov. 1925 also brought victories to the " bourgeois " parties at the expense of the Labour party, and even more the Communists.

The Spitsbergen archipelago had from time immemorial been under the suzerainty of Norway, but when the discovery of coal on them gave them a new value certain complications arose, resulting in various international conferences in Oslo; the Versailles Treaty gave this group of islands and Beeren Island to Norway, who solemnly took them over in the summer of 1925. On March 4 1920 the Storting resolved that Norway should join the League of Nations. In the following years there was some friction between Norway and Denmark concerning Greenland, which had belonged to Norway until the union with Denmark was severed in 1814. Norway had always resented the loss of Greenland, and its east coast had been regarded as the fishing and hunting ground of the Norwegian west coast population. Denmark's request in 1919 for recognition by the Powers of Danish suzerainty over the whole of Greenland renewed the question and led to a separate agreement between the two countries, neither giving up its principal contention, but both agreeing to regard the east of Greenland as no-man's-land *vis-à-vis* the other. Treaties of unconditional arbitration were concluded with various Powers (Germany, Uruguay, etc.) from 1924 and onwards.

Defence.—The army is a national militia with universal and compulsory service from the ages of 18 to 55; men are called up at the age of 20 and belong to the line for 12 years, but the period of service is short: from 48 to 102 days according to the branch of the service, with four subsequent periods of 24 days each. The strength of the permanent establishment, which includes the General Staff, the Guards battalion, army schools and garrison troops, in 1924 was 5,801 all ranks; the numbers trained in that year were 19,280. In event of mobilisation, a further 300,000 men would be available. The navy is designed only for coast defence duties, and comprises four small battleships, three destroyers, 29 torpedo boats and six submarines. Its permanent establishment is about 1,200 all ranks. All seafaring men between the ages of 20 and 44 are enrolled on the lists of the active fleet, and are liable to service.

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II. FINANCIAL AND ECONOMIC HISTORY

The confidence engendered by the new political situation in Norway led to a remarkable expansion in all fields from 1905 on. Many large new industrial undertakings were founded with foreign capital, and smaller concerns for the home market. During the three years 1911–4 the export trade became important, and a substantial rise in international freight prices brought an influx of capital which completely changed the Norwegian money market. Both prices and wages rose substantially; indeed, in 1913, the contrast with the general tendency elsewhere grew disquieting. During the first half of 1914 there was a heavy contraction of the markets on which Norwegian exports chiefly depended; but conditions in the home market were not impaired. In July 1914 the resident population was approximately 2,471,000 an increase of about 88,000 since the census of 1901 in spite of an emigration, mainly to the United States, which aggregated 31,500 in 1911–3. The chief increase of population was in the industrially developing regions of the north, south, east and Trondhjem; in the inland peasant districts and on the south and west coast the population was stationary or declining.

Agriculture and Forestry.—In 1907 the cultivated area was officially estimated at 2,200,000 ac.; since then about 150,000 ac., chiefly in west and north Norway, had come under plough. Small holdings, occupied with root crops and cattle raising on modern methods were on the increase. The average annual value (1904–14) of the products of forestry (exports only) exceeded £400,000. Forestry made important progress, thanks to the efforts of the State and the Norwegian Afforestation Association (founded 1898) which up to 1913 had planted 104,000,000 new trees; nevertheless, the annual lumbering exceeded the growth.

Fishing Industry.—The fisheries were changing character from coastal to modern deep-sea concerns. In 1914 the Norwegian fishing fleet consisted of about 550 registered vessels (above 25 gross tons for steamers and 50 for sailing boats, most of which were now provided with motors). The Antarctic whaling industry initiated in 1906 was growing rapidly; in 1913 there were 54 whaling companies with 160 vessels, 36 floating factories and 30 permanent stations. The capital invested in whaling exceeded £2,220,000. In 1914 the output of Norwegian mines was 1,200,000 tons, over three-quarters being iron ore and sulphuric pyrites. The production of iron ore was increasing, and in 1915 reached the record figure of 715,000 tons; but sank later owing to extraordinary difficulties.

Commerce.—Between 1897 and 1914 the number of industrial workmen rose by 100%, wages by 225%. The mercantile marine evolved rapidly from sail to steam; in 1914 Norway possessed a fleet of 1,973 steamers and 1,106 sailing vessels with gross tonnages of 1,793,227 and 687,968 respectively with a total value of £19,000,000. From 1911–3 inclusive the value of imports rose from £26,000,000 to £30,680,000, and of exports from £16,600,000. to £21,800,000. Great Britain supplied most of the imports, Germany took most of the exports; but there were signs that this position would be reversed.

Effect of the World War.—The outbreak of war brought a sudden check and temporary panic, followed by great prosperity up to the entry of the United States into the War in 1917. After this event the restrictions on neutral trade became very oppressive and seriously curtailed Norwegian business profits. Meanwhile the general expansion continued. The arable area was extended, and the corn crop rose from 290,000 tons in 1917 to 4,400,000 in 1918. In these two years official investigations were conducted to determine the limit to which cultivation could be extended; and this limit had been reached by 1925. The area covered with forest was approximately 28,422 sq. m. in 1917, or 22·9-7% of the total area of Norway. Between 1916 and 1920 the average annual export value of pulp and paper products was about 321,900,000 kroner.

The revenues that are derived by the state from the fisheries were very satisfactory up to 1916; in that year the revenue from the large cod fisheries was 70,800,000 kr., which decreased to 41,000,000 kr. in 1917 and 30,000,000 kr. in 1918; the value of the herring fisheries dropped from 71,500,000 kr. in 1916 to 60,600,000 in 1917, 51,700,000 in 1918; trade restrictions, shortage of petrol, and floating mines were serious difficulties. In 1919 the Storting adopted the Government Bill on the establishment

of a Fishing bank for safeguarding the interests of the fishing population. The whaling industry declined throughout the War, many vessels being diverted to the general freights. Norwegian whale oil had been 78% of the world's output in 1913; in 1918 it was only 43·5 %.

Shipping.—The chief fluctuations were in the shipping trade. The heavy demand for tonnage by the belligerent powers brought an early and very rapid rise in freights which continued throughout the War and gave rise to unparalleled speculation. The annual profits of Norwegian shipping 1914–8 were about 500,000,000 kroner. But the gross freightage profit did not rise proportionately with freights on the open market, partly owing to the depreciation of sterling, partly to hampering restrictions, rising expenses and heavy taxation. Eight hundred and twenty-nine vessels with an aggregate gross tonnage of 1,250,000, and 1,162 lives were lost during the War. Norway escaped the first decline in the international market after the War, owing partly to the depreciation of the kroner, partly to the sustained demand for products of the wood-refining industry. In 1920 conditions grew gloomy, especially in shipping, the bottom having been knocked out of freights. The State and the municipalities were borrowing heavily, and bank loans rose by 300,000,000 kr. in the year to over 4,000,000,000 kr., while deposits rose only by 100,000,000 kr. to 3,400,000,000, and foreign credits of Norwegian banks were reduced from 152,000,000 to 17,000,000 kroner.

Foreign Exchange.—In 1921 the kroner dropped heavily, weakening the position of Norwegian exporters, especially in the pulp and paper industry. Many works closed down or worked short time. By midsummer 1,400,000 tons of the mercantile fleet were lying idle. The trade balance, however, improved as regards exports. From 1922–5 conditions improved gradually in spite of the banking crisis of 1922-3. Thirty-four joint stock banks were put under public administration; 10 will definitely be wound up; the fate of the rest will be settled in 1926. The chief problems of to-day are the exchange owing to the over-rapid rise of the kroner in 1925, and the public debt which has been swollen by recent passive budgets.

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NORWEGIAN LITERATURE (*see* 19.815).—The first decade of the 20th century marks the passing away of the four great classics of the preceding age: Ibsen, Björnson, Lie and Kielland. Thereby the field of fiction was thrown open to a new generation of authors, who found themselves confronted with problems essentially different from those which had taxed the attention of the former generation.

Norway was no longer the country of consuls, shipowners, vicars, rectors, chamberlains and estate owners, representing official views and opinions against which persons not "made of that self metal" occasionally revolted, and always with deplorable result to their own social interests; nor was Norway the country of women suffering in silence under slow torture of an apparently correct marriage, or a country of workers imbued by a patriarchal respect to their employers, based on personal connections from generation to generation. On the contrary, thanks primarily to the claim of the right of personality which had been raised so energetically and consistently by the authors of the preceding age, Norway had gradually developed into a community in which democracy had established itself on a broad basis, and in which, generally speaking, a remarkably tolerant spirit prevailed. At the same time, a number of social and economic questions had come to the forefront in consequence of the extraordinary industrial development which had taken place, especially since the beginning of the 'nineties. It might have been expected that all these facts and features, which should be taken into consideration for a fair judgment on the position of Norwegian literature on the eve of the new epoch, would have contributed to bring about a new departure in literature, but nothing of the kind happened.

Drama.—As far as the drama is concerned, its flourishing age came to an end with the age of Ibsen and Björnson. Their younger contemporary, Gunnar Heiberg (1857–) who after their death was considered the greatest dramatic author in Norway, did not, however, develop any further in this line, and as a whole the Norwegian drama since Ibsen and Björnson has followed more fortuitous lines. This applies, by way of example, to *The Happy Election*[1] (1914) by Niels Kjaer (1870–), in which this author, who is considered one of the most accomplished writers of modern Norwegian prose, deals with certain contemporary phenomena of Norwegian politics, among them the language question, in a very clever and realistic way. Another example is Oskar Braaten (1881–) who has scored great success on the stage with his comedies *The Kird* (1911) and *The Wholesale Christening* (1925), written in the characteristic language of the industrial population in the vicinity of Oslo and dealing with its life and manners. A dramatist of an entirely different type is Hans E. Kinck (1865–), whose remarkable drama *The Cattle Dealer* (1908), in the opinion of many critics, is unrivalled in Norwegian literature since Ibsen's *Peer Gynt.* This drama, which is too unwieldy for the stage notwithstanding its intrinsic merits as a work of fiction, has never been performed, contrary to his Italian drama *Agilulf the Wise,* which was acted at the National Theatre in the spring of 1910, when it gave rise to a lively discussion engendered primarily by the sovereign way in which the author disregarded the conventional rules of rhythm and stanzas.

Fiction.—An examination of the history of the Norwegian novel during the same period leaves a more satisfactory impression for the very simple reason that this special form of art had not reached the same state of perfection as the drama at the end of the preceding period and, accordingly, contained possibilities of a further development. By that time some 20 years had passed since Hamsun had made his appearance in literature. Within this period he had produced a number of works, generally written in an exquisite style and filled with an exuberant vitality, of which *Pan* (English translation) 1895, ranks particularly high. Compared with this work, the *Growth of the Soil* (1917; English translation 1920), by which Hamsun has become famous all over the English-speaking world, does not approach it in range of passion and in mystic grandeur. The former is a consummate work of fiction and art. The latter is an exceedingly fine novel, inspired by the cooler views of the more mature years as well as of a more prosaic age. In the struggle between the ideas of agriculture and the ideals of industrialism, Hamsun, like the rest of his contemporaries, sides with the representatives of the "mother trade of the country" notwithstanding the marvellous industrial transformation of Norway during the last generation, or perhaps we should rather say because of it. This even applies to Kinck, who is anything but prepossessed in favour of the peasants.

Kinck, who is by all critics admitted to be an author of rare gifts, has not yet received general recognition either at home or abroad. Yet by his daring metaphors, his exuberant passions, his deep psychology supported by extensive historical studies, he is one of the most intimate guides to the depths of the Norwegian mind. His Hardanger novel, *The Avalanche* (1919–20), is considered his greatest work, but generally speaking he is at his best in the short story. Another classic writer is Trygve Andersen (1867–1920), a self-controlled author with a limited production but whose work is stamped by a keen psychological insight and imaginative inspiration and moulded in an exquisite and transparent style.

Besides these three poet-artists and classics should be mentioned Johan Bojer (1872–) whose novels notwithstanding their fame in the English-speaking world and elsewhere are not considered by Norwegian critics as revealing any particular feature typical of the Norwegian mind. A more intimate author is Peter Egge (1869–), a conscientious writer with an artistic style which adds to his original gifts as a narrator and psychologist.

[1] In this article the titles of books are translated into English for the convenience of the reader, although unless otherwise stated the books themselves have not been so translated. (Ed. E. B.)

One of the chief characteristics of Norwegian literature during the last generation is the ever-increasing number of local authors who, substituting particular districts for the country as a whole, have given rise to local literature, partly written in the literary tongue of the country known as the *Riksmaal*, partly in the *landsmaal* (*see* 19.818) or in a *riksmaal* coloured to a marked degree by some local dialect. The most conspicuous of these authors are Oskar Braaten, Hans Aanrud (1863–) who scored success as a playwright of broad humour in the 'nineties, and Johan Falkberget (1879–)—all typical East Norway novelists. Braaten's literary domain, not only as a playwright but as a novelist, is the industrial quarters in the immediate neighbourhood of Oslo. Aanrud is a keen observer of life and manners in the midland countries round Lake Mjösen. Falkberget is intimately acquainted with the miners of the mountain districts of the valley of Österdalen, whom he has depicted vividly in surroundings of an overwhelming nature.

Gabriel Scott has, in an idyllic novel *The Source* (1918), found an exquisite expression of the typical Sörland (literally Southerland) nature and Sörland temper as they reveal themselves all through the charming coastland. West Norway country life has been ably sketched by Jens Tvedt (1857–), who writes in the *landsmaal*. The particular district of the North Trondhjem country, known as the valley of Namdalen, has in Olav Duun (1876–), whose works all deal with life and manners in his native valley, produced the most gifted author of modern times writing in the *landsmaal*. Another significant author in the same language is Kristofer Uppdal (1878–), originally a navvy whose works in prose and poetry are imbued by the ideals of the labour movement. This tendency in the direction of developing a special county or district literature, as it were, is intimately connected with the national current which in 1905 brought about the dissolution of the Union with Sweden and which since then has given rise to a rather voluminous literature dealing with the local history, of which Madame Sigrid Undset may be considered the chief exponent.

Poetry.—In the noble art of poetry Nils Collett Vogt (1864–), who already in the 'nineties was known as a highly gifted lyric poet, continued to proclaim his emotions in stanzas of vigorous and beautiful metaphors. Olaf Bull (1882–) combines to a rare degree a refined versification with silent resignation and lofty enthusiasm. Herman Wildenvey (1885–) a genial troubadour talent, sings out his joys, his cares and his whims in easy verses and metaphors, striking by the felicity of phrase. Simultaneously with this lyric flourishing in the *riksmaal*, no adequate revival has taken place in the *landsmaal*. The gem of lyric poetry in that tongue is Haugtussa (1895), a lasting tribute to the genius of Arne Garborg (1851–1925), by whose death the *landsmaal* literature was left temporarily without any first rate lyric poet. (S. C. H.)

NORWICH, England (*see* 19.819), is extending and enlarging its industries. Its banking interests are less localised than formerly, owing to amalgamations, but it is the headquarters of the Norwich Union Life Office and the Norwich Union Fire Office, which societies have been under one control since 1925. The area of the borough is 7,923 ac., and the population was 120,661 in 1921. The chief magistrate was created lord mayor in 1910. The church of St. Luke's, New Catton, was consecrated and given a parish in 1915.

The house in which George Borrow resided with his parents when in Norwich is now a Borrow Museum, presented by Mr. A. M. Samuel, M.P., in 1913. Stuart Gardens, bequeathed to the city by the late Mrs. James Stuart as a memorial to her husband, was formally presented in 1922, in which year the Strangers' Hall, a 15th-century house on Charing Cross, was given as an English folk museum by Mr. L. G. Bolingbroke. In 1921 Sir Eustace Gurney presented to the city the Lazar House, a fine Norman relic contemporary with the cathedral, for the purpose of a branch public library, and as such it was opened in 1923. The City Bridewell, a fine old, flint-faced building, was presented by Mr. H. N. Holmes in 1923, and after restoration was opened in 1925 as a museum of local industries, past and present. In 1925 Miss Ethel M. Colman, the first lady in the country to hold the office of lord mayor (1923–4), and her sister, Miss Helen Colman, restored and presented to the city Suckling House (14th century), together with the adjoining Stuart Hall, which was erected by them as a memorial to their sister, Mrs. James Stuart, to be used for educational purposes. In the same year the famous Samson and Hercules House on Tombland, and the adjoining Augustine Steward House, were opened as a Y.W.C.A. centre, and the ancient and almost unique bishop's throne in the cathedral was restored by the bishop, (the Rt. Rev. Bertram Pollock).

In Jan. 1925, Prince Henry laid the foundation stone of a new children's block at the Norfolk and Norwich Hospital, and this was opened in Jan. 1926. The Maddermarket Theatre, an exact model of an Elizabethan theatre, in a building once a Roman Catholic chapel, was opened in 1921 for performances by the Norwich Players, an amateur dramatic company. Considerable developments in town planning have taken place, and several new arterial roads have been made. In 1923 the new Carrow Bridge over the river Wensum was formally opened by the Prince of Wales, and in 1925 Wensum Park was opened on the site of a refuse ground.

See Ian Hannah, *Heart of East Anglia* (1914); G. A. Stephen, *Guide to the Study of Norwich: a Bibliography*, 2nd. ed. (1919).

NOSE: *see* EAR, NOSE AND THROAT, DISEASES OF.

NOSKE, GUSTAV (1868–), German politician, was born in Brandenburg July 9 1868. He became a writer for Social Democratic papers and from 1897–1902 worked on the staff of the *Königsberger Volkszeitung* and later the *Volksstimme*, at Chemnitz. Returning to Brandenburg in 1902, he was elected to the municipal council, and in 1906 entered the Reichstag. Throughout the World War Noske belonged to the majority Socialists. In Nov. 1918 he accompanied the secretary of state to Kiel and arranged a suspension of the mutiny then prevailing. He remained in Kiel as governor till Feb. 11 1919, when he returned to Berlin as minister of national defence. In his book *Von Kiel bis Kapp* (1920) he gives an account of his difficulties in organising an army for home defence. On the occasion of the Kapp coup of March 1920 Noske was unable to prevent the occupation of the capital by Gen. von Luttwitz and fled with Ebert and Bauer to Dresden and later to Stuttgart; but after the suppression of the Kapp troubles it was impossible for him to resume office, owing to his lenient treatment of the military reactionaries, coupled with his ruthless suppression of Communist rioters.

NOTTINGHAM, England (*see* 19.826), with an area of 10,935 ac. and a population in 1921 of 262,624, has several flourishing industries, although the lace trade is less prosperous than formerly. Cycles, drugs and hosiery are made here in large quantities. The leather trade expanded greatly during the World War. Since 1918 the city has returned four members to Parliament.

In 1921 Wollaton Hall, a magnificent example of Elizabethan architecture, with the park of 750 ac. that surrounds it, was bought by the corporation from Lord Middleton. A portion of the land is to be used for building purposes, but the greater part of the park will remain an open space. Municipal schemes have provided a number of new houses since 1918. The new churches and parishes include St. Cyprian (1910), St. Christopher, Sneinton (1910), St. Faith, NorthWilford (1914) and St. Michael and All Angels (1914). The William Woodsend Memorial Homes were opened in 1913 and the William Booth Memorial Hall in 1915; the Natural History Museum was transferred from University College to Carlton road in 1920. New buildings contemplated include one for municipal purposes overlooking the market place, a large power station and a public library. A railway line to Mansfield, leaving the London & North Eastern a few miles north of the town, was opened in 1917 and gives access to the docks at Immingham.

The most important development is the erection, at the cost of Sir Jesse Boot, of new buildings for University College. These are on the western side of the town, on a site of 220 ac. called

Highfields, part of which has been devoted to recreation grounds for the public and the students. A large open-air swimming bath was opened near the estate in 1924 and a new road connecting it with the city has been made. In 1926 the work of doubling the width of Trent Bridge was completed, a slum area of 400 houses being demolished to make a new road to the bridge. Sir Jesse Boot has given 16 ac. to complete the Victoria Embankment.

NOVÁK, VÍTĚZSLAV (1870–), Czech composer, was born at Kamenice in Bohemia. He completed his studies at the Prague conservatoire of music, of which he became director in 1919. Early in his career he came under the influence of Dvořák, Brahms, Schumann and others, but he soon revealed his own individual method of expression, which was marked by powerful phantasy and boldness in musical resources. His early piano compositions, consisting of overtures and songs, are lyrical, phantastic and passionate by turns, but romanticism forms the basis throughout. Later he turned his attention to the popular music of Moravia and Slovakia, by which his subsequent compositions were strongly influenced. These include many of his best works, such as the symphonic picture *In the Tatra*, Slovak Suite, two Valach dances, the symphonic poem *Legend of Yearning*, Moravian songs, Czech suite, gypsy melodies, as well as a number of compositions based upon national ballads. Among his earlier works may be mentioned the overtures *The Corsair* and *Manfred*, *Memoriës*, serenades, eclogues and barcaroles. Of his orchestral works the most noteworthy are *Toman and The Wood Nymph* and *The Storm*. Novák also composed some operatic works, the best of which is *The Lantern*, based upon a play by A. Jirásek and exhibiting his art in its maturest form.

NOVA SCOTIA (*see* 19.830), a province of the Dominion of Canada. The population, which includes the island of Cape Breton, was 523,837 in 1921. This showed an increase of 6·4% since 1911; of the total 56·98% was classed as rural. About 80% of the inhabitants are of British descent. Halifax, the capital (pop. 58,372) and Sydney (pop. 22,545) are the chief commercial and shipping centres. The Government consists of a Lieut.-Governor, a legislative council of 21 members appointed for life, a legislative assembly of 43 members elected on general suffrage; an executive council of Ministers is appointed by the Premier. The province is represented in the Federal Parliament by 10 senators and 14 members of the House of Commons.

Education.—Each county in the province has a high school or an academy. Among the degree-granting institutions of the province the most important are Dalhousie University at Halifax (including by affiliation since 1922, King's College, Windsor). Acadia University at Wolfville and St. Francis Xavier at Antigonish. The school districts are subdivided into school sections, each administered by a board of three trustees, elected by the ratepayers. Local taxation is supplemented by legislative grants, the total expenditure on education in 1923 being approximately $3,500,000. There were then 114,458 pupils and 3,237 teachers in the schools under public control.

Production and Industry.—The acreage under crops, and consequently the quantity and value of agricultural products, greatly declined during the post-War period. In 1919 the total value of the principal field crops was $63,357,000; in 1924 this value had fallen to $16,359,000, but a slight increase occurred in 1925. The average annual yield, in bushels, of the chief crops for the period 1922–4 was: wheat, 233,533; oats, 4,094,667; barley, 195,700; and buckwheat, 188,100; the average yield of potatoes was 3,372,800 hundredweight. The production and export of apples, for which the Annapolis and Cornwallis valleys are especially suitable, has become a leading industry. The average annual crop exceeds 1,500,000 barrels. The provincial Govt. maintains 35 model orchards in various parts of the province. In 1925 there were 291,912 cattle, 273,499 sheep and lambs, 53,480 swine and 53,352 horses in the province. Dairying has increased in importance; the chief dairy product is butter, the output of which increased from 320,763 lb. in 1911 to 4,094,282 lb. in 1924. Travelling dairy schools giving instructions to farmers throughout the province have been instituted.

The forest area of Nova Scotia is estimated at over 12,000 sq. m., more than half the area of the province. The value of the lumber cut in 1923 was $2,281,949. The production of pulpwood for 1923 was valued at $838,358. The fishing industry is of vital importance: in 1924 there were 18,721 persons employed in the various branches of the industry, and the total value of the products amounted to $8,777,251.

Coal, iron, copper and gold are found, but only coal is produced to any large extent, the output being 4,973,184 tons in 1924. The production of gold has greatly declined, and only 750 oz. was produced in 1924. Colchester County contains valuable oil shales. The total value of mineral products in 1925 was $38,720,000. Extensive manufactures of iron and steel are carried on at Sydney and other parts of Cape Breton Island. The shipbuilding industry has declined steadily, except for the temporary stimulus provided by the exigencies of the World War. Other manufacturing industries of the province include sugar refineries, pulp and paper mills, canneries, textile and boot and shoe factories. The total capital invested in manufacturing industries was $107,000,000 in 1923, the number employed 17,179, and the gross value of production amounted to $82,000,000.

Trade and Communications.—Imports entered for consumption in 1924–5 amounted to a value of $22,068,108. Exports during the same year were valued at $43,487,392. Of 15,190 m. of roads in 1924, 1,255 m. were of gravel. The total expenditure on the highways in 1924 amounted to $1,728,894. The Canadian National Railway system is the chief means of internal communication; the railway mileage in 1925 was 1,434. (*See* CANADA.) (S. LE.)

NOVELLI, ERMETE (1851–1919), Italian actor and playwright (*see* 19.838), died at Naples Jan. 29 1919. His tragedy *La Masque* written in collaboration with Signor Bonaspetti, was produced in 1911.

NURSING.—The science and art of nursing has, like surgery and medicine, made enormous strides since 1910, partly due to the War, but largely owing to the general development of science in this country. Modern nursing had its origin with Florence Nightingale, and she set the standards that have been followed since. But in later years there has been a change in the manner in which the nurse is regarded. She is now looked upon, both as the possessor of a great vocation for which she has to be qualified by years of training, and as a professional woman whose loyalty to that profession should be as true as that of the doctor, and whose duty is to add to her knowledge and professional skill both for her own sake and for that of the profession to which she belongs.

I. IN GREAT BRITAIN

Training of Nurses.—In Great Britain the training of the nurse is regulated by the state through the Nurses' Registration Act of 1919. This Act was only carried into law after years of controversy, which ended with the outbreak of War, when a truce was declared and loyally maintained. The profession has now the right of self-government. There is a General Nursing Council for England and Wales and another for Scotland, and 16 of the 25 members of the English Council must be registered nurses elected by persons registered under the Act.

In addition to the ordinary registration of nurses with a general training (which occupies three or four years) there are five supplementary registers for male, mental, fever, mental defectives and sick children's nurses. Nurses usually begin their general training in recognised training schools at an age not less than 21, though for certain kinds of training (such as those for nurses of fever or sick children) probationers are taken earlier. The nurses usually live in the hospital or in hostels near it; and as a rule, those who remain in hospital retire about the age of 50 or 55, when a pension is frequently provided with or without contribution. Post-graduate teaching is developed in the best schools, as is the system of providing tutor-nurses. There is not as yet much connection with the universities though the University of Leeds grants a diploma in nursing.

Hospital training has thus become highly developed in Great Britain, and the matron of a great hospital holds a very important position as regards her staff, which is divided into sisters, staff nurses and probationers. There are specialists in electric and other technical work, but these have usually first completed their general training. Strenuous efforts have been made to reduce the hours of service and to increase the salaries, which for many years have been extremely low. There is still room for improvement in both these matters.

College of Nursing.—In the year 1916, a college of nursing was established with the view of forming a centre for all nursing activities, improving the nursing service as a whole and the conditions under which nurses work. In 1925 it had a membership of 24,000 with 42 branches and sub-branches throughout the United Kingdom. Connected with it are a student nurses' association for nurses in training, a section for sister tutors and a section for public health workers. It is recognised by the Ministry of Health as an approved centre for the training of health visitors.

Although a large number of nurses serve in hospitals, these are regarded mainly as training schools, where the young nurse is carrying on her studies as well as gaining practical experience. The difficulty with the present hours of duty is to provide the necessary time for her studies and for preparing for frequent examinations, state and hospital. In early days, the importance of the training was not fully recognised, and the nurse was regarded as one who simply performed certain useful functions. Now, the doctor or surgeon looks to the nurse for assistance in his work; he can only see the patient at intervals but she has him always under observation, and the accuracy of her observation and report is a matter of vital importance. It is probable that during the strain of War the matter was pressed home on those in control of hospitals as it never was before. Nurses have become an essential part of the social and economic life of the country and their functions are continuing to increase. It may be well to enumerate the most important of them.

District Nurses.—On completing her general training, usually of four years, a nurse may take her district training and be placed on the roll of the Queen's nurses, which are supervised from head-quarters but supported locally. There are still "cottage nurses," with a short training, but those with a higher standard are rapidly increasing, more especially as they are eligible to do county health work under the medical officer of health. Those who hold the certificate of the Central Midwives Board are frequently employed in infant and child-welfare work. Before many years have elapsed every parish or district should have its own nurse.

Public Health Work.—In addition to child welfare work many nurses are employed under county, burgh or city schemes. The education authorities require a large staff for following up the cases of children who have been inspected by their medical officers. Nurses are also required for fever and isolation hospitals. Poor Law infirmaries give excellent training and have certain advantages over hospitals, which are also training schools for the medical profession. There will probably be changes in Poor Law administration before long.

Private Nursing.—This form of nursing has expanded enormously and though some visiting nurses come in for the day, they are mainly residential. Nurses who undertake this work are to be had either from a hospital which sends out their nurses after they gain their certificates, or from an institution, possibly a co-operative institution or home. Nurses are employed in many private nursing-homes for the well-to-do.

Mental Nurses.—The training for mental nurses is usually conducted in a recognised institution for the treatment of mental disorders where the candidate serves for three years, and enters for the state examination for mental nurses. The nurses and attendants are of both sexes, but women are being increasingly employed even for male patients.

Midwives and Maternity Nurses.—Midwifery is controlled by a Central Midwives Board, established in London, with jurisdiction in England and Wales, and there are separate boards for Scotland and Ireland. The number of midwives now on the roll in England and Wales is approximately 77,791. These boards regulate the issue of certificates and the conditions of admission, and have also the power to remove names from the roll. It was only in 1910 that it was forbidden to any person to attend women in childbirth for gain (otherwise than under the direction of a qualified medical practitioner) unless certified under the Act. An incorporated Midwives Institute has done splendid work in promoting the interests of midwives. Many trained nurses take the midwives' certificate, for which they have to have a six months' special course while a twelve months' course of midwifery is necessary for those who are not trained nurses.

Masseurs and Masseuses.—The Chartered Society of Massage and Medical Gymnastics grants a certificate to those who have taken a prescribed training at a recognised school and have passed an examination. After June 1927 examination on massage as a single subject will cease.

Various Services.—A voluntary advisory nursing board was established in 1921 under the Prison Commission of the Home Office, and trained nurses are now appointed for the care of sick prisoners. A nursing service deals with hospitals under the Ministry of Pensions, and a matron-in-chief is at its head.

The Overseas Nursing Association sends trained nurses to the Crown Colonies and small British communities abroad. There is also an Indian nursing service for Europeans in India.

Queen Alexandra's Imperial Military Nursing Service originated in 1902. A nursing board advises the Secretary of State on matters connected with the service. A matron-in-chief is at its head and principal matrons, matrons, sisters and staff nurses are subordinate to her.

In the first year of the World War there were 2,323 fully trained reserve nurses, in addition to the regular service, and by 1918 the number reached 10,304. There is likewise a service called Queen Alexandra's Military Families Nursing Service. The Territorial Army Nursing Service, established in 1907–8 in connection with the Territorial Army, supplied the largest number of British nurses available on the outbreak of the World War. The probable number required is about 4,000, but the territorial nurses are only called up in case of necessity. Like the Territorial Army, they enrol with overseas obligations.

Queen Alexandra's Royal Naval Nursing Service is a small one, which also has a reserve. The Royal Air Force Nursing Service was established in 1921 and has the same formation—matron-in-chief, matrons, sisters and staff nurses—as the others. (See MEDICAL SERVICE, ARMY.)

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(E. S. H.)

SCIENCE AND TECHNIQUE

Nurses now work for shorter hours, they have greater freedom, optional out-door uniform, a rational and comfortable indoor uniform, better food, private bedrooms, a dining hall and comfortable sitting rooms. They are encouraged to take healthy out-door exercise, to play games for their hospitals, to join musical or literary societies. There has been a further reduction in the minimum age (to 19 years in many hospitals) at which probationers are engaged, in order that girls leaving good schools may pass on to a nursing training without loss of time, and find their position in that nursing training to be on a par with that of their friends, who have passed on to a university.

The standard of living for the patient also has greatly improved. The modernisation of hospital wards, singular 15 years ago, is now an almost universal fact. The introduction of up-to-date apparatus, such as steam heat, electric light, gas or electric cookers, heaters and sterilisers, electric hot air baths, adjustable beds, heated food trolleys, rubber floors, electric lifts, wheeled stretchers, high power reflector lights for operating rooms, powerful magnets, etc., is an advantage; there is a marked improvement in the quality of the patients' bedding, linen, crockery, hospital food and its service, although, in the last respect, England has something to learn from Scandinavian countries. There is a greater personal liberty for patients: in many hospitals, since the World War, smoking is permitted to the men patients within certain hours, and visitors have greater access to their sick friends.

Entirely new methods of treatment have been evolved for diseases and conditions such as diabetes, eclampsia, uraemia, phthisis, cardiac disorder, etc., necessitating, in many cases, complicated and exact diet regulated by an exact knowledge of the chemical constituents of the blood and other fluids. In other cases treatment such as immobilisation of a lung, or measurement of the air capacity of a lung, is regulated by the results of frequent bacteriological and other tests. Again, treatment by means of graduated exercises for the heart, the re-education of muscles and nerves that have lost their power, and the re-education of the brain itself, have been developed and depend for success on careful nursing.

Surgical Cases.—The advance in surgery is illustrated in delicate operations in brain surgery; plastic operations on the face; blood transfusion; tendon transplantation; periscopic examination of the abdominal and other cavities; examination of the intestinal tract, kidneys, spinal canal and brain cavities by means of opaque drugs and X-rays; bone grafts and all the skilled manipulations of orthopaedic surgery; plaster and splint work; and advances in many other special branches of medicine and surgery. In all these investigations and achievements

doctors require the intelligent and skilled co-operation of nurses. The education of modern nurses has been widened and deepened to fit them for their task. (E. E. MACM.)

II. IN THE UNITED STATES

The rapid development of the nursing profession in the United States has been due in large measure to the three national nursing organisations established by the nurses themselves, in the belief that they were responsible for the ethics, standards and educational developments of their profession.

American Nurses' Association.—The "American Nurses' Association" was founded in 1896, according to its charter, "to establish and maintain a code of ethics; to elevate the standard of nurses' education; to promote the usefulness and honour of nurses; to distribute relief among such nurses as may become ill, disabled or destitute; to disseminate information on the subject of nursing by publications in official periodicals or otherwise; to bring into communication with each other various nurses and associations and federations of nurses throughout the United States." This association has been active in legislative measures affecting nursing interests, and since 1917 has been in constructive co-operation with the National League of Nursing Education. *The American Journal of Nursing*, a monthly magazine published continuously since 1900 by the American Nurses' Association, is also the official organ of the "National League of Nursing Education."

The National League.—The "National League of Nursing Education" was organised in 1893 by 18 women superintendents of hospitals to promote nursing education and to raise educational requirements for the profession. Its membership is now open to heads of schools for nurses, teachers of nurses and heads of nursing services, all of whom are also members of the American Nurses' Association. The League has initiated many distinctive movements, the most notable of which are: in 1896, the extension of the hospital training course to three years; in 1903, the inauguration of state registration of nurses, now compulsory in the 48 States of the Union; in 1907, the establishment of a department of hospital economics at Columbia University; in 1917, the publication of a standard curriculum, designed to ensure a minimum standard for all schools of nursing, and now almost universally adopted; in 1925, the classification and grading of training schools, a task now under way. In addition, the League has during the 33 years of its existence published numerous pamphlets and reprints of value in nursing education.

The National Organisation.—The National Organisation for Public Health Nursing was organised in 1912, to establish standards in public health nursing, and to promote a general intelligent understanding on the part of the laity, as well as the nurses, of the needs and importance of well-planned preventive work in the field of public health. It publishes a quarterly journal, *The Public Health Nurse.*

Each of the three national organisations maintains ample headquarters, with secretaries and reference libraries, and in diverse ways lends its support to the body of nurses and their educational experiments. The distinctive service in America performed by these associations because of their special knowledge and experience accounts for the remarkable progress made in the nursing field in the past 30 years.

The American Red Cross.—In 1904, by Act of Congress, the reorganisation of the American Red Cross was effected, and provision thereby made for a flexible nursing reserve, with chapters in every State, ready to provide nurses from the ranks of the profession in times of emergency. The Red Cross has also initiated a peace programme for rural visiting nursing, which has developed into a national service of public health nursing. In 1919, it appropriated $115,000 for scholarships to enable graduate nurses to equip themselves more thoroughly for this service.

Army Nursing Service.—The Army Nursing Service was established by Act of Congress in 1901; the Navy Nursing Service, in 1908. In 1918, the Army School of Nursing was established on progressive lines, with hospital affiliations to give its students the experience necessary for their complete training.

U. S. Public Health Service.—The United States Public Health Service, a branch of the Treasury Dept., employs a staff of nurses under the direction of a woman superintendent, to assist in carrying out its extensive public health programme in hospitals, in foreign and domestic quarantine and in various sanitation projects.

University Courses.—At Teachers' College, New York, the first collegiate course for nurses was established in 1899 through the efforts of the nurses themselves. To-day there are in the United States 22 universities or colleges providing training for nurses. In 1909, the University of Minnesota made its school of nursing a professional school of the university, the principal being responsible to the dean of the medical school, and a member of the medical faculty. Five-year courses have been established by several colleges in order to combine liberal arts with professional training.

In 1919, through the generosity of the Rockefeller Foundation, a study was made of the conditions of nursing and nursing education. As a result of a report based on this study, Yale University established a school of nursing open only to college graduates, to be maintained as an experiment for five years by the Rockefeller Foundation. The ideal of this school is to increase the number of teachers and leaders for new lines of work.

Development of Public Health Nursing.—Perhaps the most unique contribution to nursing in the United States has been the development of public health nursing. The term "public health nurses," originated in 1893, emphasises the community responsibility of the nurse. There are to-day 12,000 public health nurses in the United States actively engaged in public health nursing, which, as now understood, proclaims the twin service of ministration and education, and includes the care of the sick in the homes and the teaching of preventive health measures. Many types of specialised work in the public health field have been developed: school nursing, municipalised in 1902, and now supported by public or private funds throughout the country; work with the tuberculous; maternity clinics; milk stations; infant health centres; prenatal clinics; clinics for the pre-school child; care of cardiac cases; industrial nursing; hospital social service; and treatment of venereal diseases.

Hospital Social Service.—The germ of Hospital Social Service, now highly developed, originated in 1879, when the Ethical Culture Society of New York employed a nurse to associate herself with a visiting physician affiliated with the dispensary. The Massachusetts General Hospital of Boston in 1905 placed new emphasis upon carrying the treatment from the hospital to the patient and utilising the opportunity of education in the home, systematising the co-ordination of the treatment and the complete rehabilitation of the family through public and private agencies. Many hospitals now employ a staff of social workers and nurses for follow-up work among their patients' families and among discharged patients. The nurses in the United States have written most of the text-books used in the schools and in public health nursing, and publish many leaflets, articles and local journals. In this they are encouraged and aided by the medical profession.

Educational Tendencies.—The present tendency in nursing education is to replace the apprenticeship system of training by professional university schools administered independently of hospitals, but affiliated with them to give ward experience to their students.

Statistics.—In 1925 the number of registered nurses in the United States was 250,000, of whom approximately 220,000 were active private-duty nurses, 11,000 public health nurses and 5,000 were in institutions or engaged in teaching. The number of training schools was 1,800, the number of graduates annually 15,000, and the number of colleges giving training courses 22. The growth in number of training schools is striking; in 1873 there were four schools, in 1883 22, in 1900 400, in 1910 1,100, in 1920 1,800. According to the 1920 census, there are 150,000 untrained nurses in the United States.

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(L. D. W.)

NYASALAND PROTECTORATE (*see* 4.595).—Area about 40,000 sq. miles. Population (1924 estimate): Europeans 1,462; Asiatics 669; natives 1,210,344. The increase in the native population (10,410 since the 1921 census) was wholly due to immigration from Portuguese Nyasaland.

The five years before the World War were marked by steady progress, notably in the advancement of the natives. In 1913 Mr. (later Sir) George Smith was appointed governor, a position he held for 10 years, guiding the affairs of the protectorate with conspicuous ability. During the War the northern part of the country was invaded by the Germans from East Africa (Sept. 1914) and there was stiff fighting around Karonga on Lake Nyasa. Later, Nyasaland was one of the bases of General Northey in his operations against the Germans. Practically every European of military age joined the Nyasaland Volunteer Reserve; the Nyasaland battalions of the King's African Rifles rendered good service, while over 150,000 natives were employed as carriers.

Chelembwe's Rebellion.—Early in 1915 there was a revolt of some 500 natives in the Shire Highlands. The rebels were led by John Chelembwe, a negro, trained as a teacher by the American Baptist Mission, who had taken a university course in the United States and had subsequently built a church in Nyasaland and preached the independence of Africans. Chelembwe and his followers attacked a planter's house and killed three white men. One, a Mr. Livingstone (a descendant of David Livingstone), was decapitated, and Chelembwe preached in his church with Mr. Livingstone's head placed on the pulpit. The rising was quickly suppressed by volunteers and native soldiers. Chelembwe fled, was tracked by native police and shot dead (Feb. 1915). This revolt, a symptom of Ethiopianism, was no reflection of the attitude of the natives generally. Under the guidance of Christian missions—of which the principal are the Church of Scotland Mission, the Livingstonia Mission of the United Free Church and the Universities Mission—the natives, naturally progressive, made marked progress, both in education and industries. The doyen of the missionaries, Dr. Robert Laws, of the Livingstonia Mission, who exercised a powerful influence throughout the protectorate, celebrated the jubilee of his work in Nyasaland in 1925.

Economic Progress since the War.—A considerable number of white men who came from South Africa or Great Britain during the War settled in Nyasaland as planters. But the development of the country was greatly impeded by the lack of adequate means of exporting produce, and both European and native cultivation suffered severely, though 1924 proved a good year for trade. The shallowness of the Shire and Zambezi made river transport hazardous. To overcome this difficulty a railway, completed in 1915, was built from Port Herald, on the Shire, to Chindi, on the north bank of the Zambezi, and in 1922 another railway, from Beira to the southern bank of the Zambezi, was opened. Until, however, the Zambezi was bridged (which had not been done up to 1926) this means of communication was unsatisfactory. Moreover, as the railway from Port Herald stopped at Blantyre, there was only road communication with Lake Nyasa and the produce of the northern part of the protectorate had practically no outlet.

Most of the whites live in the Shire highlands, the climate rendering the greater part of the country unsuitable for Europeans. As stated by the governor, Sir Charles Bowring, in 1924, " the prosperity of the protectorate depends on the development of its tropical agricultural resources, partly by a limited number of European plantations, but principally by the natives themselves with European instructors." The natives, particularly the Yaos, the Amatonga and the Angoni, are keen agriculturalists, and with the provision of ocean outlets the prosperity of Nyasaland will be assured.

Coffee growing has been almost abandoned, and the chief exports are tobacco, cotton, tea and fibres. Imports, which in 1910–11 were valued at £111,000, had risen to £548,000 in 1924. Exports were valued at £97,000 in 1910–1 and at £583,000 in 1924. Revenue, which was £76,000 in 1909–10, was estimated at £285,000 in 1924–5, while expenditure rose in the years named from £108,000 to £305,000. Revenue was burdened by railway charges under guarantees given to the companies, the net railway revenue being insufficient to meet interest and sinking fund charges.

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OAKLAND, Cal., U.S.A. (*see* 19.935), increased in population 44% in the decade after 1910, reaching 216,261 in 1920, of whom 49,895 were foreign-born (including 4,536 from China and Japan). The Census Bureau estimate for 1925 was 253,700. After the World War there was a period of great industrial expansion. Over $150,000,000 worth of building was done in Oakland in the five years 1921–5. Bank debits nearly doubled between 1919 and 1923, increasing from $751,947,000 to $1,450,856,000. The number of ships which docked at the Oakland harbour in 1924 was 7,870. Factory products were valued at $22,343,000 in 1909; $134,756,000 in 1919; $122,491,778 in 1923. Hydro-electric power was furnished by two competing companies. The water supply (from the adjoining Berkeley hills) was still in the hands of a private corporation, but a project had been undertaken by the city, in co-operation with adjacent municipalities, for bringing a supply from the Sierra Nevada mountains (at a cost of $39,000,000) and its completion was expected by 1928. Additions to the public buildings included a city hall, a municipal auditorium, high schools, a health centre and a public library. There were 57 playgrounds, covering 290 ac., with 418 ac. additional in parks, a boulevard skirting Lake Merritt and two municipal camps in the Sierras.

OBERLÄNDER, ADAM ADOLF (1845–1923), German caricaturist (*see* 19.946), died in Munich May 29 1923.

OBSTETRICS (*see* 19.962).—Since 1910 a striking change has occurred in the science of obstetrics and its practice, chiefly as the result of its invigoration by the spirit of preventive medicine.

The term " preventive medicine " does not connote any special creed or peculiar doctrine in medicine. It is, in fact, merely an attitude of mind, which has developed slowly, but with increasing momentum during this century. Lip service has always been given to the ancient platitude that " prevention is better than cure," but till a knowledge of the causes of disease and the manner of its spread was obtained, the translation of these words into action was scarcely possible. With concrete examples, such as those afforded by the adoption of Listerian principles in surgery and midwifery, and generally by the lessened incidence of contagious and infectious diseases as their causation was worked out, the development and diffusion of preventive ideals throughout the whole of medicine has become easier and more general. This fresh mental attitude has produced a change of method throughout medicine, which might be described as the observation of the bodily functions in health and watching for the first sign of departure from the normal, rather than waiting till disease develops. Its first object is to seek out the causes of disordered function and remove them before they can become operative and, in the second place, when these causes are unknown, to detect the early signs of deviation from normality and restore the normal before trouble arises. The maintenance of physiological function in all bodily systems is its aim so that the cure or relief of established disease becomes the final resource of medicine and marks the failure to attain its earlier objectives.

If obstetrics is regarded from this point of view the difference between the new and the old practice will become obvious. Its immediate purpose will be to secure normal reproduction by detecting and removing all known causes of disorder of function and by observing the healthy pregnant woman from conception onwards to discover any sign of departure from the normal. Though a physiological state, pregnancy imposes a strain on the efficient working of every system of the body, and the thorough examination of the state of health of mind and body of the woman early in her pregnancy and further observation to see how she is standing the test seem but reasonable precautions. Apart from those who have some organic weakness and may break down under the strain, there are disorders of function that may develop in those previously of sound physique. A special strain falls on the excretory organs, and the kidneys and the liver may be affected and lead to acute or chronic disease. Hence the need for the routine and repeated examination of the urine. The good health of the mother throughout childbearing increases her resistance to infection (*e.g.*, puerperal fever) and her efficiency in the rearing of her family.

The care of the pregnancy itself is likewise a matter of greater concern than in the older obstetrics, not only because of the loss of prospective life, but because miscarriage is a prolific cause of operative interference, during or after its occurrence, and of infective and other diseased conditions of the reproductive tract and thus of subsequent disability. Premature labour results in the birth of weakly infants difficult to rear and is a prominent factor in the persistent high mortality among new-born infants. Another important object of the supervision of the pregnant woman, that of foreseeing and avoiding difficulties and complications during labour, provides the simplest illustration of the changed outlook in obstetrics.

Earlier Methods.—The usual custom of a generation ago was for the woman to retain her doctor for attendance on her confinement and for the doctor to do little more than note the expected date on which his services might be required. Unless consulted by the patient because of some disturbance of health, he might not see her again until summoned at the onset of labour. He then made a thorough investigation to see if all was straightforward or if there was any malpresentation or other difficulty, and was prepared to do his best to remedy any untoward condition that might be present or arise later, often being exceedingly ingenious and resourceful in so doing. His obstetric training as a student had been directed largely toward teaching him the management of normal labour, the emergency treatment of abnormal presentations and obstructions to the passage of the foetus through the birth canal and other complications during labour, and his reputation as an accoucheur was largely determined by his capacity to cope with emergencies.

New Methods.—The training of the modern student is conducted on other lines, and whenever a complication occurs the first question discussed is, " Could this have been foreseen? " and if so, the next question is, " What should then have been done? " and a comparison of the case as he has seen it with what it might have been had the emergency been anticipated is used to impress on him that the sole criterion of sound obstetrics is the securing of natural parturition and the prevention of unexpected difficulties and complications so far as the present state of our knowledge allows.

To avoid difficulties in labour, examination is begun about six weeks before the expected date of confinement in order to determine that the child is presenting normally and that there is sufficient accommodation in the bony pelvic canal to allow of its easy passage. This examination is repeated two or three times to make sure that no change has occurred in the presentation and position and that the child does not become unduly large to pass readily. For the most part these matters can be determined with a fair degree of accuracy by the ordinary methods of obstetric examination, but in difficult and special cases examination under anaesthesia and by X-rays may be required. Should it be discovered that even at six weeks before full time there will be difficulty in the child being born by the natural passages, because of rickety or other deformity of the pelvic bones, the question arises whether it is better to resign all hope of the delivery of a living child by the natural passages and perform Caesarean section or to induce labour and learn if the natural powers can effect the delivery of a small and premature infant.

If there does not appear to be any obstruction at the time of the first examination but at a later one there is evidence of a tight fit, labour should be brought on then to avoid the risk of the child becoming too large to be born without difficulty. By eliminating difficulties due to disproportion in size between the child and the mother's pelvic canal and such malpresentations as cross births and brow-presentations (which if allowed to

remain instead of being changed would result in complete obstruction) most of the serious difficulties in labour can be obviated in some way or other. The change in presentation and position of the child can be effected by manipulation through the abdomen, if done before the child is too large to be moved readily, and in favourable cases and under anaesthesia sometimes even up to and after the onset of labour, but if left until the waters have broken or labour is advanced, requires internal operative procedures with their additional risks of injury and infection.

In these instances the cause of difficulty can be anticipated and removed before labour begins, but there are also many conditions of which the cause is unknown so that the obstetrician must fall back on the second line of defence, that of discovering the earliest signs of disturbance, taking them as a warning of danger ahead and making the best possible dispositions. Premature detachment of the after-birth commonly shows itself by haemorrhage and all pregnant women whilst under supervision are warned to report at once any bleeding, so that immediate measures may be taken to lessen the chances of serious consequences. Albuminuria, discovered by frequent examination of the urine, oedema, excessive vomiting and visual disturbances are warnings of possible complication.

Prematernity supervision is in its infancy, but with experience of its working much more will be possible in the way of prevention. Many of its problems have scarcely begun to be worked out and an example of one of the most outstanding of them is worth a little consideration as an example of the problems that obstetrics has to face.

Merely to accept the principle that its primary objective is to secure natural reproduction is not sufficient to change practice. It is also necessary to show where the methods hitherto adopted are harmful. By the infusion of preventive ideals the vision is widened beyond the treatment of the individual case and the nation's maternal and infantile mortality and disability are brought under review. The success of obstetric methods must be tested by asking what price the nation pays in maternal mortality and disability for its new lives, and whether it obtains full value in new lives for the price paid.

When those wider questions are looked into, there is little ground for complacency among those responsible for the obstetric practice of the country. There has been no reduction in maternal mortality equivalent to the drop in the general death-rate or to the remarkable fall in the infantile mortality, which has been halved since the beginning of this century. Further analysis of the registrar-general's figures in England and Wales shows that septicaemia, a form of blood-poisoning practically eliminated from general surgery by the antiseptic and aseptic technique, is still too prevalent and still causes (as puerperal sepsis) about a third of the deaths in childbearing. The annual rate of maternal deaths per 1,000 live births registered in England and Wales is a little under four mothers. In the bad years immediately after the War, the rate was over four per 1,000. This may not appear large but it means that about 3,000 women in the prime of life die in childbearing with the loss of their maternal care to many more young children, and of these mothers over 1,000 die from puerperal sepsis, a preventable disease. Its prevention is a more complicated matter than, and a somewhat different problem from, that of surgical sepsis, because septic organisms may be present in the lower genital tract and spread upwards and into the blood stream, apart from any question of failure of aseptic technique on the part of the attendant.

The statistics of all maternity hospitals show that fever in childbed increases with all complications and difficulties calling for internal manipulation, all of which tend to the introduction or upward spread of infective organisms. The more prolonged and the higher up the tract the manipulation, the greater is the incidence of fever. By far the commonest operative interference is delivery by the forceps because it is advocated by many merely in order to shorten the patient's suffering. Instead of trying to secure natural delivery in cases of weak uterine action, a substitute for the uterine power is adopted in the shape of the muscular power of the attendant exerted through the obstetric forceps. The causes of weak uterine power are difficult to determine and often impossible to foresee, but here is a direction in which investigation is necessary. What is the meaning of the enormous increase in artificial deliveries, and, is the shortening of her time of pain worth the price of the additional risk?

Particularly calling for solution are the questions, how far modern social conditions have lessened the power of the woman of to-day to stand the hardship, fatigue, and mental and physical strain of child-birth and rendered her less capable of completing the expulsion of the child naturally than the mothers in the days before anaesthesia and frequent forceps delivery; what are the factors tending to produce this lessened capacity; and, how far are they removable?

The obstetrical centre of gravity has thus been shifted backwards from the care of labour to the supervision of pregnancy and a wider outlook over the reproductive cycle is taken so that the part played by obstetrics is seen as but part of the wider subject that is concerned with securing the health of the new generation at the minimum of cost to the old. The prematernity supervision looks forward to the nursing of the child and the rearing of the family. It anticipates the natural feeding of the infant by removing all causes that may interfere with breast feeding. It has an educational side and endeavours to inculcate sound principles of hygiene in the preparation for, and the care of, the babe when born, because success in this direction will mean a better start for the new generation. The observation of the developing child falls to paediatrics and the two subjects, as maternity and child welfare, have become a duty and charge to local health authorities, and as such are well known to the public.

In conclusion a tribute should be paid to the late Dr. Ballantyne of Edinburgh, as the advocate of prematernity supervision and the pioneer of the antenatal clinic, which more than anything else has served to further the permeation of obstetrics by the spirit of preventive medicine. *See* J. S. Fairbairn, *Gynaecology with Obstetrics* (1926). (J. S. FA.)

OCEANIA or OCEANICA (*see* 19.988).—This name, in either form, is conveniently and not uncommonly used to cover all the small islands of the South Pacific Ocean which are not closely neighbouring to any of the larger lands, such as eastern Asia and New Guinea. The name is thus approximately equivalent to the former title South Sea Islands. The previous general survey of these islands is given under the heading PACIFIC OCEAN (*see* 20.436).

The War Period.—Oceania was not wholly free of incident during the World War. Very soon after the outbreak (Aug. 30 1914) a New Zealand expeditionary force occupied the former German island of western Samoa; in Sept. Nauru surrendered to a vessel of the Australian Navy; and in Sept.–Oct. the Japanese occupied the German Caroline and Mariana Islands. German vessels of war were at large in the Pacific at this time, and on Sept. 7 1914, a landing party from the "Nürnberg" wrecked the Pacific "all red" cable station on Fanning I.; but communication was restored by the operator. Moving eastward across the ocean, the German vessels bombarded Papeete, capital of the French island of Tahiti, on Sept. 22. Later, the South Pacific was outside the range of naval operations, and the remoteness of some of the islands was exemplified when Lord Jellicoe on H.M.S. "New Zealand" found in Oct. 1919 three Europeans confined on Christmas I., and ignorant of the cessation of the War.

Apart from the occupation of Samoa and the Carolines, certain changes in government took place during the period of the War. The Commonwealth Govt. of Australia took over the administration of Norfolk I. in 1914, and the executive council was made in 1915 to consist of six elected members and six members appointed by the administrator. The Gilbert and Ellice Is., previously a British protectorate, became a colony in 1916. Ocean, Fanning and Washington Islands were included later in that year, and Ocean I. became the seat of government. Christmas I. was included in 1919. The Wallis and Horne Islands, previously a French protectorate, were declared a colony in 1917. This annexation had been proclaimed four years earlier, but opposition was fomented in Fotuna (Horne Is.) by

Roman Catholic missionaries; and even in Uvea (Wallis), where the native chiefs had asked for annexation, French law could be only gradually introduced.

The so-called four-power treaty signed on Dec. 31 1921 by Great Britain, the United States, France and Japan at the Washington Conference, defined the mandated territories and the respective sovereignties in Oceania (Japanese in the Caroline and Marshall groups; Australian in the former German New Guinea and islands east of it; British over Nauru) and specified those areas in which no further fortification should take place. Japanese proceedings in the Carolines under military administration had previously evoked a good deal of criticism, especially in Australia, partly on account of their secrecy and partly on strategic grounds. The civil administration was established under the mandate in April 1922. A substantial influx of Japanese immigrants has taken place.

An administrative system which, it was hoped in some quarters, might be modified in course of the settlements after the War, but was not, was the Anglo-French condominium over the New Hebrides. Opinion has been freely expressed in Australia that the system is cumbrous and makes against progress, and that the French interest should be abolished by purchase or exchange, and the islands brought within the British sphere, under the Imperial Govt. or that of the Commonwealth.

Population.—The populations, according to recent census figures or estimates, of the principal groups covered by this notice are as follows:—

Caroline, Mariana, Marshall and Pelew Is. (Japanese), 52,222 including 3,671 Japanese (1920).
Cook Is., Niué and other oceanic islands belonging to New Zealand, 13,209 (1921).
Easter I. (Chile), est. 300 (1922).
Fiji (British), 157,266 (1921), including 3,878 whites and 60,634 Indians.
Gilbert and Ellice Is. (British), 29,897 (1921).
Marquesas Is. (French), under 3,000 (1923).
Nauru (British), 2,166 (1922), including 110 whites and 900 labourers recruited from other islands, and Chinese.
New Caledonia (French) 47,505 (1921), including 16,794 whites and 3,611 Asiatics. Nouméa, the capital, had 9,614 inhabitants, including 6,238 free whites and a penal element of 600.
New Hebrides (Anglo-French condominium), 55,000–60,000 natives; 275 British, 709 French, Indo-Chinese coolies and other immigrants, 1,032 (1923).
Tuamotu (Paumotu) Archipelago (French—the first is the proper form of the name), 3,715 (1924).
Samoa (New Zealand), 37,299 (1924): (American), 8,194 (1922).
Society Is. (French, including Tahiti), 7,145 (1924).
Tonga (British protectorate), 24,935 (1921).
Tubuai Is. (French), about 3,000.
Wallis Is. (French), about 4,500.

The decrease of native population continues in most of the islands; from whatever cause, the islands under French control, especially the Society, Tuamotu and neighbouring groups, appear to be specially affected. The French administrations have been criticised for lack of care for the wellbeing of the natives: in New Caledonia they are said to make little effort to put native labour to use, and indeed their control is not wholly effective. There was a small native rising there in 1917. Japanese, Tonkinese and Javanese labour is imported. The Fijians and the Gilbert and Ellice islanders also diminish in numbers. In the latter colony the Govt. enforces the prohibition of alcohol; but it is still urged that the adoption of European clothing, as the natives become better educated, weakens their resistance to pulmonary diseases. And not only here, but in many parts of Oceania, an influenza epidemic in 1918 caused many deaths—4,000, for example, in Tahiti, and 1,000 in Tonga.

Nevertheless, there are exceptions to these unhappy conditions. Thus American Samoa was free of the epidemic, and the native population is estimated to have increased over 40% during 22 years of American control. Native education has in some instances become a matter more of government concern and less exclusively in missionary hands. Thus down to 1916 education in Fiji was almost entirely a missionary organisation; but the Govt. then passed an Act rendering all schools which comply with certain conditions eligible for state aid. The Gilbert and Ellice Govt. introduced a new system in 1920, and the New Zealand administrations have taken similar action.

Among immigrant Asiatic peoples, apart from the Japanese, the most important group is that of the Indians in Fiji. Indentured Indian labour was stopped in 1916, though free labourers could still be admitted. Under indenture the general condition of the Indians was good, though isolated abuses gave rise to private philanthropic interference from Australia. But many Indians in Fiji have entered into trade and become well-to-do, and having (on the whole) benefited by residence in the colony proceeded to strikes and seditions, the unrest in India having been reflected in Fiji and fomented by imported agitators. Stern measures by the Govt. have been effective.

Trade.—Copra, phosphates and fruits are the chief articles of export from Oceania. Some of the islands are leased to coconut companies, and in many the industry flourishes, but not in all. The cost of importing labour and collecting the produce proves too heavy in some instances, as for example Christmas I., which has changed ownership more than once, and in 1923 employed only two Frenchmen and 18 Tahitians under a British company. Some of the copra-yielding islands are liable to occasional hurricanes which may almost wreck the industry—there was one such in Niué in 1915; but as a practical method of celebrating the end of the War 15,000 nuts were planted there. Drought also may be a deterrent of the copra industry. Thus in the Gilbert Is. in 1915–8 there was a shortage of rainfall, with only 14 in. in the driest year; the normal ranges from 80 to 140 in. annually. The fruit-growing industry of the Cook Is. is believed capable of great expansion. Fiji exports principally sugar and molasses, copra, bananas and trocas shell. Rubber is grown, but the industry could not withstand the low prices of 1920–1. An interesting attempt to acclimatise the mocora palm is contemplated in Niué, with a view to making Panama hats from the fibre; the natives are skilled weavers of pandanus hats, but the trade has declined.

Nauru is the chief producer of phosphates (*see* NAURU). The excellent quality of the nickel and chrome ores of New Caledonia has attracted attention, but there is no great development owing to difficulty in obtaining labour, and only companies established under French law are permitted. Makatea in the Tuamotu group has become a phosphate ground of some importance, and is administered separately from the rest of the group. But the trade of the eastern French islands generally is somewhat stagnant, and the development of Tahiti as a holiday resort from America (an attractive consideration being the absence of prohibition) has been seriously discussed. (*See* ARCHAEOLOGY: *Oceania*; GUAM; FIJI.)

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OCEANOGRAPHY (*see* 19.967).—In 1912 the results of the South Polar expeditions became known. Roald Amundsen landed on the great Antarctic Ice Barrier (at the Bay of Whales, in south lat. 78°, and west long. 165°) and travelled over the land towards the Pole, which he reached on Dec. 14 1911. Capt. Robert Scott had left England before Amundsen and in ignorance of the intention of the latter to seek the South Pole. Scott took his previous route, *via* the Beardmore Glacier, towards the Pole, not the easiest way, but much the most interesting one from the scientific point of view. The party (Scott, Wilson, Oates, Bowers and Evans) reached the South Pole about a month after Amundsen and, on their return, encountered a series of blizzards in which all perished.

After Scott's last voyage Shackleton made two further expeditions to the south polar regions. In the first one he left England

in the " Endurance " (in 1914); reached south lat. 76° 34′, drifted north, was beset in the ice and lost his vessel, the crew being landed on Elephant Island (in south lat. 62° and west long. 55°). This voyage is famous for the fine boating cruise made under the command of Capt. Worsley. A small party left Elephant Island in a whaleboat and, after a voyage of 14 days, reached South Georgia from where they sent assistance to the wrecked crew of the " Endurance." Shackleton again sailed for the Antarctic in Sept. 1921, in the " Quest " but died (of angina pectoris) at South Georgia on Jan. 4 1922. These voyages have roughly fixed the notions at present held about Antarctic geography (*see* POLAR EXPLORATION).

An important expedition set out (Oct. 1925) for the Antarctic regions on Scott's old vessel, the " Discovery," strengthened and refitted for special work. This is the eighth exploring vessel bearing that name—the first one having gone to Hudson Bay in 1602. The voyage is primarily intended for the investigation of the whaling industry and it will be supplemented by the continuous work of a laboratory on the Island of South Georgia. The cost of this well-found expedition is largely borne by the Government of the Falkland Islands, and important scientific results are confidently expected (*see* WHALING).

Arctic Expeditions.—The first and most notable Arctic expedition since 1913 is that of Stefansson, who left Alaska in 1913 with a vessel called the " Karluk." Stefansson demonstrated, for the first time, how Arctic investigators could trust themselves freely to the ice, finding food there and being able to keep themselves perfectly healthy (*see* ARCTIC RESOURCES). He investigated part of the Beaufort Sea, the huge inaccessible region of frozen ocean lying between the Pole, Alaska and Western Siberia. He explored some of the Parry Islands and supplemented Nansen's observations on the drift of ice in the North Polar Ocean: this takes place in a large cyclonic eddy having its centre in north lat. 83° 50′ and west long. 160° tending to leave the Arctic region through the wide passages between Greenland and Iceland and between Iceland and Europe.

It is now known (though no formal results have yet been published) that important fishery and oceanographic investigations have been made by the Russian Govt. on the Siberian Continental Shelf. Off the coast, from Novaya Zemlya to the Behring Straits there is an enormous region of flat shallow water (the greatest in the world) and some great rivers (such as the Lena, Obi and Yenesei) open into the sea here. It is stated that the fishing grounds in the neighbourhood of these estuaries are unusually productive. An American expedition (the Macmillan one) is working in the Arctic regions.

Roald Amundsen made an attempt in 1925 to reach the North Pole by aeroplane. Starting from Kings Bay, in Spitsbergen, a small party reached north lat. 87° 44′ (in west long. 10° 20′) but were then forced to descend. After abandoning one of the planes, they returned to Spitzbergen in the other. A small expedition led by Algarsson left Liverpool for Arctic investigation in 1925 but returned after some three months. Two small but very successful expeditions to Spitzbergen were organised by some Oxford scientists. Thus there have been several investigations during the post-War period, but these have added little to our knowledge of the oceanography of the North Polar Ocean beyond that resulting from Nansen's highly productive voyage with the " Fram " in 1895.

A good deal of general marine biological and oceanographical investigation is now being carried on in the shallow seas of the north-west of Europe by the various maritime states. This work is mainly concerned with questions of the productivity of the sea fisheries, with the search for new trawling grounds and with the investigations necessary for the elaboration of regulations of methods of fishing both within the territorial waters and on the high seas.

Physical Oceanography and Geodesy.—The tendency in oceanographical investigation is towards research into the physics and geology of the ocean floor; towards the physical and mathematical study of currents and tides; and towards the investigation of oceanic meteorology.

Permanence of the Ocean Beds.—There has always been much discussion as to whether or not the great oceanic depressions have always been permanent features of the face of the earth. In the latter half of the 19th century, this was generally believed. Nowhere on the dry land are there any sedimentary rocks that appear to have been deposited at the bottoms of oceans comparable in depths with those we know—that is, there are no formations known that resemble, for instance, the Globigerina Ooze now being deposited on the Atlantic floor. On the other hand the geographical distribution of many species of plants and animals points very decidedly towards the existence in the past of land connections between the various continents, and this evidence cannot be put aside. It is now believed that, in the North and South Atlantic, in the central part of the Indian Ocean, and possibly in the central part of the Pacific, there were, during the Mesozoic period, extensive land regions that have now subsided. Thus there are indications that large regions of continental land have been depressed to form the floors of deep oceans, but there are no clear indications that deep ocean beds have ever been elevated to form dry land. It is possible that the quantity of water on the surface of the earth has been increasing throughout geological time. It is known that fluid heated rock (volcanic magma) contains much water and it is probable that, in the course of geological time, large quantities of water have thus reached the surface as these magmas, are extruded, cool down and weather away (*see* GEOLOGY).

Age of the Oceans.—Fairly satisfactory data now exist for the formation of estimates of the age of the oceans. The evidence comes partly from the study of radioactivity (*q.v.*): it is known that helium and lead are the end-products of radioactive disintegration of certain minerals and from the ratios of these materials to their parent substances it is believed that a period of several thousands of millions of years must have elapsed since the first solid and cool earth-crust was formed. Some cosmographic investigations (due mainly to Jeans and Jeffreys) suggest pretty clearly that at least about 1,300,000,000 years have elapsed since the first oceans were formed.

Formation of the Ocean Floors.—Oceanic soundings are gradually accumulating (though they are still very few in comparison with what are needed) and a general idea can now be made as to the forms of the great oceanic depressions.

Geosynclines.—In general an ocean bed is a great, flat plain and there are few marked elevations or depressions on it. But, in general, the marginal regions are deeper than the central ones and there is a tendency for the arrangement of mountain chains running parallel to the ocean coast (as along the whole western sides of North and South America). Also the marginal regions of oceans tend to be regions of volcanic and earthquake disturbance. (The coast of Japan and the coastal part of California, for instance.) Jeffreys has shown how very probable it is that the central part of the earth has still a very high temperature; that a relatively thin outer shell is cold and has ceased to contract and that the hot central mass is still losing heat to the outside. Therefore the ocean floors must warp downwards at the margins, but must tend to rise slightly at their central regions. Our knowledge of oceanic depths supports this conclusion. In the Pacific notably, but also in the Atlantic and Indian Oceans, the " deeps " (that is, the regions of over 3,000 fathoms in depth) all tend to be situated near to the continental lands.

Relative Ages of the Oceans.—These features of high mountains, formed by foldings of the earth, and running parallel to the oceanic margins, are well exhibited on the American side of the Pacific. On the Asiatic side we have chains of islands (the Aleutians, Kuriles, Japanese, Philippines, etc.) which form the natural boundaries of the ocean bed. In many places these islands (the " insular arcs ") can be shown to be formed by earth-foldings. They are often volcanic and earthquake regions. Thus the Pacific Ocean is bounded by geosynclines—that is, the coastal mountain foldings and, outside of these, the marginal oceanic depressions. These geosynclines exhibit great activity, which is indicated by faulting of the strata, earthquakes and volcanic eruptions. Therefore the Pacific Ocean is still in the making, so

to speak. Indeed among the island archipelagoes there are evidences of continued subsidence. The Atlantic is a much older ocean for, except in the West Indian region, there is not much evidence of activity as in the Pacific, while the geosynclinal land elevations and depressed marginal oceanic deeps show signs of being smoothed out. The Indian Ocean is probably still older, in the geological sense.

The Theory of Isostasy (*see* ISOSTASY).—When the intensity of gravity was measured at many places on the surface of the earth, some remarkable results were obtained. The measurements are made by observing the rate of swinging of a standard pendulum (on the land) or by observing the barometric pressure simultaneously with the temperature of boiling water (on the sea). Where necessary corrections are made, the intensity of gravity is everywhere the same (with the exceptions of small deviations). Yet it ought to be less over the ocean bottom (where some two to three miles of earth crust are replaced by water) than over the continental land. Therefore, again, the materials of the earth crust must be heavier on the ocean floor than on the continental plateaux. At a certain depth beneath the surface all rocks are exposed to such enormous pressures that they are in a potentially self-crushed condition so that "flowage" of their materials must take place when there are stress-differences. There is a continual adjustment of pressure so that when shallow sea regions near the land are loaded with sediments from great rivers, material beneath this loaded region flows to underneath the continental plateau (which has undergone erosion).

The Wegener Hypothesis.—Connected with the theory of isostasy is Wegener's hypothesis of the mode of origin of the oceanic and continental earth-features. Beneath the continental plateaux and the ocean beds there is the "plastic," crushed, earth-crust layer, and the hypothesis is that the great continental land elevations actually slip on this crushed layer. The Atlantic has been formed, it is stated, by the slipping westward of the Americas and when the outlines of Western Eur-Africa and eastern North and South America are compared it is seen that the one continental land mass would approximately fit into the other. The coastal mountain ranges on the Pacific margin of the Americas are said to have been formed by the crumpling of the crust under the horizontal pressure set up by the westward drift of the American continents, and so on. The hypothesis requires that there should be evidence of progressive change of longitude. This has been claimed but the observations are doubtful. It also requires a motive force—some stress-difference under which the continental land masses yield and shift place relative to the earth-axis. This is difficult and no satisfactory verification of the Wegener hypothesis has been made (*see* GEOLOGY).

Tidal Investigations (*see* TIDES).—Much fine work, both on the theory of the tides and on the methods of tidal prediction has been done at the Liverpool Tidal Institute. The methods of prediction have been greatly improved and methods of forecasting deviations from the predicted results (which may be due to winds) are being worked out.

Long-period Tides.—The work of Otto and Hans Pettersson on the occurrence of long periodic variations in the tide-generating force due to the sun and moon has important oceanographic consequences—should the theory be confirmed and established. The Petterssons have shown that there are absolute maxima of tide-generating force recurring at intervals of about 1,600 years. The last maximum was in 1433A.D. and the next will be in 3300 A.D. Important effects preceded the last maximum—thus the coast of Greenland was relatively free from ice during the period of the Norse voyages related in the Sagas. Iceland was nearly free from volcanic eruptions during the period 800 to 1250 but such phenomena were relatively frequent during the period 1290 to 1348. During the 13th and 15th centuries, the Baltic was frequently frozen over between Denmark, Germany, Sweden, Gothland and Esthonia. About 1287 the Zuider Zee was formed. The Pettersson Theory relates many of these occurrences to the changes in the North European ocean current system set up by the high tides during the periods of maximal force (that is, at intervals of 1600, 93, 19, 9 and $4\frac{1}{2}$ years).

Marine Biology.—The most important result of oceanic biology during the post-War period is the completion of Dr. Johs. Schmidt's fine investigations on the life history of the freshwater eels. It has now been demonstrated that all the eels of Europe and America migrate out into the region of the Atlantic Ocean roughly coincident with that of the Sargasso Sea. There they spawn and, after this single reproductive act of their life-times, they die. The eel-larvae, or *Leptocephali* take several years to migrate towards the continental shores where they undergo metamorphosis into the well-known elvers and then ascend the rivers. Having attained maturity after 4 to 7 years they return to the Atlantic Ocean to spawn and die.

References to most of the matters treated in this article will be found in J. Johnstone, *Introduction to Oceanography* (Liverpool, 1923).
(J. J.)

OCHS, ADOLPH SIMON (1858–), American newspaper proprietor, was born in Cincinnati March 12 1858, of Jewish parentage. His father, who had left Bavaria for the United States in 1846, settled in 1865 with his family in Knoxville, Tenn., where the son studied in the public schools and during his spare time delivered newspapers. At the age of 15 he became a printer's devil on a Knoxville paper. Advancing rapidly in newspaper work, he moved to Chattanooga in 1877 and in 1888 gained control of the reorganised Chattanooga *Times*, which soon assumed a high position among the papers of the South. He was one of the founders of the Southern Associated Press and served as president. In 1896 he obtained control of *The New York Times*, then in financial difficulties and with circulation greatly diminished. He formed the New York Times Co., and having placed the paper on a stronger financial foundation after four years became the majority stockholder. With a daily issue on Aug. 18 1896 of 18,900 (of which over half was returned unsold), the circulation increased rapidly, reaching an average of 392,695 in 1926, (360,000 daily and over 600,000 on Sundays). The annual receipts exceeded $22,000,000 in 1925, probably equalling those of any other American paper. In 1926 the staff of *The New York Times* numbered 2,800. It was classed as an independent Democrat publication, an advocate of sound money and tariff reform, and consistently opposed William Jennings Bryan in his presidential campaigns. By the fairness and comprehensiveness of its presentation of news, editorial moderation and ample foreign service, it made secure a high place in American journalism, becoming widely read and influential throughout the country.

The *Times* has been a pioneer in many fields of newspaper publishing: in the introduction of rotogravure printing to the United States, in the reception of a new service by wireless, in the improvement of advertising typography and in the censoring of advertising to protect its readers from dishonest and misleading offers. It is also worthy of note that in an age of syndication, or exchange of news features among a great many newspapers, the *Times* has pursued a wholly different course, preparing its news and other articles solely for its own columns. The *Times* Co. also publishes the *Book Review and Magazine* (sections of the Sunday edition); the *Annalist*, a financial review appearing on Fridays; the *Times Mid-Week Pictorial* on Wednesdays; *Current History Magazine*, a monthly, started during the World War. The *Index* of the *Times*, begun in 1913 and published quarterly, forms an invaluable guide to contemporary events, to be compared only with the similar Index to *The Times* of London. In 1901 Mr. Ochs became proprietor and editor of the Philadelphia *Times*, later merged in *The Philadelphia Public Ledger*, of which he was sole owner from 1902–12, when he sold it to Cyrus H. K. Curtis. The Times Co. also has in the Wide World service a news photograph agency covering the entire world. (L. WI.)

O'CONNELL, WILLIAM HENRY (1859–), American cardinal, was born at Lowell, Mass., Dec. 8 1859. He graduated from Boston College in 1881, and then went to Rome where he studied theology at the North American College (1881–4), being ordained priest June 8 1884. He became rector of the North American College in 1895 and was consecrated Bishop of Portland, Me., May 9 1901. In 1905 he was selected as special papal envoy to the Emperor of Japan. He was appointed co-adjutor to Bishop

Williams of Boston, Mass., Feb. 8 1906, taking the titular archbishopric of Constantia. He became Archbishop of Boston Aug. 30 1907, and was created cardinal by Pope Pius X., Nov. 27 1911.

ODER (*see* 20.2), a European river. The Oder rises in Czechoslovakia, flows through the mining area of Upper Silesia, and crosses Germany, receiving a number of tributaries, of which the chief are the Warthe and the Netze,[1] both rising in Poland.

It is utilised by three main currents of traffic; traffic between Berlin and Stettin; goods transported to or from the mining area of Upper Silesia (this traffic has diminished since the partition of Upper Silesia between Germany and Poland); and traffic to and from Poland via the Warthe and the Netze, thence by the Bydgoszcz (Bromberg) canal and the Brda (Brahe) river towards the Vistula. Poland has placed on the navigation of these two tributaries certain restrictions based on her conception of their legal status.

Problem of International Status.—The Oder and all the navigable portions of its system, which provide natural access to the sea for more than one state, were declared international under Article 331 of the Treaty of Versailles. Article 341 places the Oder under the administration of an international commission consisting of three representatives of Prussia, and one each of Poland, Czechoslovakia, Great Britain, France, Denmark and Sweden. Under Article 343 it was the duty of this commission at once to prepare an act of navigation. As the commission failed to reach an agreement regarding the territorial extent of its powers, the British Govt. on Aug. 23 1924, brought the dispute before the League of Nations, in virtue of Article 376 of the Treaty of Versailles.

The advisory committee of the communications section of the League appointed a commission of inquiry consisting of M. J. Hostie, president, Gen. H. O. Mance and Prof. L. Babinski, which studied all the legal aspects of the question and also examined the situation along the Warthe at Poznań (Posen), along the Netze (Notéc) at Nakło, and along part of the Old Netze between Nakło and Lisi-Ogon. The majority of the commission reported that "Oder" in the sense of Article 341 should be taken to mean the whole international system; moreover it was of opinion that although Article 331 only includes in the system the navigable parts which naturally provide more than one state with access to the sea, the sphere of territorial application had been extended as a result of Article 338, which provides that the provisional definition given in Article 331 shall ipso facto be replaced by the general definition of the Barcelona Convention on the régime of navigable waterways of international concern. As regards consideration of fact, the Warthe, from its junction with the Oder as far as Pogorzelice, indubitably fulfils the conditions of the general definition laid down in the Barcelona Convention. The Warthe, as far as Luban, carried considerable traffic before the War. It was navigable for craft of 400 tons, which could proceed with full cargoes at mean water level. The sector between Luban and Pogorzelice was navigable for craft of 150 tons and carried an appreciable amount of traffic, although mainly of local character. The Netze, which has been canalised between Kreuz and Nakło, is navigable for craft of 400 tons. In pre-War years this waterway carried a considerable amount of traffic—mainly transit traffic proceeding from or towards the Bydgoszcz canal. The commission considered that the Netze below Nakło should be regarded as naturally navigable; the portion of this river above Nakło should not be presumed, in its natural condition, as being navigable in the sense of the Barcelona Convention.

Transit Committee's Suggestion.—The committee for communications and transit suggested on Nov. 27 1924, that the jurisdiction of the international Oder commission should extend upstream on the Warthe to and above Poznań (Posen), and upstream on the Netze as far as Ujście (Usch), from which point as far as its confluence with the Vistula through the Bydgoszcz canal, the waterway should be subject to the régime of the Barcelona Convention. In the opinion of the committee this solution, while it takes account as far as possible of the various legal and technical standpoints, is also in the general interests of navigation. The choice of the limit on the Warthe needs no comment; for purely technical reasons the limit on the Netze might have been Nakło, but this would have represented in fact a decision regarding the legal controversy. The committee preferred to reach an agreement on a practical basis. Thus Ujście was chosen; but on the other hand, realising the importance before the War of the transit traffic over the junction between the Oder and the Vistula, the committee desired to guarantee to international navigation, including floating, the benefits of an international régime on this waterway. Existing treaties guarantee to Germany freedom of transit across Poland, along all means of communication for traffic to and from East Prussia. Consequently, for a certain category of traffic, this waterway already enjoys an international régime as regards transit. It was thought that under the circumstances the proposed extensions of the international régime would not encounter any serious opposition.

However, at its eighth session in July 1925 the advisory and technical committee felt bound to note the fact that the opinion given with a view to conciliation had been accepted by all the governments represented on the Oder commission except those of Germany and Poland. The German Govt. expressed no opinion, while the Polish Govt. definitely refused to accept the solution. (R. Rn.)

[1] The Netze is a tributary of the Warthe.

ODESSA (*see* 20.3), in the Ukrainian Soviet Republic, had a population of 434,857 in 1920 as compared with 631,040 in 1912. The city was bombarded several times by the Turks during the World War, taken by German forces in 1918 and occupied by the Bolsheviks in 1920. A new mole and a special ice-breaker were built for the harbour before the War, but Odessa's share in the trade of Russia was then declining and plans had been made for further improvements in the harbour. A scheme was reported to be again under consideration in 1925, whereby it is proposed to construct a grain harbour, an additional mole and warehouse accommodation. Ground was being reclaimed and dredging carried on in 1925 and Odessa was made a free port by the Russian Govt., in the hope of improving trade. The quay accommodation in 1926 allowed 12 or 13 steamers to unload at once.

O'DONOVAN, WILLIAM RUDOLF (1844–1920), American sculptor and painter (*see* 20.9), died in New York City April 20 1920.

OFFICE APPLIANCES.—Many office tasks, being of a repetitive character, naturally adapt themselves to the principle of "division of labour," and consequently to the use of machinery also. But these facts alone are not sufficient justification for the purchase of appliances. Four purposes are considered by good office management in deciding when the use of machinery is advisable. These are:—

Objects of the Appliances.—1. To save labour. This saving should be evidenced in a reduced pay-roll. Hypothetical savings of "half a man" are seldom realised.

2. To save time. In many cases this is more important than the saving of labour; to speed up a slow routine, extra expenditure is often an economic advantage.

3. To promote accuracy. Mechanical methods are advisable when accuracy is vitally important and otherwise difficult to obtain.

4. To avoid monotony. The substitution of a machine for manual repetitive movements will usually achieve this.

Inventive skill and genius have not been lacking to meet these needs, and the list of available devices is very long, machinery being now extensively used.

Adding and calculating machines are largely used for the promotion of accuracy, and save time by avoiding extended search for errors. The ordinary clerk is usually incapable of correctly handling a large amount, even of simple calculations, with a fair degree of accuracy by the mental-manual method, and these machines have therefore become a practical necessity for the modern business office.

Adding Machines.—All adding machines may be used for addition, subtraction, multiplication and division; but as certain types are better adapted for multiplication and division, a technical distinction has grown up in the trade between adding and calculating machines, the latter being used more extensively for multiplication and division.

There are two principal types of adding machines: those which print on paper the amount being added, and those which do not—the former being known as listing, and the latter as non-listing machines. The listing machines are again divided into two classes, the first being the full keyboard model carrying a row of keys numbered from 1 to 9 for each column, and the machine of the second class having 10 keys arranged in two or three rows. Each of these keys represents a digit, and the depression of a key for an item automatically causes progressive columnar position. Thus, if 23 is to be added, the 2 is first depressed, then the 3, and the mechanism takes care of the numerical order. The items are printed either on a roll of narrow paper or on a wide form held in the carriage of the machine.

Some models have two sets of adding dials—one for accumulating individual totals, the other for accumulating a grand total. On some machines a " split " feature provides for splitting the printing mechanism into two or more sections, so that several columns may be listed and added at the same time and the total of one or more columns printed. On others, subtraction is accomplished by means of complementary numbers, a " complement " being any number which, added to another, makes a full number. Thus if the digits are changed to 9's—as 9, 99, 999 and so on—and a 1 then added, we can convert any number into a full or complementary number on the keyboard of any adding machine. The complementary numbers are usually indicated by small figures on the keys, the two digits on a key, if added, invariably making nine. Other machines perform subtraction by depressing a subtract key. Multiplication is consecutive addition. Thus, if 26 is to be multiplied by 5, it is merely added five times. For division, the divisor is subtracted from the dividend as many times as it is contained in that dividend, the number of subtractions being automatically registered on the counting wheels as a quotient. There is also a small portable adding machine, weighing about seven pounds, operated with a pull-down lever keyboard. A very small adding device, known as a vest pocket machine, is operated by inserting a pick, or stylus, in positions for the amounts.

Calculating Machines.—Where rapid addition, multiplication, subtraction and division are required, and no need for a printed record exists, calculating machines are used. They do not print a record of the items, but indicate the result on total dials. One type, known as the key-driven, causes the items to appear immediately on the dials when the keys are depressed, the operation of a crank clearing the figures off the dial faces again. As with adding machines, the four arithmetical operations are all performed as variations of simple addition. In another type, known as the key-set, the amounts are first set up on the keyboard and operation of the machine, either by hand or by motor, effects the calculation. The total dials, located in the laterally moving carriage above the keyboard, show the total in addition, the product in multiplication, the minuend or remainder in subtraction and the quotient in division. Proof dials, located in, above or below the carriage, show the multiplier in multiplication and the divisor in division. An extra set of dials is sometimes provided, which furnish an additional check for accuracy by showing the amounts set up on the keyboard. The dials are cleared by various means, distinctive with each make of machine.

For subtraction, the amount from which the deduction is to be made is set up, the operation of the machine causing that figure to appear on the total dials. The figure to be subtracted is then set up and the machine operated, and the answer appears on the total dials. Multiplication is consecutive addition, though in some models multiplication is by means of a plus bar; in others, by means of an extra row of multiplying keys. Division is consecutive subtraction, some models dividing by means of a minus key, while another model provides for setting up amounts by means of levers pulled down to the desired numbers, this machine otherwise conforming to the key-set type.

Book-keeping Machines.—The so-called book-keeping machine is in reality a device for posting on loose ledger sheets or cards. The amount is not merely entered to the account as in hand book-keeping—to be added and balanced at a specified period—but a balance is struck each time a posting is made. The original entry from which the account is posted is usually a sales ticket, credit slip or copy of the invoice (*see* BOOK-KEEPING).

All such machines are designed to print and add an old balance, print and add debit items, print and subtract credit items and compute the new balance, in some cases printing it automatically, in others showing it in the adding and subtracting mechanism so that it may be copied in the proper column by the operator. Proof of the correctness of posting varies with the type of machine. One type is an adding machine which subtracts directly; it is equipped with means for printing dates, folio numbers, characters and abbreviations, and with a tabulating carriage which moves automatically to the next column as each amount is computed and printed, and in some cases returns automatically to any required position on the printing line. Both vertical and horizontal columns are added, subtracted and computed. Items are set up as on an adding machine, the operation of the motor causing them to be printed, added or subtracted. When a new balance is printed, the accumulator clears, ready for the next operation. Some models have two counters, thus making it possible to compute individual balances and accumulate a total of all postings. The keyboard may be split into two sections so that both ledger and statement can be inserted in the carriage and posted at the same operation—that posting being automatically repeated.

The design of a second class of book-keeping machine embodies a typewriter—on which any description may be typed—and a calculating machine, built as one unit. Some machines add and subtract in vertical columns; others compute amounts across the sheets as well. The typewriter carriage moves to correct column positions by means of a decimal tabulator. Typing the amounts on the number keys effects addition or subtraction. The amounts are visible in registers or totalisers placed either on the carriage truck, in positions corresponding to the columns to be added or subtracted, or at the front of the machine below the keyboard. In posting, a new balance is computed, and the operator types in the proper column the amount appearing in the register which functions to compute across the sheet. If the typing is correct, this register clears. Ledger and statement are made at the same time, in some cases by means of a carbon and in others by the split-platen method, one machine of this class being unique in that its typewriter section is mounted on a carriage which moves from left to right across a flat printing surface on which the forms are held, a back and forward motion providing line spacing. Registers are mounted on the rear of the typewriter section, and ledger and statement are posted at one operation by means of carbon.

A third class of machine carries, below the typewriter keyboard, a 10-key keyboard which controls the calculating mechanism. Here the split-platen method is used for making ledger and statement at the same time. Still another class, used for ledger posting and instalment accounts, follows cash register design, amounts being set up on a push-in key-set keyboard, and turned into the mechanism by the operation of the motor. There is a sliding printing table on which the forms to be posted are inserted. Two forms may be posted at the same time, the amount being printed on one and repeated on the other. This machine automatically computes and prints the amount of the balance outstanding on each account. Debits and credits are classified and a total of each is accumulated, as many as 18 individual and two group totals being obtainable. A detailed record of all postings is printed on a strip of paper inside the machine.

Billing Machines.—The writing of an invoice for goods sold, by means of a carbon duplication, can be made to serve other purposes also, and it is quite common at one writing to make the invoice, the original sales record, the shipping notice, the shipping record and other memoranda required for various kinds of business. By means of calculating devices, the amounts of the items may be computed, and totals accumulated for controlling accounts. Combination typewriters designed to do this work are known as billing machines. These are designed to write, at one operation, the several necessary copies of orders, invoices, bills of lading and other forms, and in some cases to compute amounts as they are written. Cut forms, printed and padded in individual sets so that each set is torn off and loose carbon inserted between the sheets to make the necessary copies, are used with some machines. Others use continuous-length forms, which provide multiple copies of the same or related forms, in rolls or folded flat, these forms being fed through the machine with the carbon interleaved between the copies, so that it is not necessary to insert new forms after writing each set.

Among the billers which write, but do not compute, is an ordinary correspondence typewriter equipped with an inbuilt carbon-changing device which removes the carbons from a set of continuous-length forms just written and inserts them in

another set. Another non-computing biller has a standard keyboard typewriter mounted on a carriage which moves from left to right across the flat writing surface over which the forms are fed. Cut forms may be used with this machine, and it may be equipped to add in vertical columns and to cross compute as well. Book-keeping machines which combine a typewriter with a calculating mechanism have been adapted to billing work which requires the adding or subtracting of amounts as they are typed. One such has an inbuilt carbon-changing device which provides for the use of continuous-length forms; another uses cut forms and may be equipped with a split cylinder so that billing and ledger posting can be done simultaneously.

Still another embodies a typewriter and a calculating mechanism which handles addition, subtraction and multiplication, and is operated from a separate 10-key keyboard below the typewriter keyboard. By means of a split-platen, billing and ledger posting can be done at the same time.

Accounting and Tabulating Machines.—The preparation of statistics requires, first, the sorting of data, and, second, the accumulation, by classes, of the amounts involved. Machines for this work were first used by the U. S. Census Bureau, but are now being rapidly adapted to business uses, such as cost work, sales analysis and similar work.

Cards printed with vertical columns numbered from 0 to 9, or from 0 to 12, and separated into fields of one or more columns, each field representing an item, such as department, job number and so forth, form the basis of two systems. Facts are expressed in figures, letters or symbols, and are recorded by perforations on the card at the proper numerical positions, made by a punching machine which operates like a typewriter. The cards are then arranged by a sorting machine, according to a predetermined classification. Contact—electrical or mechanical, depending on the make of the machine—sets the mechanism in motion. The cards are next fed through the tabulating machine, which makes a printed final report, in multiple if so desired. Contact through the perforations causes the machine to designate and add what has been perforated into the cards—listings, sub-totals, totals or grand totals being obtained, depending upon the arrangement desired for the report. When detailed listing and printing is not required, a non-printing tabulator registers the quantities in counters which accumulate the totals, the figures being posted by hand to report forms.

Another type of machine is built on the same principle as the book-keeping machine of cash-register design. Twenty-seven keys, each representing a classification, accumulate individual totals, and as many as three grand totals can be obtained and the number of items in each classification counted. A continuous permanent record of all operations is made within the machine on a roll of paper called a visible audit sheet, and notations may be hand-written opposite any printed item. This record may be used as a posting medium, a proof sheet or a permanent record. A ticket may be issued on any operation, showing the date, serial number, identifying numbers, symbols for the totals used and the amount. It may be used as a voucher, pay ticket, receipt, requisition, or posting medium, or for filing purposes. The same information may be printed on any form inserted in the printing-table.

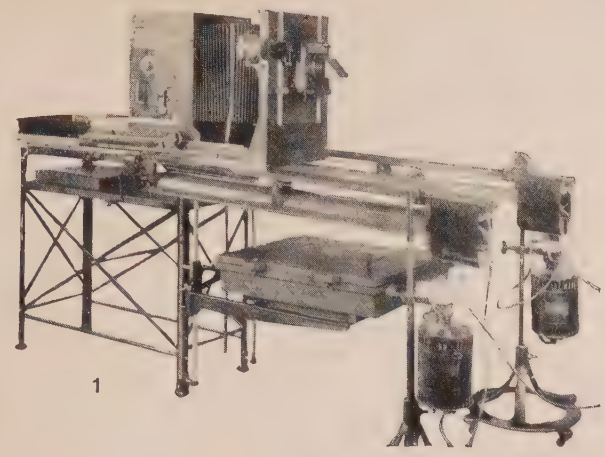
Duplicating Machines.—In offices there is much need for devices that will quickly produce multiple copies of typewriting or handwriting, for the time and labour thus saved is an important economy. Sometimes only a few copies are needed, sometimes many. For a limited number of copies, say up to five or six, the carbon method of duplication is perhaps the cheapest in most cases; but where from 5 to 100 copies are required, the hektograph process is preferable.

Stencils.—For a still larger number of copies, the stencil methods and type methods are available. With the former, the stencil was originally made on a sheet of wax-covered paper, which was written upon either with a stylus or with a typewriter from which the ribbon was removed—a system that had many defects. The modern method utilises a specially prepared sheet of tough, flexible tissue, which can be filed away after using and used many times. One manufacturer provides a glass-topped, electrically illuminated table for making stencils by hand with a stylus. Typewriting, handwriting and drawing may all be combined on one stencil sheet. The duplicator consists of a hollow revolving cylinder, partially covered by an ink pad, over which the stencil is fastened. Each revolution brings the stencil sheet in contact with the paper, and the ink, passing through the characters or design, makes the impression. From 1,500 to 5,000 copies can be made in an hour, depending on whether the model is hand- or motor-operated and whether it is automatically fed.

Hektographs.—The hektograph is many years old, and its operation is based on the principle of absorption. The original writing is done on a sheet of hard bond paper with a water-soluble ink or with a typewriter ribbon impregnated with such ink. This sheet is then placed in contact with a moist surface of gelatin or clay composition, and the writing is absorbed from the paper and appears in reversed form on the gelatin or clay surface. Then, by placing a sheet of blank dry paper on this moist surface, the impression is transferred to the paper. The gelatin was originally used in flat tin pans, and in this form the hektograph was of little use in the office, as registration was difficult. The clay form of hektograph was, and is, extensively used for the reproduction of drawings by architects and draftsmen, because it is a simple matter to prepare this composition for large sizes of work. The modern hektograph uses the old principle, but the gelatin is coated on a long band, a small portion of which is exposed at a time. This band runs over a flat iron surface. Registration is accomplished by a special feeding device. The unique feature of the hektograph duplicator is its use in routines of order or billing systems, in which from 10 to 15 copies of the same writing (or any portion of it) may be transferred to sheets of various sizes and shapes. Such copies are much clearer than carbons, and the paper does not have to be thin. The hektograph can also be used for bulletins of which 100 or less copies are desired.

Type Reproduction.—There are several devices which duplicate from type, the principal feature of most being a simple method of setting the type, which does not require a trained typesetter, the printing also being simplified by means of a revolving drum. The style of type most used is the imitation typewriter face, and the chief use is for the reproduction, through a ribbon, of facsimile typewritten letters, there being also a special device which may be used for the reproduction of the signature. A printing-ink attachment makes possible the use of printer's type and of electrotypes or stereotypes curved to fit the drum. Some models are hand-fed and operated; those which are automatically fed and motor driven attain a speed of 2,400 to 4,800 pieces an hour. Another machine produces letters from typewriter type cast on a linotype machine, at the same time filling in the name, address and salutation from slugs—one for each name on the mailing list—which change automatically as each letter is printed through a ribbon, the slugs being filed for future use. The speed is 1,000 letters and envelopes an hour, the latter being addressed from the same slugs. Certain machines which print from typewriter type are really small presses adapted to the printing needs of the layman, and print from printer's type, electrotypes, linotype, monotype, flat zincs and half-tones.

Automatic Typewriters.—The automatic typewriter is designed to produce actual typewritten letters at three times the average speed of a typist. Its mechanical movements are controlled by a paper roll, similar to that of a player-piano, in which perforations representing characters on the typewriter keys are made by a perforator. When an entire letter has been thus perforated, the paper is cut from the roll, and its ends are cemented together to form an endless belt, which is then placed over the drum of the automatic typewriter. The operator writes by hand the name and address and starts the automatic device. Pins dropping through the perforations into slots, as the roll is carried forward by the revolution of the drum, actuate the typewriter keys, causing the typing of the words; when all the perforations have passed over the drum, the operator removes the finished letter and then repeats. Insertions of special words or sentences may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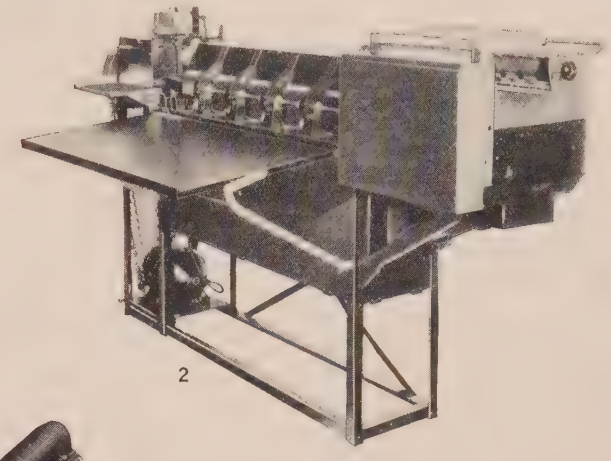
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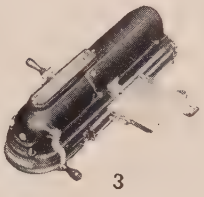
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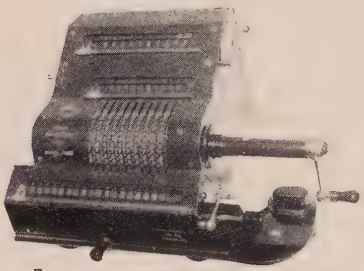
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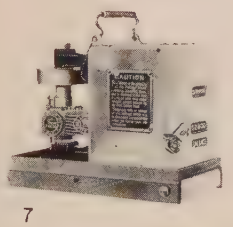
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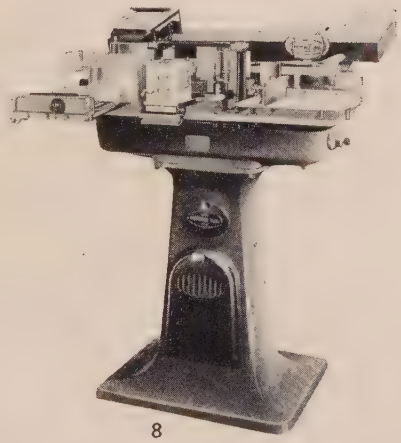
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FIG. 1. Photostat. This machine copies photographically any written or printed material, and automatically develops, fixes and washes the photographic copy. A machine used to save the labour of keeping documents. FIG. 2. Electric Printing, Tabulating and Accounting Machine. This machine tabulates data which have been previously sorted on another machine, not shown in illustration, and prints the tabulation automatically on a suitable sized sheet. FIG. 3. The Protectograph. A machine for printing the amount, and at the same time shredding the paper on cheques, to avoid the possibility of forgery. FIG. 4. Graphotype. On this machine, a metal stencil is embossed, which is later used for addressing. Fig. 5. Brunsuiga Calculating Machine. FIG. 6. Bookkeeping Machine. Used for posting debit and credit items on ledger sheets. Accounting is balanced with each posting. FIG. 7. Postal Permit Printer. FIG. 8. Postage Meter Machine. A device which seals the envelope and prints indicia which take the place of the ordinary postage stamp. The meter is locked by the postmaster, and postage is paid for the amount shown on the meter. FIG. 9. Addressograph. Prints from metal stencils made by the Graphotype. Addresses envelopes, statements and the like automatically.

be made by hand at any desired point. One operator can, without difficulty, control three or four machines.

Photocopying Machines.—A special photographic machine, in which a roll of sensitised paper coated on rag stock is used as a negative, photographing directly without the intervention of plates, has of late years been highly developed and used extensively as an office device. It offers a means of quickly producing a fac-simile copy of any document, and has therefore to a great extent eliminated the laborious hand copying of records, deeds, insurance applications, contracts and the like. The equipment consists of a large camera combined with a developing machine, so that after an exposure is made the sensitised paper is carried first to the developing bath and then to the fixing bath. Dials and levers control all operations, and the machine is so scientifically adjusted that an office boy can turn out perfect copies. The colours are reversed in the first print, called a " black print;" that is, the whites in the original are black and the blacks are white. As the photograph is made through a reversing prism, the letters appear exactly as in the original. A white positive print is made by re-photographing the black print. By continuing to photograph the original, as many black prints as desired can be made; and as many positives as required can be made by photographing the black prints.

Addressing Machines.—These are in reality devices designed for duplicating small pieces of writing. Originally designed for duplicating names and addresses—hence the name—they now have many other uses, such as the making of invoices, statements, receipts and other office records. They are of especial value in businesses where the same list of names and addresses must be repeatedly used. Each name and address must first be impressed upon a metal plate, cut on a fibre stencil or set in type, according to the character of the machine. The metal plate is prepared by an embossing machine operated by hand or electric motor; a blank plate is inserted in the machine, and the required characters are selected by an indicator and stamped into the metal. Some embossers have a typewriter keyboard, the embossing being performed by depressing the keys. Some metal plates carry a name card and others a record card for recording relevant data. A fibre stencil consists of a frame in which is mounted a panel of semi-transparent paper coated with a gelatinous material, some frames having spaces for the insertion of relevant data. The name and address are cut by means of a typewriter from which the ribbon has been removed, a special device holding the stencil while it is cut. When printer's type is used, slugs with the names and addresses are cast on a linotype machine.

Addressing machines, despite many structural differences, operate on the same general principle. The metal plates, stencils or slugs are fed from a magazine to the printing point where the envelope or other matter to be addressed is placed either by hand or by a mechanical device. Directly over the printing point is a stamping arm which comes down on the envelope when the machine is operated, thereby bringing it into contact with the plate, stencil or slug either directly, in case ink is used, or through a ribbon. As the arm rises, another plate comes to the printing point, the one just used passing to a receiving machine, where it re-files itself in original order. Models are hand, foot-treadle or motor operated, the speed varying from 1,000 to 15,000 impressions an hour. Special models are designed for publishers addressing on large envelopes, on mailer strip or directly on the margins of newspapers and magazines. The adaptability of addressing machines is greatly increased by attachments, some of which are so common as to be considered standard equipment. The metal plates and fibre stencils are filed like index cards in drawers kept in cabinets, slugs being filed in galleys and stored in cabinets. One machine is unique in that its metal plates are linked together to form an endless chain; they pass to the printing point from a reel on which they are wound and they are then re-wound on another reel, the reels being stored in cabinets.

Hand Stamp Affixers.—Stamps provided in rolls of 500 by the post-office are locked in a stamp affixer and applied to envelopes by the downstroke of a plunger, moisture being applied in some cases to the stamp, in others to the envelope. Extra containers, allowing for quick change from one denomination to another, are furnished with some models. Some machines are spring-locked; others are key-locked to guard against unauthorised operation; still others furnish the further protection of counting the stamps used, the number appearing in figures on a recorder.

Sealing Machines.—These are designed for the rapid sealing of large quantities of envelopes. The envelopes are fed to the machine one at a time, either by hand, semi-automatically by holding them against revolving feed rollers or automatically from a hopper—depending on the type of machine. The gummed flaps come in contact with a moistening device—a wick, a roller or a metal disk—which receives its water supply from a reservoir or by a position feed suction. The envelopes then pass between sealing rollers and are ejected from the machine.

Permit Mailing Machines.—An office having occasion to mail a thousand or more letters a day could greatly expedite their passage through the routine of mailing if the office were permitted to cancel the stamps or to print some indication that postage was paid. For this purpose, a U.S. Post Office regulation, passed in 1920, provides for the printing of the permit, or indicia, as it is called, directly on the envelope in the office of the mailer. Permit mail is of two kinds—metered and non-metered; for either, the licence must be obtained from the Post Office Dept. through the local postmaster, the mail being delivered to the post-office by the sender, as such mail is handled separately. Machines which handle non-metered mail print the indicia, seal the envelopes and count the pieces. The impression must show the postmark—city and state, month, day and year, denomination and sender's permit number. The number shown in the counter of the machine after a mailing is completed, multiplied by the denomination, gives the amount of postage to be paid. Payment is made either with each individual mailing or by a cash balance carried at the post-office. Certain machines will print the indicia without sealing, seal without printing, or count without either sealing or printing.

The basis of the meter system is a printing and recording mechanism demountable from the machine with which it is used, so that it can be taken to the post-office to be set for a given number of impressions, payment being made at that time, and the mechanism locked and sealed. Two sets of registers indicate how much postage has been used. A separate meter is used for each denomination, and any number of meters can be secured for one machine. The indicia are the same as those printed by the non-metering type, except that the sender's meter number is shown. The speed of such machines varies from 150 to 200 a minute. One type of machine is adapted for use with either the metered or the non-metered system. In 1924 the U.S. Post Office Dept. issued a regulation permitting first-class mail to be sent out with pre-cancelled stamps attached. The stamps, obtained in coils from the post-office, are applied by a hand stamp-affixer and the envelopes are then passed through a non-metering permit machine which seals and counts them and prints the postmark and additional cancellation required. Where bulk of mail does not warrant a permit machine, the postmark and additional cancellation are applied by a rubber stamp bearing a changeable date. One sealing machine is adapted to metered, non-metered and pre-cancelled systems, without mechanical alteration.

Cash Registers (*see* 5.446).—Motor-driven models are now available.

Autographic Registers.—On many occasions it is necessary to make by the carbon method several copies of pencil memoranda. The autographic register is a device for making at one writing an original and from one to six copies of sales slips, bills of lading, requisitions and other business records on continuous forms. These, interleaved with carbon, are retained within the register and fed across a writing table or platen. Some registers use rolled forms, one roll for each copy of the record; others use flat folded forms. Various type of registers have various methods of aligning the several copies that make up a set. As a written

set is issued from the register, either by pulling out by hand or by the turn of a crank, and is torn off against a knife edge, another set, automatically leaved with carbon, is brought into a writing position.

Coin-handling Devices.—In all business houses where large amounts of coin are handled and packaged daily, the use of mechanical devices for sorting, counting and packaging saves time and labour. Coin-counters simply sort mixed coins into denominations. The usual type of machine has a disk revolving in a hopper, and the coins are carried by the disk to a rail finger from which they roll by gravity and are sorted by dropping through slots of various diameters into separate boxes. From 1,000 to 12,000 coins can be separated in a minute, depending on whether the model is hand or motor operated. Coin-counting and packaging machines count the coins and deliver them into bags or wrappers, and, in specific cases, check pre-determined amounts into bags. One denomination of coin is dumped into the machine and a revolving disk throws the coins to the outer edge of the hopper, where they pass under a register which counts them.

In some models the coins fall through a stem into a tubular wrapper which the operator has previously placed there; other models wrap with continuous rolls of paper, fed down as the coins are counted; when the required number of coins are in place, they are carried over to the paper and tightly wrapped, the machine automatically locking off further passage of coins. Coin-counters and separators serve the dual purpose of counting and sorting coins of mixed denominations at the same operation. The registering devices of some machines provide for a totalled sum in connection with each separate adding counter; others have a sub-total and a total register. Other coin-handling devices are bag-loading machines; proving and bagging machines which recount and bag coins that have been previously separated; continuous counting and bagging machines, which count and bag coins at a high rate of speed; counting machine heads, which handle one denomination at a time and handle metal tokens also; manual counters and packagers, which combine in one operation hand-counting and wrapping.

Dictating Machines.—By means of the cylinder phonograph the time of a stenographer taking notes may be saved. The executive who uses this system speaks into the mouthpiece of a small machine which records his voice by engraving on a revolving wax cylinder. He may pause in his dictation, correct an error, and at any time listen back to what he has said. When the cylinder is full, a typist puts it in a transcribing machine placed alongside her typewriter, and the reproduction of what has been dictated is carried to her by receivers placed over her ears, she typing the words as she hears them. The engraved surface of a used cylinder is removed by a shaving machine so that it may be used again and again.

Typewriters (*see* 27.501).—One machine which has been on the market a comparatively short time is practically noiseless in operation, because the principle of pressure printing instead of percussion printing is utilised. Another is electrically powered and can be operated either from a direct or an alternating current; the keys are touched lightly—about one-quarter of an inch depression—and electricity takes up the burden. Portable typewriters serve the need of the individual for a personal writing machine. Their construction embodies many features of standard office typewriters. The machine is usually secured to the bottom of the case in which it is carried, a permanent base being thus provided, making its use convenient under all conditions. The weight varies from 7 to 12 pounds. A wide selection of special keyboards and type arrangements for engineers, doctors, chemists and all those requiring special symbols and extra characters is available.

Cheque Writers and Protectors.—Besides writing the permanent and unchangeable amounts on cheques, thereby protecting, as far as it is mechanically possible, against losses from raised and forged cheques, these devices save time and labour in concerns which issue large quantities of pay-roll cheques and in banks and establishments which issue dividend cheques periodically. Protection is afforded by printing, by shredding or by perforating the amount, using acid ink in one or two colours. The amount is written in words, in figures or in words and figures. Certain models protect the payee's name as well, by "crimping" or shredding an un-inked design over it. After a cheque is inserted in the machine, the amount to be written is selected by slide levers set in vertical columns, by a hand wheel or by an indicator on the dial, depending on the type of machine. Some models require one stroke of the operating handle for each word or number; others print the whole amount at one operation. In some models the amount is visible before and after printing, and in certain cases the name of the user is also printed. Repeated writing of the same amount on a number of cheques, without change of set-up, is a feature of some cheque writers. An interesting development is the cheque writer with many combinations of foreign denominations for use in foreign banking.

Cheque Certifiers.—These devices print a form of acceptance on cheques, either through a ribbon from a bronze die or from steel wheels inked by a felt pad. Some number the cheques with consecutive serial numbers. Certain models are locked against unauthorised operation.

Cheque Endorsers.—Motor-driven machines are used for endorsing large numbers of cheques. Impressions are made from either a rubber or a metal die inked from rollers and having movable type for dates and batch numbers. Cheques are fed by hand, one at a time, to those models designed for use alongside an adding machine, so that as each cheque is listed for clearing-house, transit, or deposit, the operator turns it over and drops it into the endorser, which prints the endorsement and places the cheque in its original order in a tray beneath the machine. Other models provide for feeding a large number of cheques held at the feeder guide by the operator's hand.

Cheque Cancellers.—Enduring and inerasable evidence that a cheque has been paid, together with the date of payment, is provided by machines which perforate the cancellation through cheques, and if desired, the bank's American Bankers Association number. Dating of deposit slips, notes, mortgages, and other papers may also be done. Hand models cancel from 100 to 225 cheques a minute; motor-driven models are speedier.

Cheque Signers.—Pay-cheque signing is speeded by devices which sign from five to 10 cheques at once. A sheet of cheques is placed on an extension table under a writing frame to which are attached five to 10 fountain pens controlled by a monitor penholder. As the operator signs a sheet of cheques they are pushed into a tray and another sheet is brought into position.

Finding and Filing Devices.—Simplification of filing and locating data compiled in digest form is achieved by three mechanical devices differing in construction, operation and purpose. The purpose of one is to find a single card by number. It is a metal, desk-like affair, in the top of which are 10 trays, each holding numerically filed cards numbered from 0 to 999—1,000 in all. A card is found and filed according to its number. By depressing the proper number-keys of the finding mechanism, the corresponding card is instantly raised above the others in the file. In filing a card, the operator raises the card immediately following to indicate the filing position. Means are provided for finding misfiled cards.

Another device finds a single card by means of the general class or name under which it has been classified. This system uses a steel drawer, on the front of which are two rows of keys marked with the classifications, such as "Farm Lands," "West Side Property," etc. The keys are connected with rods extending back through the drawer. One card can be filed under many classifications, by means of clips placed in position along its lower edge, which correspond to the classifications desired. Pressure on the proper key raises the desired card, together with all those having a clip corresponding to the key. A tap returns the card to position.

A third system provides for the automatic selection and segregation of cards according to any number of classifications, the basis of the system being the card. The top carries a brief summary of the record, or can be extensive enough for a posting

record. The body of the card is perforated, two vertical perforations constituting a "position" to which some classification is assigned. Each card is prepared for automatic selection by converting the two holes of significant positions into a slot by means of a hand-operated slotting punch. The cards are placed in a file drawer, which has a brass front perforated to conform to the cards. If, for example, the device is used for a list of garages, and all garage cards are to be selected, a steel rod is placed in the position designating garages. If all garages having service stations for a particular motor-car are to be selected, another rod is placed in the position designating that information. The more rods, the finer the classification. The drawer is then inverted, and the cards that are suitably slotted drop down. A rod inserted at the bottom of the drawer locks them in place, and when the drawer is held upright, the desired cards are held above the others in the file. When the work is finished, the locking rods are removed and the cards fall into place.

Visible Index Systems.—An operation on a card system may be divided into several parts: (1) locating and removing the card; (2) making the record or noting the information; and (3) returning the card to place. If the second part is a small proportion of the whole time required, the total operation may be greatly simplified by using the so-called visible system.

The cards are usually mounted on panels in such manner that they overlap, showing only the title line, a slight lifting movement revealing the whole card. The panels are housed in several ways. Sometimes they fit into steel cabinets and may be pulled out at a convenient angle for posting or removed entirely. In other cases, the panels—with cards inserted on both sides—are hung vertically, either on a circular track which rotates at the touch of a finger to bring the panel with the desired card before the eye or on a straight track so that they turn like the pages of a book. Another type of visible index is in book form, the cards being either held on panels inserted between the covers or fastened into the binder, as in a loose-leaf binder. Still another kind, which looks like a card drawer with the sides and ends cut down, consists of an aluminium tray in which cards tabbed at different heights so that a portion of each tab is always visible are held by a lock rod. Aluminium guides permit indexing. Pulling forward a guide exposes the tabs of a group of 24 cards, and the full surface of any one is visible when the intervening ones are thrown over. With each type of visible index colour signal systems may be used to call attention to pertinent facts.

Electric Paging Systems.—By audible code signals sounded throughout the premises, this equipment immediately locates individuals who are away from their desks. The central station is usually located near the telephone switchboard, and the telephone operator sends the signals.

Telegraph Typewriter.—An electrically operated typewriter used in hotel offices, banks and other businesses where information is daily transmitted to distant points, transmits messages in written form to any number of distant stations. As the message is typed on the sending typewriter, the words are written simultaneously and automatically by the distant receiving typewriter. The paper is fed from a roll mounted on a frame behind the typewriter. Tabulated forms and duplicated copies can be written. The telautograph is used for a similar purpose, but the message is handwritten instead of typed.

Credit Authorising Systems.—Three distinct types of systems are used for transmitting to a department making a charge sale, the credit department's O.K. on the sale. One is an electric telephone system with a switchboard in the credit department and a telephone in each sales department. As the sales person calls the credit department, she places the slip in an aperture in the telephone, and the credit authoriser causes his approval to be printed on it if the sale is approved. (W. H. L.*)

OFFICE MANAGEMENT.—The office is that part of an enterprise which is devoted to the direction and co-ordination of the various activities of the enterprise. It is characterised by the gathering, classification and preservation of data of all sorts; the making, using and preservation of all kinds of records; the analysis and utilisation of these data in planning, executing and determining the results of operation; the preparation, issuing and preservation of instructions and orders and the composition, copying and filing of written messages.

Though clerks and clerical work have existed for centuries, and large groups of clerks for decades, it is only in recent years that the management of clerks, or office management, has become a problem of importance. This is wholly due to the rapidity of industrial change, which is best shown in the United States. In 1880, when there were but 172,575 clerks in that country, mostly book-keepers and accountants, the problem might be considered as practically non-existent; but in 1920, when the number of clerical workers of all kinds had grown to 2,951,008, it assumed proportions that could not be ignored. In 1920, one in 10 of all persons engaged in "gainful occupations" was a clerical worker. The change was necessitated by the exigencies of an ever-growing large-scale industry. While business organisations were small, and direct contact existed between producer and consumer, beyond simple bookkeeping few records were required, there was little written communication between sections of an organisation, and consequently few clerks were needed. All this has changed, and to-day the office has attained a position of major importance in business.

Many offices employ more than 100 clerks each, and a considerable number employ several thousands. Evidently the employment of such numbers of workers requires management of a high order, yet it is only recently and among the most progressive companies that the subject has received the attention it deserves. Ingenious systems of record keeping and filing have been invented, scores of clever appliances and marvellous office machines are available (*see* OFFICE APPLIANCES), but the problem of securing the greatest result for the least expenditure of effort has not been given the attention in the office that it has in other lines of endeavour. This is due to the newness of the problem, but there are signs that this condition is sure to change as time passes.

Frederick Winslow Taylor (*q.v.*), the "father of scientific management," was himself probably the first person to apply—at least in a limited measure—scientific principles to office work. In Copley's biography of Taylor is shown a "Time Note," dated about 1885, giving "piece-work" rates on 17 clerical operations, the implication being that Taylor had at least studied these operations, found the best method of performing them and controlled them to the extent that he offered an incentive wage for their accomplishment.

THE HUMAN ELEMENT

The major divisions of office work are given herewith, but not necessarily in the order of their importance.

Organisation.—The most essential factor here is clearly defined lines of authority, and its lack is the greatest defect to be found in many companies. In the struggle for advancement it seems difficult to prevent officers from claiming more authority than is granted them, and where confusion of this kind exists, loss of morale invariably results. Functionalisation—one of the leading principles of scientific management—is as efficacious in the office as elsewhere. The office manager himself holds a functional position—that of managing clerks, wherever located. Where this principle is fully carried out, work, instead of being departmentalised, will be functionalised, and therefore performed much more effectively. Thus, a stenographer employed exclusively in taking notes and transcribing letters, will do much more effective work than one who also keeps and files records, answers telephone calls and performs other miscellaneous work. Functionalisation, however, is to its fullest extent only feasible in large offices. It is uneconomical to have too many departments under the charge of one officer. A chart of the organisation, and an organisation diagram, both giving not only the position of each individual in the office but his duties and relation to others, are necessities. Also there should be standard methods for performing each task, and written standard practice instructions so that the carefully devised methods may be perpetuated. Otherwise great loss of output will result.

Personnel Methods.—Progressive records of each employee's performance are necessary as they serve as a basis for future advancement. Special tests for ascertaining the ability of new employees will prevent to a large extent the great wastage of continuous hiring and discharging. Many psychological tests, special ability and trade tests have been prepared, extensively used and found advantageous (*see* INTELLIGENCE TESTS). While there are many clerical positions which demand the very highest intelligence, all clerical work does not, and much of the simpler

clerical work is found irksome when allotted to those capable of a higher grade of activity. Training is extremely important, though often sadly neglected. In some offices the various lines of promotion are laid down and made known to all employees, so they can prepare themselves for advancement. Some offices also have officers who devote their activities wholly to employment, and all persons who are to be discharged are referred for final adjudication to this officer—the employment manager. The advantage here is that competent employees are not lost to the organisation solely because of the personal pique of some hasty or temperamental officer. The employment manager also ascertains by tactful questioning the reasons why employees leave, and by a careful, classified record of such reasons is enabled to check bad practices, and to determine any other causes for dissatisfaction.

Turnover.—The " rate of turnover," that is, the ratio of employees leaving to those on the pay-roll, is a most important factor in good office management. An average cost of over $100 is represented in the training of a new employee who replaces one who has left, so that it is evidently desirable to retain employees for long periods. Turnover is dependent upon many factors. If employees are not properly selected, many replacements will be needed; if salaries are not right, physical conditions bad, or the relations of officers not as they should be, there will be many voluntary separations. A minimum turnover is considered to be about 10% annually. Length of service depends upon much the same conditions as rate of turnover.

Routines and Methods.—A routine is a collection of separate operations through which a piece of work successively passes. Division of labour has been highly developed in office work, and few operations are complete in themselves. Routines as a rule are seldom consciously developed but come into existence gradually through the use of machinery combined with hand-work. As a result, operations wholly or partially useless and of little or no value to the " finished product "—the result desired—are frequently found. Methods also have generally speaking a similar evolution, and yield great results from scientific research. Unless both routines and methods are carefully studied, there is apt to be much waste.

Control of Output.—To secure maximum results for minimum effort, a continuous and uninterrupted flow of work is necessary, and this is one of the most difficult achievements in office work. In the manufacturing of any material commodity the work can be precisely scheduled, step by step, and the maintenance of a steady flow is largely a mechanical problem, as every piece of similar character goes through precisely the same steps. But in the office there is the added difficulty that office work of similar character does not always take the same course; and even in some work of exactly the same nature, the flow is governed by conditions beyond the control of the office manager. Because of this fact it was, until very recently, considered impossible to plan and schedule office work. Peaks, that is, periods demanding intensified and additional work, were handled either by overtime work, or by the permanent maintenance of a sufficient force of clerks to handle them, both plans being evidently wasteful. Analysis of this matter, however, showed that in many cases they could be adequately met by pre-planning. The office force should be well balanced, and sufficiently large to handle average conditions; but a sufficient number of clerks should be trained in several operations. Then by utilising the idea of the " flying squadron "—a selected group of clerks that can be used almost anywhere in an emergency—most of the minor peaks can be handled without difficulty. Major peaks can be dealt with by a re-adjustment of working force and the employment of extra clerks for positions which require only a minimum of training.

Clerical Output.—On this subject all the major factors of office management converge, and all have a bearing upon it. Under conditions where all factors have been scientifically studied, clerical output is invariably much greater than in organisations in which they are largely ignored. Thus in the office of the latter character the average output of a stenographer will rarely exceed 100 sq. in. per hour, while in a scientifically managed office this particular output will be increased to an average of 200 sq. in. per hour. The maintenance of the latter rate does not depend alone upon the skill and application of the stenographer—for 200 sq. in. per hour is but 30 words a minute, while the world's typewriting record is over 800 sq. in. per hour—but largely upon other factors outside the control of the operator and decidedly within that of the office manager. As with typewriting, so it is with all other clerical operations; the output usually depends much more upon the efforts of the management than upon those of the individual clerk. The effort should not be to obtain the highest possible output from any individual, but that which should be expected from a first-class worker.

The Incentive Wage.—Still another factor which aids in obtaining a high clerical output, is an incentive wage of some kind, wherever it is possible to measure the work. The various methods of incentive wage used in other lines of business endeavour have all been tried in the office, some with considerable success, others with disastrous results. In the cases of failure the main causes generally are that (1) work was not properly standardised; (2) not properly measured; (3) steady flow not obtained; (4) work not properly controlled; and (5) no adequate check upon its quality. Piece-work in the office is not so generally applicable, because the worker must have a guaranteed minimum wage, and it is not always possible to supply him with sufficient work to make that wage on a piece-work basis.

The Mechanical Side

The preceding factors deal almost wholly with the management of the human element, and now other factors must be considered—those physical factors without which efficient management is not possible.

Arrangement.—The physical arrangement of an office affects all other factors of management. As most offices are in large cities, rentals are high, and therefore space must be conserved. For this reason the cubicles of the old-fashioned office are giving way to the open office. Departments having relations with each other should be contiguously located, and the seating of the workers in each department be regulated also on this principle. Work should flow in straight lines. Adequate light, both daylight and artificial, should be provided, the standard of the latter being placed by experts at not less than 10 foot-candles (*see* Illumination Engineering). The totally indirect system, in which the light is thrown from its source to the ceiling, and from thence reflected down, is considered the best. Ventilation is an important matter also. Experiments show that the best ventilating system is that which brings in fresh air from the outside without altering it in any way, this being superior to the elaborate washed and heated air systems (*see* Heating and Ventilation). Excessive noise is also detrimental to good work, and noisy machines, if numerous, should be segregated.

Equipment.—Under this head are included desks, tables, chairs, filing cabinets and similar furnishings. The old-fashioned roll-top desk is being rapidly eliminated, and as the present tendency is to the extended use of small loose-leaf books and cards, the high-standing book-keeper's desk has largely disappeared. At present the usual office desk is too large and contains too many drawers, and as clerks have little need for more than one or two drawers, a table is generally preferable. The size of a desk depends naturally upon the character of the work, but a desk larger than 54 in. x 30 in. is rarely needed, though no desk should be smaller than 40 in. x 30 inches. Chairs to be comfortable require designing to fit the human anatomy in an upright seated position. A few good anatomical chair types are available, but most of the others are uncomfortable.

Office Machinery.—Here the greatest development has taken place, office appliances being now available for almost every occasion (*see* Office Appliances). There was a tendency to use machines to the exclusion of competent brainwork, but office managers are beginning to see that this is a mistake.

Correspondence.—This is naturally an extremely important part of office management, not only between the company and outside correspondence, but within the organisation itself. The present tendency is toward brevity and clarity, and the florid style and redundant expressions of the so-called " business English " are in process of elimination.

Filing.—The vertical system of filing has almost entirely superseded the old-fashioned flat file, and elaborate systems have been greatly simplified. Its greatest present misuse is the filing of valueless and superfluous material. The filing problem requires not only adequacy in equipment and system, but also accuracy, which necessitates adequately trained operators, for misfiled papers may easily cause great loss.

Stock-keeping.—In a large office the maintenance and issue of an adequate stock of all forms in use becomes a problem in scientific stock-keeping. Order and neatness are necessary, and an adequate location system, so that material can be found with a minimum loss of time. Stores should be classified according to some well-devised system, and there should be a perpetual inventory and a systematic method of issuing stores to, or on the order of, authorised persons.

Intercommunications.—This factor is a most important one in large offices. The telephone is of course the most common method, but there is usually a large transfer of papers from one part of the organisation to another, and this must be taken care of by well-organised messenger systems with regularly scheduled trips. In many offices automatic belt systems or other forms of conveyors are used. Mechanical devices of other kinds are automatic signalling systems, automatic telephones and so forth.

Forms.—Most office work is performed by writing upon some kind of blank form, whether they be detached or loose-leaf forms. The quality of paper selected for any form should be governed by the use to which it is put. If it is to be written upon with pencil it is wasteful to use a high-grade paper designed for writing with ink. When forms have a temporary value only, the paper should be of a cheaper quality than that of forms to be kept for a number of years. Selecting standard qualities of paper for these various purposes requires considerable study. A large variety of colours should not be used, as many of them—particularly the reds and blues with their varying shades—are difficult to read under artificial light. Not more than nine standard sizes of forms are usually needed.

Salary Standards.—In most offices salaries vary widely and often unreasonably, clerks doing similar work frequently receiving widely different salaries. Some of the best-managed organisations have made a careful gradation of salaries, with a maximum and minimum for each class of worker. The minimum is that salary which a clerk is entitled to as soon as he is assigned his position, and the maximum the highest salary which the company can afford to pay for that type of work. Such gradation eliminates gross inequalities, gives more equitable payment for results and minimises dissatisfaction among the office force.

Summary

Office management is highly complicated, and requires a specialist—a manager of high order who at the same time thoroughly understands clerical work. The scientific approach to the factors of office management may be briefly defined. First it is necessary to define thoroughly the purpose of any work about to be undertaken, for if this is neglected the path of the subsequent investigation is likely to follow incorrect lines. Then the problem should be carefully analysed by dividing it into its factors. These preliminary steps, though simple in a statement, are by no means so simple in fact. The next step involves a careful search for all the facts in the situation which govern each and every factor in the analysis. It is a very common oversight to gather an abundance of facts on one part of a problem, and ignore or minimise other parts. To infer, without investigating, is a most prolific source of error, the method of actual test being by far the best. These three steps are precisely those of experimental science, and may be called the scientific method of thinking out a problem. By its use, the office manager can correctly approach each problem and devise the right method, otherwise known in management as "the one best way." With the best method secured, it is then necessary to select the person best fitted to perform it, for all cannot be equally proficient in the same things. The person best fitted for any particular task will invariably produce better results than the so-called "average" person. When found, it then becomes necessary to teach the person who has been thus selected.

These six steps constitute the basic procedure in any form of scientific management and lead up to the seventh, which is planning. Without careful planning, all the scientifically designed work which has gone before will be wasted. Finally, to secure the best results it is vitally important to win the co-operation of the workers. An office force labouring without interest or enthusiasm will accomplish some results, but certainly not of the type desired by a competent office manager. The management which does not and cannot secure co-operation is necessarily defective. These eight steps cover the basic principles of scientific management in all activities. There is also a considerable tendency toward the simplification of office methods and the entire elimination of much that has been done in the past, on the ground that it is either superfluous or not worth the effort expended. These tendencies are continuously accelerated by economic conditions. Scientific management will be the principal means of reducing the numerical growth of office workers.

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OHIO (*see* 20.25), a State of the United States of America. In 1924 Ohio had a population of 6,219,330, an increase of 20·8% in the decade 1910–20 or of 30·5% since 1910. The density of population rose from 117 per sq. m. in 1910, to 141·4 in 1920. There was a marked increase in the negro population of the cities owing to migration from the South, and also of the foreign element. More significant was the drift from rural districts to cities. In 1910 the urban population in cities and incorporated villages of 2,500 inhabitants or more, formed 55·9% of the total; in 1920 it was 63·8%. In 1925 eight cities had a population in excess of 100,000.

Cities with 100,000 Inhabitants or Over (1925).

Akron	208,435[1]	Columbus	292,222
Canton	114,648	Dayton	178,642
Cincinnati	418,792	Toledo	288,792
Cleveland	922,864	Youngstown	159,870

[1] 1924.

Communications.—A flood in 1913 wrecked the two principal canals, the Miami and Erie from Cincinnati to Toledo, and the Ohio and Erie from Portsmouth on the Ohio river to Cleveland: They had not been restored by 1926. The lower part of the Muskingum river and that part of the Ohio bordering the State has been canalised. The chief development in transportation has been the expansion of interurban traction service and the establishment of motortruck lines. In 1919 there were 4,223 m. of electric railway. In steam-railway mileage there was no significant change between 1900 and 1920. In order to meet the demand of the motor-car for improved roads large State expenditures have been made, and in 1918 31,800 m., or 36·8% of the rural public roads had been surfaced.

Agriculture.—The total value of all farm property in 1920 was $3,095,666,336, as against $1,902,694,589 in 1910, an increase of 62·7%. The total value of live stock in 1920 was $287,655,118. In 1919 the value of all crops was $607,037,562, an increase of 174·6 over 1909. The following table shows the quantity and value of the chief agricultural products according to the United States Census.

Agricultural Production 1919

Crop	Quantity in bushels	Increase % over 1909	Value in $	Increase % over 1909
Corn	149,844,626	− 4·9	217,274,709	163·9
Oats	46,818,330	−18·7	39,795,590	71·4
Wheat	58,124,351	89·6	127,873,574	311·0
Hay and forage	7,661,890[1]	..	130,187,929	..
Tobacco	64,420,472[2]	−27·3	13,528,302	50·3

[1] Tons. [2] Pounds.

The total acreage harvested in 1919 was 11,780,554, an increase of 3·1% over 1909.

Mineral Products.—From 1900–18 there was an increase in the annual output of bituminous coal from 16,900,000 to 40,900,000 short tons; in 1923, 40,546,433 short tons were produced. The coal of Ohio is produced mainly in the southeastern part of the State. The fire-clay mines of Tuscarawas, Jefferson, Columbiana Stark and Carroll counties supply the raw material for a rapidly rising industry. In 1917 3,694,302 net tons of coke were produced: in 1918 the output of natural gas was valued at $24,234,741. The production of crude petroleum has fallen; the total for 1918 was 7,285,005 bar. with a value of $23,465,197 (*see* Petroleum).

Manufactures.—According to the preliminary report of the biennial census of manufactures, 1923 (Dept. of Commerce), the manufactures of Ohio have nearly returned to the War-time level. The table below gives the development from 1914–23.

The most notable advance was in the production of motor-cars and in the manufacture of motor-car tires. The value of all tangible property in Ohio was estimated in 1922 at $18,489,000,000. The *per capita* wealth increased from $1,076 in 1890 to $3,048 in 1922.

History.—The chief political advance has been the progress in adapting the constitution and the system of administration to the new needs of the State. At the election of 1910 a general constitutional convention was approved by a large majority. Delegates were chosen in Nov. 1911, and the convention sat Jan.–June 1912. The delegates, of whom the majority were Democrats, represented the progressive elements of both major parties. Forty-two amendments were submitted to the voters on Sept. 3 1912, of which 34 were ratified; among those defeated were the abolition of capital punishment, woman suffrage, and a $50,000,000 bond issue for a state system of roads. The tax-reformers secured for the general assembly the power to impose inheritance, income and franchise taxes as well as taxes upon the production of coal, oil, gas and other minerals. A tax commission created in 1910 succeeded in bringing out for taxation the property of corporations at something near a true valuation, and in obtaining the adoption of the 1% rule as the maximum rate for taxation. The League for Direct Legislation secured the initiative and the referendum, the liquor interests a licensing system. In 1918, on the eve of Federal prohibition, an amendment incorporated state prohibition in the state constitution.

A law of 1910 centralised the taxing power in a small state tax commission, bringing to an end an expensive system of decennial boards of equalisation. The following year all the charitable and penal institutions were placed under a board of administration. In 1911 the old railroad commission became the public service commission. The act of 1911 gave the public service commission the same power over public utilities in general which the railroad commission had had over railways and telegraphs. In 1913 the legislature changed the public service commission to a public utilities commission. At the same session of the general assembly a state industrial commission was created to assume the functions of the older boards of awards, departments of inspection, etc. In 1911 the Workmen's Compensation Act substituted "a system of compensation for industrial accidents, which compensation is to be paid out of a state insurance fund, to which both employers and employees contributed (90% and 10% respectively) in lieu of the civil action for damages." A law of 1913 made compulsory the system of state insurance. Employers were required to guard the safety of employees and also to arrange reasonable hours of work. Ohio under the Act maintains its own state insurance fund. By 1918 the premium income to the state fund amounted annually to $9,000,000. At a cost of 4½% of the premium receipts the industrial commission gave protection to more than 1,500,000 workmen.

In 1913 the Department of Agriculture, the State Experiment Station and the College of Agriculture, together with the dairy and food commissioner and the fish and game commissioner, were brought under an agricultural commission with four members. Two years later, the legislature undid the reform in part, making the experiment station and the agricultural college independent institutions, and restoring the large Board of Agriculture of 10 members without a salary. A change in political parties occurred again in 1917 and the legislature, while retaining the large Board of Agriculture, made its functions those of an advisory council. The position of Secretary of Agriculture was created.

One of the constitutional amendments of 1912 instructed the legislature to make provision for a state-wide public-school system, and substitute for the commissioner elected by the people a superintendent of public instruction, appointed by the governor. In 1914 the legislature enacted a Rural School Code; and in 1917 created a State Board of Education. The reorganised Department of Education was instructed to emphasise rural agricultural education, and to co-operate with the Federal Govt. in vocational education. The old State Board of Health was reformed at the same session. In the Act of 1917 a State commissioner of health was supported by an advisory public health council of four members. A statute of 1919 created a state-wide system of municipal and general health districts and the powers of the Department of Health were greatly increased. The General Assembly in 1915 created a state highway commissioner, and in an Act of 1919 authorised the development of a state system of highways and co-operation with the road-making enterprises of the Federal Government.

In 1921 an Act was passed which combined the numerous departments and commissions into nine departments—finance, commerce, public works, agriculture, health, industrial relations, examinations, education and public welfare. If the Act stands the test of constitutionality Ohio will have a system of administration analogous to that of the Federal Government. Other legislation included a children's code (1913), providing a state-wide juvenile court and a mothers' allowance system, and a pension system for teachers in the public schools (1919). In 1921 the legislature authorised a World War compensation fund of $25,000,000, and the establishment of co-operative marketing associations. In 1925 it once more undertook, with only slight success, to adjust an antiquated tax system to modern conditions.

A disastrous flood in 1913, affecting especially the inhabitants of the Miami, the Scioto and the Muskingum river valleys, led to a measure for the protection of the river valleys from future damage of the kind. By 1921 the Miami Conservancy District had practically completed a series of dry reservoir dams costing $25,000,000.

Governors since 1913 have been Judson Harmon (Dem.), 1909–13; James M. Cox (Dem.), 1913–5 and 1917–21; Frank B. Willis (Rep.), 1915–7; Harry L. Davis (Rep.), 1921–3; Victor A. Donahey (Dem.), 1923– . (E. J. B.*)

OHIO RIVER: *see* MISSISSIPPI.

OHNET, GEORGES (1848–1918), French novelist and man of letters (*see* 20.35), published in 1908 *La route rouge*, and in 1912 *La serre de l'aigle*. His last work was *Journal d'un bourgeois de Paris pendant la guerre de 1914* (1914–5). He died May 5 1918.

OIL: *see* PETROLEUM.

OILS AND FATS (*see* 20.43).—Long experience in the construction and use of hydraulic presses led to something approaching a state of perfection early in the present century. The process of extraction of oils by means of solvents is, however, a more recent introduction into the industry.

I. THE MANUFACTURING SIDE

Solvent Processes.—In the earlier extraction plants losses of solvent were often high, extraction of oil from seed was incomplete, and the oil obtained was of inferior quality and frequently unsuitable for edible purposes. The methods of construction and operation of extraction plant have been improved to such an extent that the losses of solvent (generally light petroleum spirit) only amount to about 1% of the weight of seed treated. The oil content of the residual meal can easily be reduced to 2%, or even less, and oil of excellent quality is produced, the oil being quite equal to that prepared by expression.

There is, therefore, at the present time but little to choose between pressing and solvent extraction, and the choice of the process rests

	1914	1919	1921	1923
Average number of wage earners	510,435	730,733	494,288	699,031
Wage payments	$317,923,000	$944,651,000	$627,033,000	$979,660,000
Value of products	$960,811,000	$5,100,308,000	$3,300,693,000	$5,046,504,000

rather on the kind of seed to be treated than on grounds of cost of working or efficiency. Where the maximum yield of oil is desired, and the residual meal is not required to contain more than traces of oil, solvent extraction is obviously better. In a good many cases seed is pressed first and the residual cake afterwards extracted by solvents. In the oil seed crushing industry it has always been an aim to devise continuous methods of operation. Several machines for the continuous expression of oil seeds have been devised and patented, but so far only one such machine, the Anderson "expeller," appears to have met with commercial popularity. Patents have also been taken out for continuous processes of solvent extraction, but it does not seem that any of these have been put into actual commercial operation.

Refining and Bleaching.—Many of the chemicals formerly used or proposed are not now employed. In practice treatment of certain oils (*e.g.*, linseed and rape oils) with sulphuric acid is effective, while treatment with caustic soda, which neutralises free fatty acids, and in many cases also removes colouring matter and other impurities, is largely employed. The use of caustic soda for neutralising oils has certainly increased in late years with the growing use of oils for edible purposes. Outwardly the principles of the process are simple, neutralisation of free fatty acid by soda and the removal of the soap formed from the neutralised oil. Actually the problem is one of some complexity from the physico-chemical point of view, involving as it does the formation of emulsions.

Various processes have been devised with a view to obtaining better or more rapid separation of the soap from oil, and also to lowering the loss of neutral oil carried away with the soap, such as that of C. Baskerville (*J. Ind. Eng. Chem.* 8, 118, 1916) in which about 2% of prepared cotton fibre is added with the soda to the oil, enabling the soap (and cotton) to be separated from oil by means of a filter press. In other processes a vacuum is employed to assist removal of water after neutralising, so as to obtain the soap in a dry form, which can be separated from oil by filtration.

Filtration.—The methods of removal of insoluble suspended impurities from crude oils have been improved, and the use of filter presses, which assist filtration and also cause clarification of the oil, is common. High speed centrifugal clarification is in many cases advantageous, while the introduction of a new type of filter—the Hele-Shaw "stream-line" filter—may have far-reaching applications. Considerable advances in the methods of "bleaching" oils by means of various decolourising materials such as natural fullers earths, chemically treated earths, and charcoals, have been made and the use of such materials, particularly in the edible oil industry where freedom from colour is desirable, has undoubtedly increased.

Activation.—Methods of "activating" vegetable carbons so as to render them highly efficient as decolourising agents which can compete with animal or bone charcoal, formerly the most efficient variety of decolourising charcoal have been developed. The methods of activating vegetable decolourising charcoals owe a good deal to the investigations carried out during the War on methods of producing vegetable charcoal with a high absorptive capacity for gases such as was required in gas masks. The nature of the physical reactions of carbon treated in various ways was thus elucidated. While the removal of colour is due chiefly, if not entirely, to physical adsorption of the colouring matter, further investigation is desirable, both in the direction of elucidating more fully the *modus operandi* of the decolourising effect and also towards further improvement of decolourising agents.

Chemical methods of bleaching oils and fats generally involve treatment by oxidising agents, and are seldom, if ever, employed in bleaching oils for edible purposes. Oils for technical use, *e.g.*, for soap manufacture, are still generally bleached by air or by bichromate and acid or by hypochlorites, but various other oxidising agents such as certain organic peroxides and metallic per-salts are also used.

Deodorisation of Oils.—Practically all processes depend on the passage through the heated oil of a current of steam, which carries off the more volatile substances to which odour is due. In the earlier processes steam at comparatively low temperature was employed, and as much as 2 lbs. of steam was often required to deodorise 1 lb. of oil. Deodorisation is still to some extent regarded as a trade secret, but modern development has all been in the direction of employing superheated steam and higher temperature of oil assisted by high degree of vacuum. Deodorisation is now much more efficient than formerly, both in degree and in consumption of steam. The use of inert gases, such as carbon dioxide or hydrogen, in place of steam has also been tried.

Artificial Oils and Fats.—The conversion of hydrocarbons from petroleum into fatty acids by processes of oxidation has attracted a good deal of attention, by reason of the large difference in price between hydrocarbon oils and fatty acids (which may be converted to oils by reaction with glycerol). Fatty acids undoubtedly can be produced from hydrocarbons, but so far it does not appear that any process has been devised which shows a likelihood of commercial success.

Fatty acids are in many cases by-products of the oil industry; they also frequently exist in a free state mixed with neutral oils in crude oils, and have to be removed before the oil can be used for many purposes. The conversion of fatty acids into neutral oil by esterification with glycerol is the subject of certain patents. Technically the conversion of fatty acids into neutral glycerides has been suggested. (1) for the purpose of converting fatty acids of low value into neutral oils of higher value, (2) for the neutralisation of free fatty acids naturally present in crude oils, (3) for the production of glycerides having certain desirable properties, *e.g.*, mixed triglycerides containing definite fatty acids. Esterification has certainly been carried out technically but, owing to the reticence of manufacturers, it is not possible to indicate its technical importance.

Hydrogenation of Oils.—In principle the process is one of great simplicity, involving the combination of hydrogen with a liquid oil containing unsaturated fatty acids, the resulting product being a solid fat containing saturated fatty acids. Thus liquid olein, the triglyceride of oleic acid, a common constituent of liquid oils, is converted to solid stearin, the triglyceride of stearic acid, according to the chemical equation $C_{17}H_{33}COOH + H_2 = C_{17}H_{35}COOH$.

This reaction is effected by bringing the liquid oil into contact with hydrogen gas in presence of small amounts of catalytic metals. Metals such as platinum and palladium are active hydrogenation catalysts at low temperatures, even at ordinary atmospheric temperature, but these metals are too expensive to be used on the large scale demanded by modern requirements, and have been displaced in the oil industry by nickel catalysts. Many patents dealing with the production of suitable catalysts, machinery for carrying out the reaction, and other details, have been taken out. The process consists as a rule in heating the oil and nickel powder catalyst to 150–200° C., in a closed vessel with hydrogen under pressure of 50 lb. per sq. in. or more, thorough agitation being effected either by stirring gear or circulation of hydrogen through the oil by pump or by both these means. After hydrogenation to the desired degree, *i.e.*, after sufficient hydrogen is combined to produce an oil of the required hardness, the mixture of oil and catalyst is run out of the reaction vessel and the catalyst removed by filtration.

The catalyst most usually employed is a mixture of nickel and some inert material such as kieselguhr (siliceous earth), the latter being used to afford a large surface of catalytic material. The catalyst is produced by precipitating an insoluble nickel salt in presence of the inert material; nickel carbonate is commonly employed and this is formed by adding the requisite amount of sodium carbonate solution to a suspension of the inert material in a solution of nickel salt (generally nickel sulphate). The precipitated nickel salt, etc. is collected and washed in filter presses until free from soluble salts; it is then dried and reduced in a current of hydrogen, generally at a temperature of 300° C. or over. After reduction the catalyst is kept from contact with air either by admixture with oil or by keeping in an atmosphere of inert gas.

The reduced catalyst powder has generally a content of nickel of about 20 per cent. In the hydrogenation of oils of good quality an addition to the oil of as little as 0·1% of actual nickel is sufficient to bring about hydrogenation, but lower grades of oil may require considerably more, while very low grades of oil cannot be treated economically owing to the presence of impurities which "poison" or render the catalyst ineffective. This powder catalyst process has been developed to a very high degree of efficiency, and the process of hydrogenating oils has grown to a very large extent.

The powder process is not continuous and the powder catalyst must be removed from the oil by filtration. Further the nickel catalyst can only be recovered for re-use by costly processes. By a recently developed process metallic nickel in the form of fine turnings is employed as catalyst. These turnings are packed permanently in cages which fit into the reaction vessels. In this process of hydrogenation the oil flows continuously through heated reaction vessels containing cages of nickel turnings in presence of hydrogen; and hydrogenated oil entirely free from nickel and requiring no filtration is delivered from the plant. The degree of hydrogenation is readily controlled by the rate of flow of oil, while the nickel catalyst is regenerated without loss in weight, and at low cost by a simple process of electrolytic oxidation (*Eng. Pat.* No. 203,218).

The process of hydrogenation has led to much important work on the mechanism of the reaction, the effect of "poisons" on catalysts, and the nature of the catalytic action of metals. Oils hydrogenated under such conditions as obtain in technical practice as a rule contain considerable amounts of iso-oleic acid, a solid unsaturated acid isomeric with ordinary liquid oleic acid. This facilitates the identification of hydrogenated oils in compounded oils (K. A. Williams and E. R. Bolton, *Analyst*, vol. 49, p. 460 1924), which was otherwise difficult or even impossible.

Speaking broadly, the hydrogenation of oils may be looked upon as the most important advance in the oils and fats industry during the present century, and hydrogenated or hardened oils are used to a very large extent chiefly in edible oil and in soap manufacture. By it liquid oils may be converted into solid fats of any desired degree of hardness and many oils which are of low value on account of odour and flavour, such as fish and whale oils, can be rendered odourless and tasteless.

Oil Analysis and the Constituents of Oils.—The general tendency has been to increase the delicacy and reliability of the various tests, and from increased knowledge obtained as to the " constants " of various oils to render more easy the detection of admixtures or adulterants. The task of the analyst has increased considerably in difficulty owing to the improved methods of refining oils employed in commercial practice, to the increased complexity of mixtures of blended oils and to the widespread use of hardened oils. Much work has been done on the nature of the fatty acids present in oils and fats, and the relative proportions of the different fatty acids occurring (as neutral glycerides) in commercial oils and fats are now generally known with a desirable degree of exactitude.

There is a lack of information as to the exact forms of triglycerides existing in most oils and fats. Mixed triglycerides, such as oleodistearin, have been separated from natural fats, but so far such substances can only be separated by tedious methods of fractional crystallisation, which do not afford accurate quantitative evidence. The importance of mixed triglycerides is certainly great, for example, their influence on the consistence and general physical properties of fats. The inner structure of the molecule of various fatty acids has received attention, by the application of the X-ray spectrograph (*e.g.*, A. Müller, *Chem. Soc. Trans.*, vol. 123, p. 2043 1923).

New Constituents of Oils.—In the liver oils of certain sharks and other marine animals large amounts of unsaponifiable matter, consisting of highly unsaturated hydrocarbons, have been discovered, thus spinacene—$C_{30}H_{50}$—was isolated from the liver oils of *Centrophorus granulosus* and *Scymnus lichia* by A. C. Chapman (*Chem. Soc. Trans.* vol. 111, p. 56 1917). Similar or identical hydrocarbons have been obtained from many other marine animal oils by A. M. Tsujimoto.

Soap (25.296).—An interesting example of the application of scientific methods to the technique of soap making is the work of K. Maclennan (*Chemistry and Industry*, 1923, 393 T) dealing with the microscopical character of the soaps of individual fatty acids, and with the structure of the soap during different stages in the manufacture.

A general improvement in technique and machinery is evident. Machines for artificial cooling of soap enable the soap to be obtained in the form of solid slabs ready for cutting in about two hours, compared with the four or five days formerly necessary when spontaneous cooling in frames was employed. The oils used by the soap maker in recent years have to some extent changed, and the increased demand for oils for edible purposes (*e.g.*, margarine) has caused a rise in price in some cases, and such oils have consequently been replaced by other cheaper oil for soap making. Soya bean oil has proved useful to the soap maker as a substitute for more expensive materials. Hardened oils have also come into use in soap making, while full use has been made of the increasing quantities of by-products obtained as a result of the removal of free fatty acids in the refining of crude oils for edible and other purposes (*see* under REFINING).

In refining oils with caustic soda the soap formed together with any excess of caustic soda and associated neutral oil is deposited as soap stock; this forms a useful raw material for the soap maker on the spot, if not used in the same factory the soap stock is generally converted into " acid oil " (by treatment with an excess of mineral acid) so as to obtain a more homogenous material and to save cost of transport by removal of water. The production, improvement and use for domestic as well as technical purposes of dry soap in the form of powder or flakes; are noteworthy. Investigations into the colloidal and other physical properties as well as to the chemical nature of soap and soap solutions, have resulted in a better understanding of many problems connected with soap; for example, methods have been devised for measuring the detergent action of soaps.

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II. THE DISTRIBUTING SIDE

The trade in oils and fats has always been important, but it was not until the War period that any systematic attempt has been made to compile statistics. During the War industry was brought temporarily under Governmental control in Great Britain, in Germany and some other countries, and the need for more accurate information as to available supplies was acutely realised. The International Institute of Agriculture, Rome, began to collect statistics from the various producing and exporting countries, and these have been published in *Oleaginous Products and Vegetable Oils.*

Figures dealing with production are in most cases largely guesswork. The bulk of the oilseeds are shipped from tropical countries, many of which are still in a primitive state of development. Moreover, a considerable proportion of the production is consumed in various ways in the countries of origin, and in most of them are numerous small native mills producing oils for local use, and using up in many cases as much as half the total crops. The difficulties therefore in the way of obtaining complete statistics are very great. Since the War, however, a considerable advance has been made in the method of estimating crops, and Government reports for the principal producing countries are now issued at regular intervals for most of the oilseeds prominent on the international markets.

The pioneers in the oilseed industry were the soap manufacturers, who, as they found their supplies of raw material being encroached upon by the demands from the edible oils trade—demands which steadily increased with the development of better refining methods—were driven to search in new directions. The effect of the War was to arrest this expansion, to divert available supplies to Allied countries, and to favour those sources of supply which lay nearest to hand. The blockade cut out Germany as an importer, and many seeds and nuts which previously had gone mainly or exclusively to the Continent, such as groundnuts, sesame seed, palm kernels and copra, were diverted to Great Britain. Moreover, economy of freight space being essential, and oil occupying much less room than seed, a considerable stimulus was given to the erection of oil-mills in countries of production, and to the development of the export from there of oil in bulk. Particularly was this the case with copra and coconut oil. In both the Philippines and Dutch East Indies extensive crushing plants were put up, and shipments of oil increased in the one case from 5,000 tons in 1913 to 140,000 tons in 1919, and in the other, from 1,000 tons in 1913 to 75,000 tons in 1919. After the War former conditions were gradually restored, though Great Britain continued to import palm kernels, copra and groundnuts to a much greater extent than before.

The War helped the development of refining processes. The vital necessity of finding supplies of oils and fats for the armies and the civil population gave a great impulse to research, and many oils which had hitherto been regarded as purely industrial, became available for edible purposes as a result of improved methods of refining and deodorising; rape oil, which had previously been used for burning and lubricating, and palm oil for soapmaking, took a place in the list of important potential edible oils. Another process—hydrogenation, whereby a liquid oil is enabled to absorb hydrogen and is hardened—was greatly developed. This process brought whale oil to the margarine manufacturer.

The general effect of these changes has been to increase very considerably the interchangeability of oils. While each oil may be said to have a particular purpose for which it is most suited, it can be readily turned to other purposes if the price factor is right. Whereas previously there were wide differences in prices the tendency now is for all refined oils to approximate in value.

The production of oilseeds is liable to very considerable fluctuations, but in a normal year the following estimates of the main crops may be taken as approximately correct:—

Product	World's Production Oilseeds	Exportable Surplus from Producing Countries	Approximate Oil Equivalent of Exportable Surplus
	Tons	Tons	Tons
Linseed	4,000,000	2,000,000	600,000
Cottonseed	11,000,000	900,000	162,000
Ground Nuts	2,500,000	800,000	280,000
Rape and Mustard	1,500,000	380,000	133,000
Sesame	600,000	300,000	135,000
Soya Beans	4,500,000	1,000,000	100,000
Sunflower	2,000,000	30,000	9,000
Copra	1,500,000	600,000	390,000
Palm Kernels	500,000	450,000	202,000
Castor Seed	300,000	150,000	63,000
Oil			
Olive Oil	700,000	120,000	120,000
Total			2,194,000

Linseed.—The main producing countries are Argentina, India, U.S.A., Canada and Russia. About 50% of the total is now produced in Argentina, where expansion has been steady over the last 20 years, and was largely unaffected by the War. The seed is mainly exported to the crushing mills in Europe, though America imports considerable quantities, varying according to the fluctuations in the home crop. Production in Canada and the United States has varied largely. Normally America consumes about 1,000,000 tons of seed and any deficiency in the home production has to be made good by imports of seed from Argentina or of oil from Europe. In 1922, 64,000 tons of linseed oil were exported from Europe to America. In India, flax is cultivated for the seed and not the fibre. Production of linseed amounts to from 500,000 to 600,000 tons, of which about 80% is exported, almost entirely to Europe. With the increasing competition from Argentina there has been a tendency to diminish production. Russia as a producer and exporter of linseed was practically eliminated during the War and subsequent revolution, but is now again resuming exports. Production in 1925 reached 600,000 tons, which is about normal. Pre-War exports amounted to approximately 150,000 tons a year.

Cottonseed.—The main producing countries are the United States, India and Egypt, but cultivation has extended to other countries, *e.g.*, South America (Brazil, Peru, Argentina), East and West Africa (Nigeria, Uganda, Sudan) and Australia. With the increasing demand from the textile industry for cotton, a great expansion in cultivation is inevitable and with it the production of cottonseed, one of the greatest sources of edible vegetable oil. Up to 1870 cottonseed in the United States was a useless encumbrance to the planter. With the discovery and development of refining, numerous oil-mills were erected, and now some 4,000,000 to 5,000,000 tons of seed are crushed annually, producing about 600,000 tons of oil. Up to a few years ago 150,000 tons of oil were exported annually to Europe, but owing to increasing home consumption the exportable surplus has now diminished to about 28,000 tons, with every probability of a further decrease.

Europe has had to depend for its supplies of cottonseed mostly on Egypt and India, though with the extension of cultivation to other countries many varieties are now coming on to the European market. Egypt normally produces about 600,000 tons and exports to Europe 400,000. India produces rather over 2,000,000 tons, but exports only from 200,000 to 300,000 tons. Figures relating to China are difficult to obtain, but it is estimated she produces about 1½ million tons, practically all of which is consumed locally. The striking fact about cottonseed is that out of a total production of about 11,000,000 tons of seed, only some 900,000 tons find their way to the international markets, the rest being disposed of at home.

Groundnuts.—The main producing countries are India, West Africa China and the U.S.A., the two first being the principal sources of supply for the world markets. In all areas production is continuously expanding to meet the demand both for the purposes of oil production and for direct use as food. The chief importing country is France, which takes about 500,000 tons annually.

India produces well over 1,000,000 tons, more than half of which is retained for home consumption. The nuts are shelled before exporting. West Africa produces well over 500,000 tons and exports about 350,000 tons, practically all in shell. Figures are not available for China, but production is probably very large. Exports amount to only about 60,000 to 70,000 tons. The U.S.A. consumes all it produces, viz.: about 350,000 tons.

The pre-War export trade in ground-nut oil was confined mainly to France, the Netherlands and China. During the War French and Dutch exports were reduced to a minimum, and China became the chief source of supply, increasing its export from 15,000 tons in 1913 to 75,000 tons in 1919—mainly to America. Since then the pre-War position has gradually been restored.

Rapeseed.—India produces four-fifths of the world's supply, the remainder being grown in Japan, Rumania, Russia and other European countries. European cultivation has decreased considerably. The great bulk of seed produced in India is consumed locally, exports even before the War showing a marked tendency to diminish. In recent years exports have fluctuated widely, varying from 56,700 tons in 1921 to 271,500 tons in 1924 and 165,000 tons in 1925.

Soya Beans.—The chief producer of soya beans is China, the normal crop being estimated to be between four and five million tons. The soya bean has long been one of the staple foods of the East; since 1904 when the first shipment was made to Europe there has been a very rapid expansion in trade. Some 500,000 tons are now exported to Europe, a similar quantity being exported locally—mainly to Japan. In addition, a large number of mills have been erected in Manchuria to crush the soya bean, the oil being exported mainly to Europe and the cake to Japan for use as a fertiliser for the rice crop. Exports of oil amount to over 100,000 tons a year.

Sunflower Seed.—This is produced mainly in Russia, but to an increasing extent in Rumania, Hungary, Bulgaria and Poland. In 1913 some 180,000 tons of oil were produced practically all of which was consumed locally.

Copra.—The two main zones of cultivation are the Southern Asiatic, including Dutch East Indies, Philippines, Ceylon and Malay States, and Oceania, comprising the various Pacific Island groups. The former is the more important, supplying about four-fifths of the total. During the War the export trade to Europe in copra suffered severely. In the case of the Dutch East Indies, exports fell from 230,000 tons to 65,000. The United States, however, increased its imports both of copra and coconut oil. A marked revival took place in 1919, total exports amounting to 650,000 tons of copra.

Palm Kernels.—West Africa holds practically a monopoly of the production, although plantation cultivation is being extended to other tropical countries, notably the Dutch East Indies. Practically the whole of the production is exported to Europe. The War diverted supplies from Germany to Great Britain. In 1909 only about 20,000 tons were brought into England, as against 240,000 tons to Germany. After the War Germany gradually recovered her position. In 1924 the respective figures were 280,000 as against 102,000 and in 1925 226,000 against 225,400 tons.

In addition to palm kernels, West Africa produces large quantities of palm oil, *i.e.*, oil from the palm fruit. It is difficult to estimate total production owing to the large local consumption. The method of producing the oil is still primitive, and the free, fatty acid content is high. The oil, therefore, is used principally for soapmaking in importing countries, though the best qualities can be made edible by refining. About 180,000 tons are exported annually to Great Britain, the Continent and America.

In the same group of oil nuts may be mentioned the cohune, babassu, ucuhubu, all of which have only come on the international market so far in small quantities. The producing country is Brazil, which is known to be rich in oil seeds.

Castor Seed.—India has practically a monopoly. During pre-War years the average export amounted to about 120,000 tons, the chief importing countries being Germany and Great Britain. During the War Brazil began to cultivate this seed, and in 1918 exported 4,000 tons and in 1924 15,000 tons. After the War exports from India fell heavily, due to the accumulation of Government stocks in Great Britain. Since then recovery has set in and in 1925 100,000 tons were exported. The United States has become one of the chief importing countries. Small quantities are also exported from Dutch East Indies and Portuguese West Africa.

Olive Oil.—Cultivation of the olive has not undergone any material change during the last 25 years. The principal producing countries border on the Mediterranean, *i.e.*, Spain, Italy, Greece, Algeria, Tunis, and, to some extent, France and Turkey. Annual production amounts to 700,000 tons, of which over 100,000 tons are exported, mainly to Argentina, the U.S.A., Great Britain and Germany. The War reduced the exports of Italy, Greece and Tunisia and doubled those of Spain. As much as 87,000 tons in 1916 and 110,000 tons in 1919 were exported from Spain. Pre-War conditions however eventually re-asserted themselves.

Animal Fats.—In addition to the vegetable oils, considerable quantities of animal fats, such as lard and tallow, are produced for edible and industrial purposes. The United States produces some 700,000 tons of lard, of which about one-half is exported. The main exporting countries for tallow are Argentina and Australia, which between them account for about 100,000 tons. The United States consumes practically all its production which amounts to about 170,000 tons.

Marine Oils.—The principal marine oil is whale oil. These oils were used only for burning until the hydrogenation process was developed; since that time all the whale oil is used in soap and margarine manufacture. The total production of marine oils is approximately 200,000 tons, whale oil accounting for about 130,000 tons (*see* WHALING).

See International Institute of Agriculture, Rome, *Oleaginous Products* (1923); *International Crop Report and Agricultural Statistics* (monthly.) (J. W. P.)

OKLAHOMA (*see* 20.57).—A State of the United States of America. The population in 1920 was 2,028,283; in 1910 it was 1,657,155; an increase of 371,128, or 22·4% as compared with 866,764 or 109·7% in the preceding decade. The urban population increased from 320,155 in 1910 to 539,480 in 1920. During the same period the density of population increased from 23·9 per sq. m. to 29·2. Indians decreased from 74,825 to 57,337. Negroes increased from 137,612 to 149,408. The population in 1920 of the larger cities was:—

Oklahoma City	91,295	Okmulgee	17,430
Tulsa	72,075	Enid	16,576
Muskogee	30,277	Shawnee	15,348

The population of the State in 1925 was estimated at about 2,250,000 persons.

Mineral Production.—The most important development between 1910 and 1920 was in the production of oil and gas. In 1924 there were 50,000 wells producing either oil, or gas, or both, and 43 counties were classed as oil and gas producers. Tulsa is the centre of the oil and gas area of the State: its population increased from 18,000 in 1910 to 72,075 in 1920. The production of oil increased from 52,028,700 bbl. of crude oil in 1910 to 161,000,000 bbl. in 1924, and its value from $19,227,000 in 1910 to $279,000,000 in 1924. In 1924 Oklahoma produced 3,500,000 tons of coal, 178,000,000,000 cu. ft. of gas, 67,000 tons of lead, 242,000 tons of zinc, 290,000 tons of gypsum and 2,000,000 bbl. of Portland cement. The total value of Oklahoma's mineral production increased from $33,000,000 in 1910 to $410,600,000 in 1924.

Agriculture.—The total area of farm land in 1910 was 28,859,353 ac. of which 17,551,337 ac. were improved; in 1920 the total area was 31,951,934 ac. of which 18,125,321 were improved. The value of farm property in 1910 was $918,148,882; in 1920 it had increased to $1,660,423,544. In 1909 the total value of all crops was $131,522,220. In 1919 it was $550,084,742, but, owing to the drop in prices, in 1924 the total value was only $427,934,000. Dairy products in 1924 were valued at $25,000,000, as against $20,878,920 in 1919. The following tables show the quantities and values of cereal production in 1909, 1919 and 1924, and the numbers of live stock in 1910, 1920 and 1924:—

Cereal Production

	1909	1919	1924
Wheat: quantity	14,008,334 bu.	65,761,843 bu.	54,870,000 bu.
Value	$13,854,322	$140,730,350	$68,048,000
Corn: quantity	94,283,407 bu.	53,851,093 bu.	65,600,000 bu.
Value	$48,080,554	$72,698,979	$58,384,000
Oats: quantity	16,606,154 bu.	45,470,191 bu.	38,880,000 bu.
Value	$7,172,267	$36,376,150	$20,606,000
Kafirs: quantity	4,658,752 bu.	17,901,096 bu.	29,614,000 bu.
Value	$2,531,036	$23,271,427	$22,803,000
Barley: quantity	127,641 bu.	1,781,839 bu.	4,675,000 bu.
Value	$75,059	$2,049,119	$3,273,000
Rye: quantity	37,240 bu.	705,124 bu.	518,000 bu.
Value	$30,364	$1,022,434	$523,000

Live Stock

	1910	1920	1924
Horses	786,700	790,670	633,000
Mules	258,152	358,200	330,000
Dairy Cattle	1,765,346	870,690	565,000
Other Cattle		1,284,753	1,044,000
Sheep	49,157	106,024	8,300
Swine	..	1,366,722	841,000

The chief industries are the manufacture of flour and meal, smelting, oil refining and meat packing. The following table prepared by the U.S. Census Bureau gives a comparative summary for 1914 and 1921:—

	1914	1921
Number of establishments	2,518	1,398
Proprietors and firm members	2,464	1,262
Salaried employees	2,793	5,443
Wage-earners	17,443	22,241
Capital	$ 65,477,654	..
Salaries	3,202,332	$ 11,801,000
Wages	11,011,043	29,532,000
Cost of Materials	70,969,750	203,803,000
Value of products	102,005,693	283,764,000
Value added by manufacture	31,035,943	79,961,000

Education.—During the period 1910 to 1924 great progress was made in education. The enrolment of pupils in 1910 was 415,116, and in 1924–5 it was 654,742. The number of accredited four year high schools increased from 29 in 1912 to 508 in 1924. The total expenditure for public schools in 1910 was $8,600,450.32, as against $30,187,233 in 1924–5. Similar growth has been shown in the higher educational institutions supported by the state. The six state teachers' colleges, the Agricultural and Mechanical College and the secondary agricultural schools as well as other State secondary schools have made progress. The University of Oklahoma, which in 1907–8 had 40 instructors and 790 students, had in 1924–5 264 instructors and 5,561 students, inclusive of the summer session, but exclusive of correspondence and extension work. In 1916 the industrial institution at Chickasha was re-organised and renamed the Oklahoma College for women. It is the only school maintained by the state that is not co-educational.

History.—At the time of its admission in 1907 Oklahoma contained more than one-third of the Indian population of the United States. These Indians came from numerous tribes that had moved to Oklahoma in the 19th century, and their absorption into the general body of citizens has proceeded increasingly since 1910. The Indians of Oklahoma had by 1920 practically no separate history, and such tribal organisations as were maintained were not for governmental purposes, but were business corporations for the control of tribal property. The great mineral output has made many of the Indians extremely wealthy. The Osage tribe in particular continued to hold much of its land as tribal property, and its members receive very large royalties. This was not true of certain other tribes, as the lands assigned to them are valuable only for grazing purposes, and the individual allotments under such circumstances bring small incomes. The fact that a large part of the land, especially in the eastern half, has been allotted to the Indians, serves to account for the large number of tenant farmers in a state. The governors of Oklahoma between 1910 and 1925 were Lee Cruce (Dem.), 1911–5; Robert L. Williams (Dem.), 1915–9; James Brooks Ayres Robertson (Dem.), 1919–23; John Calloway Walton (Dem.), 1923; Martin Edward Trapp (Dem.), 1923– .

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OKLAHOMA CITY, U.S.A. (*see* 20.61), the capital of the State of Oklahoma and its commercial centre, continued to grow

rapidly after 1910, reaching a population of 91,258 in 1920 (of whom 8,241 were negroes and only 3,477 foreign-born), and 139,947 on Jan. 1 1925, according to an official census made by the city.

In a zone 50–100 m. from Oklahoma City lie (1925) most of the 250 producing oil-fields of the state. The nearer territory, within a radius of 50 m., is believed to contain oil far below the surface, and its development may be expected with the exhaustion of the more accessible supplies and improvement in methods of reaching lower levels. In 1924 the assessed valuation of taxable property in the city was $119,000,000; bank clearances amounted to $1,283,152,000; building permits represented a value of $8,060,845; the volume of wholesale business was estimated at $175,000,000; and freight originating in or destined for the city amounted to 1,880,426 net tons. The value of products manufactured within the city increased from $7,868,000 in 1909 to $69,971,000 in 1919. In 1925 there were 431 manufacturing establishments with an output valued at $150,000,000, the principal industries being packing, flour-milling, cotton-pressing and ginning.

The commission form of government was adopted in 1911. By 1925 a new water supply system costing $5,500,000 had been completed; and 2,200 ac. had been laid out in public parks and playgrounds. Oklahoma City University (established in 1911 and superseding Epworth University) had a roll of over 1,300 students.

OKUMA, SHIGENOBU, MARQUESS (1838–1922), Japanese statesman (*see* 20.61), emerged from his retirement in 1914 to become Prime Minister, in which capacity it was his fortune to guide the country through the opening months of the World War. In Oct. 1916, Count Okuma retired from office owing to his failing health. In the same year he was raised to a marquessate. He died at Tokyo Jan. 10 1922.

OLD AGE PENSIONS: *see* INSURANCE, SOCIAL.

OLDENBURG, SERGEI FEDOROVICH (1863–), Russian orientalist, was born Sept. 14 1863 at Bjankino, Siberia, of a family of German origin. Oldenburg learnt Greek and Latin at a secondary school in Warsaw and later entered the University of St. Petersburg (Leningrad) to study oriental languages. He specialised in Indian dialects under Professor T. P. Uinajer, graduated in 1890 and went to England where he did research work at Cambridge. In 1894 he published his *Buddhist Legends*. In 1903 became a member of the Academy of Sciences, of which in the following year he was elected permanent secretary. In this capacity he controlled the official and scientific correspondence of the academy, its publications and their exchange, the academical archives, the scientific expeditions and the regional surveys of the country. He also became director of the Asiatic Museum, founded by the academy in 1818, which contains many valuable oriental manuscripts. Oldenburg took a leading part in two archaeological expeditions to Chinese Turkistan, which discovered a whole library of ancient Mss. buried in sand among ruins of a deserted town. He was appointed professor at the University of St. Petersburg in 1895 and still occupied the chair of Indian languages and literature in 1926.

OLD TESTAMENT: *see* BIBLICAL CRITICISM.

OLLIVIER, OLIVIER ÉMILE (1825–1913), French statesman (*see* 20.89), died at St. Gervais-les-Bains, Savoy, Aug. 30 1913.

OLNEY, RICHARD (1835–1917), American statesman (*see* 20.91), died in Boston, Mass., April 8 1917. He declined, in 1913, President Wilson's offer of the ambassadorship to Great Britain.

OLYMPIC GAMES (*see* ATHLETIC SPORTS, also 2.846).—The modern revival of the Olympic Games of ancient Greece is due to a Frenchman, Baron Pierre de Coubertin, whose personal admiration of the English public school and English ideals of sport determined him to impart those ideals both to France and to the rest of the world by organising an amateur meeting of all nations in athletic rivalry every four years. The Baron succeeded in his efforts so far that by the fourth celebration of Games in 1908 he saw collected in London the representatives of 20 different nations competing in 20 different forms of sport, involving more than 100 separate events, with a complete illustrated code of rules for each of them, accepted by more than 2,000 athletes. In 1924 he saw in Paris an even longer programme, in which 45 different nations contributed a total of competitors three times as large as that of 1908.

As it is therefore clear that the modern Olympic Games have become, in all human probability, a permanent feature in the world's calendar of sport, it would serve no good purpose to say more concerning recent developments than that they appear to be more warmly welcomed by the Americans and by other nations in Europe and elsewhere than by the population of Great Britain as a whole, which has been for long accustomed to an annual round of organised competitive sport quite unfamiliar to any other country.

Early Meetings.—It was by the British Olympic Committee, headed by Lord Desborough and the Rev. R. S. de C. Laffan, that the first real organisation of these Games was sucessfully carried through in 1908 in London. Previous meetings, though recorded, were neither representative nor properly organised. The third celebration at St. Louis in 1904 had attracted hardly any competitors from outside the United States. The second, in Paris in 1900, had suffered from inadequate preparation and control. The first of the revival, appropriately held in Athens in 1896, where the famous Marathon Race was standardised, was made possible by the munificence of a private citizen (M. Averoff); but the marble stadium built at his expense, though splendidly adapted to local festivals, did not permit of a running-track suitable for the athletic championships of the world.

After the success of the London meeting in 1908, that of Stockholm in 1912 carried on the movement with all the enthusiasm to be expected from the compatriots of Sir Viktor Balck; and their wonderful stadium combined with thoroughly skilful organisation in all directions to make the future of these Games still more firmly assured. The meeting of 1916, originally fixed for Berlin, was impossible owing to the World War; and it was the opinion of many that neither Belgium nor the rest of the world were ready for the Games of 1920 in Antwerp. The Belgians were unable to produce the usual official report, and therefore certain details about the Games of 1920 cannot here be given; but both in the total of entries and in the standard of achievement these Games maintained an unexpectedly high level. The Games of 1924 were again celebrated in Paris.

Organisation.—Of the International Olympic Committee Baron Pierre de Coubertin was for many years president, being succeeded by Count Baillet-Latour. It is the central body by which the general policy of the Olympic movement is (or should be) controlled. In 1910 the representatives of the United Kingdom were Lord Desborough, the Rev. R. S. de Courcy Laffan and Sir Theodore A. Cook. In 1924 they were Lord Cadogan, the Rev. R. S. de Courcy Laffan and Brigadier-General R. Kentish, C.M.G., D.S.O. The American members in 1924 were Professor Sloane, Mr. W. M. Garland, General Charles Sherrill and Dr. David Kinley. Forty-four nations are represented by one or more delegates each. It is hoped that by degrees this influential committee will crystallise such ideals as a world-wide amateur definition which will cover every sport; an Olympic programme restricted to those first-rate forms of sport in which at least half the competing nations have personal experience; a prize schedule of permanent medals and certificates alone, with an official list of properly constituted challenge cups; a universally accepted code of laws to govern every competition in the Games; and a body which will appoint juries and officials with power to inflict penalties that cannot be evaded.

Besides this central committee, on which all nations are represented, each nation has its own Olympic association and its own Olympic council. The British Olympic Council, which may be taken as typical of the rest, contains one or more representatives of every association governing every sport in Great Britain, and a few other co-opted members chosen for their special knowledge or experience in organisation. Through this committee the association controlling each sport selects the best representatives in that sport. By this committee the funds necessary for British participation in Olympic meetings are collected.

Finance.—The Olympic Games in Great Britain are not assisted by any grant of public money, as is the case with nearly every other competing nation. It was necessary in 1908, for instance, to build a stadium in London that would hold 70,000 spectators, and would contain a first-class cinder track with three laps to the mile, a cement cycle track outside it, a swimming bath inside it 100 metres long by 50 ft. broad and 12 ft. 6 in. deep; and a central oval of turf 700 ft. by 300, suitably laid out for all the different contests arranged in it. In this stadium 27 athletic events were decided; and six other forms of sport, archery, fencing, cycling, gymnastics, swimming and wrestling, also took place. The cost of this stadium was over £60,000 in 1908. The marble erection in Athens may have cost more. The permanent stone stadium in Stockholm cannot have cost much less. As an indication of the rise in expenses since the War, it may be added that the huge stadium built at Wembley in 1924 cost over £500,000. The Games were planned to be held in Holland in 1928 and in the United States in 1932, and these two countries had thus to incur this particular expense. But there is gradually rising throughout Europe a series of permanent buildings, fitted for Olympic Games, which will by degrees greatly reduce this item of expenditure in the organising country.

Those countries, however, which are not obliged to build a stadium have always before them the expense of sending teams, totalling from about 50 to as many as 500, to the country in which the Games are being held. The problem of these expenses has not been satisfactorily solved, but the shortening of the programme has been suggested as one solution. There were 109 first prizes in 1908, 102 in 1912, 100 in 1920 and 111 in 1924. In addition to the sports mentioned as taking place in the London Stadium in 1908, there are such events as lawn tennis, shooting of every kind, rowing, yachting, football and boxing. This by no means exhausts any possible list. In 1924 a whole series of winter sports was added to the Paris programme of 111 events. Clearly the Games should not be confined to track and field events in athletics alone. It is equally clear that some standard programme must be laid down for the future by the international committee.

Records.—A comparison of the events to which most importance is popularly attached in the various Olympic Games from 1896 to 1924 will show the following Olympic records, (Table I.) to which the world's records have been added in a separate list (Table II.) for purposes of comparison:—

TABLE II. WORLD RECORDS.

Race	Date	Winner	Time or Distance
(1) 100 metres	1921	C. W. Paddock	10⅖ sec.
(2) 200 metres	1921	C. W. Paddock	21⅕ sec.
(3) 400 metres	1924	E. Liddell	47⅗ sec.
(4) 400 metres relay	Metric world's record not available.		
(5) 800 metres	1917	J. E. Meredith	1 min. 51 9/10 sec.
(6) 1,500 metres	1924	P. Nurmi	3 min. 52⅗ sec.
(7) 1,600 metres	Metric world's record not available.		
(8) 3,000 metres steeplechase	1924	W. Ritola	9 min. 33⅗ sec.
(9) 3,000 metres team	1924	Finland (P. Nurmi 1st)	8 min. 32 sec.
(10) 5,000 metres	1924	P. Nurmi	14 min. 28⅕ sec.
(11) 10,000 metres	1924	P. Nurmi	30 min. 6 sec.
(12) 10,000 metres walk.	Metric world's record not available.		[sec.]
(13) Marathon	1924	C. de Mar	2 hr. 29 min. 40⅕
(14) Hurdles (110 metres)	1920	E. J. Thomson [1]	14⅘ sec.
(15) Hurdles (400 metres)	1924	F. M. Taylor	52⅗ sec.
(16) High jump	1925	H. M. Osborne	6 ft. 8¼ in.
(17) Long jump	1925	de Hart Hubbard	25 ft. 10⅞ in.
(18) Pole jump	1925	C. Hoff	13 ft. 10½ in.
(19) Weight	1909	R. Rose	51 ft.
(20) Hammer (16 lbs.)	1913	P. Ryan	189 ft. 6½ in.
(21) Javelin	1924	H. Lindstrom	218 ft. 7¼ in.
(22) Discus	1925	G. Hartranft	157 ft. 1⅝ in.
(23) Hop, step, and jump	1924	A. W. Winter	50 ft. 11¼ in.

[1] In 1920 E. Thomson set up a World's record of 14⅖ sec. for 120 yards over 10 flights of 3 ft. 6 in. hurdles.

The division of victories, as opposed to records, in the 23 events given above since 1896, has been as follows:—(1) U. S. A. 1896, 1900, 1904, 1912, 1920. Great Britain 1924. South Africa 1908. (2) U. S. A. 1900, 1904, 1912, 1920, 1924. Canada 1908. (3) U. S. A. 1896, 1900, 1904, 1912; Great Britain 1908, 1924. South Africa 1920. (4) Great Britain 1896, 1900, 1920, 1924. U. S. A. 1904, 1908, 1912. (5) Great Britain 1896, 1900, 1912, 1920. U. S. A. 1904, 1908; Finland 1924. (6) Finland 1912, 1924. France 1920. (7) Finland 1920 1924. U. S. A. 1904, 1908. Greece 1896. South Africa 1912. (8) U. S. A. 1896, 1900, 1904, 1908, 1912, 1924. Canada 1920. (9) U. S. A. 1900, 1904, 1908, 1920, 1924. (10) U. S. A. every year. (11) U. S. A. every year except 1920, Sweden. (12) U. S. A. every year. (13) U. S. A. every year except 1920, Finland. (14) U. S. A. every year. (15) U. S. A. every year except 1896 and 1900, no contest. (16) U. S. A. every year. (17) U. S. A. every year except 1920, Sweden. (18) U. S. A. every year. (19) U. S. A. every year except 1920, Finland. (20) U. S. A. every year except 1896, no contest. (21) Sweden 1908, 1912, Finland 1920, 1924. No contest in 1896, 1900, 1904. (22) U. S. A. 1896, 1904, 1908, 1924, Finland 1912, 1920. Hungary 1900. (23) U. S. A. 1896, 1900, 1904. Great Britain 1908, Sweden 1912. Finland 1920. Australia 1924.

TABLE I. OLYMPIC RECORDS.

Race	Date	Place	Winner	Country	Time or Distance
(1) 100 metres	1912	Stockholm	D. F. Lippincott	U.S.A.	10⅗ sec.
	1924	Paris	H. M. Abrahams	Great Britain	10⅗ sec.
(2) 200 metres	1904	St. Louis	A. Hahn	U.S.A.	21⅗ sec.
	1924	Paris	J. V. Scholz	U.S.A.	21⅗ sec.
(3) 400 metres	1924	Paris	E. Liddell	Great Britain	47⅗ sec.
(4) 400 metres relay	1924	Paris	U.S.A.	U.S.A.	41 sec.
(5) 800 metres	1912	Stockholm	J. E. Meredith	U.S.A.	1 min. 51 9/10 sec.
(6) 1,500 metres	1924	Paris	P. Nurmi	Finland	3 min. 53⅖ sec.
(7) 1,600 metres relay	1924	Paris	U.S.A.	U.S.A.	3 min. 16 sec.
(8) 3,000 metres steeplechase	1924	Paris	W. Ritola	Finland	9 min. 33⅗ sec.
(9) 3,000 metres team	1924	Paris	Finland	Finland	8 min. 32 sec.
(10) 5,000 metres	1924	Paris	P. Nurmi	Finland	14 min. 31⅕ sec.
(11) 10,000 metres	1924	Paris	W. Ritola	Finland	30 min. 23⅕ sec.
(12) 10,000 metres walk	1912	Stockholm	G. H. Goulding	Canada	46 min. 28⅖ sec.
(13) Marathon	1920	Antwerp	H. Kolehmainen	Finland	2 hr. 32 min. 35⅘ sec.
(14) Hurdles (110)	1920	Antwerp	E. J. Thomson	Canada	14⅘ sec.
(15) Hurdles (400)	1924	Paris	F. M. Taylor	U.S.A.	52⅗ sec.
(16) High jump	1924	Paris	H. M. Osborne	U.S.A.	6 ft. 5·95 in.
(17) Long jump	1912	Stockholm	Gutterson	U.S.A.	24 ft. 11¼ in.
(18) Pole jump	1920	Antwerp	F. K. Foss	U.S.A.	13 ft. 5 in.
(19) Weight	1912	Stockholm	Macdonald	U.S.A.	50 ft. 4 in.
(20) Hammer (16 lb.)	1912	Stockholm	M. J. McGrath	U.S.A.	177 ft. 7 in.
(21) Javelin	1920	Antwerp	J. Myrra	Finland	215 ft. 9¾ in.
(22) Discus	1924	Paris	C. Houser	U.S.A.	151 ft. 5 1/16 in.
(23) Hop, step and jump	1924	Paris	A. W. Winter	Australia	50 ft. 11 3/16 in.

It should be noted that 100 metres = 109·3 yards; 200 metres = 218·7 yards; 400 metres = 2·6 yards less than a quarter of a mile; 1,500 metres = 119·6 yards less than a mile. 110 metres (hurdles) is nearly 11 inches over 120 yards. The Marathon Race is 42·263 kilometres or 26 miles 385 yards.

These 23 events all occur in the department of athletics, which is only one division of the Games. In 1908, the United Kingdom, with 839 entries, scored 57 first prizes and five more went to the Dominions; the United States, with 160 entries, scored 22 first prizes. The remaining 22 first prizes went to the 1,529 entries from all other nations. In 1912, the United Kingdom, with 526 entries, scored ten first prizes and eight more went to the Dominions; the United States, with 572 entries, scored 24 first prizes; Sweden, the organising country, with 881 entries scored 24 first prizes; the remaining 36 first prizes went to the 3,651 entries from all other nations. Sufficient records were not kept of the next two Games to continue the comparison in full. But in 1920 the United States won 22 first prizes; Great Britain took eight; the Dominions four; Belgium, the organising country, one; and the remaining 65 first prizes were divided among all the other nations. In 1924, with 424 entries, the United States won 27 first prizes; Great Britain, with 443 entries, won six; and the Dominions, four; France, the organising country, won four. The remaining 69 first prizes (without counting winter sports, in which Norway won easily with Finland second) were divided among all the other nations. These figures are not taken from victories in the athletic sections only; but from the full programme.

Some Reflections.—On these statistics a few words of explanation are necessary. There is not supposed to be a winning nation of any particular Olympic year. But human nature insists on classification of results, and this may be roughly obtained by scoring ten for a first prize, five for a second and four for a third. Even then, it is clear that the Marathon Race is really worth more than the 100 metres; or a sculling-race than a miniature rifle. The Americans have done wonderfully well by specialising in athletics, and their all-round ability is shown by the fact that at Paris in 1924 H. M. Osborne won the Decathlon comprising ten events, and also set up a new world's record for this particular competition.

But the country that has made the most extraordinary progress of all is Finland. In estimating the percentage of victories to entries it must be remembered: (1) that not all athletes entered were actually competing, (2) that gymnastic and other teams absorb a large number, (3) that women have entered, since 1912, for certain events like swimming and lawn tennis, (4) that some (though few) athletes compete in two or more events, (5) that the organising country in which the Games are held can invariably count on producing, if she desires, the full number of competitors legally permitted to enter for every event.

The art competitions have not been considered in these statistics. But it may be noted that in 1920 the silver medal in literature was awarded to Sir Theodore Cook (Great Britain) for his poem on "Pindar and the Olympic Games," and in 1924 the same prize was won by Miss D. Margaret Stuart (Great Britain) for her "Sword Songs." For the guidance of future organisers, it may be added that out of £27,183 available for the expenses of the British team of 1924, a surplus of £1,458 was left in hand on Dec. 31 of that year for the purposes of the British Olympic Association.

The Games in 1924.—The winter sports began at Chamonix on Jan. 25 1924, and 39 entries represented Great Britain. There were 14 events in all, in skating (speed and figure), ice hockey, curling, bobsleighing and ski-racing. The programme in Paris was opened at Colombes on July 5 1924 and consisted of athletics (27 events), swimming (ten events for men and seven for women), boxing (eight events), cycling (six events), wrestling (two styles, 13 events), shooting (eight events), lawn tennis (five events, including ladies), gymnastics (two events), fencing (four events), rowing (seven events), weight lifting (five events), the modern Pentathlo and polo. Association football was held in Paris from May 15 to June 9 1924, Uruguay beating Switzerland by three goals to nil in the final. Rugby football was held in Paris from May 3 to 18, the United States defeating France in the final by 17 points to three. Neither baseball nor cricket has been included in the Games. In 1924, in polo, Argentina won four games, the United States three, Great Britain two, Spain one and France none. Many other sports were omitted. The programme was very much too long for practical purposes, and a standardisation of the Games, in this and other directions, became a pressing necessity for the Olympiad of 1928 in Holland. The Games of 1932 will be held in the United States (*see* ATHLETICS).

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(T. Co.)

OMAHA, Neb., U.S.A. (*see* 20.98), 34th city in size in the United States, and the principal retail trading centre between Chicago and Denver, ranked first (1924) in the production of dairy butter and of pig lead, first as a primary grain market and disputed with Kansas City for second place in packing-house products and as a live stock market. South Omaha, the site of the Union stock yards (*see* 25.514), which had a population of 26,259 in 1910, was annexed in 1915; Benson, Florence and Clontarf in 1917; thus increasing the area to 37 square miles. The population was 191,601 in 1920, of whom 35,381 were negroes and 35,645 foreign-born; and the census bureau estimate in 1925 was 211,768. The products manufactured within the city limits were valued at $60,854,000 in 1909; $452,237,000 in 1919 (when South Omaha was included); $315,971,430 in 1923; and, according to a local compilation, $388,018,541 in 1924. The 550 wholesale and retail houses distributed merchandise valued at nearly $500,000,000.

The packing industry, employing 14,000 persons, dealt with 70% of the 8,697,690 head of live stock received in the city in 1924, producing an output valued at $198,392,582. Industries next in importance were smelting, principally of lead and silver (value of products, $42,708,485); butter and other dairy products ($24,331,395); automobiles, trucks and accessories ($19,007,475); flour and grist-mill products ($11,180,808). Omaha is the headquarters of the Union Pacific system, central station of the transcontinental air-mail route, and national headquarters of the air-mail branch of the postal service. It is an important centre for insurance. The percentage of homes owned is high and increasing: (1910) 39·8%; (1920) 48·4%; (1925) 55%. The public schools included 58 "grade" and five high schools in 1925, representing an investment of $20,000,000 and an annual expenditure of $4,000,000. The combined budget of the philanthropic institutions financed by joint appeal was about $400,000. With the completion of projects under way in 1926, the parks will comprise over 2,000 ac. and the city will have 50 m. of boulevards. A new "home rule" charter was granted by the Nebraska legislature in 1923.

OMAN, SIR CHARLES WILLIAM CHADWICK (1860–), British historian, was born at Mozufferpore, India, the son of a tea planter, Jan. 12 1860. Educated at Winchester and New College, Oxford, he distinguished himself at both seats of learning, and in 1883 was made a fellow of All Souls College. In 1905 he became Chichele professor of modern history at Oxford and he was chosen a fellow of the British Academy in the same year. He was president of the Royal Historical Society 1917–21. In 1919 he was elected M.P. for the University of Oxford and in 1920 he was knighted. As a historian Oman won his spurs by his studies on the art of war, the result being his *History of the Art of War in the Middle Ages* (1898, new ed. 1924). His other works include a *History of Greece* (1890); *A Short History of England* (1895, new ed. 1920); and six volumes of a *History of the Peninsular War*. Sir Charles is an authority on coins, on which subject he writes in this Encyclopædia.

OMAN (*see* 20.99) roughly comprises the extensive and mountainous promontory which forms the eastern extremity of Arabia, extending from Ras Musandam on the Gulf of Oman to the eastern limits of Hadhramaut at Ras Sajar (*lat.* 16° 8″ N.) on the Indian Ocean. Its capital, Muscat (*see* 19.43), was before the

War an important centre of the traffic in arms, which was in 1912 subjected to control by the establishment of a warehouse at the instance of the British Government. The Sultan of Muscat, Saiyid Taimur, who succeeded his father, Saiyid Faisal ibn Turki, in 1913, enjoyed a nominal authority over the whole of Oman, but his rule is effective only on the coast.

The tribes of the interior are practically independent under the loose control of an Imam of the 'Ibadi sect, whose centre is at Rustaq. A rising of the 'Ibadis in 1913–4 against the Sultan resulted in the occupation of Bait al Falj near Muscat by a British Indian force, which remained there throughout the War, defeating the rebels in 1915. Since the War the Sultan's administration has given rise to much dissatisfaction and in 1920–1 the British Govt. intervened to patch up an understanding between him and the 'Ibadi Imam. Shortly afterwards the Sultan had to agree to the creation of a sort of council of regency for the administration of the State and since then he has taken no active part in the government of his dominions, residing partly in India and partly on his personal estates. The administration is controlled by the Govt. of India. (*See* ARABIA.)

O'NEILL, EUGENE GLADSTONE (1888–), American dramatist, was born in New York City Oct. 16 1888. His early education was received at Roman Catholic schools and at the Betts Academy, whence he proceeded to Princeton University, remaining for one year. At different times he worked as sailor before the mast, actor and reporter. In 1914–5 he attended Harvard University. He rapidly became the most conspicuous of the younger American dramatists, and twice was awarded the Pulitzer Prize: in 1920 for his play, *Beyond the Horizon*, and in 1922 for *Anna Christie*. He finds his dramatic material among simple people, often sailors, and he deals in terms of tragedy with their conflicting passions and dreams and inner questionings. Among his works are: *Thirst and Other Plays* (1914); *The Moon of the Caribbees and Other Plays of the Sea* (1919); *Emperor Jones* (1921); *Straw* (1921); *Gold* (1921); *The Hairy Ape* (1922); *Welded* (1924); *All God's Chillun's Got Wings* (1924); *Desire Under the Elms* (1924). A complete edition of his plays in two vol. was published in 1924. His *Fountain* and *The Great God Brown* were produced in 1926.

ONNES, HEIKE KAMERLINGH (1853–1926), Dutch physicist, was born in Groningen Sept. 21 1853. He studied mathematics and physics in his native town, where in 1879 he took his doctor's degree on presenting a dissertation entitled *New Proofs of the Earth's Rotation*. He became professor of experimental physics at Leyden in 1882, and devoted himself especially to the study of properties of matter at low temperatures. As director of the Cryogenic Laboratory, founded by him at Leyden, he succeeded, in 1908, in liquefying helium. He later carried out important investigations on the influence of low temperatures on nickel and manganese iron alloys. He also demonstrated that the resistance of electric conductors disappeared suddenly at a certain temperature and that electric current could exist without electromotive force. In 1913 the Nobel Prize for physics was conferred on him. He became a foreign member of the Royal Society in 1916 and a corresponding member of the Prussian Academy of Sciences at Berlin in 1923, the year in which he resigned his chair at Leyden. His published work includes *Algemeine Theorie der Vloeistoffen* (*General Theory of the Fluids*, 1881). He died at Leyden Feb. 21 1926. See J. P. Kuenen, *De Toekenning van den Nobelprys aan H. Kamerlingh Onnes* (*Chemisch Weekblad, 1913*).

ONTARIO (*see* 20.113), a province of the Dominion of Canada. Through the addition in 1912 of Patricia, formerly part of the northwest territories, the area of Ontario was increased to 407,262 sq. m., of which 41,382 sq. m. are water. In 1921 the population was 2,933,662, an increase of 16·08% in the preceding decade. Sex distribution showed an excess of 30,118 males over females: 77% of the population were of British, 8·4% of French and 4% of German origin. The number of Indians in the province in 1921 was 26,654. The chief towns and their populations in 1921 are Toronto, the capital of the province, 521,893; Hamilton, an important manufacturing centre, 114,151; Ottawa, the federal capital, 107,843; and London, 60,959. The Government consists of a lieutenant-governor and a legislative assembly with a single chamber, the term for members being four years. The province is represented in the Federal Parliament by 24 senators, and by 82 members of the House of Commons. Women may vote, and are eligible for election to the Legislature.

Education.—The increased range of compulsory attendance and the more efficient enforcement of the law provided for in the provincial Education Act of 1919 led to increased numbers of pupils, especially in the secondary schools. The school age having been raised from 14 to 16, increased attention was devoted to technical education, which has shown considerable progress. In 1924 there were 7,022 elementary schools, with an enrolment of 610,322, an increase of nearly 10,000 over the preceding year, 189 continuation schools, and 183 high schools and collegiate institutes, with an aggregate enrolment of 66,784. The University of Toronto and its affiliated colleges had a total staff of 583 in 1924.

Agriculture.—Ontario is the chief mixed farming province in the Dominion. The value of all field crops in 1918 was $363,909,778, but by 1924 it had fallen to $260,534,000. The table below shows the yield in thousands of bushels and value in thousands of dollars of the principal field crops in 1922–5.

Dairy farming has steadily increased in importance, the gross revenue of dairy products reaching a value of $71,000,000 in 1918 and $95,005,000 in 1924. An intensive programme of agricultural education has been carried on by the provincial Government. Live stock in 1924 included 2,917,000 cattle, 1,807,903 swine and 870,279 sheep; horses numbered 673,371 in 1923.

Forests and Lumber.—The total area of forests in Ontario in 1924 was estimated at 240,000 sq. m., the chief timber being spruce, pine and poplar. The production of lumber, laths, and

Ontario. Yield of Principal Field Crops (000's of bushels)

Crop	1922		1923		1924		1925	
	Yield	Value	Yield	Value	Yield	Value	Yield	Value
Wheat	19,893	20,131	18,537	17,789	23,346	29,711	25,205	30,649
Oats	116,034	46,404	103,485	45,850	114,249	58,794	118,100	51,288
Barley	13,972	7,932	13,523	8,063	14,570	11,287	14,917	10,070
Rye	2,500	1,900	2,011	1,592	2,300	2,331	1,784	1,445
Peas	2,077	2,907	2,031	2,912	2,456	3,771	2,607	3,592
Buckwheat	4,266	2,993	5,012	3,727	6,449	5,401	5,579	4,098
Mixed grains	21,270	12,255	23,881	13,971	26,403	18,149	28,246	17,696
Corn for husking	12,306	9,599	12,861	11,318	11,141	12,924	9,736	8,763
Potatoes	12,210[1]	10,989	11,479[1]	14,560	14,980[1]	13,278	9,429[1]	15,652
Turnips, mangolds, etc.	23,381[1]	8,885	21,126[1]	10,047	24,283[1]	7,772	21,611[1]	8,644
Hay and clover	5,568[2]	69,049	5,799[2]	62,671	5,615[2]	60,803	5,233[2]	62,013
Alfalfa	629[2]	7,266	788[2]	8,980	1,068[2]	12,119	1,398[2]	17,706
Fodder corn	4,413[2]	19,197	3,651[2]	16,284	3,977[2]	19,527	3,614[2]	13,228
Sugar beet	190[2]	1,500	216[2]	1,401	334[2]	2,268	417[2]	2,549

[1] Cwts. [2] Tons.

shingles in 1922 was valued at $25,687,380. Pulp production in 1923 was 877,921 tons, valued at $33,481,035; the manufacture of paper is increasing in importance.

Fur and Fisheries.—The fur trade of Ontario is the most important in the Dominion. In 1922–3, 838,249 pelts were purchased by traders at a value of $3,616,692. The fisheries of Ontario, due to its wealth of lake shoreline and inland waters, were valued at $3,159,427, which was just $1,000,000 greater in value than the fisheries of Quebec.

Mining.—Northern Ontario has become increasingly notable as one of the world's great mining areas. The production of petroleum fell from 226,165 bar. in 1913 to 154,317 bar. in 1924. Construction materials, including Portland cement, and stone, increased in value from $5,866,775 in 1913 to $10,833,670 in 1924.

Ontario. Quantity and Value of the Chief Minerals Produced in 1913 and 1924

Product	1913		1924	
	Quantity	Value $	Quantity	Value $
Gold	220,837 oz.	4,558,518	1,241,728 oz.	25,669,303
Silver	29,724,931	16,579,094	10,699,684	7,233,078
Copper and Copper Sulphate	..	..	17,422,888 lb.	2,275,597
Cobalt (metallic, oxides and salts)	1,188,526 lb.	420,386	686,295	1,421,826
Nickel (metallic and oxide)	232,255	13,326	37,574,414	7,379,260
Arsenic, white	2,450,758	64,146	3,596,165	309,108
Natural Gas	15,558,400 cu. ft.	2,362,021	7,370,914 cu. ft.	4,076,014

Manufactures.—Ontario is the leading manufacturing province of Canada, 9,174 establishments in 1922 employing 237,319 persons with an annual production of $1,274,424,000. The leading manufactures are pulp and paper, textiles, iron and steel, boots and shoes, and sugar refining. The rapid expansion of the industrial activity of Ontario has been greatly stimulated by the development of hydroelectric power, chiefly at Niagara Falls. The Queenston-Chippawa development, begun in 1917, was completed in 1925 at a cost of over $60,000,000; there are eight units, totalling 440,000 horse-power. On Feb. 1 1924 the available 24-hour power at 80% efficiency at ordinary minimum flow was 18,225,316 H.P.: the developed water power was 1,445,480 horse-power.

Communications.—The province is well provided with railways for internal communication and for connecting all the leading industrial centres with neighbouring provinces and with the United States. There were 10,956 m. of steam railways in operation on Dec. 31 1923; several electric railways were also in operation. The greater part of the 117·2 m. of canals of Canada are situated in Ontario, the most important system being that which connects Port Arthur with Montreal through the Great Lakes. While the number of Canadian vessels using this system has shown a steady increase since 1917, the number of American vessels has declined proportionately, as also has the freight originating in the United States. Ontario possesses the best road system in the Dominion. Of its 64,258 m. of highway in 1924, 22,127 were of gravel, 11,446 were macadamised, and 185 were of concrete (*see* CANADA). (S. LE.)

OPERA (*see* 20.121).—In spite of the World War, the first quarter of the 20th century was fruitful in the production of new operas. But there is a distinct cleavage between the works of the pre-War period and those written after the War. Before the War restlessness and impatience with the old methods were the exception. They became the rule after 1919. Opera which conforms to the commonly accepted rules and standards is found only in the case of composers who belong more properly to the preceding era, like Boito, Puccini and Stanford. The general tendency is towards innovation and experiment—innovations of a radical nature affecting not only the technique of musical composition but also the whole conception of opera, and experiments in which the relation between the component parts, their worth and usefulness are questioned.

There are examples of opera in which music appears to have resigned all claims in favour of poetry, and examples in which both poetry and music give precedence to some far-fetched idea of scenic presentation. The change cannot be ascribed to the War. The most famous modern composer before 1914, Richard Strauss, never found one form of composition more congenial than another; he turned from the sonata to the symphonic poem, from symphonic poem to Biblical and classical opera, from opera to ballet, and from ballet to comedy. But this restlessness, like the innovations of Strauss, pales by comparison with the impatience and the boldness of the post-War generation.

The war, naturally, exercised a disastrous effect on opera. In Great Britain operatic enterprise was, during these years, entirely in the hands of Sir Thomas Beecham, who did much to raise the standard of opera in English. Beecham and the British National Opera Company (formed on his retirement) are mainly responsible for the production of the new British operas—Dame Ethel Smyth's *The Boatswain's Mate*, Gustav Holst's *The Perfect Fool* and *At the Boar's Head*, and Vaughan Williams's *Hugh the Drover*. These ventures attracted considerable attention, and various schemes were suggested for establishing British opera on a less precarious footing. The full international season was resumed at Covent Garden in 1924, when a German company was readmitted for the first time since the War.

Opera in Germany

Strauss.—Richard Strauss's first essays in opera came when he was at the height of his fame, and audiences were ready to accept and to welcome anything he chose to give them. The remarkable success of *Salome* and of *Elektra*, however, does not seem likely to stand the test of more critical days. Certainly neither of these, nor *Ariadne auf Naxos* (revised version in 1916), has increased his reputation. *Der Rosenkavalier* (1911) based on a libretto by Hugo von Hofmannsthal, is more likely to stand the test of time. That certain scenes are coarse rather than immoral cannot be doubted, but the skill shown in the drawing of characters is beyond question. The librettist has provided a comedy of manners which gives Strauss every opportunity to display his special genius for portraying comic and pathetic situations.

Although he has evolved no new theories, Strauss has given us in *Der Rosenkavalier* a whole gallery of characters every one of which is drawn with extraordinary felicity, varying from the sketch of a negro page boy to that of the provincial baron—the gross and material Ochs von Lerchenau; from the full length portrait of the heroine to the caricature of the adventurers who seek her patronage. Light comedy has induced him to adopt a frankly melodic style, often in waltz rhythm, which stands at the opposite pole to the declamatory style of *Elektra*. The dance melodies are as fluent as those of Johann Strauss, and much more subtle. It is Strauss's greatest asset that he can turn from laughter to tears, revealing at once the pathos that underlies laughter and the oddities and whimsicalities of a quasi-dramatic situation. The librettist may not convince us that the sorrows of a heroine who has resigned her lover to a younger rival and who trembles at the thought of a lonely old age are very deep or undeserved. The musician, however, is perfectly convincing, and just as in his symphonic poems he asked us to sigh for as well as to laugh at Don Quixote, so in *Der Rosenkavalier*, he depicts humanity in its pathetic and its ludicrous aspects. The scene which describes

the arrival of the Rosenkavalier bearing the token of betrothal to the bride, like the ensemble of the third act, is an admirable example of his power to describe different emotions at the same time.

Die Frau ohne Schatten (1919) tempted both composer and librettist (Hofmannsthal) into obscure symbolism, which, perhaps, cannot be expressed effectively in terms of music. While making the fullest use of his great skill in instrumentation, Strauss sought here as in *Ariadne* and in the ballet *Joseph's Legende* to make use of broad, diatonic melodies. These, owing to their gorgeous orchestral colour, may seem impressive at first, but soon betray inherent weakness and artificiality.

Some success attended the performance in Germany of two operas by Hans Pfitzner, *Das Christelflein* and *Palestrina*—both produced in 1917. These, like the operas of Erich Wolfgang Korngold—*Der Ring des Polykrates*, comedy in one act; *Violanta*, opera in one act (1917); and *Die Tote Stadt* (1920), and of Franz Schreker, *Der Ferne Klang* (1912), *Das Spielwerk und die Prinzessin* (1913), *Die Gezeichneten* (1918) and *Der Schatzgraber* (1920) leave the main problems of opera untouched. More originality was shown by Walter Braunfels in his adaptation of the " Birds " of Aristophanes (1920).

Busoni.—The contributions to opera of Ferruccio Busoni are intended for the German stage, and must be taken in conjunction with the art of Germany rather than with that of Busoni's countrymen the Italians. This remarkable artist was 46 years of age when he first turned his attention to the theatre. Two short operas—*Turandot*, founded on Gozzi's fairy play, and *Arlecchino*, based on a libretto written by himself—added considerably to his reputation as composer. But his most remarkable contribution is *Doctor Faust*, the libretto of which, dealing with the legend from an entirely new point of view, was first published in 1921. The music unfortunately was not finished at the time of his death in 1924, but the score was skilfully completed by Philipp Jarnach, and performed in Dresden in May 1925. It made a deep impression, both on account of the ideas embodied in the play and of the manner in which they were presented.

Busoni's *Faust* differs from Goethe's, as it differs from Marlowe's, in that the central idea is not the strife between good and evil, but the continuity of the human effort towards a goal which, hidden from our knowledge, is embodied in a Divine Will incompatible with the traditional conception of God and the devil. This idea is presented in a set of scenes derived from an old puppet play, and connected by unity of style and a single purpose. The music is not a symphony on which the action has been imposed, but it springs from the same source as the words and the action. Considered apart from the play, it reveals an instinct for classic dignity combined with the freedom of a modern. Although he never falls into extravagance, Busoni's power of suggesting atmosphere, mood and emotion is as considerable as the variety and resource of his orchestration. His profound knowledge of the classics gives breadth and depth to a style which is never heavy or unduly complex, but alert, elastic and free from the influence of prevalent schools. Whether in time *Doctor Faust* will rank with the acknowledged masterpieces, or whether its finer points must escape the average theatre audience, may be doubted, but Busoni is certainly the musicians' musician.

Opera in Italy

The composer who in some ways most nearly approaches Busoni, is Arrigo Boito, whose *Nerone*, first begun when the composer was a young man, was left unfinished at his death in 1918. It was completed under the supervision of Arturo Toscanini, and performed at La Scala, Milan, in May 1924. There is one important point of divergence between Busoni and Boito. Busoni was first and foremost a musician who wrote his own libretto because of the obvious advantages to be gained by unity of control. Boito was equally pledged to both poetry and music. The profound learning found in Busoni's music and in Boito's poetry resulted in an entirely different conception of music drama. In *Nerone* Boito attempted to place on the same level all the arts which constitute opera. He meant it to be spectacular enough to please the audience by a striking stage picture; he devoted great care, skill and an extraordinary wealth of information to the writing of the libretto, so that poetry should be duly honoured; he restrained the lyrical impulse in music with the double object of allowing complete freedom to scenic and poetic art and of giving prominence to the dramatic effects of a musical accompaniment which was in the main descriptive.

It may be questioned whether the idea of perfect equality between sister arts originated in Boito's mind, or whether he arrived at it after balancing the claims of other systems. He was a close observer of artistic movements, and it is possible that he became early acquainted with Moussorgsky's *Boris Godnov*, which is the best example of this theory. But while Moussorgsky adopted it because it seemed the only possible form for a musician of his temperament, Boito's lyrical reticence may have been the outcome of deliberate choice. It is not surprising, however, that opera based on the equality of the arts should have some of the faults of the ideal state based on the equality of men. However admirable, logical and just the theory, the practice is likely to result in a weakening of power and interest. So far, the greatest operas have been those in which music predominates.

The musical value of *Nerone* is far from negligible. The scene in which the early Christians learn the doctrine from the lips of their leader Fanuel has a delicate beauty that is very rare in Italian music, and there is a poignant pathos in the death scene of Rubria. On the other hand, in almost the whole of the first and second acts there is little genuine musical interest, apart from the adaptability of the music for the stage. The libretto has many lines of good poetry, and the historical learning amassed in its few pages constitutes probably a record of compression. Unfortunately, much of this is inevitably lost when put to the test of the theatre. The demands made on stage appliances make it impossible to contemplate a performance in any theatre not equipped with modern resources. If the system has proved far from flawless, the opera leaves us in no doubt as to the genius of a composer whose chief failing was the inability to choose between the claims of two arts he loved with equally deep devotion—music and poetry.

Puccini.—A less thoughtful and more popular composer, Puccini, after the early successes, touched the lowest point of his career with a comic opera *La Rondine* (1917), and rose to the highest with the comedy *Gianni Schicchi* (1919), which revealed a freshness and humour hitherto unsuspected in his music. Neither the failure nor the success owes anything, however, to a development of artistic ideals. *Gianni Schicchi* marks if anything a return to the old system, and contains a typical *aria* or two of the old pattern which won the warmest approval of his admirers. His technique shows a great advance on his previous work.

Pizzetti.—From the point of view of the development of music drama, the work of Ildebrando Pizzetti is more interesting. He began by accepting the criterion of his Italian contemporaries, and then, dissatisfied with what he conceived to be the dramatic ineptitude of lyricism, evolved a style which seeks to give to the melody of the singer beauty, but consistent with greater freedom than is possible in music which aims entirely at lyrical expression. In this he comes near to *Pelléas et Mélisande*, but with the important reservation that while Debussy envelops the drama in an atmosphere of mystery and shadows, Pizzetti expresses himself with absolute directness, and asks of music only that it should have the pliability, if not the swiftness, of words. These theories are exemplified in *Fedra* (1915) and perfected in *Debora e Jaele* (1922).

Malipiero.—More daring but also more questionable are the theories advanced by G. Francesco Malipiero, and exploited in works representing a complete reaction from all accepted ideas of opera. In *Pantea* the singers are not seen, and the action is expressed in the movement and gesture of a dancer whose mimicry is stressed by the music. *Sette Canzoni* consist of episodes unconnected by anything like a plot, and relying for their appeal not in any development of events but in the contrast between

the characters or between the moods of each picture. Greater prominence is given to the musical elements in *Le Baruffe Chiozzotte*, a free adaptation in one act of Goldoni's comedy for which Malipiero has evolved a "spoken" recitative, while the duty of the orchestra is to provide mood and atmosphere. *Orfeo* is satire, uncompromising in its music and in the action. The value of such works is negative, but it shows clearly enough the trend of musical ideas in Italy.

Wolf-Ferrari.—Quite traditional, on the other hand, are the operas of Ermanno Wolf-Ferrari, whose best work is comedy. A lurid melodrama, *I Gioielli della Madonna*, has made Wolf-Ferrari known beyond Italy and Germany; it is not equal to *Il Segreto di Susanna*, or to the charming arrangements of Goldini's comedies, *Le Donne Curiose* and *I Rusteghi*. Wolf-Ferrari combines some of the virtues of the Germans, such as solid, well-balanced workmanship, with an Italian bias for lyrical expression. This combination is not without its drawbacks, and is inclined to blunt the individuality of his music.

The English Revival

The general revival of interest in music in Great Britain has had a remarkable effect on opera, and operas by native composers written and performed in the first quarter of the 20th century exceed in number and in interest those of any other period in the history of English music. Although the greatest musician of the time, Sir Edward Elgar, has never written for the theatre, a group of gifted musicians has sprung up not only willing to devote themselves to a form which still offers scant chances of performance and reward, but also, in some cases, determined to make it the vehicle of new and individual expression.

Stanford and Ethel Smyth.—Sir Charles Stanford belongs on the whole to an older generation, yet his last work (which he did not live to see performed) was an opera, *The Travelling Companion* (1914: produced at Liverpool, 1925), in whose fantastic adventures some trace may perhaps be seen of the influence of the Russians. Dame Ethel Smyth, devoted to opera from the early days of her career, was writing for the theatre at the beginning of the century. But it was only with the comic opera *The Boatswain's Mate* (based on a story of W. W. Jacobs, performed by the Beecham Company during the War) that she made her mark. It has been pointed out that her music lacks unity of style, and the charge cannot be easily brushed aside. But, whatever its defects, the opera has the rare merits of speedy action, a whimsical story, and music which, however indebted it may be to other sources, has intense vitality and comic verve. Another work, *Fête Galante*, had a favourable reception when first performed at Covent Garden in 1923.

Boughton.—High hopes were aroused by Mr. Rutland Boughton's *The Immortal Hour*, which, performed first at the Glastonbury Festival in 1914, did not come into its own till eight years later, when it was given in London with considerable success—first at the "Old Vic." Theatre, and later at the Regent and Kingsway theatres. The unusual story, steeped in Celtic romanticism, the easy flow of the melodic themes, the genuine, glowing passion of the love scenes, the well-built choric sections, made a deep impression, and led some to expect even better things from Mr. Boughton.

These expectations, however, were not realised in the immediate future. Mr. Boughton's next essay was more ambitious, for it meant nothing less than the translation into opera of the *Alcestis* of Euripides in the English version of Professor Gilbert Murray. It is much to the composer's credit that he refused to be bound by archaeological considerations, and aimed rather at music which could bring home to a modern public the rich pathos and humanity of the Euripidean drama. In this he partly succeeded. The chorus is treated with skill and sympathy, and many scenes have great beauty. There is a delicate tenderness in the account given by the Handmaid of the grief and resignation of the dying Queen; the funeral procession moves to a strain that is at once expressive and dignified; and the music of Herakles lacks neither vigour nor originality. Yet on its performance at Covent Garden (1924) the work was found, on the whole, disappointing. An inadequate performance, and, still more, the barrenness of the orchestral setting, may be held partly responsible for this impression. But the revival of a Greek play in a modern theatre is apt to show to disadvantage the vaunted resources of the modern stage. The intimate relation possible between spectator and performer in an amphitheatre becomes impossible as soon as the modern stage sets up its barrier. This becomes all the more evident when music inevitably retards the course of the action and the speed of the words. No doubt for this reason *Alcestis* was found much more impressive accompanied by the piano in a small hall at Glastonbury than at Covent Garden, where the composer had at his service a vast stage and a large orchestra. A somewhat riper dramatic style was shown by Mr. Boughton in *The Queen of Cornwall*, a musical version of a play by Mr. Thomas Hardy.

Perhaps greater musical accomplishments are to be found in Mr. Granville Bantock's *The Seal Woman* (Birmingham, 1914), a "Celtic" opera which unfortunately suffers from a libretto which is neither convincing nor well constructed.

Holst.—The greatest interest was aroused by the performance of Mr. Gustav Holst's one-act opera *The Perfect Fool* at Covent Garden (1923), soon after the composer had made a great reputation with the symphonic suite "The Planets." The libretto (written by Mr. Holst) is highly fantastic. The value of *The Perfect Fool*, however, lies not in the text or in the story, both of which reveal obvious inexperience, but in music which lacks neither ingenuity nor dramatic expression. The choral writing is exceedingly effective, and thus well in keeping with the high traditions of British choral music. Such a chorus as that of the peasants flying the country ravaged by the Magician and his imps compares not unfavourably with the great choruses of *Boris Godunov*. Mr. Holst's mastery of instrumentation, the marked individuality of his orchestral colour, stand him in good stead and give considerable point to every bar of the score, irrespective of the action which takes place on the stage.

The libretto, were it to be extended to three or four acts, would be wholly inadmissible, and even in its present form it is not free from errors of construction as well as instances of verbal infelicity. But the music bears evidence to a dramatic talent which, directed to a more worthy purpose might, in the end, produce something more important than *The Perfect Fool*. Originality is evident in both text and music. But the originality of the music is easy; it is part of a temperament; its influence permeates every component element—harmony, counterpoint, orchestration. The originality of the story is purely negative, and contributes nothing to the success of the opera.

If the weakness of *The Perfect Fool* is a libretto unworthy of its music, the weakness of Mr. Holst's next opera, *At the Boar's Head* (1925), is a libretto to which music can add little or nothing. *At the Boar's Head* consists of various scenes from Shakespeare's *King Henry IV.*, with Falstaff as the central character. Mr. Holst, out of reverence for the poet, has adopted every word without alteration or excision, and also without allowing sufficient latitude for the inevitable retarding effect of music applied to words. Perhaps he hoped to neutralise this defect by the adoption of folk melodies, most of them derived from Chappell's *History of Popular Music in England*, or from *Country Dance Tunes* and *Morris Dance Tunes* (edited by Cecil Sharp), and the Folk Song collection of G. B. Gardiner. He has also deliberately given music a less important part than has been the custom of the great opera composers and, with considerable ingenuity, made the words bear the very lightest of musical burdens. In conformity with this purpose, the orchestra has been reduced in numbers, and there are not a few pages in which the vocal part proceeds unaccompanied or is reduced to a recitative, enabling the singer to pronounce his words with the greatest speed. Of actual action there is practically none, and the dramatic interest is limited to such traits of characterisation as these brief scenes reveal.

The value of *At the Boar's Head* lies for us in the extraordinary skill with which Mr. Holst has woven together some forty folk-tunes and in the novelty of an opera where the usual relation

between words and music is reversed. In spite of care and cleverness, there are moments when the listener cannot but feel that the notes are holding back the pace of the dialogue. When one good joke caps another, or when a period of prose makes for a definite climax, even the lightest music becomes an impediment. Mr. Holst's stimulating and vigorous freshness and ingenuity are never absent from his music. But they are the gifts of the musician in general rather than of the composer of opera in particular.

Vaughan Williams.—In the libretto of *Hugh the Drover* Dr. Vaughan Williams was more fortunate, for Mr. Harold Child has provided him with a story which possesses human interest, moves swiftly and logically to an appointed end, and is told in words which are never too sublime or too homely for musical treatment. It was produced in 1924 by the British National Opera Company, and made an immediate appeal. It is based, like the music of Mr. Holst's *At the Boar's Head*, on folk tunes. Dr. Vaughan Williams has used them very deftly to emphasise the simple and direct nature of the story. It may be said here that the use of folk songs in opera by these British composers owes more to the researches of Mr. Cecil Sharp than to the example of continental musicians. Abroad the general tendency has been to add splendour and brilliancy to a folk-tune used in opera. Mr. Holst and Dr. Vaughan Williams appear to be mainly concerned with keeping fresh the fragrant flavour of these native wood notes wild. The question of the fitness of a subject has to be considered afresh when the musician means to draw his raw material largely from the vast wealth of folklore. It is obvious, for instance, that such a play as "Othello" would gain nothing if it were set to music derived from popular melodies. *Hugh the Drover*, on the other hand, is admirably adapted for such treatment.

Mention must yet be made of the graceful light work of Mr. Nicholas Gatty, whose *Prince Ferelon*, first produced at the "Old Vic." theatre in 1921, has been repeatedly performed since with conspicuous success by the Carl Rosa Company.

Revivals.—Characteristic of this period is the number of revivals. J. S. Bach's *Phoebus and Pan* has been revived and prepared for stage presentation by the company of Sir Thomas Beecham. Later the same composer's *Coffee Cantata* was put on the stage by the British National Opera Company. Cambridge witnessed a revival of Handel's *Semele* in the form of opera, and to Oxford must be given the credit for the first performance in England in modern times of Monteverde's *Orfeo*. Most fortunate of all was the revival of Gay's *The Beggar's Opera*, which had a run of three and a half years in London, during which 1,453 performances were given. Its sequel, *Polly*, has also been produced, though not with the same good fortune.

Opera in other Countries

France.—Apart from Debussy's *Pelléas et Mélisande*, which remains an isolated example of individual genius, French contributions to modern opera are, generally speaking, copious rather than notable. The promise of Gustave Charpentier's *Louise* was not maintained in the sequel *Julien*. The operas of Alfred Bruneau, of Charles Marie Widor and Gabriel Fauré are little known abroad, where Massenet and Thomas remain the representative composers of French music drama. A far more brilliant achievement is Maurice Ravel's one-act opera *L'Heure Espagnole*, the orchestral score of which may be described without exaggeration a marvel of wit and skill. Indeed, its worth is mainly in the felicity and deftness of the scoring. The plot and the scenic action are nothing more than a *jeu d'esprit* of typical Parisian flavour. At the opposite pole stands Vincent d'Indy, who attempted a new compromise between opera and oratorio in *La Légende de St. Christophe* (1920). In this a narrator is made to tell the story of St. Christopher, who is shown in various scenes, embodying, at first, pleasure, then repentance and ending with death. D'Indy's music, like his text, offers the strongest possible contrast to Ravel's. While the former is severe and restrained the other is wordy and whimsical; Vincent d'Indy stands for the classics and, in particular, for the traditions of César Franck, while Ravel is the apostle of modernity, intolerant of restrictions and of scholastic canons. Both in France and out of France Ravel has the larger following.

Of the novelties produced later at the Opera in Paris the most notable is perhaps Albert Roussel's *La Naissance de la Lyre* (1925), the music of which has a certain distinction, not however without artificiality.

Russia.—The only important addition to Russian opera since the death of Rimsky-Korsakov has been Igor Stravinsky's *Nightingale* (1914), which is described as a "lyrical tale." There is, however, as little "lyricism" in the music as there is in the story, which is derived from Hans Andersen's well-known tale. It belongs to the kind of opera of which the finest example is Rimsky-Korsakov's *Golden Cockerel*. The *dramatis personae* are no more than puppets, and the purpose of the musician is not so much to bring home the pathos or wit of a dramatic or comic situation as to emphasise the artificial nature of the story, and in this the highly sophisticated music of Stravinsky succeeds admirably. The atmosphere is cold and unemotional, the play appears to evolve at considerable distance from the spectator, who is asked not to follow in sympathy the adventures of the characters, but to admire the artistry and the aptness of the performance. The action is reduced to a minimum. Stage pageantry takes the place of stage action, and *The Nightingale* may be placed, as an entertainment, half way between opera and ballet. It is true that the actors sing and do not dance. But if the action were to be presented by mimes or marionettes and the singers used as a complement to the orchestra the loss would be trifling.

The opera aroused at first keen interest on account of its music and of the novelty of its scenic presentation. However much we may doubt the real value of innovations which tend to deprive opera of its surest means of appeal—that is, dramatic action—there is no questioning the extraordinary skill and ingenuity of Stravinsky in the domain of harmony and orchestration.

United States.—America has made so far no contribution to international opera, nor can it be said that a school of national opera is already firmly established, even though some original works have been produced with fair success. The conditions are undoubtedly favourable. The nation as a whole appears to be passionately devoted to its music; musical institutions are supported with a generosity which has no parallel in Europe, and every effort is made to keep the public constantly in touch with the best that the Old World produces. If the results have not fully justified the hopes of the patrons who more than once have offered valuable prizes for American operas, the reason probably is to be found in the fact that the absence of a tradition or of national schools adds considerably to the difficulties of the composer. Having nothing of this nature to guide him in the choice of model or style, even the comprehensive knowledge of other schools which may otherwise nourish his mind and individuality is apt to leave him perplexed, and to suggest a hopeless attempt to balance their virtues and combine them in himself. Such, for instance, is the case of Mr. De Koven's, in many ways, able opera *The Canterbury Pilgrims* (pub. New York, 1917), the style of which owes something—on the composer's own admission—to Verdi, to Wagner and to Massenet. Genius, no doubt, is not to be hired, and the inducements which it is in the power of patrons to offer are, at best, a poor substitute for friendly rivalry and example.

But if there are no American operas of the first rank, works have been produced which deserve attention and are of good omen for the future. The accomplished conductor of the New York Symphony Society, Mr. Walter Damrosch, has written a musical version of Rostand's *Cyrano de Bergerac* which was received on its first production (New York, 1913) with every mark of favour. Horatio William Parker aroused unusual expectations with *Mona* (New York, 1912) and *Fairyland* (Los Angeles, 1915). Other composers have produced operas of some merit, amongst them C. W. Cadman (*Shanewis* New York, 1918); J. A. Hugo (*The Temple Dancer*, New York, 1919) and V. Herbert (*Natomah*, Philadelphia, 1915). (F. Bo.)

OPHTHALMOLOGY (*see* 10.91 and 28.130).—The science of ophthalmology deals with the processes by means of which the images of external objects are brought to our consciousness. It is therefore concerned:

(*a*) with the eye itself; (*b*) with the nerve paths and tracts which convey visual impulses originating in the eye, through the different parts of the brain to the brain cortex, where these impulses are converted into conscious impressions; (*c*) with the eyelids which cover and protect the eyes; (*d*) with the tear glands and ducts; (*e*) with the muscles that bring about the movements of the eyes and keep them trained in the desired direction; (*f*) with the nerves and their complicated cerebral connections which supply these muscles; (*g*) with the bony walls which comprise the boundaries of the orbit; (*h*) with the blood-vessels and lymph paths which maintain the nutrition of all these structures.

It concerns itself with diseased conditions of these parts and derives particular importance from the fact that many diseases of the central nervous system and many general constitutional diseases of the body manifest themselves by some derangement of function or structure which is to be discovered by the various means of investigation which are available to the ophthalmic surgeon.

Many of these investigations are capable of an accuracy and a minuteness which is possible with no other structure in the body, and the eye, as an organ, is unique in the body in the important particular, that its retina is, in essence, a portion of the brain itself which is available to minute examination by means of the ophthalmoscope, and is the only portion of the brain which is available to inspection during life. The arteries and veins which supply the retina can also be minutely examined during life, the diseases of them observed and followed in all their changes, and they are the only arteries and veins in the body which can be seen clearly during life. The value of these observations is enhanced by the fact that the eye itself acts as a sort of low-power microscope, providing a magnification of about 15 diameters for the examination of these structures. The eyes are the subject of a number of hereditary diseases, and form one of the most convenient media for the study of transmission of such diseases.

Affections of the Eye.—The whole function of the eyeball itself is to provide that a clear image of external objects shall be formed upon the retina, but, considered as an optical instrument, in certain cases it departs from the normal, with the result that the acuity of sight is lowered. Thus it may be too long, so that the retina comes to be behind the point at which the images of external objects are formed; this condition is known as myopia or short-sightedness, and may be compensated by the wearing of concave lenses in the form of spectacles.

In other cases, the eyeball is too short, so that the retina comes to be placed in front of the point at which the image of external objects is formed. This condition is known as hypermetropia or long sightedness; this can be compensated by the use of the focusing muscle of the eye, making the lens more convex; or, what is preferable, by the wearing of appropriate convex lenses in the form of spectacles. In astigmatism the refractive power of the eye varies in different axes, so that, for instance, in an extreme case the vertical axis may be myopic whilst the horizontal axis is hypermetropic.

Normally the visual axes of the two eyes are parallel, so that images of external objects are formed upon corresponding points of each retina. This arrangement is largely responsible for the phenomenon of stereoscopic vision, which enables us to judge the position of objects in space with great accuracy. Should this parallel arrangement of the two eyes become upset by any means, such for example as paralysis of some of the muscles, the power of stereoscopic vision is lost and double vision usually arises.

Eyeball and Camera Compared.—The eyeball may with considerable aptitude be likened to a photographic camera. Roughly speaking it is globular in shape and is an inch long in all dimensions. The front part, or cornea is curved, is perfectly transparent and functions as a lens. Behind it is a chamber filled by the aqueous humour—little more than water. Further back is the iris—the coloured part of the eye—which in infants, up to about three months of age, is always of the same bluish-grey colour, and afterwards attains the different tints and colours which produce the blue, the grey, the green or the brown eye. The hole in its centre forms the pupil, and by contraction or dilation of the tissues of the iris the pupil can be varied in size through a wide range; it may be compared to the stop in the camera. In bright lights the pupil is small, and it becomes large in dull illumination. The iris rests behind upon the lens.

The lens is bi-convex, its back surface having a greater curvature than the front. It is perfectly transparent, and the focusing of the eye for near or distant objects is brought about by alteration in its curvatures by contraction of the ciliary muscle. Here is an essential difference between the eye and the photographic camera, whose focus is adjusted by shifting the position of the lens. As age proceeds, opacities frequently develop in the lens, until at the age of 60 very few individuals have lenses which are entirely free of opacities; almost everyone, then, at the age of 60 or over may be said to have the beginnings of cataract, though the sight is quite unaffected thereby. When, however, these opacities have so increased as to involve markedly the central part of the lens, and so render sight very imperfect, the term of cataract becomes applicable to the condition; in such a case the cataract can be removed by operation and the sight restored.

Vitreous Chamber and Retina.—Behind the lens is the largest chamber of the eye, the vitreous chamber, which is occupied by a perfectly transparent, colourless substance, much like the white of an egg. Clothing the back part of the eye, and extending forward some distance in front of its equator, is the retina. It rests upon a highly vascular membrane which is responsible for the nutrition of the greater part of it, namely the choroid; in man, however, the retina has blood vessels of its own, which are seen with great distinctness by means of the ophthalmoscope. These vessels supply the inner parts of the retina with their nutrition. The retina is the sensitive layer of the eye and may be likened to the sensitive plate of the camera for upon it images are formed which initiate impulses which, when conveyed to the cortex of the brain, give rise to the sensations of sight. Its sensitive layer is placed posteriorly, and is composed of very delicate structures known as the rods and cones.

At the central spot or yellow spot of the retina, the point of distinct vision, cones alone are present. The rods are believed to be concerned with lights of lower intensities, and in accordance with this they alone are present in night-flying birds (*see* COLOUR VISION).

Optic Nerves.—The nerve fibres from all these tissues converge upon the optic disc, and leave the eye by means of the optic nerve, which traverses the orbit to enter the skull. Inside the skull the two optic nerves meet and each is divided into two parts, one part continuing to the mid-brain on the same side, the other part crossing over to the opposite side. This crossing forms what is known as the chiasma; in many animals, the birds for instance, the whole of each optic nerve crosses over in this way. Beyond the chiasma the nerve fibres are again collected into a compact bundle known as the optic tract, which terminates in the mid-brain. From here nervous impulses are relayed in two chief directions; some connect up with the nerves which control the movements of the eyes and others, forming the so-called optic radiations, make a long sweep backwards to reach the cerebral cortex, where, as already stated, the impulses are transformed to sensations of sight.

Cerebral Cortex.—The exact area of the cerebral cortex, in which these fibres end, is known with great accuracy and forms the visual cortex. It is placed at the extreme hind end of the brain, and the adjoining mesial surface of each hemisphere, in the region of the calcarine fissure (*see* 4.408). Should a minute portion of this cortex be cut out as the result of injury or blocking of its blood supply, the precise area of the defect which will be found in the vision can be stated with certainty. This accurate localisation was much advanced as a result of observations made during the War.

Amongst the general diseases of the body in which important manifestations occur in connection with the eye a few may be mentioned.

Clinical Symptoms.—In brain tumours or abscesses, swelling of the optic disc is seldom absent, and forms perhaps the most important sign in the diagnosis of the condition. In addition the ocular nerves may have their functions interrupted, so that the movements of the eyes are interfered with, they no longer move in unison and double vision occurs. If nothing can be done for the brain tumour the optic nerve atrophies and blindness ensues. In advanced renal disease changes in the retina develop and convey a particularly grave prognosis, for patients seldom live so long as two years after their discovery. In diabetes a similar change may also arise, which may greatly spoil the sight, and although of less serious import than in renal cases, it must be considered a bad omen. Syphilis frequently attacks the eye, whether in the early or late stages, and is perhaps the most prolific single source of blindness. Tuberculous disease occasionally occurs. In diseases of the blood in general, eye signs are very common, and there are many other diseases where the diagnosis may be greatly assisted by the discovery of changes in some part of the ocular apparatus. The introduction of what is known as the " slit lamp " has made many investigations possible which previously were quite outside our scope.

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OPIUM, TRAFFIC IN (*see* 20.130).—It was first realised in 1906 that if the Chinese Govt. were to be able to suppress the opium evil, she must be assisted by other nations. In 1909 President Roosevelt proposed that an international investigation should be made. As a result an international opium commission met that year at Shanghai at which 13 Powers were represented. The recommendations made at this meeting formed the basis of the First Opium Convention, which was drawn up at The Hague in 1912. The articles of this convention may be summarised as follows:—

1. The distribution of raw opium to be controlled and the use of prepared opium to be gradually suppressed.
2. The export of raw opium to countries prohibiting its entry to be stopped and its export to countries restricting its import to be controlled.
3. The export and import of prepared opium to be prohibited except to those countries not yet ready to suppress its use.
4. The use of alkaloids of opium and its derivatives to be confined to medical and legitimate purposes: a Government licence to be obtained by all persons engaged in the manufacture, sale, distribution, import and export of the drugs.
5. The last chapter of the convention consisted of clauses dealing with assistance to China and with certain obligations undertaken by China herself.
6. Before the convention came into effect the adherence of the 34 non-signatory Powers in Europe and America was required.

International opium conferences were held at The Hague in July 1913 and June 1914, at which a number of Powers ratified the convention. During the War all action in this connection was suspended until the Paris Peace Conference in 1919. In the peace treaties of 1919–20 the signatory Powers agreed that the ratification of these treaties should constitute a ratification of the convention of 1912 and the protocol adopted by the Third Opium conference of 1914 (according to which the convention should come into effect upon its ratification regardless of the non-signatory Powers).

Opium and the League of Nations: Appointment of Advisory Committee.—Under the Covenant (Article 23 c), the duty of supervising the execution of agreements with regard to the traffic in opium and other dangerous drugs devolved upon the League of Nations, In order to carry out this obligation, the first Assembly of the League constituted a committee on opium and other dangerous drugs to be advisory to the council. This committee consisted of representatives of the countries chiefly concerned in the production of raw opium or manufacture of the drug, assisted by three assessors appointed for their special knowledge of the opium question. To the governments originally invited to nominate members, *i.e.*, Holland, India, Siam, Great Britain, Japan, Portugal, France and China, have since been added the United States of America, Bolivia, Germany, the Kingdom of the Serbs, Croats and Slovenes and Switzerland. The first assessors to be appointed were Sir John Jordan, Mrs. Hamilton Wright and M. Brenier.

The advisory committee, which sits only once a year, except in special circumstances has obtained certain important and definite results, such as additional ratifications to the Hague Convention (56 states have now ratified, 50 of these states being members of the League) and the adoption by a very large number of countries of an import certificate system. Under this system no government may allow the export from its territories of any dangerous drugs covered by the Hague Convention, except on the production by the exporter of a licence from the importing country, certifying that the drugs in question are required for legitimate purposes. The committee also encourages the use of the secretariat as a centre for the exchange of information concerning seizures of drugs within the territories of the different states. As a result, it is more possible to know the extent of the illicit traffic which takes place and the main sources and centres of the traffic. The committee receives and examines annually reports from the states as to the exports and imports which have taken place in the current year and of the amounts manufactured.

Annual Requirements of Drugs for Legitimate Purposes.—The council, on the recommendation of the advisory committee, invited the governments and the members of the League to prepare an estimate of total annual requirements for the inhabitants of their territories for medical, scientific and other uses with a view to proposing at some future date to the states concerned a new distribution of production which would limit the total output of raw material to the amount required for legitimate medical and scientific purposes.

The representative of the United States of America urged on the advisory committee the recognition of the principles that the use of opium products for other than medical and scientific purposes is illegitimate and they further urged the necessity, in order to prevent the abuse of these products, of exercising the control of the production of raw opium in such a manner that there would be no surplus available for non-medical and non-scientific purposes. The advisory committee expressed its agreement with this view, the representative of India, however, stating that, in the opinion of the Indian Govt., the use of raw opium according to the established practice in India and its production for such use are not illegitimate under the convention. The council and the assembly also approved the principles laid down by the representative of the United States of America.

International Opium Conferences of 1924 and 1925.—A number of replies had been received from governments giving estimates of their annual requirements of drugs for legitimate purposes when the committee decided to recommend to the council the calling of two international conferences. One, at which the producing and manufacturing states were to be represented, was to deal with the limitation of the production of raw opium and cocoa leaf for export to the amount required for medical and scientific purposes, and with the limitation of the amounts of morphine, heroin and cocaine to be manufactured; the other was to be a special conference to consider the suppression of opium smoking. The council forwarded this proposal to the assembly without comment, and after discussion by that body it was decided to ask the council to take the necessary action to put these resolutions into effect.

The assembly suggested, when forwarding the recommendation to the council, that the conference which was to deal with the problem of raw material and manufactured drugs should include all countries who are members of the League and parties to the convention of 1912, and not only representatives of producing and manufacturing States. This proposal was approved. The two conferences met during the latter part of 1924 and the early months of 1925, the conference on the use of prepared opium sitting first. This included representatives of the British Empire, China, France, India, Japan, Netherlands, Portugal and Siam.

The following 41 states attended the second conference: Albania, Australia, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, China, Cuba, Czechoslovakia, Danzig, Denmark, the Dominican Republic, Egypt, Finland, France, Germany, Great Britain, Greece, Hungary, India, the Irish Free State, Italy, Japan, Luxembourg, the Netherlands, Nicaragua, Persia, Poland, Portugal, Rumania, the Serb-Croat-Slovene Kingdom, Siam, Spain, Sweden, Switzerland, Turkey, United States of America, Uruguay and Venezuela. The United States and China withdrew before the close of the conference, as they were unable to obtain the support of the conference on certain principles which appeared to them to be vital.

The Agreement of 1924.—The 1924 conference did not find it possible to recommend the immediate complete suppression of the use of prepared opium, but drew up an agreement which embodied the substitution of government monopoly for other systems in force. No general agreement could be reached regarding any provisions for registering or rationing addicts, nor was it found possible to embody in the agreement provisions for uniform prices or uniform penalties for the infraction of law or for the limitation of imports. It was held by the majority of members of the conference that no rationing could be enforced or total suppression imposed so long as a large illicit supply of opium remained uncontrolled. To this the representative of China objected, protesting against the refusal of the majority to take immediate steps to suppress opium-smoking until producing countries should find it possible to control smuggling. The conference, in a protocol to the agreement, decided to take any necessary measures not already taken for the entire suppression within a period of 15 years of the consumption of prepared opium in the territories under their authority, this period to begin so soon as the effective execution of the measures required to prevent illicit exportation of raw opium from their territories had been undertaken by the poppy-growing countries. Provision under the agreement is made for a League Commission to decide when these measures have been effectively executed. The agreements reached took the form of an Agreement, a Protocol and a Final Act. Instruments of ratification have been deposited by Great Britain, France and India only.

The Convention of 1925.—The result of the deliberations and discussions of the conference of 1925 was a convention providing for the more effective restriction of the production and manufacture of narcotics, and establishing stricter control and supervision of the international trade. This convention has been ratified by the following states: Australia, Great Britain, India, New Zealand, Sudan, Union of South Africa and the Govts. of Egypt Rumania and Salvador have adhered to it.

Among the more valuable suggestions were the creation of a central board, whose task it would be to follow the course of international trade, and the general acceptation of the export and import certificate system. The conference also drew up a protocol by which the signatory states, recognising their obligations to establish such control over the production, distribution and exportation of raw opium as would put a stop to illicit traffic, agreed to take within five years of the date of the coming into force of the protocol such measures as might be required to prevent the smuggling of opium seriously interfering with the effective suppression of the use of prepared opium in those territories where such use is temporarily authorised. A Final Act, containing further recommendations, was drawn up. Among these special mention may be made of a request to the council to consider the possibility of sending a commission to various opium-producing countries to study the difficulties connected with the limitation of the production of opium in those countries, and to advise as to what measures should be taken to make it possible to limit the production of opium in those countries to the quantities required for medical and scientific purposes. The result of this Final Act is shown in the League of Nations commission of enquiry sent to Persia to report on the possible substitution of crops for the existing opium crops. Half the money for this investigation was contributed by the League of Nations, the remainder by the American Social Hygiene Bureau.

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OPPENHEIM, HERMANN (1858–1919), German physician and neurologist, was born Jan. 1 1858 at Warburg in Westphalia. He studied at Göttingen, Berlin and Bonn and graduated in 1881 with a thesis: *Beiträge zur Physiologie und Pathologie der Harnstoffausscheidungen.* From the beginning of his scientific career Oppenheim devoted himself especially to investigations concerning illnesses following upon dreams and to the rebuilding of the central nervous system. His monograph *Die traumatischen Neurosen* (1889, 2nd ed. 1892) attracted wide attention, but also evoked much opposition from Charcot, Schulze, Seeligmuller, Mendel and others. In 1894 appeared his *Lehrbuch der Nervenkrankheiten* which has been translated into English (1910) and other languages and is a work of international importance. It was followed by two other highly important works: *Die Encephalitis und der Hirnabscess* (1894) and *Die Geschwülste des Hirns* (1896). Oppenheim was the first to initiate the use of operative methods in the treatment of abscesses. His investigations in connection with spinal abscesses were very successful. Here his mastery of diagnosis stood him in good stead. The World War turned his attention anew to traumatic neuroses, and he published *Die Neurosen infolge von Kriegsverletzungen* (1916), *Beiträge zur Kenntnis der Kriegsverletzungen des peripherischen Nervensystems* (1917) and *Stand der Lehre von den Kriegs und Unfallsneurosen* (1918). Oppenheim died in Berlin May 26 1919.

OPTICAL GLASS (*see* 12.87).—Although prior to 1914 the manufacture of optical glass in Great Britain had been steadily, but very slowly, making headway, the research work carried out by Abbe and Schott at Jena, stimulated by the facilities afforded by the German Govt., resulting in a lengthy list of glasses both suitable and available for optical purposes, did not encourage any other European maker to take any decisive steps towards exhaustive scientific investigation of the supply of optical glass.

War Developments.—The ready supply thus afforded by Germany at the beginning of the War found the belligerent nations other than Germany unprepared both with information and supply for military needs. In 1914 there was one maker only in Germany; in France and in Great Britain, and although the quality of the British glass even then was beyond question, yet the small list of British glasses available at the outbreak of hostilities with the still smaller list in France, made decisive action on the question of manufacture imperative. At that time only 26 optical glasses were listed by the British maker, a number quite insufficient for the needs of the modern optical instrument maker, whereas the list of the same manufacturer now shows over 112 varieties. Dense barium crown glasses are now made in England, possessing more extreme properties than any ever before made. Progress has also been made in the fluor crown varieties.

In addition excellent material is produced in England in sufficient quantities and varieties to meet a world demand. Undoubtedly the necessity for the use of good optical glass in military, naval and aerial operations stimulated its manufacture both in England and France and it is unlikely that in future contingencies either of these countries will be found unprepared. British manufacture of optical glass owes much to the very strong financial support and encouragement given by the British Government.

Features of Manufacture.—Optical glass differs from other commercial and domestic purpose glass in that it is not produced in large masses and rolled out in sheets as is window glass, but is melted in smaller quantities in crucibles, allowed to cool, the crucible cracked, the resultant mass broken up and certain comparatively small pieces selected and approved. It differs from commercial and domestic glass in the need of care in its manufacture and the many factors which tend to make the results uncertain. Variation in results in commercial glass or those required for domestic purposes are of little importance; but with optical

glass, even when every care is used in the batches and the meltings, the occurrence of double-refraction and iridescence causes the resultant mass when annealed and examined by a refractometer sometimes to show variations which make final selection of each piece necessary before the results of the batch can be classified. Optical glass is much more costly, ranking from 7s. a lb. in the case of barium crown glasses to about 40s. a lb. for some flint crowns. For some optical instruments large pieces or slabs of perfect purity, homogeneity and durability are necessary, as in the case of two 41-in. disks for the large telescope made in Great Britain since the War.

Economic Difficulties.—Its manufacture by small firms, as is possible in the case of glass used for domestic purposes, is not feasible and rarely successful. Access to special sands for the silicate constituents, the services of a highly specialised chemical laboratory staff and substantial financial resources are requisite. Such restrictions obviously confine its production to very large firms with unusual technical resources. In Germany the list of useful glasses issued by Schott of Jena has been extended, and the Sendlinger Works have also placed certain glasses on the market. Conditions in France have prevented any extension by other firms than the Paris works of Parra-Mantois. In America, although other firms, such as the Spencer Lens Co., entered upon its manufacture, the bulk of optical glass is made by Bausch and Lomb of Rochester. Most of the ophthalmic spectacle glass used in the United States is made in England, by the firms of Chance Bros. of Birmingham, the Parsons Glass Co. of Derby and Barr and Stroud of Glasgow.

During the War the manufacture of optical instruments, especially range-finders, binoculars and telescopes, fulfilled all requirements. Since the War, their production has naturally decreased, although there is still a large field of useful work being done in surveying instruments and especially in research against disease. Notable improvements have been made in the manufacture of refractometers, ophthalmic instruments and slit-lamp microscopes (*see* MICROSCOPY; TELESCOPE).

Anti-actinic Material.—But by far a greater field has been explored in Germany, America and Great Britain in the development of glasses suitable not only for refraction purposes, such as lenses and prisms, but in the important direction of anti-actinic and anti-caloric material.

Although certain research work has been done on the Continent in this direction, it was not until Sir William Crookes turned his attention in 1909 to the question of adding various metallic oxides to the constituents of glass, in an endeavour to discover a combination which would absorb the invisible rays of the infra-red and ultra-violet regions of the spectrum without obscuring too much light or materially affecting the colours of objects seen through the glass when fashioned into spectacles, that this question of anti-actinic glass began to receive serious consideration. The result has been that a series of crown glasses of index 1·523 has been made with a very appreciable ultra-violet and heat cut-off, transmitting at the same time about 88% of light, and yet without imparting any appreciable unpleasant tint to the glass.

Special Varieties.—Until recent years spectacle manufacturers were content to use good quality white ordinary glass, but the demand for such special varieties as bi-focal, tri-focal, aspherical and special ophthalmic lenses has been so enormous as to result in the production of a large variety of glasses with definite indices and dispersions.

Other Developments.—Improvements have also been made in the transparency of certain glasses for the ultra-violet spectrum, perhaps one of the greatest advances made in recent manufacture, due to the research work carried out on glass annealing. Formerly more or less a lengthy and uncertain process, due to a tendency to fracture and double refraction unless a lengthy time of about 14 days for a period of cooling was given, the annealing period has now been reduced to about three days. The quality of the glasses has been improved, so much so that since the War it has been possible for a British manufacturer to introduce the first anastigmatic lens, having the hitherto unheard of aperture of F.2, which makes it possible to photograph a stage scene without flashlight and with the help of ordinary stage lighting (*see* PHOTOGRAPHY). One of the principal economical strides made in the manufacture of optical glass has been the possibility of moulding small plates of glass to practically any desired size and thickness, or into flat disks or disks with specified curves. *See also* GLASS.

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OPTOPHONE.—The optophone is an instrument for enabling totally blind people to read ordinary letterpress, such as a printed book or newspaper, without the necessity of printing it in raised type to be read by touch. The instrument was invented in 1914 by Dr. E. E. Fournier d'Albe, then a lecturer in physics in the University of Birmingham. It is based upon the properties of selenium, an element which is a better electrical conductor in light than in darkness. A beam of light is rendered intermittent by the interposition of a revolving siren disc and is then concentrated into a small bright point on the paper to be read. If the point on the paper is white, it will reflect the light; if it is black it will not. A selenium cell placed close to the paper, on receiving the reflected beam of intermittent light, will respond to each flash by a change in conductivity, and if the frequency of the flashes is of the "musical" order (between 30 and 30,000 per second), a telephone receiver connected with the selenium and a battery will sound a musical note. A blind person could thus tell whether the paper is black or white.

That is the principle of the optophone. In practice a small row of luminous points is substituted for a single point, and each point in the row is given a different frequency by suitably perforating the siren disc. The row, usually of five or six points, just fills up the size of the tall letters of the print to be read. When the whole row falls upon the black stem of a letter there is silence in the telephone. As the letters pass their various shapes are indicated by the sounding or silence of the different notes, and after some practice the blind person learns to recognise letters from their sounds, and so to read ordinary type.

The first reading test was given by the inventor in March 1917, the matter read being a leading article in *The Times*. In Aug. 1918, Miss Mary Jameson, a blind pupil from Norwood, gave the first public reading demonstrations, reading an unknown page from a book at a speed of about two words per minute. Later, with an improved instrument, she attained a speed of about 20 words per minute. A new type of optophone was brought out in 1920 by Barr & Stroud, of Glasgow. In this instrument two selenium cells were used, balanced against each other in such a manner that white paper produced silence, and the black letters themselves made the musical sounds. Reading demonstrations were also given with this instrument, a maximum of 85 words per minute being attained by a blind reader at the meeting of the British Association in Liverpool in 1923. The new type is known as the "black-sounder," and the original type is termed the "white-sounder." The latter type was approved by the Inventions and Research Committee of the National Institute for the Blind in 1921 after an exhaustive series of tests. The optophone is intended to place the world's printed literature once more within reach of the blind. It is applicable, without special preparation, to any language, and can also be used for reading typescript, but not handwriting.

See "A Type-reading Optophone," *Roy. Soc. Proceedings* (1914); "The Optophone," *Journal of Roy. Soc. of Arts* (1921); "The Optophone," *St. Dunstan's Review*, No, 55 (1921).

(E. E. F. D'A.)

ORANGE FREE STATE (*see* 20.151), since 1910 a province of the Union of South Africa. The area is 49,647 sq. m.; according to a recomputation made in 1924, the population (1921) was 628,827, of whom 188,758 were whites, an increase in the white

population since 1911 of 13,381. Of the non-whites, only 395 were Asiatics. Agriculture, including stock raising, is the chief occupation of the people, the Orange Free State being essentially a pastoral region. There are, however, diamond fields, including the Jagersfontein and Koffyfontein mines, and coal mines by the Vaal river near Vereeniging. The only big town is the capital, Bloemfontein (*q.v.*). The great majority of the inhabitants are of Dutch descent.

Dr. A. E. W. Ramsbottom was the first administrator, being succeeded by Mr. (later Sir) Cornelis Wessels. Both had been members of the Ministry during the brief period (July 1907—May 1910), when the province had been a self-governing colony. In 1924, on the death of Sir. C. Wessels, Senator E. R. Grobler was appointed administrator. Education occupied much of the attention of the provincial council. In 1912 the provincial council adopted, in the main, the proposal suggested by the Union Parliament that up to standard IV. instruction in the schools should be given in the "home language" of the scholar. In 1920 an ordinance was passed recognising "Afrikaans," *i.e.*, South African Dutch, as equivalent to Netherlands Dutch as a medium of instruction. In most respects the provincial administration was progressive. For the provincial system *see* CAPE PROVINCE.

The province was the stronghold of the Dutch Nationalists. Up to his death in 1916 ex-President Steyn, who lived near Bloemfontein, though he held no office, exercised very great influence on public affairs. In the crisis caused by the World War Steyn opposed operations against German Southwest Africa. There followed the rebellion of General De Wet, the Free State being the principal theatre of the campaign. General Hertzog, the parliamentary chief of the Dutch Nationalists and, after Steyn's death, their undisputed leader, was supported by the Free State in the general elections of 1915, 1920, 1921 and 1924. (*See* SOUTH AFRICA, UNION OF.)

ORCHESTRATION (*see* 20.168 and INSTRUMENTATION, 14.651). —The orchestration of the 19th century is dominated by the names of Berlioz, Liszt, Wagner and Strauss, and it is not without significance in regard to the continuity of its evolution that the last of these re-edited the treatise written on the subject by the first. Berlioz was in fact the true creator of the orchestra employed by Strauss, and even the tendency to increase its dimensions was initiated by him. This tendency in the end became its weakness. Beyond a certain point it was still possible to increase the richness of an orchestra, but only at the cost of merging its individual hues, so that, however polyphonic the invention of the composer, its orchestral expression tended towards a more highly coloured homophony. To a certain extent this was consistent with the ideals of the Romantic movement, which were generally best served by the blending of tone-colours, and only in special situations welcomed their sharp impact one upon another.

Rimsky-Korsakov's Orchestral Theory.—Even in the 19th century this tendency in orchestration was not allowed to pass unchallenged. The founders of the Russian school were not at first differentiated, except in idiom, from the general trend of European music, but their less sophisticated colour sense, and congenital delight in bright and sharply defined colours, were bound to affect their orchestral method. Thus arose a new movement, at the head of which stands, so far as orchestration is concerned, the name of Rimsky-Korsakov. His method is imperfectly expounded in a treatise, but is clearly discernible in the numerous examples from his own works. So far from aiming at the harmonious fusion of the various timbres of the orchestra, he is often at considerable pains to prevent it, and make them stand out clearly one from another.

The first step in this direction was the dispersal of the groups. Though there had been considerable freedom in the orchestration of the Romantics, they were still almost instinctively disposed to regard the principal homogeneous groups, of strings, wood-wind and brass, as the three manuals of an organ, to be used alternately or combined (*tutti*) as opportunity arose. The occasional soli were mere incidents in the flow of sound. With Rimsky-Korsakov and his followers, on the other hand, it is the occasional use of homogeneous groups that is incidental, the general conception of the orchestra being that of an assemblage of solo instruments. That, at least, appears in the light of recent developments to have been the end towards which Rimsky-Korsakov was striving, though he only partially attained it. His method spread to other countries, mainly through the medium of Debussy, who quickly influenced the entire French school. It has been consciously or unconsciously assimilated by the majority of modern composers in England (*e.g.*, Holst) and elsewhere, and is now in such general use that for the first decades of the 20th century it may be regarded as the new orthodoxy in succession to that of the 19th. This, of course, does not preclude the existence of many intermediate methods. In orchestration most composers are, and will always be, eclectics. Hence any too rigid classification of methods would be confronted with a multitude of contradictory instances.

The most important outcome of the Rimsky-Korsakov orchestration is the impetus it gave to the study of individual timbres and the corresponding instrumental idioms. Compared with other branches of musical technique this study had proceeded slowly. In the 18th century composers did not discriminate very strictly between instruments. There are numerous examples, by Bach and others, of works which exist as piano concertos and also as violin concertos. Even more frequent is the indication "flute or violin." But though in the 19th century composers were more definite in assigning to particular instruments everything they wrote, in adapting their ideas to the respective instruments they were more often guided by considerations of executive technique than by the implications of timbre. Some characteristics, such as those of the oboe and its relatives, were too marked to escape notice and there are passages in Wagner which cannot be imagined as conceived for any other instrumental medium. But in general usage a passage was entrusted in turn to any instrument on which it was practicable. It is in the fullest sense a modern discovery that for each timbre there is a corresponding dialect of the melodic language, into which the musical idea should be translated if it is to be adequately expressed. The procedure of composers being mostly empirical, this matter still awaits the investigation of the theorist but it will most likely be found dependent upon the relative intensity of the overtones, which varies in each timbre. Already J. M. Hauer has published some interesting speculations bearing on the point.

The Reaction Towards Counterpoint.—The most prominent composer who has proceeded on these lines is Stravinsky. Starting from the basis of Rimsky-Korsakov's teaching, he soon began to explore the idiomatic qualities of individual instruments and the world-wide reputation he enjoys for clever scoring, even among those who do not appreciate his music, largely rests upon this feature of his practice. He is not content that a passage should be effective, for instance, on the clarinet, but he demands that its inflections should be those implicit in the tone-colour of the clarinet and foreign to any instrument not akin to it. This led him at first to advocate an enlargement of the wind sections of the orchestra, to permit of full harmony in any timbre, while the strings were to be reduced on the ground that the duplication of parts, though increasing their tone, weakened their character. The question of balance he regarded as a matter involving the orchestral skill of the composer. Soon, however, he found that the assertion of the individual character of an instrument made much of the background superfluous, and this led him to turn from harmony to counterpoint, and from large orchestras producing the former to small combinations of contrasted timbres producing the latter. Thus originated the newer tendency, still regarded as heterodox in relation to the prevalent allegiance to Rimsky-Korsakov, but possibly destined to take the place of the latter, just as that has succeeded to the Berlioz-Wagner-Strauss tradition.

Though the name of Stravinsky is most prominent in this connection, the same principles are behind many contemporary manifestations, such as Schönberg's *Pierrot Lunaire*, and have gained many adherents. The younger French composers, among

whose critics one encounters the term *art dépouillé* (*i.e.*, music stripped of its harmonic envelope), Hindemith and many others in Germany, Bliss in England and, in general, the younger generation everywhere, have come under the spell of this movement, which replaces the multiplication of instrumental means by the intensive exploitation of small numbers. It is a strange coincidence that this tendency, which set in two or three years before the World War, should develop in a period of general impoverishment, whereby an economy of means which was originally dictated by artistic considerations has become financially expedient. As, however, the spread of new musical forms is always very slow, the larger and more expensive orchestra is, despite adverse conditions, still the standard.

A further result of the contrapuntal character of the new orchestration is that it has added a kind of neo-classicism, which consists in a return to old, pre-romantic conventions. It is, for instance, safe to say that never since the 18th century have so many composers been attracted to the older type of instrumental concerto. Schönberg's chamber-symphony for solo instruments came before this revival, but in its instrumental complexion it is prophetic of much that has followed. In 1926 there is a growing literature of *concerti grossi* revealing a somewhat sophisticated affinity to the period of Bach and Handel.

At the same time, a corresponding " stripping " of the texture has affected the normal orchestra, especially when used by composers of the same school, such as Auric in France and Rieti in Italy. It generally produces an impression of austerity, not to say acidity, a deliberate casting away of all orchestral brilliance as too liable to distract attention from the music. This new sobriety, curiously enough, has led in some instances to a qualified reinstatement of the old grouping system. The wheel has come full circle, and it looks as if we shall presently be practically where we were rather more than a century ago, but with a vast fund of technical experience garnered in the interval and a medium of expression more sensitive to the creative impulse than could ever have been foreseen by the classics. It is no exaggeration to assert that, thanks to this experience and the teaching based upon it, any student of average talent leaves a good conservatoire to-day as proficient in this one subject of orchestration as any of the great masters. (E. Ev.)

ORDERS OF KNIGHTHOOD: *see* KNIGHTHOOD AND CHIVALRY.

ORDNANCE (*see* 20.189).—The chief developments in ordnance that have occurred since 1911 are in the nature of increased range and shell power. To these must be added the new guns required to meet the special conditions of the World War: the anti-aircraft gun, the tank and anti-tank guns, the trench mortar and the long-range guns.

I. THE GUN

Gun Construction and Design.—The period since 1911 shows a tendency towards the use of steels of a higher yield point and a consequent increase in the use of alloy steels. The immense demands for alloy steels during the War and the difficulty of obtaining sufficient supplies led to a reversion to the use of carbon steel for small and medium guns with a consequent shortening of the life of these guns. Since the War, however, there has been a demand for increased range without increase of weight of the equipment. To meet this it is necessary to use steels of great strength such as nickel chrome molybdenum and chrome vanadium. The general design of guns has altered but little. Great Britain retains the wire wound gun for almost all types, with a slight modification in breech end construction. Fig. 1 is typical of present day British practice. Continental nations retain the all-steel system of construction.

Manufacture.—The great expenditure of ammunition and consequent rapid wear of guns in modern warfare renders the question of rapid and easy repair of guns a matter of paramount importance. British wire wound guns from 4 in. calibre upwards are fitted with removable liners known as inner "A" tubes, a feature which increases the weight of the piece, but facilitates repairs. Other European nations retain the all-steel designs on the lines of the French or Krupp systems (*see* 11.217). These, on account of the heavy shrinkages necessary, are difficult to reline. Many expedients have been adopted to speed up manufacture and repair. The British 60 pdr. and similar guns were manufactured without inner " A " tubes, being subsequently bored out and fitted with the latter. Short liners were fitted extending from the rear of the chamber, and over the worn region of the bore. These were, however, unsatisfactory and were abandoned. The

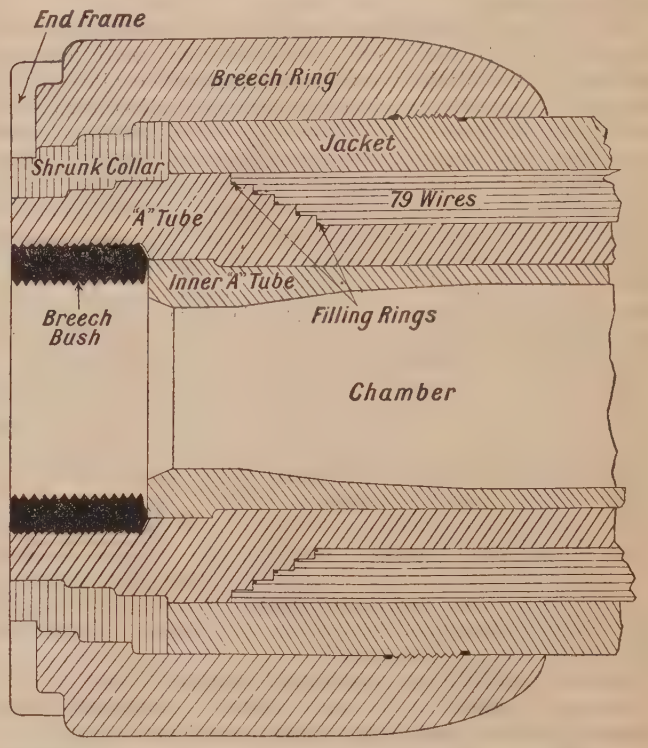


FIG. 1.—Sectional view of breech end of B.L. 15-in. gun.

French in some cases adopted the system of boring out worn-out guns to a larger calibre. A 145 mm. gun was bored out after its first life to 155 millimetres.

Auto-frettage.—A new method of building a gun termed " auto-frettage " (self hooping) has been tried by various nations. In a single tube gun pressure applied to the bore produces a tension in the various layers of the wall. This tension is at a maximum on the inside and decreases continually towards the outside of the tube. The successive layers will be deformed, the greatest deformation taking place at the surface of the bore. If the elastic limit of the steel is exceeded the deformation will be permanent. The metal of the layers least deformed, *i.e.*, those at a greater distance from the axis of the bore, acts elastically on the layers beneath, producing a graduated shrinkage on those layers.

It is argued that if a pressure equal to, or less than, that which has caused the deformation is subsequently applied to the gun no further deformation will take place. In the auto-frettage system the wall is permanently deformed by the application of hydraulic pressure to the bore. The advantage claimed for this system is that it will be possible to make small and probably medium guns of single tubes, thereby effecting savings in time, skilled labour and material. It is possible that the process may be applied to the relining of existing types, and to the manufacture of large guns, using two or three tubes. The limiting factor appears to be the size of sound forging that can be produced.

Trench Mortars.—The trench mortar was a weapon originally designed for the destruction of wire, and short range bombardment in the siege of fortresses. Prior to 1914 these weapons had been developed only by Germany which used them with considerable success when trench warfare commenced on the Aisne in Sept. 1914.

The ordnance plants of the Allies being fully occupied in the manufacture of guns, it was necessary to turn to the ordinary

engineering firms for the supply of mortars. This necessitated a simple design capable of speedy manufacture with existing machines. Three types have been employed:—

1. The stick bomb type firing a large spherical bomb with cylindrical stalk from a smooth bore gun of small calibre. This type was used by the British and German armies, but was discarded on account of its inaccuracy.
2. Smooth bore mortars either muzzle or breech loading. The Stokes mortar is of the former type, and the French 165 mm., in which the bomb is loaded from the muzzle while the propellant charge is loaded from the breech in a small case, is of the latter.
3. Rifled muzzle loading mortars. These were much used by the Germans but require the use of special plants in their manufacture.

The conditions of the War tended to crystallise the trench mortars into two main types: (*a*) a heavy mortar for bombardment purposes and (*b*) a light mortar to accompany attacking infantry for dealing with machine-guns and providing smoke screens. The former has been practically discarded under the conditions of mobile warfare contemplated by European nations; the value of the latter is a matter of controversy, but it is retained in some armies.

Long-Range Guns.—In 1918 Germany produced a gun of 21 cm. calibre which shelled Paris at a range of 45 miles. Similar guns of great range were constructed by various nations. These guns must be of great length which results in excessive wear and stripping of the copper driving band. Shell for the German guns were provided with steel ribs to take the rotational thrust in addition to a gas check driving band. The effect of these guns was almost entirely moral. Owing to their great cost and short life it is unlikely that they will be extensively employed in future wars.

Breech Mechanism.—With the introduction of the breech loading 6 in. 26 cwt. howitzer in 1916, a new type of mechanism known as the Asbury type (see fig. 2) was introduced. It was

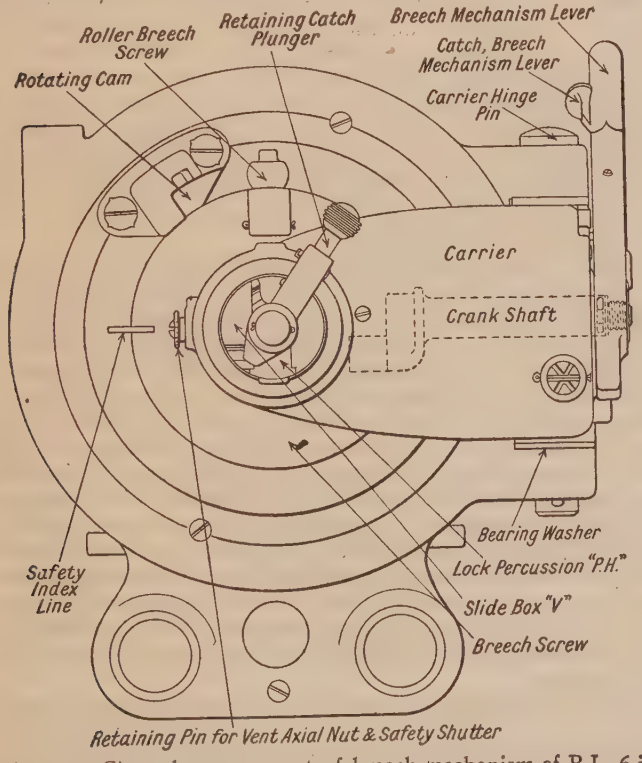


FIG. 2.—General arrangement of breech mechanism of B.L. 6-in. 26 cwt. howitzer.

subsequently adopted for the majority of medium and heavy guns in the British Army. The breech screw is of the Welin type with arm carrier. The rotation of the breech screw is effected by a vertical lever with crank connection to the breech screw. It is claimed for this mechanism that the lever is more conveniently situated for operating the breech than in the normal type with horizontal lever. The obturator is positively unseated by a special cam on the breech face, and the breech screw is positively locked when the breech is open. Semi-automatic mechanisms were introduced owing to the advent of aeroplanes and coastal motor-boats which demand guns that can fire extremely rapid bursts to counter them. The speed of loading these guns is increased by automatic ejection of the fired case and automatic closing of the breech.

These mechanisms are usually of the sliding block type; as the gun returns to the firing position a rod on the mounting fouls a pawl on the crank shaft of the mechanism, causing the latter to rotate and the breech to open; at the same time a spring is compressed. The spent case is ejected by the extractors which engage with the block and hold it open. On the loading of the next round the rim of the cartridge clears the extractors from the block which is then closed by the spring (see fig. 3).

Obturators.—Prior to 1914 the German Army relied solely on the quick firing (Q.F.) system in which the charge is contained in a brass cartridge case which effects the obturation. The British and French Armies used the quick firing system for light guns

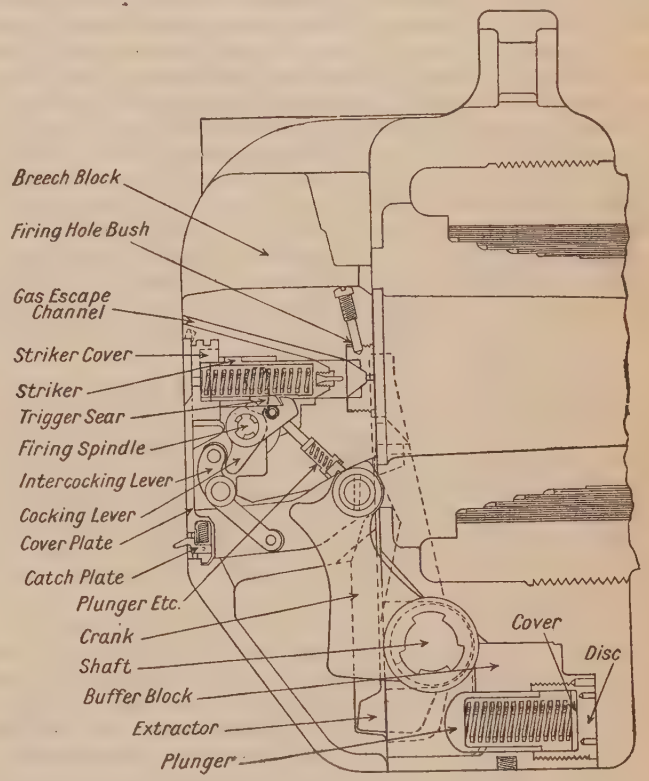


FIG. 3.—Section of breech end of Q.F. 3-in. 20 cwt. Mark I. Gun.

and the "B.L." or de Bange system for medium and heavy guns. The large expenditure of ammunition in the World War rendered the supply of brass cartridge cases a matter of great difficulty, so that an increasing tendency towards the "B.L." system is noted. Germany still retains the "Q.F." system as the sole method of obturation.

Improvements have been effected by the British, French and American armies in the de Bange obturator with the effect of giving it a longer life. The latest design in the British service consists of an asbestos (with rape oil) pad enclosed in a brass gauze casing. The pad is protected in front by a thin copper disc with a split steel ring about its periphery. A similar ring protects the edge of the pad in the rear and a solid ring forms a bearing for the pad on the vent axial. (E. A. W.)

II. THE CARRIAGE

All artillery carriages must be designed primarily, to provide a support for the gun during firing, and to allow of three separate movements:—

(*a*) Right and left in the horizontal plane . . . . traverse
(*b*) Up and down in the vertical plane . . . . . elevation
(*c*) Axially back and forward . . . . . recoil

All carriages, therefore, are built up on the same general lines, and consist of two main portions:—

The basic structure provides the support, and should remain fixed during firing.

The super-structure provides for the three firing movements, and is divided into:—

1. Carriage body, which is pivoted on the basic structure and is capable of movement in the horizontal plane to a greater or less extent according to the type of carriage. It consists of two steel side pieces joined by transoms. On the top of each side piece is a bearing to receive the trunnions, one on each side of the cradle.
2. Cradle, which is pivoted by its trunnions in the carriage body, and can be elevated and depressed in the vertical plane. It is so constructed that the gun can slide backwards and forwards through it, if it be a ring-shaped cradle; or on it, if it be trough-shaped.
3. Recoiling parts, which connect the gun to the cradle and govern its movements.

The superstructure, having in all cases the same functions to perform, does not alter greatly, except in size and weight for different carriages. The type of basic structure depends altogether on the purpose for which the equipment is designed. Guns of the fixed defences, for instance, which are securely anchored to the ground, and may have to traverse in any direction, have their basic structure circular in shape. Semi-mobile equipments, which are moved to a temporary position in separate loads, cannot be anchored as firmly as fixed guns and have the basic structure a rectangle with its long sides in the line of fire, so as to provide support in the line of greatest shock. In this case the carriage body is pivoted near the front of the basic structure, and traverse is reduced to about 25 degrees each way. The mobile gun, or howitzer, must be ready to come into action at short notice, and so its basic structure must form a travelling as well as a firing support. Thus, the basic structure in this case consists of a pair of wheels, an axletree and a trail. The mobile carriage may be supported at three or four points.

Three Point Support.—Only the two wheels and the point of the trail, which is secured by a spade embedded in the earth, are in contact with the ground. To preserve lateral stability the force of the recoil must not be allowed to act far to either side of the centre of the trail; consequently only a small angle of traverse—4 degrees each way—is possible without lifting the spade and moving the whole carriage. A wide space must be left, in the centre of the trail, into which the gun may recoil when firing at high angles of elevation.

Mention must be made here of a special type of three point support carriage, in which traverse is given by moving the front of the trail along the axle. In this case the carriage body becomes unnecessary, and bearings for the cradle trunnions are formed on the sides of the trail. The force of recoil always acts straight down the centre of this trail, which gives great lateral stability. A disadvantage, however, is that the spade forms the centre of the circle in which the front of the trail must move, and it follows that when the gun is traversed to the right, the right wheel must move back and the left wheel forward, and vice versa. This makes traversing very hard work on any but the most favourable ground and necessitates a somewhat complicated traversing gear. Examples of this type are the British Q.F. 18 pr. mark IV and the French 75 mm. guns.

Four Point Support.—The amount of traverse given by ordinary three point support carriages is quite insufficient for dealing with rapidly moving targets such as tanks and armoured cars. The need for more traverse is met by using a split trail, the halves of which can be splayed out for firing, each half having a spade at its rear end. This greatly widens the support in rear, and allows of traverse up to 25 degrees each way, while maintaining stability. At high elevations the gun is free to recoil between the legs of the trail. For travelling the legs are pinned together and hooked to a limber in the usual way.

Anti-aircraft Equipments.—For defence against aircraft, the first requirements are all round traverse and extreme elevation. This necessitates a carriage approximating in design to the fixed mounting. The basic structure consists of a base ring bolted down to the travelling platform. The carriage body, built specially high to allow of great elevation, has a circular race on its underside to fit over a "live roller ring" which revolves on the base ring and so facilitates rapid traverse. The travelling platform can be lowered from its wheels to the ground and anchored for firing.

Possible Developments.—The rapid advance of mechanical transport and the increased use of tracked in place of wheeled vehicles for cross country work give an indication of the lines on which mobile carriages of the future may develop. Tractor drawn artillery is now common, and it is easy to imagine that the mobile gun of the near future will leave its wheels, and fire either from the tractor itself, or from a tracked vehicle towed by the tractor. In either case the basic structure will probably be a circular pedestal clamped to the floor of the vehicle and capable of all-round traverse.

Gears.—To provide the necessary movements of the parts of a carriage in relation to one another certain gears are used. They are traversing gears, elevating gears and sight actuating gears. Traversing provides for the movement of the carriage body on the basic structure in the horizontal plane. In its simplest form this gear consists of a nut and screw, the nut being held on a pivot at the rear of the carriage body, and the screw carried in a pivoted bearing on the trail in such a way that it can revolve but can have no lateral movement. The screw being turned by a handwheel, forces the nut to one side or the other, thus traversing the carriage body about its pivot. For heavy equipments and those requiring wide traverse, a more complicated system is employed; and may include one or more driving shafts with spur, bevel and worm gearing.

Elevating Gear.—This provides for the elevation and depression of the cradle in the bearings of the carriage body. It is effected by a toothed arc or arcs attached to the cradle, and actuated by spur pinions on a cross shaft carried in the bearings in the carriage body. On one end of the cross shaft a worm wheel is keyed. A handwheel on the carriage body, working through spur or bevel gearing, if necessary, turns a worm which rotates the worm wheel and with it the horizontal shaft and its pinions. The pinions, being in mesh with the elevating arcs, impart the necessary movement to the cradle. It should be noted that the elevating arcs can, in many cases, be detached from the cradle, and are provided with hollow bosses which fit loosely over the cradle trunnions, so that arcs and cradle may move independently of one another when required.

Sight actuating gears may include spur, worm or nut and screw gearing, and are employed to give the necessary movements to the axis of the sight, relatively to the axis of the piece. At the same time the angle, or equivalent range, at which the sight has been set with regard to the axis of the piece is recorded.

Sighting.—A gun carriage must provide means of laying the line of sight on the target, and of laying the axis of the piece at such an angle (tangent elevation) relative to the line of sight that the trajectory will intersect it at the target range. The arrangements are complicated by the necessity of allowing for the lateral movement of a projectile due to its spin, known as "drift" and for any difference in level of the wheels due to uneven ground. The reciprocating sights used with modern carriages allow for drift and for difference in level of wheels by tilting the sight at an angle to the vertical. This is done by cross levelling a bubble mounted on the bracket which carries the telescope.

Two main sighting systems are used with mobile carriages:—

1. *Rocking bar system.* In this case, the axis of the sight is first moved relatively to the axis of the piece, through the angle of tangent elevation. This is done by the sight operating gear. Next, the gun and sight are moved together, by the elevating and traversing gears, until the line of sight is on the target. One man performs these two separate operations, a process much too slow for the engagement of rapidly moving targets.
2. *Independent line of sight.* Here the laying is done by two men. One, by means of the elevating and traversing gears, keeps the line of sight continuously on the target. The other, using the range gear, which moves the gun independently of the sight, keeps the axis of the piece continuously set at the angle of tangent elevation. As these movements can be carried out simultaneously and independently, much time is saved.

III. BUFFERS AND RECUPERATORS

The kinetic energy acquired by the gun on firing is absorbed by the buffer, recuperator and friction, and in this way the velocity of recoil is diminished, and the gun finally brought to rest. The recuperator is designed to store up energy so that it may return the gun to the firing position and retain it there at the maximum elevation. The buffer must absorb energy not accounted for by the recuperator and friction.

In mobile carriages, to preserve stability, the heavier portion of the recoil system recoils with the gun, and a long recoil is provided for the same reason: further, as the gun recoils, the stability moment decreases, so the resistance to recoil must be correspondingly decreased. Hence the system of graduated resistance is employed with mobile carriages. While the gas is acting on the gun, recoil should be as free as possible to preserve the aim, and reduce the couple on the recoiling parts. The

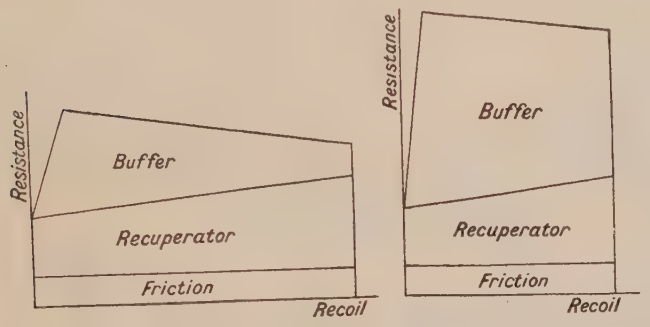


FIG. 4.—Resistance space diagrams. Graduated recoil (left) and controlled recoil (right).

maximum resistance to recoil comes into action at the end of the period of free recoil, and then diminishes. Fig. 4 (left) is a typical resistance space diagram for graduated recoil.

The length of recoil is determined from the condition that the maximum recoil energy with free recoil (calculated from the ballistics of the gun) must equal the work done by the total resistance to recoil, *i.e.*, the area of the diagram. The buffer resistance can be obtained from the diagram, for the recuperative and frictional resistances can be calculated reasonably accurately. British mobile equipments have centre trunnions, so recoil must be shortened as elevation increases in order that the recoiling parts may not foul the ground. Recoil is then said to be controlled. The resistance-space diagram for such a system will be similar to that shown in fig. 4 (right). Since recoil is shorter and the total area must be the same, the resistance due to the buffer is greater than in graduated recoil (fig. 4 left). This increase in resistance does not affect the question of stability, since the stability moment increases with the elevation.

With fixed mountings the question of stability does not arise, so short recoil is generally employed. Further, the total resistance to recoil is a minimum when retained constant, and the system of equalised resistance is therefore adopted.

The Buffer.—This consists of a cylinder filled with liquid in which works a piston and rod: either the cylinder or rod recoils with the gun; between piston and cylinder is a flow space for the liquid which decreases during recoil. The resistance to the flow of liquid through this flow space retards and finally checks the motion, and the resistance can be varied by suitably varying the flow space. The withdrawal of the piston rod at full recoil leaves a partial vacuum in the cylinder which assists the initial stages of recuperation, but before the buffer can act as a control to recuperation, the liquid must be banked up on the face of the piston remote from the rod. At this instant the recoiling parts have their maximum recuperative velocity: further, the flow space is increasing, and the resistance is insufficient to absorb the surplus energy. A further controlling device is therefore fitted to ensure the gun coming quietly to rest in the firing position.

The flow space, calculated and afterwards corrected experimentally, is varied by the following methods:—

(*a*) A circular piston and longitudinal grooves of constant width and varying depth cut in the cylinder walls.

(*b*) Rectangular ports in the piston sliding over valve keys, metal bars contoured to give the required flow space, fixed to the cylinder walls.

(*c*) A hollow piston rod with circular piston sliding over a tapered control rod fixed to the cylinder. Ports in the piston provide a passage for the liquid.

(*d*) A valve with ports cut in it is rotated on the piston rod by feathers upon it engaging spiral feather-ways in the cylinder walls. It rotates against a valve having similar ports which is fixed to the piston rod.

Systems (*a*) and (*b*) are suitable for short recoil. System (*d*) is particularly adaptable to controlled recoil and is used in modern mobile carriages. Controlled recoil necessitates cut off gear to reduce the flow space automatically as the gun elevates. A link or cam gear placed between cradle and carriage body rotates the piston rod through bevel or spur gearing. Cut off therefore occurs earlier in the recoil stroke.

Control to recuperation is necessary to prevent a metal to metal blow, as the flow space in the buffer increases with recuperation. The following devices are in use:—

(*a*) A control plunger with a flat on it displaces liquid from a control chamber, the chamber having filled with liquid on recoil. The most modern equipments combine an additional adjustable exit for the liquid with this system to suit special conditions. Thus recuperation takes place in three stages: (1) unresisted except by friction; (2) resisted by the buffer and friction; (3) resisted by the buffer, plunger and friction.

(*b*) Two separate valves, one to control recoil, the other to control recuperation, the former being idle when the latter is functioning and vice versa. The system is best applied to the rotating valve type of buffer and affords two-stage control to recuperation.

(*c*) A valve on the tapered control rod allows the hollow piston rod to fill with liquid on recoil. On recuperation the valve closes and the rod displaces the liquid through shallowing grooves in the hollow piston rod. Recuperation is thus controlled from the outset.

The Recuperator.—This consists of a set of springs either in a single or a double column, or of a chamber containing compressed air; in either case it must be under sufficient initial compression to retain the gun in the firing position at the maximum elevation. Part of the recoil energy is stored in the recuperator by further compressing either the air or springs, and this energy returns the gun to firing position.

Spring Recuperator.—A single column consists of one or more spiral springs, separated by parting plates, placed end to end on a compressor rod secured to the gun. The system is mounted in a case fixed to a cradle, so that on recoil the springs are compressed by the compressor rod. The telescopic system consists of two banks of springs separated by a hollow tube, but connected to each other by a flange at each end of the tube. The outer bank bears against the casing in rear, the inner bank against the compressor rod in front. On recoil the action is telescopic, so that the compression per column is reduced. For this reason the system is more suitable for long recoil equipments than a single column. In any case the life of a spring is limited and it is liable to fatigue.

Air Recuperator.—Air, initially compressed, is in contact, either directly or through liquid, with a piston, which on recoil further compresses the air. Recuperators are thus classed as pneumatic or hydro-pneumatic, the latter class being subdivided according as the liquid and air are in contact or separated. Liquid is used on account of the difficulty of sealing air at a high pressure. With pneumatic recuperators the air is sealed by a liquid gland, the liquid pressure being intensified in order to effect the seal. With the hydro-pneumatic system, one cylinder contains liquid acting on the face of a packed piston connected by its rod to the cradle cap, and communicates through a retard valve, port and pipe to another cylinder containing liquid and compressed air, the cylinders recoiling with the gun. The retard valve permits a free flow of liquid during recoil, but closes to control the rate of recuperation; the outlet of the pipe is arranged to be always below the liquid level, to prevent the air passing to the liquid cylinder.

This system is liable to aeration, and in a more modern design, liquid and air are separated by a packed floating piston having a tail rod which intensifies the liquid pressure, reducing the tendency for air to escape. The tail rod also acts as an indicator for the quantity of liquid in the system, as it is visible from the front of the cradle cap through which it projects.

The compression ratio should be low to reduce the final pressure and heating effect, and usually lies between 1·5 and 2. To give a low compression ratio the piston area should be small relative to that of the air cylinder, but, at the same time, it should be as large as possible to reduce the initial pressure for convenience in charging and sealing. From a knowledge of the compression ratio, piston area and length of recoil (which is the working length of the recuperator) the volume of the initially compressed air can be estimated. Low initial pressure and low compression ratio entail bulky construction, particularly of the air cylinder; the design of the cradle limits the size of the system, and for this reason the initial pressure in a mobile equipment is generally higher than that in a fixed mounting.

Air recuperators, compared with springs, have the advantages that, firstly, an increase in power can easily be obtained without an increase in weight; secondly, run up can be controlled by the recuperator as well as by the buffer; and, thirdly, troubles due to fractured or fatigued springs are eliminated. On the other hand, air systems require skilled attention for their proper maintenance, and as they absorb a greater proportion of recoil energy than springs, a loss of pressure is much more likely to overload the buffer than a spring breakdown; correct charging is therefore essential.

The air used in recuperators must be dry and free from dust to prevent rust and abrasion and to preserve the mirror surface

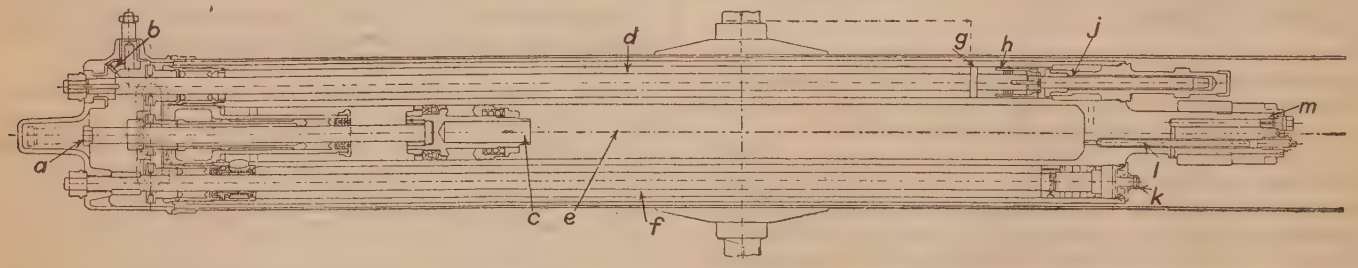


FIG. 5.—General arrangement of buffer and recuperator. *a.* Tail rod (leakage). *b.* Cut-off gear segments. *c.* Floating piston. *d.* Buffer cylinder. *e.* Air reservoir. *f.* Recuperator cylinder. *g.* Recoil valve. *h.* Rotating valve. *j.* Control plunger. *k.* Dust cover. *l.* Air valve. *m.* Air filling plug.

necessary on the rods and cylinders; the use of air bottles charged with specially dried air instead of pumps minimises the risk of allowing moist air to enter a system, while the French favour the use of nitrogen instead of air. Some experimental recuperators of stainless steel are being tried, but certain manufacturing difficulties remain to be overcome. A special liquid mixture is used in buffers and recuperators; it should be non-freezing in any climate, acid-free, non-inflammable and of slight viscosity which should be little affected by temperature change. Only the specified liquid should be used, as it is for that liquid that the flow space is designed, but glycerine may be used in emergency.

Packings.—These may be distinguished as joint rings, soft packings and high pressure packings. Joint rings, copper, leather or vulcanised fibre are used with plugs, stuffing boxes, etc., for standing joints. Soft packings of asbestos, lead and hemp moulded to shape are used in stuffing boxes to seal under normal pressures, and to centre the rod. High pressure packings in the form of rubber or leather rings of " U " or " L " section are used to seal under high pressures. Generally a combination of soft and high pressure packings is used. Fig. 5 shows the general arrangement of a modern rotating valve type of buffer and hydro-pneumatic recuperator with floating piston as fitted to a mobile carriage. (E. J. C.)

IV. NAVAL ORDNANCE

War experience has proved that, at sea, victory will always rest with the side that can hit the hardest at the longest range, and recent years have seen a steady increase in the size of the guns carried by warships of all types.

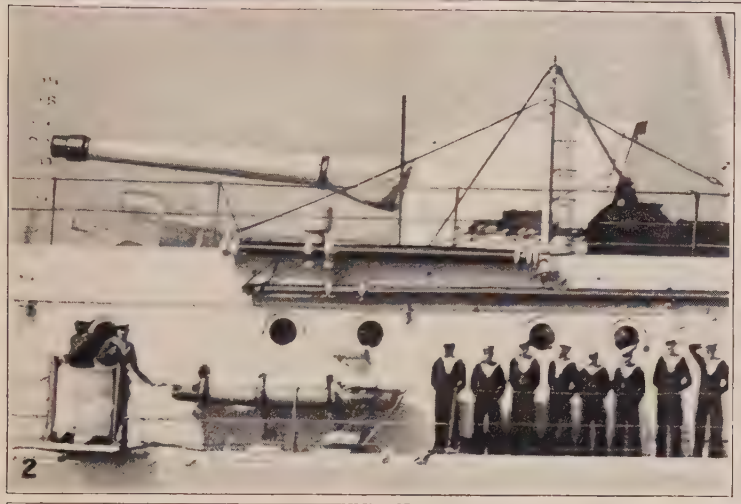
The 12-inch Gun.—In 1911 the 12-in. gun, which for over 10 years had been the standard heavy gun for the navies of the world, had, in the British Navy, reached the limit of its development in the 12-in. mark 11 50 calibre gun. This gun formed the main armament of the six battleships which followed the first " Dreadnoughts " and of the contemporary battle cruisers. In the first three battleships (" Vanguard " class) the guns were placed as in the " Dreadnought," but in the " Colossus " class the midship turrets were placed " en échelon," so that all 10 guns could be fired on either broadside. This disposition of the main armament marks the transition stage to the centre line arrangement, which by 1915 had been adopted in the capital ships of all navies. In the secondary or anti-torpedo boat armaments, the 12-pdr. Q.F. gun was replaced by a 4-in. Q.F. or B.L. gun in all these ships.

In contemporary ships in foreign navies the 12-in. gun still held its place as the main armament, but the desire to increase the heavy gun power was shown by both the United States and Japan, who mounted 12 of these guns as against 10 in the British ships. The secondary armament in foreign navies was usually greater at this period than in the British ships. The Japanese used a mixed armament of 6-in. and 4·7-in. guns and the United States employed the 5-in. gun.

By 1912 the demand for an increase in range combined with greater hitting power became insistent and a new gun—the 13·5 breech loading mark 5 was introduced into the British fleet. This gun, which weighs 68 tons and fires a 1,400 lb. projectile with a velocity of about 2,500 fs., shows a very marked advance in power over the most highly developed gun of 12-in. calibre. Ten of these 13·5 guns formed the main armaments of the " Orion " and " King George V." classes which were completed in 1912–3, and the battle cruisers of the " Lion " class, built at the same time, mounted eight. In these battleships and battle cruisers, and in all subsequent capital ships built for the British fleet, the heavy guns are mounted on the centre line. Thus the whole armament can be brought to bear, through a very large arc of fire, upon either broadside, and the maximum gun power is developed. In all these ships the 4-in. gun was retained as the secondary armament, but a change was made in the next class—the " Iron Duke " completed in 1914. The main armament of these ships remained the same but the 6-in. B.L. gun displaced the 4-in. in the secondary armament.

The 15-inch Gun.—The year 1915 marked another great step forward in the gun power of the British fleet by the introduction of the 15-in. gun. This gun weighs 100 tons and fires a 1,920 lb. shell with a muzzle velocity of 2,500 foot seconds. The muzzle energy developed is thus twice that of the most powerful 12-in. gun, and as the rate of fire of the 12-in. and 15-in. guns is the same under battle conditions, upon this count alone the hitting power of a British battleship may be said to have been doubled between 1912 and 1915. In addition, the heavier gun has a greater range—and what is most important of all—considerably greater accuracy at extreme ranges.

The 10 battleships of the " Queen Elizabeth " and " Royal Sovereign " class each mount eight of these 15-in. guns in their main armament, supported by a powerful battery of 6-in. guns. The battle cruisers of the " Renown " class have six 15-in. guns,



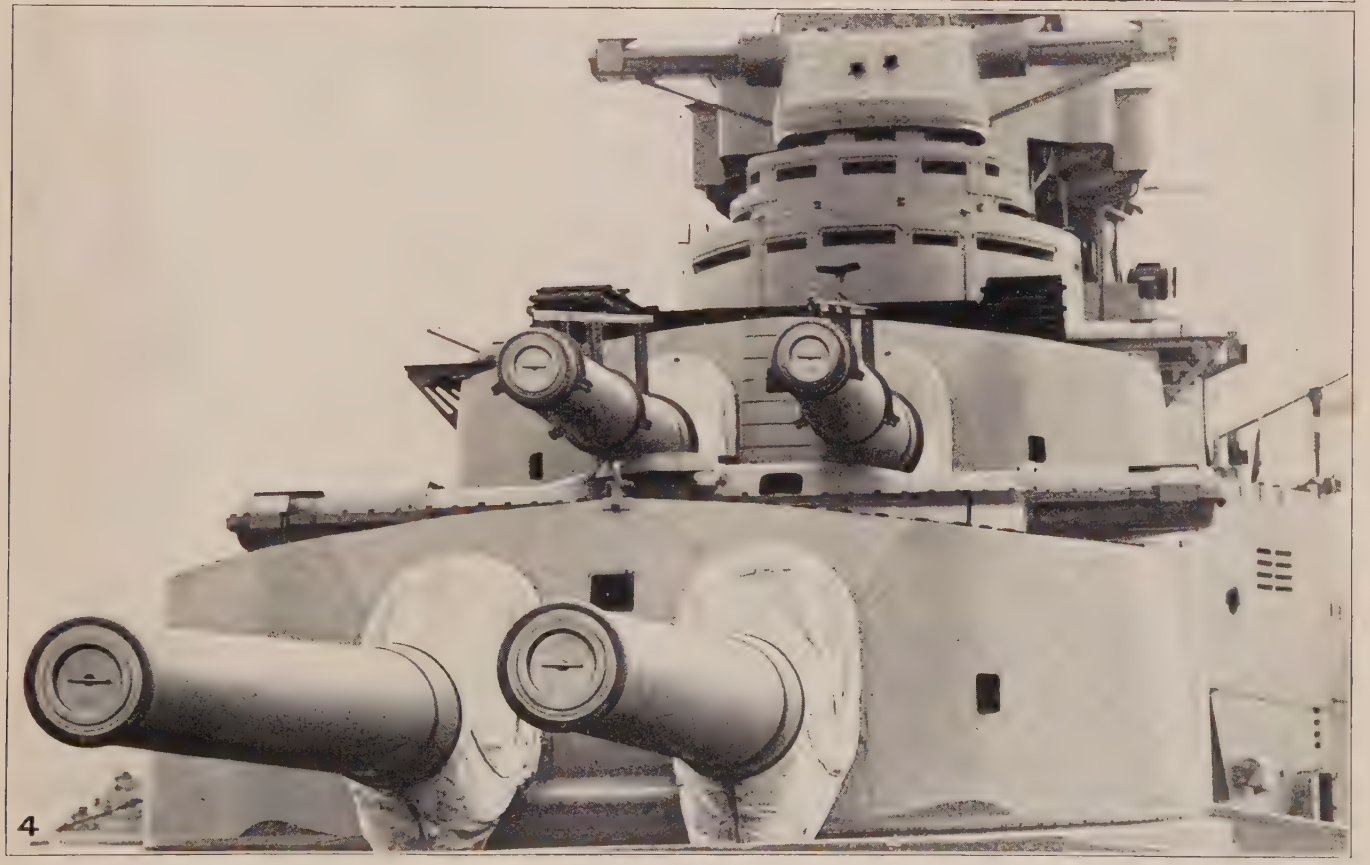


FIG. 1. 12-in. guns on H.M.S. "Dreadnought" (stern turret). FIG. 2. 7·5-in. guns (bow) of H.M.S. "Effingham." FIG. 3. 4·7-in. guns of H.M.S. "Wallace" ("W"-class destroyer). FIG. 4. 15-in. guns of H.M.S. "Hood."

(Photos. Stephen Cribb, Southsea.)

with a reversion to the 4-in. gun, mounted in triple mountings, as a secondary armament. The "Hood," which was the first capital ship completed whose design embodied the lessons learnt at the battle of Jutland, carries eight 15-in. guns and a battery of 16·5·5-in. B.L. guns. The armament of this ship is arranged in the same way as that of the "Queen Elizabeth," but the ship is much longer and faster.

The 16-inch Gun.—A further advance has been made in the size of the guns of the capital ships now being completed—the "Nelson" and "Rodney." These ships carry nine 16-in. guns of a new pattern in three triple turrets, all in the centre line forward in the ship, and the secondary armament consists of 12 6-in. guns in double turrets, three on each side in the after part of the ship.

In other navies during the period 1911–25 a similar general increase in the size of the guns, both for the main and secondary armaments, has taken place. In both the United States and Japanese navies, the 12-in. gun was replaced by the 14-in. in all ships built after 1914, and this gun remained the standard weapon in both navies until the ships projected in 1921, wherein a 16-in. gun has been adopted, the general arrangement of the armament being similar to that of the British "Queen Elizabeth." For the secondary armament, the United States retained the 5-in. gun, until 1921, when the 6-in. gun was adopted. Japan, on the other hand, after adhering to the 6-in. gun as the secondary weapon in her later ships, has now reverted to a gun of 5·5-in. calibre.

The German Navy was always one step behind other fleets in the size of the guns mounted in the main armament. The early German "Dreadnoughts" were armed with the 11-in. gun, which had for many years been the heaviest weapon employed in the German fleet. After 1912, the 12-in. gun became the standard weapon for the capital ships and remained so until the battle of Jutland in 1916. At this date, a few ships mounting 15-in. guns were approaching completion, but they were not finished in time to be actually employed. The guns employed in the secondary armament of the German ships were similar to those in the British Fleet—a 4·1-in. gun in the earlier ships or a 5·9-in. gun in the later ones.

Heavy Guns and Mountings.—Recent years have not brought about any very drastic changes in the main principles by which heavy gun turrets are worked. The most recent designs of twin turrets in the British Navy show no very great difference in general arrangement from those in which the 12-in. guns were mounted in the earlier "Dreadnoughts." The guns have increased from 12 in. to 15 in. in calibre, their weight and that of their ammunition has been more than doubled; consequently there are additional and more powerful machines, and many alterations in detail, but the general design has not been altered. The power used in the British Navy for working the turrets is entirely hydraulic, supplied by hydraulic pumps which are situated outside the structure of the turret. The hydraulic system is heavy, but it is reliable and successfully withstood the severe test imposed upon it during the War, in the very large number of turrets afloat in the British fleet. Any other system will have to be proved to be very reliable before it can be expected to supplant it.

The Japanese follow the British system, but in other navies electrical power has been used almost entirely for working the turret machinery. Electrical machines have made great strides in efficiency and reliability in recent years, and the combination of electric motors and hydraulic transmission (of the type of the Williams-Janney and Hele-Shaw machines) has rendered electric power peculiarly adaptable to turret machinery. This system has been used in all recent United States designs and the increased use of electrical power for the auxiliary and possibly for the main engines of warships, may lead to the electro-hydraulic system being generally adopted in power-worked gun mountings.

Triple Turrets.—Triple turrets have appeared in most navies, but the British Navy has been slow to adopt the innovation. The development is due to the desire to increase the gun power of the ships, without unduly increasing the size of the ships themselves. By the agreement made at Washington the size of capital ships is limited to 35,000 tons and of guns to 16-in. calibre. All nations therefore began to try to place the greatest gun power possible into ships of this size without sacrificing protection and speed and having due regard to the radius of action required of the units of each particular fleet. Six guns mounted in two triple turrets occupy less length of the ship, which is one of the most important factors, than do the same number of guns in three twin turrets. Weight of heavy armour is thus saved which can be used for other purposes. Designs of quadruple turrets have been made, but it is not clear that economy of space results from their adoption, chiefly owing to difficulties in the ammunition storage and supply. There appears to be little doubt that the triple turret will be adopted by all navies in the near future.

Medium Heavy Guns and Mountings.—No modern capital ships now mount medium heavy guns in either their main or secondary armaments. Guns from 11 to 7-in. calibre are not powerful enough to be of any real use at long range against armoured ships, and, since their ammunition is too heavy to be manhandled, they cannot be used for rapid fire, and would consequently be out of place in the secondary armament. The relative weakness of the medium calibre gun was well illustrated at the battle of the Falkland Islands, when the German armoured cruisers, armed with 8-in. guns, speedily fell victims to the greater range and hitting power of the 12-in. guns of the British battle cruisers.

In the mountings of 6-in. and smaller guns a general change has taken place as the result of war experience, from the old pedestal (P.) mounting to the central pivot (C.P.). This was necessitated by the demand for greater ranges and therefore increased elevation. In the P. mountings the elevation was limited to about 20°, as the bottom of the cradle carrying the gun then fouled the pedestal. In the C.P. mountings a circular plate is bolted to the deck, having a low pivot in the centre; on this plate is carried, on rollers, a revolving platform, the pivot being only used to prevent lateral motion. On the platform are built two transoms, on the top of which are the trunnion bearings, in which the gun and cradle swing in elevation between the transoms. The latest C.P. mountings for 6-in. and 4·7-in. guns admit of elevation of 30° or more. The C.P. principle has also been adopted for all anti-aircraft mountings in which elevations up to 85° are necessary.

Anti-aircraft Guns.—The rapid development of aircraft has called for a new type of armament in the form of the high angle gun. The commencement of the War found all nations unprepared to meet the new form of attack. The menace had been realised, but none of the belligerent nations had advanced much beyond the experimental stage in the development of an anti-aircraft armament. Consequently a large number of improvised equipments were produced, none of which were satisfactory. The problem of hitting an airship or aeroplane is a difficult one, since the target is moving in three planes at high speed. A vast amount of experience was obtained on shore during the War and high angle gunfire succeeded in making aircraft fly at a greater height and therefore the attainment of their objective became more difficult. At sea, much less experience was gained and the problem is a much more difficult one, since the platform upon which the gun is mounted is a moving and unstable one, thus adding greatly to the complications.

All warships now carry two or more anti-aircraft guns. In the British fleet a 3-in. Q.F. semi-automatic gun was used at first, but this has now been replaced by the 4 in. Q.F. mark 5 gun on a specially designed high angle mounting. The tendency is to increase the size of anti-aircraft guns. The first essential, however, for an efficient gun for this purpose is extreme rapidity of fire and a limit is imposed upon the size of the gun by the weight of the ammunition. A round of fixed ammunition for a 4.7-in. gun weighs about 80 lb. and this is as much as can be handled by one man with any degree of rapidity. It does not appear therefore that high angle guns will increase above this calibre unless a complicated power worked mounting is introduced, and this does not at present appear probable. (*See* GUNNERY: WASHINGTON CONFERENCE.) (S. H. W.)

OREGON (*see* 20.242), a State of the United States of America. The population in 1920 was 783,389 as against 672,765 in 1910, an increase of 16·4%: at the end of 1925 it was estimated at 1,007,725. The 1925 population of the 33 cities and towns with more than 2,500 inhabitants was 51% of the total population, as against 49·9% and 45·6% in 1920 and 1910 respectively.

Forestry.—In 1922 the virgin forest area was 21,344,000 ac., or about 34% of the total area. The timber stand in 1923 was 395,776,229 mill board feet. The total annual depletion of merchantable stand by fire and cutting during the years 1920–5 was about 1·2%. There were 14 national forests with an area of 24,086 sq. m. within the boundaries of the State. Oregon ranked first in the nation as a timber-bearing State and second in lumber production. In 1923 it produced 12·61% of the nation's soft-wood lumber; its cut was 3,800,000 mill board ft., valued at $110,000,000. The number of sawmills was 685; 45,000 men were employed and the lumber industry pay-roll was 65% of the entire industrial pay-roll of the State: 80% of the outgoing products were lumber and wood.

Agriculture.—Of the total land area 22·1% (13,542,318 ac.) was in 1920 included in the 50,206 farms; in 1925 14,170,043 ac., of which 4,984,375 ac. were improved, were in 55,909 farms. The gain in the total farm acreage during the decade 1910–20 was 15%, and from 1920–5, 4·3%; the gain in the improved acreage during the decade was 14·9%, but from 1920–5 the shrinkage of tillable land in the farms was nearly 2%. The average value of farms and buildings was 12·4% less in 1925 than in 1920. The total value of farm property in 1910 was $528,243,782, and in 1920 was $818,559,751: 81% of the Oregon farms were, in 1920, operated by the owners. The crop values in 1920 were 192·7% higher than in 1910. The conspicuous increases in production in

the decade 1910–20 were in forage, ensilage and fruits. The total field crops in 1920 were worth $131,884,639. Live stock in 1925 consisted of 2,002,378 sheep, 483,813 beef cattle, 312,518 dairy cattle, 225,350 horses and 223,287 swine. In 1924, 16,250,000 lb. of wool were produced.

Mining.—The mineral output includes gold, silver, copper, lead, platinum, quicksilver, Portland cement, lime, clay products, monumental and building stone, coal, crushed rock, sand and gravel, diatomaceous earth, gypsum and mineral water. The total annual value is about $5,500,000, and in the years 1920–5 increased at the rate of about $250,000 a year. Its most valuable mineral products are sand and gravel for building and highway construction and the common clay used in the manufacture of brick and drain tile. The expansion of mining activity has centred in the production of copper east of Baker, and that increase adds to the production of the precious metals associated with copper ores.

Industries.—Oregon has distinct advantages for special lines of industry, including an abundance of raw materials, an equable and moist climate favourable to the production of textile fabrics, and readily available hydroelectric power. The relatively high transportation cost has been the main factor handicapping development. In 1914 Oregon's manufactured products were valued at $109,761,951 and the average number of wage-earners employed was 28,829: in 1925 the volume of output had increased to about $363,912,328, and employment was furnished to some 62,655 workers. The chief industries arranged in order of value of products were lumber and timber products, slaughtering and meat-packing, dairy products, woollen goods, printing and publishing and canning and preserving.

Transportation.—In the years 1910–25 there were two distinct periods of transportation improvement. In the decade 1910–20 there were the opening of the main waterways, the extension of the railways (increasing the mileage by more than one-half), and a thorough commitment to the construction of a system of State highways with a consistent development. During the five years 1920–5 there was the maintenance of the channel depths of the waterways, the projecting and partial construction of the extensions needed to complete the Oregon railway network, and the continuation of highway construction. With the completion of the Celilo canal in 1915, the Columbia and its tributary, the Snake, were made navigable to Lewiston, Idaho. Through the construction of this canal above the city of The Dalles a fall of 80 ft. in a stretch of 9 m. was overcome. With the transference to the Federal Govt. in 1915 of the canal and locks around the Willamette Falls at Oregon City, the free use of the Willamette was secured. The co-operation of the Federal Govt. and the port authorities of Portland secured a deep-water channel in the Willamette and Columbia from Portland to the sea.

The railway construction during the decade provided:—

(1) Lines to the Pacific coast, from Portland to Tillamook and from Eugene to Coos Bay; (2) extensions into central Oregon with parallel lines up the Deschutes river to Bend and westward from Vale in the Snake river valley; (3) construction on the gap between Natron and Klamath Falls as part of a double line for Oregon-California traffic; (4) an electric line from Portland to Eugene and a steam line from Corvallis to Eugene.

The railway mileage in the State in 1910 was 2,413·61; in 1920, 3,626·77; in 1925, 3,347 steam and 589 electric.

In the period 1920–5 a 30-m. extension into central Oregon by the Oregon short line was completed, and construction activity on the Natron-Klamath cut-off has brought it almost to completion. Notwithstanding these additions to the railway mileage in Oregon in the 15 years 1910–25, a complete lack of railway lines still existed in the large southeastern section of the State, comprising about one-half its area. Not only is the possible development of this section thus hindered, but the timber-covered area to the west has no direct transportation route to the great lumber market of the prairie states to the east. The development of a state highway system, begun in 1917, has been regularly carried forward: at the close of the year 1925 the total mileage was 4,463, of which 889 m. were paved and 2,188 m. had macadam surfacing. A definite market road system for each county has been approved.

Education.—In 1920 the total enrolment of grade-school and high-school pupils was 148,412; in 1925 it was 187,982. Funds for the maintenance of the schools increased 69% in the years 1920–5.

History.—During 1910–20 recourse was freely had to the "Oregon system" of direct legislation to enact constitutional amendments and statutory laws. Through initiative petition, referendum petition and by vote of the Legislature, 174 proposals were submitted to the people; of these, 73 were approved. The people of Oregon by this procedure established prohibition, woman suffrage and a rural credit system. Citizenship qualification for the franchise, the right to veto single items in appropriation bills, the abolition of the poll tax, classification of property for taxation and State-wide limitation of the rate of increase of taxation and indebtedness were also thus enacted. Legislation also included the establishment of a minimum wage, workmen's compensation and pensions for widows and a "blue-sky law" licensing sales of corporation securities. While three-fourths of the voters usually vote with the Republican party, the representative leaders of the State during 1910–20 were two Democrats, George E. Chamberlain as U.S. Senator and Oswald West as governor. Mr. Chamberlain was promoted from the governorship to the Senate. During the period 1920–5 the majority party was better able to maintain its unity, electing two governors in succession and sending a solid delegation of Republicans to Congress. In 1922, however, the Democratic governor, Walter M. Pierce, was elected by a decided majority on issues of retrenchment and revenue reforms.

In the decade 1910–20 the people of Oregon began to demand more active progress in their State Government. While there had been before 1910 a half-hearted venture in railway regulation, later repudiated, and institutions of higher education had been receiving meagre support for some decades, the spirit of the constitution of 1857 was still dominant. Later, however, the desire for an early realisation of an adequate highway system, and the assured prospect of regular revenues from automobile licences, led to the authorisation in 1917 of a State bond issue for the building of a State highway system. The limit of indebtedness then fixed was 2% of the assessed valuation. This limit was raised in 1920 to 4% for the State. The counties are authorised to borrow up to 6% of assessed valuation to secure funds for highway improvement. The governors during 1911–25 were Oswald West (Dem.), 1911–5; James Withycombe (Rep.), 1915–9; Ben W. Olcott (Rep.), 1919–23; Walter M. Pierce (Dem.), 1923– .

(F. G. Y.)

ORELLI, HANS KONRAD VON (1846–1912), Swiss theologian (*see* 20.251), died at Basle Nov. 8 1912.

ORINOCO (*see* 20.275).—During the 15 or 20 years ending in 1926 economic conditions in the region of the Orinoco and its tributaries have passed through three states: normal, depressed during the World War years and a subsequent revival. The improved conditions are largely caused by Europe's renewed demands for raw materials. Ciudad Bolivar (pop. 20,000), the metropolis of the region, has extended modern sanitation and improved health conditions, paved some streets, installed electricity, initiated motor-car service, extended telegraph and telephones and constructed some modern homes. Beer, ice, candles, macaroni, lumber, fishing and mining are local and regional industries. Cattle business, largely north of the Orinoco and Apure rivers, is expanding, and estimates place the number of head at several million. British interests in the San Fernando region are active in breeding and shipping to Port of Spain for slaughter and re-export. Ciudad Bolivar is increasing the export of hides; tonka-bean shipments range from 70,000 to 600,000 pounds yearly; exports of egret feathers to France and of balata largely to England are increasing. The indications of petroleum in the Orinoco delta are promising. German, British, French and American companies, in the order given, represent foreign investments. There is some gold mining and much prospecting is carried on in the region.

ORLANDO, VITTORIO EMANUELE (1860–), Italian politician and jurist, was born at Palermo March 19 1860. Becoming a barrister and a law professor, he was first elected deputy for Partinico in Sicily in 1898. He was Minister of Education in the Giolitti-Tittoni Cabinet of 1903–5, and of Justice in the Giolitti Cabinet of 1907–9, and again under Salandra in Nov. 1914. Although a Giolittian at heart, he was in favour of Italian intervention in the World War. On the resignation of the Salandra Cabinet in June 1916 he remained in office under Boselli as Minister of the Interior, and when the latter resigned Orlando was entrusted with the formation of a new Cabinet. After the Armistice he went to Paris as president of the Italian peace delegation. When President Wilson launched his appeal on Fiume to the Italian people over the heads of their delegates, he returned to Rome, where he was triumphantly received, but after his return to Paris without the guarantees he was supposed to have secured, and without obtaining any satisfactory solution of the Adriatic problem, the Chamber voted against him and he resigned on June 19 1919.

On Dec. 2 1919 he was elected President of the Chamber. He at first supported Fascism and the Mussolini Govt. and was re-elected deputy in 1924 on the Government list; but after the Matteotti affair he withdrew his support, without, however, abandoning the Chamber. At the municipal elections of Palermo in Aug. 1925 he mobilised all his adherents in favour of the anti-Fascist list but upon the subsequent triumph of the Fascists Sig. Orlando retired from Parliament.

ORLEANS, LOUIS PHILIPPE ROBERT, DUKE OF (1869–1926) (*see* 20.285), died at Palermo March 28 1926.

ORPEN, SIR WILLIAM NEWENHAM MONTAGUE (1878–), British painter, was born at Stillorgan, County Dublin, Nov. 27 1878 and studied at the Dublin Metropolitan School of Art and at the Slade School, London. He was elected A.R.A. in 1910 and R.A. in 1919. He first exhibited at the New English Art Club, of which he became a member in 1900, his early work being marked by preoccupation with spacing and silhouette and the use of quiet harmonies of grey and brown, with a note of vivid red or blue. He soon turned to the use of bright colour and the study of light, seen in a series of brilliant portrait interiors such as the "Hon. Percy Wyndham" (1907), "Myself and Venus" (1910, now in Pittsburgh Gallery, U.S.A.). About this time he became well known for his vigorously characterised portraits. During the World War Orpen received an appointment as official artist and in 1918 an exhibition of his war pictures was held in London. Many of these are now in the Imperial War Museum. He was created K.B.E. in 1918. He wrote *An Onlooker in France* (1921) and *Stories of Old Ireland and Myself* (1924).

ORTHODOX EASTERN CHURCHES (*see* 20.333).—As regards the ecclesiastical position in the Near East, this article deals only with the "Orthodox" Churches—an adjective used in its technical sense, and having here no bearing on the question of right or wrong belief—and not with the uniats (the Churches which acknowledge the Roman obedience but keep their own rites), or with the separated Churces of the East—the Armenians, Nestorians, Jacobites and Copts. It is necessarily dependent on literature of a fugitive nature, such as magazines and newspapers, and on the observation of recent travellers. One preliminary remark, which throws light on many of the problems to be discussed, must be made. A marked feature of Orthodox Christianity is that political independence has usually led to ecclesiastical independence. This is a fact of great importance.

The Position Before the War

Position at the Outbreak of War.—Russia, with Georgia, is reckoned to have had nearly 100,000,000 Slavonic Orthodox.[1] Georgia, an exarchate once independent, was gradually being Russianised; the exarch was a Russian and an *ex officio* member of the Russian Holy Synod since 1801, while his suffragan bishops were Georgians. The effects of Tsarism on the Russian Church have been described by a learned observer as not good.[2] "Under the guise of protecting the Church, the state in reality had enslaved it." The Church was, he continues, in a state of paralysis, and the Russian educated classes were estranged from it.

The Orthodox Church in Turkey (Greek), under the Ecumenical Patriarch, Archbishop of Constantinople— often erroneously in the West called the Patriarch of Constantinople—is believed to have numbered 2,500,000 in Europe—counting in those transferred to the kingdom of Hellas in 1912—and 2,000,000 in Asia Minor and the islands.[3] In Greece proper, where the autocephalous position of the Church was recognised by the Ecumenical Patriarch in 1850, there were about 2,000,000 orthodox (*ib.*)

In the Austro-Hungarian Empire there were several orthodox Churches, chiefly Slavonic, with some 3,000,000 souls: The Karlowitz Serbian Church; those of Dalmatia and Cattaro, joined to the Ruthenian Bukowina, though far distant from it; of Bosnia and Hercegovina; of Transylvania; and a certain number of orthodox scattered in various districts. The Bulgarian Church was made autocephalous by the Sultan in 1876, when the Bulgarian exarch resided in Constantinople; but the Ecumenical Patriarch did not recognise its independence. It numbered about 4,000,000.

In Rumania the old Church of Okhrida was suppressed in 1767, and the Orthodox then became subject to the Ecumenical Patriarch till recent times. They numbered about 4,500,000. The same state of things obtained in Serbia (1,500,000), where the old Church of Ipek was suppressed in 1766.

The little Church of Montenegro (about 200,000 souls) was made independent in 1766 and governed by a metropolitan who had one suffragan bishop.[4] (Note that in some of the separated Churches of the East the metropolitans have no suffragans.) In addition there were the Orthodox in the patriarchate of Antioch, that of Jerusalem, that of Alexandria, Cyprus, autocephalous since 431, and the monastery of Mount Sinai, autocephalous since 1575, the archbishop of which usually resides in Egypt

The Position After the War

The alterations in the boundaries of the various states have necessarily had a great effect on the Church.[5] But a much greater effect has been produced by the internal convulsions in Russia and Turkey.

Russia has lost Poland and the Baltic provinces; but this has not affected the Orthodox Church to a very great extent, as the bulk of the population was of other faiths. Poland has still 3,000,000 Orthodox; Lithuania has 23,000 Orthodox and 35,000 "Old Believers;" Czechoslovakia has very few orthodox, 90% of the population being Roman Catholics or Uniats.[6]

In Russia proper and in Georgia the effect has been most disastrous. At first the revolution promised well for the Orthodox. A Holy Synod of 12 bishops and a council of bishops, priests and laymen were established in 1917; the office of Chief Procurator—a layman who had represented the Tsar, and who wielded very great powers—was abolished; the patriarchate, discontinued by Peter the Great since 1700, was revived (Nov. 1 1917) in the person of Tikhon, Patriarch of Moscow and all Russia, who was enthroned on Dec. 4 1917. But the Bolshevist régime dashed all the hopes of the Church. The new rulers set themselves to oppose Christianity in all its forms. The patriarch was imprisoned, and only liberated, owing to the general expression of civilised public opinion, after a long incarceration, in May 1923.

All teaching of religion in public schools was forbidden; parents were not allowed to teach their children religion; only candidates for the priesthood, if over 18 years of age, might learn theology. No minister of religion could enjoy full civil rights. No religious association could hold property, and all property of existing religious associations was confiscated to the State,

[1] Hastings, *Encyclopaedia of Religion and Ethics*, 10. 875.
[2] Prof. Agéiev in *The Christian East*, 1920, 1. 15.
[3] *Encyclopaedia of Religion and Ethics*, 6. 429.
[4] *Encyclopaedia of Religion and Ethics*, 6. 431.
[5] The new frontiers, as far as they are fixed, may be seen in the *Royal Geographical Society's Journal*, 53. 370, 54. 188, 55. 160, 65. 90.
[6] *Goodwill*, pp. 135–139.

which might at its pleasure lend buildings for religious worship. Monasteries were to be converted to useful purposes.[1]

A great persecution of the Orthodox has broken out, and according to the official figures, within a period of less than two years, 1,275 bishops (and priests?) and 6,775 other persons have been executed for their religion.[2] Most of the remaining bishops who have not escaped from Russia have been interned in or about Moscow, or in monasteries in the Far North. And the only organisation that has been found possible is a synod of 15 Russian bishops which holds its sessions outside Russia, at Belgrade. The patriarch Tikhon died in 1925, and a makeshift for the patriarchate has been devised in the shape of a locum tenens. The passive resistance of the Russian peasantry has been the great obstacle to the Government's endeavour to suppress Christianity, and the so-called reformed Russian Church, a body encouraged by the Soviet power, has so far been a failure for the same reason. In Georgia, the Church is in as great confusion as in Russia; since the first revolution the tendency has been towards independence in ecclesiastical matters.

The Ecumenical Patriarchate.—Post-War Turkey, with its curtailed frontiers, has as its aim the creation of an entirely Moslem State; and among other things the Turkish Govt. desires the abolition of the Ecumenical Patriarchate. But the European Powers, while restoring Constantinople to Turkey, prevented this, and at Lausanne the Turkish delegates made a formal declaration of their Government that the Patriarchate would be allowed to continue.[3] Yet, as far as Turkey is concerned, the Patriarchate is little more than " the shadow of a shade." By the Treaty of Lausanne all Greek Orthodox residents in Constantinople before Oct. 30 1918 are exempt from expulsion. All other Greeks in Turkey, however, are liable to expulsion, and those in Asia Minor have been settled in the new Greece and elsewhere, in many cases in exchange for Moslems. Only Turkish subjects can be metropolitans in Turkey, and therefore the episcopate has to be recruited from the comparatively few Greek residents in Constantinople. Outside modern Turkey the Ecumenical Patriarch, not the Metropolitan of Athens, has jurisdiction in Macedonia, Western Thrace, Epirus, Crete and the Aegean Islands, and this is an exception to the rule about ecclesiastical independence mentioned above.[4]

Yugoslavia, called in the Treaties the Serb-Croat-Slovene State, is now re-organising its Church, which includes the former Serbian Church, the Karlowitz Serbian Church, that of Dalmatia and Cattaro, that of Bosnia and Hercegovina (these three formerly in Austro-Hungary) and Montenegro. During the Great War many Serbians were in England; over 600 refugees, young ordinands, were there instructed and prepared for the Orthodox priesthood under Serbian priests.[5] Many others were in France, engaged in secular pursuits, and in other countries. This will be a convenient place to remark on the changed ecclesiastical conditions in both Yugoslavia and Rumania. Before the War Rumania and Serbia were inhabited practically by Orthodox alone. But the enlarged boundaries have brought in many Roman Catholics and Lutherans, and this has complicated the problem of national religions. The former idea of one country, one church, has to be given up, and religion and politics cannot have the same close connection that they had before. Moreover, the greatest hindrance to the reorganisation of the Orthodox Church in the Balkans and in Rumania is the exaggerated national feeling and jealousy of each country against the others. This jealousy is much more felt between the different branches of Orthodoxy than between them and the Roman Catholics or Lutherans.[6]

Rumania.—To the former Rumanian Church, with its two metropolitans, is now added the Transylvanian Church (formerly in Hungary), with its Metropolitan at Hermannstadt, and suffragan bishops at Arad and Kazansebes; and also the Churches of Bukowina and Bessarabia. The United Church now numbers some 11,000,000, out of a total population of about 12,500,000.[7]

Greater Greece.—The old metropolitanate of Athens has not been greatly affected. For Macedonia, etc., see above; but it is hard to see how the Ecumenical Patriarch in Constantinople can under the changed conditions exercise an effective supervision over these districts. Salonika has now become once more a Christian city, and the mosques which had originally been Christian churches have now been restored to Orthodox worship.

Bulgaria has lost the Aegean coast to Greece, and part of the Dobruja to Rumania. Otherwise the Church has not been much affected. It has, by the official census of 1920, about 4,000,000 members, almost all of Bulgarian nationality, out of a total population of nearly 5,000,000, of whom about 700,000 are Moslems, chiefly Turks.[8]

We now pass to the smaller communities in Asia and Africa which were once under Turkish rule. The orthodox patriarchate of Jerusalem, now under British mandate, consists of about 30,000 Arab and Greek Christians and a few Russians. The chief obstacles to progress are the jealousies between Arabs and Greeks, and the financial difficulties of the monasteries. There is now no orthodox theological seminary in Palestine.

The orthodox patriarchate of Antioch, now under French mandate, suffers from the same difficulties as that of Jerusalem. It has some 300,000 members. The orthodox (" Melkite ") Patriarch of Alexandria has only a small following of about 100,000, as has been the case since the Monophysite schism in the 5th century. Under him is the Archbishop of Nubia. The autocephalous Churches of Cyprus (with about 200,000 orthodox) and Mount Sinai have not been greatly affected by the War.

(A. J. M.)

ORTHOPAEDIC SURGERY.— The influence of the War upon the practice of orthopaedic surgery is related to organisation, and to lessons learnt in technique from the handling of large groups of cases. Efficiency at the front and at the hospitals in England was attained only when segregation of various types of injury became established. The treatment of fractures during the early part of the War was attended not only by unnecessary deformity, but also by a high mortality, and remained unsatisfactory until special hospitals were started, manned by teams of expert surgeons. In compound fractures of the femur an initial mortality of 80% was ultimately reduced to 25%. This dramatic change was accomplished by immediate reduction and fixation of the fracture, by segregation and by continuity of treatment both at the seat of war and at home. Knowledge thus gained has formed the basis of the efforts to place the organisation and teaching of fractures upon a different basis with a view to minimising the disabilities of industrial accidents. Reform lies in the simplification of apparatus, and in an intensive education in their application, in segregation of fractures in special wards and in appointing surgeons with special qualifications to teach the student.

Technique.—The World War supplied us with exceptional opportunities of acquiring an improved technique in certain reconstructive operations which have an important bearing upon civil surgery. Amongst these stand prominently injuries to the peripheral nerves, tendon transplantations, bone grafting and bone infections. The enormous number of complete nerve lacerations enabled a finished operative technique to be built up, which was largely wanting before the War. Many misconceptions were corrected, such as the worthlessness of complete transplants of nervous or other tissue to bridge gaps in peripheral nerves, and the doubtful value of lateral nerve anastomosis. In cases of irreparable destruction to nerves, healthy muscles were transposed to take the place of paralysed ones. These operations proved singularly successful where large tracts of the musculospinal nerve were irreparably damaged.

[1] The translation of an official summary of Soviet legislation against religion is given in the *Church Times,* Oct. 30 1925.
[2] *Church Times,* Nov. 20 1925.
[3] June 10 1923.
[4] *See* an informative series of four articles on *The Orthodox Churches* by Dr. Greig, Bishop of Gibraltar in *Theology,* 10–11, March, April, July, Aug. 1925.
[5] *The Christian East,* 48. f, 51. f, 54.
[6] Greig in *Theology,* 11. 8, 66.
[7] *Goodwill,* p. 114 ff.
[8] *Goodwill,* p. 127.

Certain flexor muscles of the forearm were attached in such a way that extension of the wrist and fingers became assured. Bone graft surgery received a great impetus during the War and has since been extended. This has led to considerable research on the viability of transplanted tissue, and in the case of the bone it is held that the transplant is a scaffold along which the fresh bonelaying cells creep from the embracing bone and deposit new bone, the scaffolding itself being ultimately removed by absorption. War experiences have permanently affected the treatment of virulent infections. The Carrel-Dakin method has permanently established itself as well as the procedure of laying open infected bone cavities so that the soft tissues fall in easily to obliterate the gap when the infection is at an end.

Care of Cripples.—The most notable advance in orthopaedic surgery following the War is in the organisation for the care and cure of cripples. This consists in the establishment of well-equipped open-air hospitals in various parts of Great Britain, known as hospital schools, fully staffed by surgeons specially trained to deal with deformities of every kind. These schools provide treatment and education for the cripple, and are associated with what are known as after-care clinics situated in small towns covering an area of from 40 to 50 m. distant from the hospital in every direction. These after-care clinics are visited by the hospital staff at stated times, and are attended by out-patients who have been inmates of the hospital school, and by cases from the district, who are often seen at a sufficiently early date to prevent deformities from arising. These hospitals and clinics are run in close association and agreement with the local practitioners, the education authorities and the Ministry of Health. This scheme, in association with preventive measures, promises practically to eliminate the cripple. Its aims are to secure the potential cripple at the earliest moment, to give him expert institutional treatment in fresh air and sunlight and to secure continuity of treatment until recovery is complete.

Artificial Light.—Of the special advances in knowledge that have taken place since the War, the evolution of the artificial light treatment as an auxiliary form of therapeutics for tuberculosis of bones and joints and of rickets may be instanced. The work of Rollier, Leonard Hill and others has given prominence to the therapeutic value of sunlight (*see* HELIOTHERAPY), and in the absence of sun extended observation favours the conclusion that we have in various forms of artificial light a promising substitute. This treatment, as in the case of heliotherapy, must be looked upon merely as an accessory measure in surgical tuberculosis. It is most effective when used in combination with other surgical procedures. It should be pointed out that there is grave danger in spreading a belief that other forms of treatment are unnecessary and subsidiary.

Infantile Paralysis.—The serious epidemic of infantile paralysis has resulted in a more widespread knowledge of the early symptomatology and important work has been done, especially by the late Prof. Lovett of Harvard from 1916 onwards. It has now been proved that complete rest and immobilisation and the elimination of meddlesome therapeutics have resulted in lessening the severity of symptoms by limiting the paralysis. The mass of material rendered available by these epidemics has thrown new light on the actual treatment of deformity. Tendon transplantations for various deformities of the feet have given place to operative stabilisation of the flail foot, and transplantations when practised are now associated with reconstructive operations upon bone. This combination has resulted in more satisfactory function.

Rickets.—Rickets and allied nutritional diseases, largely as a result of starvation diets during the War, have received close investigation by many observers abroad and at home. Considerable work on the aetiology, particularly with reference to diet, exercise and sunlight, has been carried out at Johns Hopkins Hospital, the Lister Institute and by Findlay of Glasgow, Mellanby and Chick. Much has been discovered regarding "vitamines" or "accessory food factors" (*see* VITAMINES). The report of the Research Committee provisionally deals with only two varieties; one known as vitamine A, or fat soluble A, and the other as anti-rachitic vitamine. Both are essential to the diet of growing animals. Defect in the one leads to arrest of growth and loss of weight; in the other a deficiency in the deposit of lime salts. The committee conclude that an anti-rachitic vitamine is a central factor in the prevention of rickets; and that a deficiency of calcium and phosphorous, in conjunction with a deficiency of anti-rachitic vitamine, hastens rickets. The greater the discrepancy in the calcium phosphorus intake the greater need for an appropriate anti-rachitic intake. It has now been proved that sunlight and ultra-violet rays act as an antidote to a deficiency diet, and can ward off the on-coming of rickets. This work has added considerably to the knowledge of orthopaedic surgeons, and has rendered unnecessary a good deal of the operative treatment for rachitic deformities.

Spinal Treatment.—The writings of Hibbs, Calve, Girdlestone and Waldenstrom have enabled us to place in accurate perspective the bony fixation of the vertebral column in tubercular disease of the spine. Forcible correction and fixation of the spine in lateral curvature is being abandoned in favour of less drastic measures, and bony fixation of the flail spine in paralytic cases is being performed with promising results.

Other Operations.—Operative treatment in osteoarthritis, especially in the non-articular type, is being more widely practised. This consists in stabilising the joint by exercising the joint surfaces and in the complete removal of diseased synovial membrane in the knee joints. The so-called operations of arthroplasty, or mobilisation in ankylosis of joints is becoming more common, and the results more encouraging. They mainly consist of the loosening and reconstruction of the bone ends, and the introduction of transplanted or living tissue between the bone ends to secure movement.

The treatment of fractures of the neck of the femur by wide abduction of the limb with internal rotation have been still further perfected by Royal Whitman of New York, and a large percentage of recoveries in this obstinate type of fracture occurring in old age is reported. The pathology of the rarer bone diseases such as "cysts of bone," "myeloid sarcoma," "Paget's disease" have been closely studied by many observers, resulting in valuable information in relation to operative procedure.

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ÖRTZEN, GEORG, BARON VON (1829–1910), German poet and prose writer (*see* 20.342), died in Freiburg May 26 1910. His later works include: *Nebensachen* (1910); *Auf Schwarzwaldwegen* (1910).

ORZESZKO, ELIZA (1842–1910), Polish novelist (*see* 20.343), died at Grodno May 18 1910.

OSAKA, Japan (*see* 20.344), brought several suburban districts within its boundaries in 1925 and had a population of 1,252,972 in 1920. It was a busy industrial centre with over 7,000 factories in 1921; the cotton manufacture, in particular, has developed rapidly. There is an acute shortage of houses and rents are high. Many people migrated from the north to Osaka after the earthquake in 1923, since the southern and south-western districts are believed to be immune from severe shocks. In 1909 one-third of the city was destroyed by fire and though it was rebuilt with wider streets and better buildings, there are still many wooden houses and bridges, dangerous in case of fire, and its factories and warehouses compare less favourably with European and American standards than those of Tokyo. Work on a drainage system was started in 1909, but is still incomplete. Railways in the neighbourhood are in process of electrification, and there were 51 m. of tramways in 1925.

Trade has grown very largely, but most goods are loaded and discharged at Kobe, as the river is only navigable for small vessels. A programme of port improvements was, however, undertaken in 1906 to make the harbour suitable for ocean-going ships, including the erection of jetties and warehouses, and the protection of the shore was practically completed in 1914; and further work on land reclamation has been undertaken. A fourth

shipbuilding yard was opened in 1911. A pharmaceutical school was opened in 1917 and in 1919 the university of medicine was made into a general university. The spread of pulmonary tuberculosis has caused alarm and a tuberculosis laboratory has been opened. In 1919 a municipal home for workpeople, including an employment bureau and a children's clinic, was inaugurated.

OSBORN, HENRY FAIRFIELD (1857–), American palaeontologist, was born at Fairfield, Conn., Aug. 8 1857. Graduating from Princeton University in 1877, he was appointed assistant professor of natural science there in 1881, becoming professor of comparative anatomy in 1883. He went to Columbia University as Da Costa professor of biology in 1891 and was professor of zoology there from 1896 to 1910, in the latter year being appointed research professor of zoology. He was also curator of the department of vertebrate palaeontology of the American Museum of Natural History from 1891 to 1910. He was appointed vertebrate palaeontologist to the U.S. Geological Survey, 1904. From 1894 to 1916 he was connected with the Brearley School for Girls as director and president. He served as chairman of the executive committee of the New York Zoological Society 1896–1903, and assisted in founding the fine Zoological Park in the borough of the Bronx, New York City. (*See* EVOLUTION; PALAEONTOLOGY.)

Osborn's works include *From the Greeks to Darwin* (1894); *Evolution of Mammalian Molar Teeth* (1907); *The Age of Mammals* (1910); *Huxley and Education* (1910); *Men of the Old Stone Age* (1915); *Origin and Evolution of Life* (1917); and *The Earth Speaks to Bryan* (1925).

OSLER, SIR WILLIAM (1849–1919), British physician, was born at Bond Head, Canada, July 12 1849. He was educated at Trinity College School, Port Hope, Trinity University, Toronto and at McGill University, Montreal, where he took the M.D. degree in 1872. He studied medicine in London, Leipzig and Vienna and was in 1874 appointed professor of medicine at McGill University. From 1884 to 1889 he was professor of clinical medicine in the University of Pennsylvania, and from 1889 to 1904 professor of medicine at Johns Hopkins University. In 1905 he was appointed regius professor of medicine at Oxford, where he also served as a curator of the Bodleian Library, as a delegate of the University Press and as one of the Radcliffe trustees. In 1911 he was created a baronet. Sir William Osler carried out original and valuable researches on the diseases of the spleen and blood and also made eminent contributions to the study of infections of the heart, of angina pectoris, of malaria and of many minor maladies. He was the author of many medical works, of which the most important is *The Principle and Practice of Medicine* (1892, latest edition 1916), and of a volume of essays entitled *Aequanimitas*. Sir William died at Oxford Dec. 29 1919.

OSLO, formerly CHRISTIANIA (*see* 6.279), the capital of Norway, changed its name as from Jan. 1 1925, Oslo being the original appellation of the city. The population was 258,483 in 1920. Between 1912 and 1921 large sums were spent on building and equipping quays. Vessels up to 10,000 tons can be built in the ship-building yards. Garden suburbs have been erected by the municipality at Ullevaal, where there is the largest municipal hospital in the country, and at Töien. At the latter place are three buildings, the first erected in 1908, which house the mineralogical and palaeontological, zoological and botanical collections. A third Viking ship, that of Oseberg, has been added to the others in the historical museum. The Margaret church, built by the Swedish colony in memory of the late Crown Princess of Sweden, was consecrated in 1925. Three new theatres have been built since the World War. A trade intelligence bureau was founded in 1919, and the central bureau of statistics reorganised in 1918. A beginning has been made with the electrification of the state railways, from Oslo to Drammen. The Dovre railway, connecting Oslo with Trondhjem, was completed in 1921, and the Östbane station has been extended. The joint scheme of the state and the municipality for deriving power from the Glommen river has been delayed, but three units of 13,000 kw. were in use early in 1925.

OSSENDOWSKI, FERDINAND ANTHONY (1876–), Polish traveller and writer, was born May 27 1876 in the government of Witebsk. He studied at the University of St. Petersburg (Leningrad) and at Paris, where he received the degree of docteur des sciences and officier d'Académie for his work entitled *The Allotropy of Silver*. He was appointed lecturer of physics and physical chemistry at the Tomsk Polytechnic and then became successively a lecturer in chemistry, physics, geography; a manufacturer, a commercial manager, a journalist, a novelist, a physician, a draughtsman, a teacher of languages, and a mineralogist. Ossendowski was twice imprisoned for supposed political offences. While at the university he was sentenced to five months' imprisonment for taking part in a manifestation against capital punishment, and, at the time of the Russo-Japanese War, he was brought before a Russian law court for leading a patriotic organisation in the Far East with the object of preventing civil war after the defeat of the Russian Army. He was sentenced to death but the sentence was later commuted to 20 months' imprisonment. During this period Ossendowski's books on prisons appeared, which aroused a great deal of controversy and led to a revision of the Russian prison system.

After the outbreak of the Communist revolution, Ossendowski held office as financial adviser to the Government of General Kolchak in Siberia. After Kolchak's Govt. fell, he made his way through the forests to Mongolia disguised as a peasant. His journey through Central Asia is recounted in *Beasts, Men and Gods* (1923), and his other works on Asia include *Man and Mystery in Asia* (1924), and *The Shadow of the Gloomy East* (1925). His play *The Living Buddha* had a successful run at the National Theatre in Warsaw.

Ossendowski also published a number of scientific books, including *The Theory of Fermentation, Vegetation of the Pacific Ocean and the Extraction of Iodine; The Origin of Petroleum according to Scientific Hypothesis, Contribution to the Hydrography of the Ussuri Territories; Contribution to the Oceanography of the Pacific, The Coal Industry in Russia and Its Possibilities.* See Sven Hedin, *Ossendowski und die Wahrheit* (1925).

OSTEND, Belgium (*see* 20.356), had a population in 1923 of 44,271. Large sums have been recently spent in enlarging and improving the town and suburbs, which is one of the most popular watering places in Europe. It is computed that it is visited by nearly 1,000,000 people yearly. It is also a port for cross-channel services and the chief Belgian fishing port. The new fishing harbour includes a wet dock for steam trawlers, a tidal dock for sailing boats and a slipway. Extensive harbour and dock works were completed before the World War.

The War Period.—Ostend was occupied by the Germans for four years during the War, and was at first, until it was rendered untenable by aerial bombardments, a base for destroyers and submarines. In May 1918 the entrance channel to the harbour and the canal to Ghent and Bruges were blocked to all craft except the smallest submarines by the sinking of the "Vindictive." After the War she was raised and broken up. Parts of the "Vindictive," "Intrepid" and "Thetis" have been made into a memorial on the Digue. During the German occupation over 2,000 bombs were dropped on the town, and an enormous amount of damage was done. The new marine station and the locks were blown up, and the Central station badly damaged. Restoration, however, was so rapid that two years after the Armistice hardly a trace of the havoc was left. A new lighthouse, in place of the large one destroyed in 1916, was finished in 1924. In 1922 a monument to commemorate the work of the people of Ostend among refugees fleeing to England was unveiled in front of the church of St. Peter and St. Paul, and in the English church is a plaque in memory of those who were killed in the raid on Zeebrugge. (*See* ZEEBRUGGE.)

OSTEOPATHY.—According to its advocates, osteopathy is that system of the healing art which regards the structural integrity and adjustment of the mechanism of the body as the most important single factor in maintaining the organism in health, in contrast to the older systems which regard the chemical intake of the body as the most important factor. In other words osteop-

athy is based on the belief that the human body is a vital mechanism, a living machine, which, given wholesome physical and mental environment, good food, proper exercise, pure air and pure water, will be healthy—that is, will function properly, so long as all the cells and parts of that vital mechanism are in normal adjustment. Osteopathy teaches that structural derangement of the body is the predisposing cause of disease. Such structural derangement causes functional perversion of the vascular and nervous system, weakening the nutritional processes and lowering the powers of resistance of the body; on the one hand, producing congestion, either general or local, active or passive; on the other, depriving tissues of an adequate blood and lymph supply. This perversion impairs the rebuilding of cells after waste due to active functioning and retards the elimination of waste products through body drainage, thus making the body unable to withstand climatic changes or unhygienic and insanitary surroundings, and offering a hospitable medium for the invasion and propagation of pathogenic germs. Integrity of mechanical structure determines the normality of functioning. That structural perversion is the basic cause of functional disturbance or disease is a distinctive and fundamental principle of osteopathy.

Diagnostic Methods.—Osteopathic diagnosis includes examination of the whole body and its excretions, especially the articulations and alignments of the vertebrae, ribs and pelvis. Symptoms are noted, and chemical, microscopic, hygienic, sanitary and other findings are studied to aid in determining the existing conditions of tissue, viscera and function. Of supreme importance, however, is the physical examination to discover existing mechanical tissue lesions.

Therapeutic Methods.—Osteopathic therapeutics may, and usually does, consist in the specific manipulative removal of the lesion or structural perversion, by effecting tissue adjustments, which free the remedial anti-toxic and auto-protective resources of the organism itself; or it may consist in correcting hygienic, dietetic, environmental and psychic conditions; or in the application of operative surgery for fractures, lacerations, and the removal of abnormal growths or organs so diseased as to be dangerous to life; or it may be the administration of antidotes for poisons and other dangerous substances. In osteopathic therapeutics the fundamental principle is, " Find the lesion, adjust it, and let it alone."

Historical Matter.—The founder of osteopathy, Dr. Andrew Taylor Still, was born in Virginia Aug. 6 1827, and died at his home in Kirksville, Mo., Dec. 12 1917. He was a practising allopathic physician at the beginning of the American Civil War, served as a Union officer, and at the close of the war returned to his home in Kansas and resumed the practice of his profession. Gradually his confidence in the efficacy of drugs as a means of healing weakened, and his faith in the inherent curative power of the body strengthened, until June 22 1874, when he publicly announced that he would henceforth discard the use of drugs as a curative measure and would dedicate the remainder of his life in aiding nature in the alleviation of disease by the mechanical readjustment of the disordered body. The American School of Osteopathy was opened at Kirksville, Mo., in 1892. There were in 1925, over 9,000 graduate practitioners of osteopathy in all parts of the world.

Legal Recognition.—In addition to the school at Kirksville, there were in 1921 six others in the United States devoted to the teaching of osteopathy. The curricula of the osteopathic colleges embrace all the subjects taught in other medical colleges, except *Materia Medica*, in place of which there is included " Principles and Practice of Osteopathy " and " Osteopathic Therapeutics." Osteopathy was by 1925 recognised and regulated by law in 47 states of the United States. The one remaining state, through court decisions, makes its practice legal.

There is an international organisation, The American Osteopathic Assn., having some 4,000 active members; an osteopathic association in each state in the Union; associations in Canada; the New England Osteopathic Assn., the Western Osteopathic Assn., the Eastern Osteopathic Assn., the South Atlantic States Osteopathic Assn., Osteopathic Women's National Assn., a British Osteopathic Association, the Academy of Osteopathic Clinical Research, and the American Society of Ophthalmology and Oto-Laryngology. There are 10 or 12 magazines and periodicals published by the profession.

OSTWALD, WILHELM (1853–), German chemist, was born in Riga Sept 2 1853 and educated at the University of Dorpat. In 1882 he became a professor in Riga, and five years later was appointed professor of physical chemistry in the University of Leipzig, where he was later director of the Physico-chemical Institute. In 1906 he resigned his university appointments and subsequently lived in retirement in Saxony. Ostwald will be chiefly remembered for his discovery in 1900 of a method of oxidising ammonia to form oxides of nitrogen; a mixture of air and ammonia being passed over a platinum catalyst with a specially treated surface. By means of this process and by later developments in connection with it, Germany was enabled to continue the manufacture of explosives during the World War after the Allied blockade had been enforced. In 1909 Ostwald was awarded the Nobel Prize for chemistry. His published works include *Lehrbuch der allgemeinen Chemie* (2nd ed. 1884–87) and *Grundlinien der anorganischen Chemie* (5th ed. 1922) which have been translated into English.

OTIS, HARRISON GRAY (1837–1917), American journalist, was born near Marietta, O., Feb. 10 1837. He became a printer's apprentice, working in various offices in Illinois, Iowa, Ohio and Kentucky. He served throughout the Civil War, and rose to be lieutenant-colonel. He was in the Government printing office at Washington, D.C., 1867–70, and in 1870 moved to California, where he managed the Santa Barbara *Press*. In July 1882 he became connected with the Los Angeles *Daily Times*, obtaining control of that paper in 1886. He served in the war with Spain as brigadier-general in the Philippines 1898–9. In 1910 the *Times* building was dynamited, 21 employees being killed. He died at Los Angeles July 30 1917.

OTTAWA (*see* 20.369), the capital of the Dominion of Canada, had a population of 107,843 in 1921; a later estimate gives it as 126,000. The population is about half British and half French. Ottawa is the headquarters of the Air Force and the Royal Canadian Mounted Police, and contains the National Victoria Museum, the National Art Gallery, the Royal Observatory and the Royal Mint; while the Central Canadian Experimental Farm is in the vicinity. Parliament buildings were almost completely destroyed by fire in 1916; the magnificent library and the Senate House fortunately escaped. Reconstruction was started at once. The main front of the new buildings is the same length as that of the former one, but the height is double; in the main tower is a War Memorial chamber. Other buildings erected since 1911 include the Grand Trunk (now Canadian National) Union station, on the east bank of the Rideau canal and the south side of Rideau street, and the Château Laurier hotel facing the Parliament buildings. The Canadian War Memorial, an arch 45 ft. high, was in course of erection in 1926. A colony for the use of civil servants has been built close to Rockliffe Park. The city possesses 2,000 ac. of park lands. Ottawa in 1924 had 452 industrial establishments, largely for wood products, including one of the biggest lumber factories in the British Empire. Electric power is generated at Chaudière Falls.

OTTOMAN EMPIRE, THE (*see* 27.426).—After an existence lasting well-nigh six centuries and a half the empire founded by Osman (1288–1326) expired on Oct. 29 1923 when the Great National Assembly at Angora by an unanimous vote constituted the Turkish Republic. Since the death of Suleiman the Magnificent in 1566 the Ottoman Empire had been gradually decaying, and throughout the 19th century its demise from time to time had been almost hourly expected. Successive wars had shorn it of its outlying provinces, especially in Europe, and from being an empire that extended in the 16th century from Budapest to the Sudan and from Oran to the Caspian Sea it was left by the Treaty of Sèvres (*q.v.*) with an area of no more than 175,000 sq. m. and a population of barely 8,000,000.

Contrary to expectations, it received its *coup de grace* not from one of the great Christian Powers but from a section of

its own subjects. It fell before the democratic movement inaugurated at Angora in 1919 by Mustafa Kemal Pasha (*q.v.*), and in the following year the Parliament at Constantinople held its last meeting. Two years later Mehmed VI., last Sultan of the House of Osman, fled from Constantinople on board a British ship of war. In consequence the Great National Assembly at Angora decreed his deposition both as Sultan and Caliph in a *fetva* passed on Nov. 19 1922. As Caliph the Assembly elected Abdul Mejid Effendi, a son of the late Sultan Aziz; but in less than two years even the Caliphate was swept away and the House of Osman finally banished (March 2 1924) from the lands over which it had for so long held sway. (*See* CALIPHATE; TURKEY.)

See Lord Eversley's *The Turkish Empire* (2nd ed., 1923), probably the best general survey of the history of the Empire. See also W. Miller, *The Ottoman Empire, 1801–1913* (1913).

OUSE (*see* 20.380).—The question of the navigation of the English river, the Great Ouse, between Bedford and King's Lynn was raised in 1913 at Bedford and a committee was formed to inquire into the subject, but no further steps were taken until the Land Drainage Act of 1918 made it possible to deal with the problem. The Ouse is a long and difficult river, largely artificial, and in 1913 the locks were decayed and unworkable between Bedford and St. Ives. Parts of the stream had never been adequately cleared and the cutting called the New Bedford river, which carries one arm of the river to the sea, was suffering from a long period of neglect. In 1920 an Act was passed superseding various minor authorities and placing the drainage of the Ouse in the hands of a board. The decision to rate the owners and occupiers of land adjoining the river in the upper reaches above Earith, where it enters the Fen country, as well as the Fen dwellers, for the purpose of making drainage and tidal channels in the Fen area, aroused opposition from the first. The "uplanders" considered that their assistance should be confined to the portion of the river above Earith, and the comparatively small area of land adjoining it. The Ministry of Agriculture, as the result of an inquiry held in 1924, decided that it was impossible to relieve them of their liabilities under the Act, unless the Government undertook comprehensive works on the tidal portion of the river. A suggested grant of about £1,500,000 was refused as insufficient and a long dispute followed between the drainage board and the upland farmers, who refused to pay the rate levied for administrative purposes. Distraints were carried out in Jan. 1925 and the goods sold at Cambridge.

Protests from the Upland Riparian Owners and Occupiers' Association and continued refusals of payment led to further negotiations with the Ministry of Agriculture, which resulted in the passing of a temporary suspension order in April, with the proviso that no fresh rate should be levied or drainage work done in the "upland" area (except by consent of a sub-committee of the board consisting of representatives of that area) until the end of 1926; that the Ouse district should be surveyed; and that a commission should be appointed to investigate the whole problem. The Upland Riparian Owners' Association adopted a fighting policy, stating that they did not require a drainage commission in their area; and that the river could be surveyed for obstacles and these removed, if necessary, by the National Farmers' Union. They also put forward the suggestion that with co-operation between the millers and the county surveyors the flood waters could be passed through more rapidly. Efforts were being made later in the year to induce the "uplanders" to pay their arrears of rates. A new bridge over the old Bedford river was begun in 1925, but difficulties were caused by the floods. It was decided to approach the county authorities with a view to their taking responsibility for the bridges, many of which were inadequate for the traffic.

OXFORD (*see* 20.405).—The population of the city increased from 53,048 in 1911 to 57,052 in 1921. The garden suburbs on the Cowley and the Iffley roads are only small, but others are in progress. In 1925 the city adopted a town-planning scheme, by which arrangements are made for diverting through traffic round the city, and to preserve its amenities.

The War Period.—The two most important facts in the history of the university since 1911 have been the World War and the two commissions. In the War 14,561 Oxford men served in the British Forces, and 2,660 lost their lives. But the greatest service rendered by the university was the supply of officers. Thanks to the O.T.C., nearly 2,000 Oxford men received commissions in the first two months of the War. After this, Oxford became one of the main training grounds for officers; for the last three years of the War, there always were nearly 2,000 cadets in Oxford and the examination schools and those colleges which were not given up to cadets became hospitals. The number of undergraduates fell to 1,087 in Jan. 1915 and 550, 460 and 369 in the same months in 1916, 1917 and 1918 respectively. The tide began to turn in the latter part of 1918; in Jan. 1919 there were 1,357 men in residence; and in the following 18 months the entries were so heavy that by Oct. 1920 there were about 4,500 men and 650 women actually in residence. Since that time, all the men's colleges have striven to reduce their numbers; so that the figures for undergraduates in Oct. 1925 were about 3,400 men and 750 women. These figures indicate clearly one of the indirect results of the War, the admission of women as full members of university. This change was made in 1920.

New Statutes.—The royal commission, set up in 1919, reported in 1922; most of its recommendations had been embodied in Statutes by the end of 1925, by the statutory commission appointed in 1923, although the actual changes made by the commission will only begin to come fully into effect in Oct. 1926. It was satisfactory to Oxford men to find that a commission appointed by a reforming government, and composed of men of all political parties, reported so favourably on the work of the universities as a whole; so far from being pronounced to be homes of idleness, the main complaint made against most of the teachers was that they worked too hard (see *Report*, pp. 26, 39, 48). To remedy this, and to allow for the extension of university activities, the royal commission recommended a grant to Oxford and to Cambridge of £110,000 a year each; only £60,000 was given at first, but in the spring of 1925 this was increased to £85,000.

It is hard to say what the effect of the new statutes will be. They seem likely rather to carry on the developments which the old universities were already making, than to introduce revolutionary changes. At Oxford, for example, there has been a growing tendency since about 1900 to lay ever-increasing stress on the necessity of research work. To encourage this, the degrees of Bachelor of Letters and Bachelor of Science were set up in 1895, the Doctorate of Philosophy in 1917; the regulations for the B.Litt. are now being remodelled in the light of experience. In the examination, too, for the honours degree in natural science, students of chemistry can only obtain a class if they spend a year on a piece of research.

Another important line of change is that in future the full emoluments of college entrance scholarships will be given only to those who show actual need for help. It remains to be seen how this change will work; but in this, as in other matters, the commissioners have done as little as possible to interfere with the independence of colleges, and great care has been taken to prevent the lowering of standard for scholarships and to see that scholarships do not become merely eleemosynary.

The machinery of government of the university has also been developed since 1900, mainly by voluntary action, but in part by the commissioners. The hebdomadal council has been made more representative of the whole university; university finance management has been remodelled, first in 1912 in one of the reforms carried out by Lord Curzon, and then by a statute of 1920. The studies of the university too are now put under a general board of the faculties, which was set up in 1913 and is elected by the resident teachers. A further instance of development is the change in the theological degrees, which in 1920 were thrown open to students of all denominations, and made to depend, so far as the D.D. is concerned, on the production of a "serious contribution to learning."

Benefactions.—The material resources of Oxford have also been steadily increased by the generosity of benefactors, espe-

cially old members. Natural science has been the chief gainer, with new laboratories for engineering (1912), for chemistry (thanks mainly to Mr. Dyson Perrins) in 1912, for pathology from the Dunn trustees and for biochemistry from Mr. Whitley and the Rockefeller Foundation. The Welch bequest (1915) has added another £50,000 to the resources of biological science, and the Govt. by placing at Oxford the Institutes of Agricultural Engineering (1923) and of Imperial Forestry (1924), has shown its confidence in the oldest university as the fittest place to provide for the newest needs of the empire.

Next to the development of natural science, the most marked feature of the decade 1915–25 has been the growth of modern language teaching. Professorships of French and Italian have been founded by Sir Basil Zaharoff and Mr. Arthur Serena respectively; Sir Heath Harrison has provided scholarships for undergraduate travel (1919), and Mr. Laming has founded travelling fellowships in connection with his old college, Queen's (1924). Closely allied with this development is the increasing number of fellowships for study in the universities of the United States, which are being founded by Americans as a counterpart to the work of Cecil Rhodes.

The Bodleian continues to receive gifts, not only of books and pictures as in Lord Curzon's Napoleonic Collection (1925), but also in cash, as Walter Morrison's £50,000 in 1920. Mention should also be made of Barnett House, founded in 1914 in memory of Rev. S. A. Barnett.

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OXFORD AND ASQUITH, HERBERT HENRY ASQUITH, 1ST EARL OF (*see* 2.769).—The opening of the session of 1911 may be taken as the crowning moment in Mr. Asquith's public career. The issue of the constitutional struggle with the Lords was not yet decided, but it was no longer in doubt. It had been practically settled by the events of the previous autumn. The round table conference, which had been called in the hope of reaching an agreed settlement, had broken down, and Mr. Asquith had decided to appeal once more to the country. The election took place in December and the Govt. returned with a commanding majority of 126.

The decisive mandate which the country had given in December dictated the issue that immediately occupied the new Parliament. A bill abolishing the veto of the House of Lords was introduced into the House of Commons and, despite energetic opposition, passed all its stages by the beginning of the summer. But the real crisis had yet to come. The battle had still to be won in the Lords and there the opposition were entrenched in overwhelming power. There was only one way to victory. Ever since the emergence of the struggle it had been evident that the attainment of Mr. Asquith's goal depended on whether he could in the last resort invoke the authority of the Crown to dilute the House of Lords with new peers sufficient to change its complexion. It had been assumed that he had armed himself with this authority after the first election in 1910; but the assumption was unfounded. What was the position now? The question was answered on July 20. The Parliament bill, now in the House of Lords undergoing its second reading, was so amended as to deprive it of any utility for the purpose for which it was framed. Mr. Asquith therefore addressed to Mr. Balfour, the leader of the opposition, a letter stating that the Govt. had decided, if the bill in its essential form could be passed in no other way, the Crown would be advised to create a sufficient number of peers to ensure its passage, and that the Crown had signified its willingness to accept such advice.

The publication of this letter aroused an unprecedented storm, and on July 24, on rising in the House of Commons to make a statement, Mr. Asquith was greeted with a demonstration without parallel in living memory. For the best part of an hour he stood speechless before the roar of anger that issued from the Opposition benches, and at last resumed his seat without having uttered a continuous sentence. What became known as "the pothouse brawl" inaugurated the last stage of the struggle. The Govt. was accused of "dragging in the King," and the Opposition organised an uncompromising resistance in the belief that the Govt. would not dare to carry its threat into execution. The issue, however, was determined on Aug. 10, when the final debate was taking place in the House of Lords, by a statement of Lord Morley confirming the Government's previous intimation of His Majesty's intention. Up to this point the "Die-Hards" seemed to be assured of a majority, but in the division they were defeated. The bill was passed. On Aug. 18 the Parliament Act received the Royal Assent, and the House of Lords stood shorn of its historic privileges.

From this victory Mr. Asquith proceeded to his next great task, with the ground sensibly cleared for action. Gladstone's successive Home Rule adventures had broken on the rock of the Lords' veto. Mr. Asquith now approached the subject with the advantage that that rock no longer obstructed the channel. But before the Irish issue was fully launched another controversy absorbed the Prime Minister's activities. From that controversy the country has not yet emerged. Discontent had long been growing prevalent in the mining industry, and at the end of Feb. 1912, having failed to secure the concessions and advances they demanded, the miners' union declared a strike. Vast dislocation followed and unemployment became widespread. From the outset the Govt. endeavoured to bring the conflicting parties to agreement and Mr. Asquith took on himself the personal charge of the negotiations. A month's fruitless efforts left the country on the brink of paralysis, and the Govt. thereupon introduced the Miners' Minimum Wage bill, which, by providing a half-way solution, forced the hands of both sides and brought the immediate struggle to an end, although the issue incidentally raised—that of the reorganisation and control of the coal industry—was to perplex Parliament and the country for many years to come.

Meanwhile, the Home Rule bill had been introduced and with the Government majority behind it there was little difficulty in securing its passage through the House of Commons, while the Parliament Act provided adequately against the resistance of the House of Lords. That House fought the delaying action, which was all the opposition now in its power. On Jan. 30 1913 it rejected the Home Rule bill at the second reading. Under the Parliament Act the Lords' power of rejection is limited to two successive sessions. The bill was introduced again and in July 1913 it was again rejected by the Lords. After its next passage through the Commons it would have overridden opposition and automatically become law. By this time, however, the political atmosphere was heavy with forebodings from other quarters. The opposition to the measure took an extra-parliamentary shape. The notorious Ulster Covenant had been promulgated in the previous Sept. and talk of open rebellion, should Home Rule be passed, was already current. In June arms had been discovered both at Belfast and Dublin. As the year wore on the outlook became still more serious and a speech by Mr. Bonar Law, the leader of the Conservative party, at Blenheim, seemed to give encouragement to the idea of resistance by force. On Sept. 25 the Ulster Unionist Council appointed a provisional Govt. and prominent Conservatives openly preached armed resistance, Sir Edward Carson, the leader of the Ulster Unionists, left no doubt that in the last resort Ulster would fight.

With the close of the session of 1913 there came a brief lull, and during the recess conversations with the Opposition leaders were opened by Mr. Asquith, who throughout preserved an attitude of patience and forbearance. It will always be matter for controversy whether, when the policy of violent resistance had been adopted, he was justified in ignoring so direct a challenge to constitutional government. His natural disposition was to allow the utmost scope for the play of discussion and the influence of the time element; but it is an open secret that he would have taken up the challenge but for the persuasions of Mr. John Redmond, the leader of the Irish Nationalists, who believed that the prosecution of the Ulster leaders would prejudice the prospects of friendly relations with Ulster when Home Rule was

actually on the statute book. In any case, the conversations of the autumn were futile, and on March 9 1914 the Govt. announced the provisions of their amending bill, their last word of compromise. The chief provision of this bill was that any county in the north of Ireland was to be allowed to vote itself out of the operation of Home Rule for a period of five years.

The offer was rejected by the Opposition and now events rushed forward to an apparently unavoidable catastrophe. Sir Edward Carson was hastening to and fro, reviewing the rebel army of Ulster which had now assumed alarming proportions. On the night of April 24–5, 55,000 rifles were landed at Larne from a German port for the use of the Ulster army. On the other side of the border the Nationalists were beginning to enrol a volunteer army and to make counter-preparations. Meanwhile a more sinister menace appeared. In the debate on the vote of censure on the Govt. on March 19 Mr. Bonar Law, speaking on the Home Rule issue, had used the ominous phrase "soldiers are citizens like the rest of us." There had been much talk of disaffection in the army in regard to the coercion of Ulster, and on March 20 it took shape in the Curragh incident (*see* IRELAND) which led to the resignation of Col. Seely, the Secretary for War. For a moment it seemed that the loyalty of the army was imperilled and the situation that confronted the Govt. looked desperate. But the announcement by Mr. Asquith next day that he would assume the Secretaryship for War created a profound impression in Parliament and stopped for the time being at all events what had seemed like a riot in the army. Following the mutilation of the amending bill by the House of Lords and Sir Edward Carson's challenge to the Govt. to "give us a clean cut or come and fight us," the King, on Mr. Asquith's advice, summoned a conference at Buckingham Palace on July 20 to see if some agreement was still not possible. It broke down four days later and the last hope of avoiding a violent issue seemed gone.

What Mr. Asquith would have done to avert a civil war while maintaining the authority of the constitution was not to be revealed, for on the day that the Buckingham Conference broke up Austria sent her ultimatum to Serbia, and within 10 days the British Army was embarking not for Ulster but for Flanders. In the feverish struggle within the Cabinet that preceded the entry of Great Britain into the World War Mr. Asquith's position was never in doubt. He had throughout been a party to the ambiguous military understandings and conversations which had been in progress with France since before the fall of the Balfour Govt. in 1905, and when the War came he did not waver in his conviction that both the duty and the interest of this country lay in throwing the country's whole weight into the scales against what he considered to be the calculated design of the Central Powers to establish a military despotism over Europe.

The invasion of Belgium by Germany saved his Govt. from disruption, and he addressed himself, free from domestic disquietudes, to the heaviest task ever imposed on a British Prime Minister. For the moment even the Irish trouble subsided, all political differences were shelved and Mr. Asquith became the voice of a united nation in a measure unequalled in modern Parliamentary history. The speeches he delivered in the early days of the War have taken their place beside the classic orations of Pitt during the Napoleonic wars, and his constancy of mind and freedom from all personal ambition played a dominating part during the next two years in laying the foundations of the ultimate victory. It was not to be expected that in the presence of so vast a convulsion discontents would not develop. They became clamant as the true character of the struggle emerged and as the popular idea of a swift decision gave place to the certainty of a long war of attrition. Mr. Asquith had made no change in the political constitution of his Cabinet at the outbreak of war, although he had taken the leaders of the Opposition into his confidence and private counsels, but by the spring of 1915 it became clear that this informal relation would have to yield to a formal coalition.

In Feb. Mr. Bonar Law and Lord Lansdowne intimated that they could accept no responsibility for the way in which the War was being conducted, and in the popular Press—which Mr. Asquith had no talent for flattering—a powerful and ceaseless agitation arose, directed mainly against Mr. Asquith, Sir Edward Grey and Lord Haldane and inspired by the inevitable shortage of munitions which the progress of the War had revealed. Coincidentally, a violent disagreement as to the employment of the navy in the Gallipoli adventure had arisen between Mr. Churchill, the First Lord of the Admiralty, and Lord Fisher, the First Sea Lord, and on May 26 Mr. Asquith reformed his Cabinet on a Coalition basis, bringing in the leaders of the Opposition and excluding Lord Haldane. To meet the growing need for munitions, a special Ministry of Munitions was set up with Mr. Lloyd George at its head.

The reconstruction of the Ministry did not allay dissatisfaction. Within the Cabinet friction developed, and, outside, the Press agitation grew in violence. There was a persistent leakage of Cabinet secrets, certain newspapers betraying a knowledge of most confidential government business with such regularity as to suggest inspiration. A phrase, "Wait and See," which Mr. Asquith had used in reply to a question in the House of Commons years before, became the daily gibe of the malcontent Press, and Sir Edward Grey, then in the midst of the most delicate situation with the United States, was accused of "feeding Germany" because of his attitude on the subject of contraband from America. The war-weariness that had overtaken the country provided an atmosphere in which this propaganda of discontent flourished, and the head of the Govt. was the easier target for attack because he neither "squared" the Press nor hit back at his critics. The inevitable rupture came in the autumn of 1916, when the German raid into Rumania—now seen in its true proportions—served to drive home the attack, and at a time when Mr. Asquith was severely stricken by the loss of his eldest son in the War.

It arose over a question of Cabinet reorganisation. For some time the formation of an inner Cabinet had been under discussion. At the beginning of Dec. 1916 Mr. Lloyd George, who upon the death of Lord Kitchener had become Secretary for War and whose prestige with the Press had long been in the ascendant, submitted a definite scheme for the formation of such a body. From this body the Prime Minister was to be excluded. His right to control policy was not challenged, but he would not direct the deliberations of the inner Cabinet. The *coup* burst upon the country with the announcement of the popular newspapers that Mr. Lloyd George was "packing up" in sheer despair at the inefficient conduct of the War. His highly confidential challenge to the position of Mr. Asquith was under consideration when an article appeared in *The Times* (then owned by Lord Northcliffe) giving full details of the supposed arrangements and suggesting that Mr. Asquith had already agreed. Mr. Lloyd George denied any knowledge of this article; but Mr. Asquith, after consulting with his friends, decided to reject the proposal. Upon this Mr. Lloyd George resigned, and his resignation being followed by that of other influential members of the Cabinet—including some who hoped that their action would give the Prime Minister the opportunity of reforming his Cabinet on a new basis—Mr. Asquith informed the King that he could no longer be responsible for carrying on the business of the Govt.; and within a few days the second Coalition Govt. was formed with Mr. Lloyd George as Prime Minister.

Thus ended Mr. Asquith's long and memorable tenure of the Premiership. This is not the place to pass judgment upon his career or upon his conduct of the War, but it may be pointed out that the hopes of an early victory as the result of a change of Govt. were not realised, and the subsequent disclosures have thrown an entirely different light on the military position at the end of 1916 from that which prevailed at the time. For the remainder of the War he occupied a seat in the front Opposition bench, speaking rarely and only on occasions when the interest of the nation seemed to demand his intervention. At the election of 1918, when Mr. Lloyd George swept the country with an appeal for the maintenance of the Coalition, he did not escape the general wreck of the Liberal party, losing the seat of East Fife which he had held throughout his parliamentary

career. In 1920 he returned to the House of Commons as member for Paisley and resumed his position as head of the remnant of the Liberal party in that House. This position he occupied during two succeeding Parliaments. In 1924, after an election fought on the issue of Protection, he, as the head of a pivotal majority, was responsible for the accession to power of the first Labour Govt., and later in the year for the Government's overthrow on a question of alleged governmental interference with the prosecution of a Communist. At the election which followed he was defeated at Paisley, and he retired to the House of Lords as the Earl of Oxford and Asquith.[1] (A. G. G.*)

[1] On May 26 1926, consequent on the General Strike, correspondence was published between Lord Oxford and Mr. Lloyd George with reference to the failure of the latter to consult his colleagues. This led to a breach in the party. (See LIBERAL PARTY.) (Ed. *E.B.*)

OXFORD AND ASQUITH, MARGOT, COUNTESS OF, the sixth daughter of Sir Charles Tennant, 1st Bart., married, in 1894, as his second wife, Herbert Henry Asquith, later the Earl of Oxford and Asquith. Previous to her marriage she was well known as a member of the coterie known as the "Souls," and afterwards continued to be one of the wittiest and most brilliant women in London society. In 1922 she published *The Autobiography of Margot Asquith* (2 vol.), which attracted considerable attention and a certain amount of criticism owing to the writer's frankness of expression. It is generally acknowledged to be, however, one of the most valuable chronicles of the time. After its publication she undertook a lecture tour in America, and in 1925 published *Places and Persons*.

OYAMA, IWAO, PRINCE (1842–1916), Japanese soldier (*see* 20.424), died on Dec. 12 1916.

END OF THIRTIETH VOLUME
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